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April 7-9, 2008
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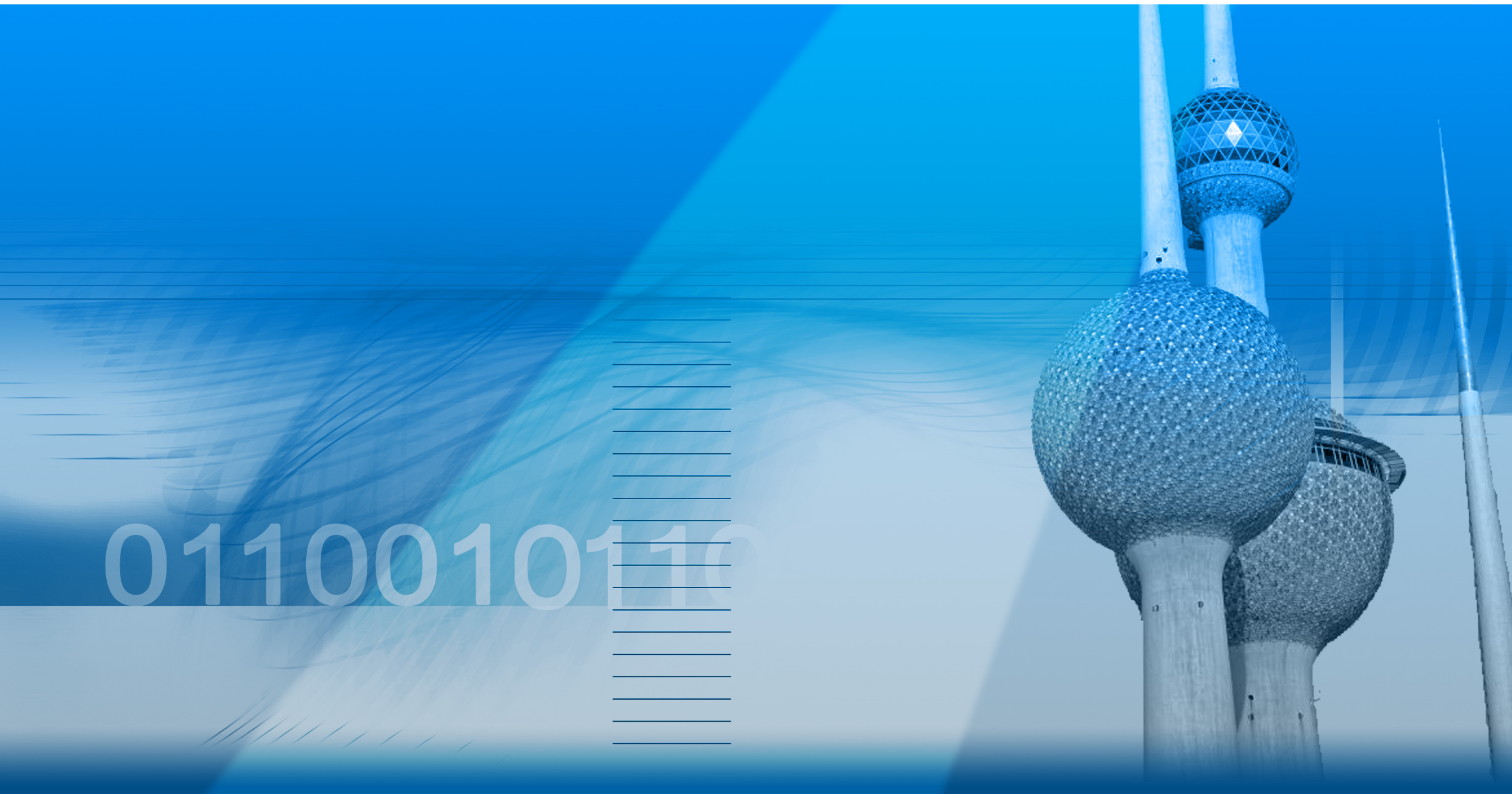

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Arabian Advanced Systems

The International Conference on Technology Communication and Education

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Gulf University for Science & Technology

Proceedings

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Pattern Analysis and Machine Intelligence, University of Waterloo, Canada

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Arabian Advanced Systems (AAS)

The International Conference on Technology, Communication and Education

April 7 – 9, 2008

Gulf University for Science & Technology, Kuwait

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PREFACE

The purpose of the first International Conference on Technology, Communication and Education (i-TCE) is to create a link for experts in the fields of education, technology and communication. Researchers around the world exchange their ideas, concepts and innovations by using the latest technologies in learning academics, research, applications and commercial levels.

Papers have been thematically organized into several areas such as e-learning technologies issues with concentration of infrastructure and network. Another area is the core e-learning domain applications such as m-learning, virtual university and remote laboratories. The proceedings also contains a theme on evaluation and standards with several concepts such as security of evaluation processes in higher education and personal response systems.

Another theme is the e-learning domain application which provides several research papers on areas such distance learning, multimedia and several e-learning case studies from different countries, in addition to specific and specialized areas such as medical and engineering technologic. The theme of the e-learning technology issues presents two research areas namely, tools and systems and web-based learning with different applications. An important theme tackles issues related to the e-learning curricula,

The papers presented as the i-TCE2008 are delivered by regional and international speakers, including renowned international keynote speakers.

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Classroom Response System using Mobile Phones and 2D barcodes

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***Abstract*— this paper presents the idea of a *Mobile Snapshot Response system*, which uses the camera-integrated within mobile phones and a 2D barcode to leverage student interaction in the classroom. The potential objective of the system is to increase the connectivity between the instructor and the student by offering the student the opportunity to evaluate the lecture content and send inquires to the instructor after class.**

Keywords- Mobile phones; 2D barcodes; E-learning; Mobile Learning; Class Particpation

I. INTRODUCTION

Mobiles and Internet have become an important aspect of our lives. The comfort and convenience they provide certainly made our lives and in particular our learning much easier than ever before. One brilliant feature in mobile phones is the ability to access the Internet anytime and anywhere, thus, enabling us to seek information when we need it.

M-Learning (Mobile-Learning) is a new learning approach that benefits from mobile phones to create comfortable learning environments for learners. Some of these environments use the built-in digital cameras found in mobile phones to scan a Two-Dimensional bar code and resolve the bar code into a webpage that contains information about the scanned object.

Two-Dimensional bar codes such as SemaCode[1] and Quick Response[2] (QR) System are two well-known ways used to reach internet resources.

These systems work by generating a "tag" that contains an embedded URL used to reach a specific web page. Mobile phones equipped with digital cameras are then used to scan the tag and displays the corresponding web page.

The idea of utilizing the capabilities of modern mobile phones with 2D bar codes is very promising especially in the educational field. Therefore, in this project, we intend to build an M-Learning system that uses the technology of Two-Dimensional bar code with the capabilities of Camera-equipped mobile phones. The system that we will build will be called Snapshot Response System (SRS). The SRS system will help educators and instructors evaluate students' degree of comprehension, by giving out short assessments, and allowing feedback on the overall course evaluation at the end of each semester. Also, the system will help students send their inquiries directly to the instructor after each lecture.

To further discuss our potential project the paper is organized as follows: In section 2, the motivations and goals for initiating such a project are outlined, In section 3, related works are discussed, In Section 4, the proposed system is demonstrated and in section 5 we concluded the paper with future directions.

II. MOTIVATIONS AND GOALS

Many instructors in academia wish to know how much their students understand the content of the lecture, and doing this manually will be very difficult and time consuming task.

Similarly, most students have communication problems with their instructors, and they wish if they can ask their questions without any fear. So a need for a technology to bridge these gaps is becoming apparent in our rapidly changing world.

Our proposed system, The Snapshot Response System, has originated in order to solve the above mentioned problems and to achieve the following goals:

[1] http://www.semacode.com/
[2] http://qrcode.kaywa.com/

- **Automation** by enabling students to access the internet via mobile phones.
- **Save time and effort** by collecting students' inquiries electronically, correcting short assessments automatically and displaying students' statistics.
- **Increase interaction between instructors and students.**
- **Make a difference in education.**

To check whether our proposed system will succeed in achieving its goals, we need to check first our students' readiness for embracing such a technology. A survey was distributed among the students of Information Technology department at the College of Computer and Information Science-King Saud University, Riyadh, in order to check the students' awareness of Mobile response systems such as QR Code, and to measure the possibility of applying such a system by checking their mobile phone readiness. The results of the survey are presented in Figure 1, 2, 3 and 4

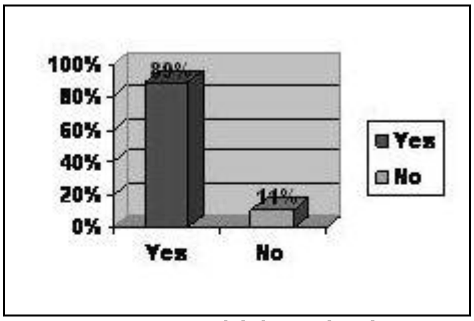

Figure 1. Does your mobile have a digital camera?

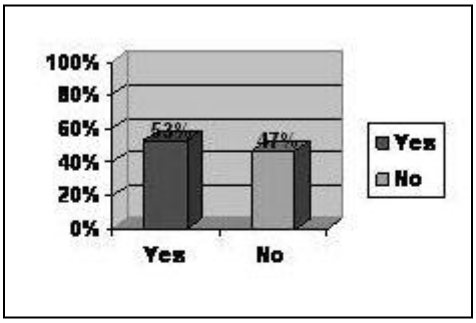

Figure 2. Have you ever used the internet via mobile phones?

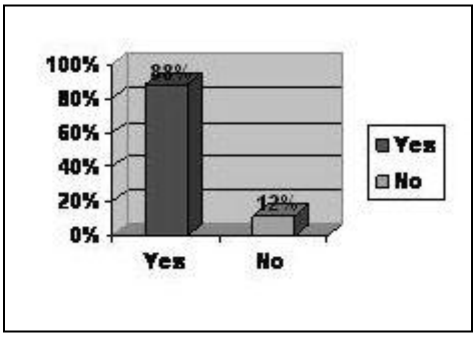

Figure 3.is it important to you to ensure that you have understood the lecture?

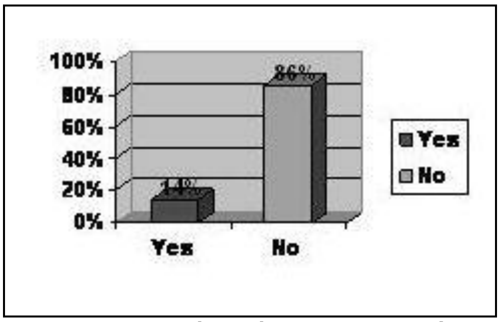

Figure 4. Do you know about QR or SemaCode technology?

As shown from the students' responses, our proposed system has a big chance to succeed. As for the technical side of the project, the students' mobile phones are equipped with digital cameras, also students use their mobile phones to access the internet. Most importantly, both students and instructors were interested in testing the extent of students' comprehension.

III. RELATED WORK

The Two-Dimensional bar code stores data along two dimensions and is therefore capable of containing much more information than the One-Dimensional bar code (seen on many food products) or the magnetic stripe (seen on credit cards and some drivers' licenses). Specifically Two-Dimensional bar code can hold about 2,000 bytes of data, or enough to encode some text and a compressed image file.

Two-Dimensional bar code technology was initially developed for Medicine [1], Press [2], and many other fields. Also applications for Two-Dimensional bar code technology have recently found a great growth with the spread of camera phones.

In m-learning, camera phones provide an essential tool for capturing, sharing, and reflecting on learning

experiences [3]. They can be used to capture images or video for assessment purposes. Camera phones can be used to access information and resources through 2D barcodes.

Some of the most powerful examples of m-learning are when learners are truly mobile. Sharing in a real-time event is MediaBoard [5]. MediaBoard lets you host such events with ease.

The MediaBoard is a flexible, web-based tool which lets learners build up online web pages by sending messages, pictures and audio from their phones. Authors can set up their own online MediaBoards and use these for a great variety of mobile and interactive learning tasks and projects, such as:

- Working as a team to give and receive directions and instructions or discuss and agree how to solve a problem
- Making enquiries, conducting interviews or surveys, and recording speech or other audio
- Learning about and using the Internet and mobile technologies**.**

There are many other m-learning projects that concentrated on the use of camera phones such as the "*HELLO*" project. At *"HELLO"*[5] (*Handheld English Language Learning Organization*) the project team integrates the 2D barcodes, camera phones, the Internet, mobile computing and database technologies. The aim of this system is that students can perform mobile context-aware learning to improve their English effectively at anytime and anywhere.

Another example is Fujimura and Doi project [6], in this project the team has developed a system for students to answer questions about the class and send some comments to the teacher using mobile phones and QR codes in the middle of each class. Although the idea of this project is very similar to our proposed system, yet, we plan on adding new functionalities to the system as will be describe in section 4.

The above mentioned projects showed us the importance of applying m-Learning using mobile phones. Therefore, we are going to utilize mobile phones technology to provide a new educational environment in our collage, which will make it easy for teachers to deliver knowledge to students in a more convenient way.

IV. PROPOSED SYSTEM

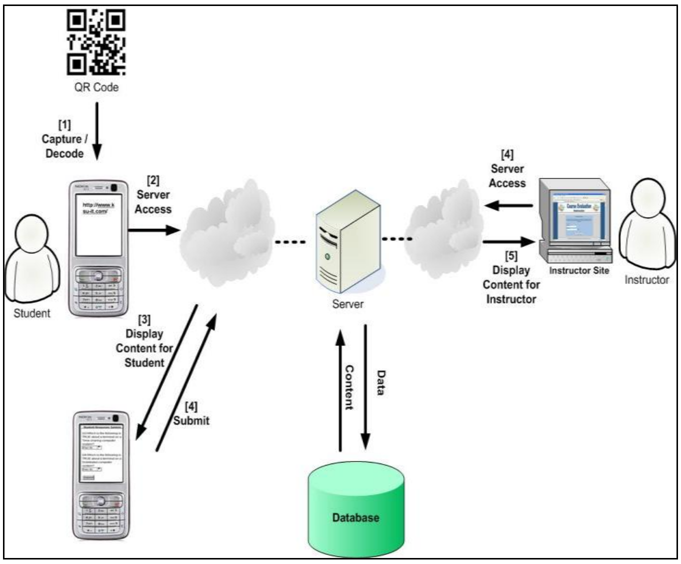

Figure 5.System Configuration

We will develop a system that enforces the communication between student and instructor through mobile phones and QR code technology. The main goal of our system is to ensure the lecture has been understood as intended by the educator before moving on to next lecture. Our system is divided into two subsystems that communicate with each other: web interface system for the instructor and mobile interface system for the student as shown in Figure 5.

Mainly, there will be a site that will contain a page for every instructor.

A. *Web Interface System for the instructor*

The instructor teaches students different courses; each instructor has a web site that contains all courses he/she teaches. The site allows the instructor to prepare a short assessment, which may be on every lecture. The instructor can edit or delete the assessments. The assessment consists of several close ended questions. However, the system provides some level of flexibility. The instructor has the option to give different assessments for different sections related to the same lecture. The instructor can summarize the results of each question in each assessment using charts and according to the instructor`s choice, i.e. lecture, section or assessment.

The system provides another mean of communication between the instructor and the student. It will collect students' inquiries then display them according to lecture. To focus on the most frequently asked questions and give some questions a priority, the system will use

some kind of text mining techniques to extract important topics.

B. Mobile Interface System for the student

In the mobile interface system we will use Quick Response (QR) code technology.
QR code is a matrix code (or two-dimensional bar code) created by Japanese corporation in 1994 (see Figure 6). QR uses convenience-oriented applications aimed at mobile phone users.

Figure 6. QR code

The QR Code will store instructor URL address as a 2D barcode. The student will then access a mobile interface by scanning the instructor's QR tag using his/her mobile camera phone and internet capable mobile phone.

To fully benefit from our system, the student has to complete a registration phase, in order to become a member. Then he/she can answer the short assessment. When the student submits his/her answers, the model answers will be displayed on his/her mobile phone screen.

Naturally, the student cannot answer the same assessment more than once, thus emphasizing the importance of registration. Moreover, the student can send his/her inquiries about any misunderstood information, anytime before the next lecture, using a special form in our service.

V. CONCLUSION

Recent interest in M-Learning applications has greatly increased. One of these applications is the utilization of mobile devices in student evaluation and education. We envision the potential of using our proposed system, i.e. SRS system, in improving the communications between teachers and their students and in providing students with the ability to raise questions and comments without embarrassment. Moreover, by using our proposed system, the students will be able to answer short assessments at the end of each class in an easy and convenient way. Thus, our proposed system will benefit teachers as well as students, it will also improve the delivery of lectures by getting a timely feedback and automatically analyzing student's answers.

ACKNOWLEDGMENT

We wish to thank Dr. Hend Al-Khalifa, our supervisor for her great support and continued supervision. We also thank her for believing in us.

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Effect of Energy Carried by Radio-Frequency Radiation on the Weakest Bond in a DNA Molecule

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*Abstract*__ **We present theoretical calculations about the energy deposition of radio-frequency radiation RFR, used in mobile phones, to a carbon-carbon bond in an organic molecule (e.g. DNA) during receiving a call. We have found that the energy that binds a pair of carbon atoms is 2899 times stronger than the incident RFR energy. Moreover, the time needed for a RFR wave to destroy a carbon-carbon bond is 6.83 hours . Our calculations show, also, that the RFR wave can penetrate in tissue to .125 cm with an absorption coefficient 11 cm^{-1} and so; it can never attain the brain. This work demonstrates, theoretically, that the specific absorption rate is a linear function of wave frequency and is independent on the exposure time. Moreover, the thermal effects due to ultra high frequency waves are negligible i.e. the time needed to rise the tissue 0.1K is 2.5 hours.**

Key words: *mobile phones; energy of radio-frequency waves; binding energy in DNA molecule; absorption coefficient; specific absorption rate.*

I. Introduction

The UK official Report, [1] published in May, 2000, makes some sensible recommendations, but unfortunately some of its greyer areas are now being exploited by the industry to obfuscate the issue. As yet unresolved is the question of adverse health impacts provoked by the contentious non-thermal effects of the low intensity, pulsed microwave radiation used. For these effects are not taken into account in current safety guidelines, [2] which simply restrict the intensity of the radiation to prevent tissue heating in excess of what the body's thermoregulatory mechanism can cope with. Whilst these guidelines, which are the result of careful investigation over many years, are clearly necessary, the question remains as to whether they are comprehensive enough. Although numerous scientific reviews, [3-5] have concluded that there is a net evidence of a health risk from wireless phones or other wireless communication devices, the concerns continue to be reflected in media reports. On the contrarily, other authors have proposed no risk when using this hi-technology equipment, [6-7].

On another hand, the meaning of the 1.6 W/kg local specific absorption rate (SAR) limit in the Institute of Electrical and Electronics Engineers (IEEE/ANSI) standard [8], and the similar 2–4-W/kg local SAR restrictions in the International Commission on Non-Ionizing Radiation Protection, ICNIRP guidelines [9], can be judged by noting that this closely matches the human whole-body resting metabolic rate, and is of the order of one-eighth of the brain's resting metabolic rate. After the IEEE/ANSI [8] a typical cellular telephone has a time-averaged power output of 600 mW or less and yields numerically modeled SARs which may sometimes exceed the 1.6W/kg limit, but which generally lie within the ANSI/IEEE [8] ''controlled environment'' limit of 8 W/kg averaged over 6 min [11]. This 600 mW is less than 1% of the body's normal resting metabolic output and under 4% of the brain's normal resting metabolic output.

In fact, this argument has never given an accurate and clear calculation about how the energy ΔE carried by the radio-frequency radiation (RFR) wave interacts with the bonds in a molecule inside the brain (organic molecule).

Moreover, we didn't find in the literature any study relating the RFR energy, ΔE, with the energy necessary to break, or to deform, the bond of atoms in a DNA molecule. This is the purpose of our study. We calculate ΔE for one of the strongest RF wave and compare it with a weakest energy in a DNA molecule i.e. if the RFR energy is stronger than the weakest bond energy in the molecule, this latter will be damaged leading, plausibly, to DNA damage. But if, oppositely, ΔE is weaker than the energy of molecule bonds no action will be remarked as we will see in the following text.

II. Results and Discussion

A.. *Specific Absorption Rate*

The SAR indicates the amount of energy from RFR that is absorbed by the body when a wireless phone is used. It is defined as the rate of energy absorption per unit mass, and is expressed in watts per kilogram (m^2s^{-3}). The internal SAR cannot be measured directly in the body, but is estimated by theoretical calculations. The ANSI/IEEE [8] has given an excellent empirical equation to calculate the power density I, or wave intensity, as a function of its frequency *f*, in hertz, as:

$$I = f / (1.5x10^8) \qquad (2\text{-}1)$$

Where $1.5x10^8$ $m^2Watt^{-1}sec^{-1}$ is an experimental constant proposed by the ANSI/IEEE [8]. This constant leads to a reasonable range of SAR varying from 2 W/kg to 20W/kg [8]. The (ICNIRP) [9], has, also, recommended similar power density guidelines for limiting exposure of the general public to RF radiation**.** Our task is to know the origin of these limits and to know from where the constant $1.5x10^8$ s^2m^{-2}, proposed by the ANSI/IEEE [8], is coming?

We state, firstly, the factors affecting the absorption of an EM wave in a tissue (i.e. affecting the SAR):

1) the RFR energy E_{ph} which is proportional to the frequency *f,* in Hertz, $E_{ph} = hf$,

2) the number of these waves (photons) per second, n ,

3) the time of exposure t_{expos},

4) the distance which separates the RF source from the tissue *r* in meters,

5) the density of the medium ρ in kg/m^3 and

6) the coefficient of absorption of RFR photons in the tissue, μ in $(cm)^{-1}$, which depends on material of tissue.

Noting that the total number of photons n_{tot} is given by n_{tot} = n . exposure time t_{exp}.

So, the wave intensity, I, could be given as: $I = \{n_{tot} .h / (4\pi r^2. t_{expos})\} f$

$$I = f / \{(4\pi r^2)/ (nh)\} \qquad (2\text{-}2)$$

To compare last equation with equation (2-1) one can show that ANSI/IEEE [8] has considered:

$$4\pi r^2/ (nh) = 1.5x10^8\ m^2\ (Watt^{-1}sec.^{-1})$$

Secondly, we examine the validity of this last equality by proposing some reasonable values: *r* = 2.8mm, and n = $1x10^{21}sec^{-1}$ (section II D). Equation (2-2) gives $I = f / 1.49x10^8$ which is not too far from, $1.5x10^8$ s^2m^{-2}, proposed by ANSI/IEEE [8]. The SAR values are given as:

$$SAR = I /(\lambda.\rho) \qquad (2\text{-}3)$$

As an example, we use equation (2-3) to calculate the intensity I at 800MHz ($8x10^8$Hz): $I = 8x10^8 /1.5x10^8= 5.33$ watt/m^2 which is a reasonable value.

Taking a density for tissue $\rho = 1065kgm^{-3}$ and RFR penetration depth $\lambda = 1.25\ x10^{-3}$m (see section II C) one can find that SAR (at $8x10^8$Hz) = 5.33/ ($1.25x10^{-3}x1065$) = 4 watt/kg which is a reasonable value as stated by ANSI/IEEE [8].

B. The Energy of RF Wave Compared with the Binding Energy in Organic Molecules

To affect a change in biological material through which it is passing, an electromagnetic wave (EM) must deposit enough energy to alter some structure significantly. But every material particle within the body already possesses an average thermal kinetic energy of the order of some kT's, where k is the Boltzmann constant and T is the absolute temperature , and these particles continually collide with other particles of similar energy. For a change to occur in biological material the EM wave seemingly should transfer energy considerably above kT to selected particles, and at 310 K (body temperature), kT is 4.3 x 10^{-21} J (26.7 meV). Another standard of comparison is the chemical bond, because to be effective in promoting change the field should be able to deposit packets of energy larger than (or at least equal to) the bond energy. Absorption of RFR energy leads to formation of either free radicals or ions (homolytic or heterolytic cleavage). As expected, weaker covalent bonds dissociate into radicals (or ions) more readily than stronger covalent bonds.

Kenneth et al. [12] have reported that the energy which can break all the covalent bonds between carbon and carbon atoms in one mole is 346 kJ/mole. While 463 kJ/mole can cut all the bonds between oxygen and hydrogen atoms in a mole. Moreover, atom such as nitrogen, phosphorus, or hydrogen is linked to carbon by energy greater than 346kJ. Thus, any bio-molecular arrangement (e.g. DNA molecule) which exist in the human organ (e.g. brain) can be broken out by supplying at least 346 kJ/ mole. In fact, one mole contains Avogadro's number $\mathscr{A}$ and we can calculate the energy ΔE_0 which can cut only one bond by dividing 346 x 10^3 Joules/$\mathscr{A}$ = $5.7x10^{-19}$Joules; which equals ΔE_0 = 3.59 electron volts (eV). As a result, the threshold energy which can damage an organic molecule is 3.59eV.

For some chromosomes, Ravichandran N et al [13] have reported that the weakest free energy

of unfolding the protein F37H is 6.1kJ/mole which corresponds to 6.33×10^{-2} eV (63 meV).

On the other hand, the energy emitted by a RFR, E_{ph}, depends linearly on the frequency, f, as: $E_{ph} = hf$ where h is plank's constant. Using a relatively high frequency, 300GHz, which has a relatively strong energy, $E_{ph} = 300 \times 10^9 \times 6.64 \times 10^{-34} = 1.99 \times 10^{-22}$ Joules. = 1.24 meV. E_{ph} is by far smaller than ΔE_0. Thus one can easily conclude that one wave has energy which is weaker than the binding energy ΔE_0. At 300GHz: the ratio $\Delta E_0 / \Delta E_{ph} = 2899$. At lower frequencies, this ratio increases. Similarly, to unfold a protein in a chromosome (modify the crystal structure without breaking the bond), the RFR waves are 51 times weaker than unfold free energy.

As a consequence, it is impossible that the weakest c-c bond can be destroyed, or even modified, by the RFR energy. This consequence is supported by the experimental results of Adair E et al [6] and recently by Hirata A et al [7]. Even at more high power microwave pulses (65 kW and 8.8GHz), experimental results done by N K Chemeris [10] support our theoretical calculations.

C. Absorption of Radiofrequency Waves in Human Tissue

To bring the possible consequences of external exposure into perspective, we use the relation (2-1). At a frequency of 800 MHz which lies in the mobile phones frequency spectrum, the previous relation gives a power density $I_{(f=800MHz)} = 5.33$ W/m^2 (see section II-A) Then, we start with a mean density of tissue about $\rho = 1065$ kg/m^3 and consider the SAR value of, ANSI/IEEE [8] and (ICNIRP) [9], which is 4 W/kg. So, one can calculate the approximate maximum depth, λ, of the RFR waves which can penetrate in human tissue as follows:

The total power absorbed in the body, in watts, is

$\mathcal{P}$ =(SAR) (volume x density)

= (SAR) x (area A x depth λ x density ρ)

$$\mathcal{P} = (SAR) \times (A \times \lambda \times \rho) \quad (2\text{-}3)$$

The power $\mathcal{P}$ can be given by another approach:

$$\mathcal{P} = \text{power density} \times \text{surface area} = I \times A \quad (2\text{-}4)$$

Equating equations (2-3) and (2-4), one can writ:

$\mathcal{P} = SAR \times A \times \lambda\rho = I \times A$.

This gives: $\lambda = I / (SAR.\rho)$

Our calculations give the depth λ of RFR in tissue as: $\lambda = (5.33\ W/m^2) / (1065\ kg/m^3 \times 4\ W/kg) = 1.25$ mm. This value is in good accordance with the experimental results given, for water, by JA Curcio [13].

The absorption of electromagnetic waves inside matter is given by the well known decay relation: $I = I_o \exp(-\mu\xi)$; where, I_o is the intensity of wave at the tissue surface, μ is the absorption coefficient of tissue, ξ is the depth and I is the final intensity of wave inside tissue. Taking a special case where $I = I_o/2$ corresponding to $\xi_{1/2} = \lambda$ and taking into consideration that the half value of this depth is denoted $\lambda = 0.626$ mm. One gets: $\mu = \ln 2/\lambda = \ln 2/(0.0656\text{cm}) = 11$ cm^{-1}.

This value is in good accord with the experimental value given by Curcio et al [13].

D. Time Necessary for a RFR Wave to Break a Carbon-Carbon Bond

A phone mobile produces 4 watts when used, in normal way, at the human ear (2). The intensity I of the radio waves that reaches the brain is given by: $I = 4$ Watts/ $(4\pi r^2)$. Where r is the mean distance from the mobile to the nearest point in the brain (conventionally, we take r = 10 cm). This leads to an intensity I = 31.8 watts/m^2. An effective area of half of the brain which is facing the mobile phone is about 250 cm^2. This leads to a power that can arrive the brain about 0.795 Watts. Taking the assumption that these 0.795 W's can penetrate till arriving at the brain and spread allover the brain area, one can pose the question by this power, what is the period of time, t_1, at which C-C bonds can be broken?

To calculate the total energy that binds C-C atoms; we consider that the mass of the human brain is 1350 g for an adult male. The effective mass, in our calculations, is only half of these values because one uses, generally, one ear to use the mobile hand set.

Half of the brain mass contains (1.35 kg / 2) x $\mathcal{A}$ / (carbon mass number 12) = 3.389×10^{22} carbon-carbon bond. We calculate the total time, t_1, as follows:

t_1 = total energy / total power

= ΔE_0 x number of bonds/ 0.795 W

= 5.77×10^{-19} Joules x 3.39×10^{22}/0.795 Watts

= 2.46×10^4 seconds = 6.83 hours.

So, radio waves can cut the carbon-carbon bonds in about 6.83 hours.

III. CONCLUSIONS

The endless controversy about electro-magnetic fields and cancer reflects the intrinsic difficulties inherent in cancer risk assessment. It is relatively easy to prove that exposure to an agent is not associated with a statistically significant increase in the incidence of a specific type of cancer under specific exposure

conditions. It is impossible, however, to prove that exposure has no association with any type of cancer under all possible exposure conditions.

The controversy about cell phones and cancer is likely to continue either until clear-cut evidence of a hazards is established. Perhaps the greatest contribution that scientists can make to this debate is to help educate the public (and other scientists) about the uncertain nature of risk assessment, and about the breadth of disciplines and rigor of analysis that must be brought to bear if high-quality risk assessment is to be accomplished.

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Changes based on information communication technology

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Abstrac t- **Modern life is outlined by changes. These changes are global and affect practically all spheres and activities of humans' life. Revolutionary transformations in field of information and technologies are important facilitators of changes and innovations. It not only the change the daily routine but also enforce a new way of thinking, change the world vision. A new form of society existence is being built – information society. The globalisation processes are intensified due to the rapid development of information communication technologies (ICT). Globalisation is connected with the emersion of new kinds of risks, which notably affect people's security. Knowledge is an instrument which facilitates both development of the country in general and development of particular individual's legal capacity, consequently – security.**

Key words - Changes, the globalization processes, information communication technologies, risks, people's security.

I. THE CHARACTERISTIC OF INFORMATION SOCIETY

The society has experienced different forms of organization during the process of the humanity development, which could be characterized by various features and dominants of values. The four most important models of society development could be pointed in chronological order:

►Primary society – the main value – job;
►Agrarian society – the main resource – arable land;
►Industrial society – the basic value – capital;
►Information society – the main activating force – knowledge.

At the end of the 20th century and in the beginning of the 21st century industrial society has been overtaken by a new form of society existence – information society. Knowledge becomes the driving force of this society in all spheres of activities. They incorporate in the scale of economic values alongside with capital, technologies and labour widely substituting materials, energy resources and brawn. Human, as a carrier and preserver of information and knowledge, becomes the main factor for the creation of economic growth and value.

Information society (new, digital economics) can be characterized by new environment of peoples' intercommunication, business activities and other relations. The importance of geographic location of stake holders who are involved in business or other projects tends to diminish [6]. This happens because availability of high quality modern communication technologies becomes more important, which provides global society in real time.

One of the first persons who described the concept of information society (society based on knowledge) was economist Fritz Machlup, who from 30-ies till 60-ies of the 20th century was engaged in analysis of the knowledge society, wherewith his book „Placement of Production and Knowledge in the United States of America" was published. Information society called as a model of society gives possibilities for peoples' interconnection in the new environment, where availability of high quality modern technologies giving real co-operation in real time, is more important.

Jeremey Rifkin, the prezident of the Foundation on Economic Trends, the USA, calls this age as a transition from market to network, form the ownership to Access. The significance of the property diminishes bit the value of the intellectual property increases. The knowledge obtained in the process of experience becomes an ideal product. He calls this age as the beginning of „The age of Access". Rifkin specifies the fact that the impulse and capital of the new age is intellectual capital but human's creative skills are the measure of wealth. In the age of Access and network, where the commerce is based on ideas, the unwordly purpose is to be omniscient, as the one who knows how to use one's intellectual faculties will be the one who holds the power [9]. The changes mean the transformation to the knowledge society where knowledge becomes the driving force o fall spheres of human activities [5]. They incorporate in the scale of economic values alongside with the capital and other factors of manufacturing.

The economist P.Rommer characterizes accumulation of knowledge as the main factor influencing the manufacturing. He marks the fact that the company benefits not only from knowledge which it create but also from the total volume of knowledge in economics [10]. The volume of knowledge increases in the course of time as enterprises invest in the process of knowledge accumulation. This means that the differences existing in nowadays life levels of different countries start to depend already on the knowledge accumulation and the development of human capital.

As we see, the new economics relates to the sphere where the use of computer becomes a routine, information is transmitted practically immediately; and hardly anything remains constant in the process and result of continuous technical transformations [2].

The conclusion is that qualitative changes in technology nowadays have caused essential transformation in society. The transition form the industrial society to the knowledge society takes place, where the work of a human both physical and intellectual more and more is being performed by the „smart" machines crated by humans. Consequently the development of society is not possible without ICT any more. However, it is necessary to obtain appropriate knowledge and master adequate skills to use them. It means that the increasing application of ICT and development of human capital becomes the main driving force of the development [3].

II. GLOBALISATION AND ITS CAUSED RISKS

The globalization processes tend to deepen as the result of the rapid ICT development. Due to this fact reciprocal dependence of countries becomes stronger with intensification of goods and capital trade, as well as international mobility of the labour force. The countries can successfully develop with their incorporation in the commercial movement and system of international integration.

The concept of globalisation is modern and yet insufficiently defined concept which helps different authors to label rather diverse things. In spite of variety in its interpretation, globalization is a consequence of modernization and it relates to real changes which affect various areas of human activities – information and communication technologies, situation in international goods, services and other areas, situation with flow of capital, human resources and ides, condition of global environment etc. Globalisation is a consequence of modernization but not on the contrary, and it has diminished the size of the world. Consequently contacts among different cultures, which till nowadays were not real at all, now have become possible.

These changes in every area find expressions differently, however they have common basic elements. Firstly the process of globalisation means increase in economic, social, political and ecologic phenomenon scale, which is connected with the second basic feature – increase of number and intensity of reciprocal relations dependence. If two or more countries develop their reciprocal economic, political and culture connections, then the two or more parties involved gradually get used to and adapt to free access of different resources provided by their partners of co-operation; and due to specialization result stops living according to principles of self-subsistence economy [7].

Therefore countries and other subjects of international relations, their economical, and political and social security becomes dependent on international co-operation partners and conditions of their co-operation. This process could be characterized as narrowing of the global world both in time and in space dimensions and slowly changing into "global village". The globalisation process could be described as essential changes in the management of previously mentioned areas. With the diminishing of the significance of national state broader in the process flowing of goods and services, capital, human resources as well as flows of ideas, the power and ability of the state to control or even only have a minor influence is really reduced.

In the model of global world the rules of the game are not any more dictated by the decisions of particular countries' political leaders but by international economics itself, the market of global capital, goods and services with all its subsequent activities incorporated.

Globalisation is connected with the emergence of new kinds of risks. The first variety global risk is caused by the rapid increase of the world's population, which takes place simultaneously with more and more intensive use of natural resources. As the result, individual activities, which in itself do not cause direct threats to their performers, if being summed up in the world's scale, can cause hardly anticipated consequences, which can remarkably influence the security of population, and even their chances of survival. This variety of risks includes most of the global and ecological risks.

The second variety of global risks is caused by the incorporation of different countries and regions of the world in one information space, as the result negative phenomenon, e.g. financial crisis, in one country or region can in a very short period of time take over other countries and regions, cause mass panics and at least for short-term become practically unpredictable and unruled. Many global risks of economic kind have such origin; however similar risk situations can be caused by radical socially political or nationally political ideas with rapid and massive possibilities of spreading. The basis of the third variety is the global distribution of new technologies. New technologies provide possibilities both to the development and destruction of humans' security and welfare – everything depends on the application of these technologies and purposes of their users (according to A.Broks). Under conditions of globalisation it becomes more difficult to control the distribution and application of these technologies.

All varieties of risks become especially topical due to the minimal experience humans have in solving problems that are caused by interaction between the two previously mentioned elements of globalisation process – increase of intensity of reciprocal international dependence and diminishing of state's powers. The actualisation and searching for solutions is hindered by the fact that distribution of both global risks and their negative consequences are distributed very irregularly over the world; besides this irregularity is observed both comparing different regions, and as well different layers of society within one country.

In order to prevent, diminish and limit global risks, which often forward also the formation, aggravation and spreading of local risks, people must understand the

connection between their individual safety and such kind of risks. Numerous international organizations take part in the exploration and diminishing of these global risks.

III. EDUCATION – FACTOR OF SECURITY

Individuals are never directly contiguous with global risk because, although frequently it is a real phenomenon, most often is described as a theoretical argument for explaining of particular regional or local problems. Global economical, social, political and ecological risks influence the security of an individual implicitly, i.e. through local risks. Consequently it is not surprising that people are most of all upset with different actual local and individual problems. They are direct and demonstrative while global problems seem to be distant and abstract. However frequently objective reasons of these local and individual problems are problems of global scale, which can be inefficient if solved on the level of separate individuals or separate countries [7].

Knowledge is also an instrument which gives possibility to think about activities possible to implement in order to activate own feelings and opinions, as well as moral position. People are often classified according to one dimension, concentrating attention on particular issues and excluding the rest.The low lever of education means also low level of information.

People's striving for knowledge has not changed since olden times however different methods and possibilities for the world's cognition are available now – we don't have to walk with bare feet across the frozen sea in order to find out what there is behind the horizon. Today information and communication technologies provide us with much safer and faster way to cognise the world. However this is available only in case if we know how to apply these technologies but not to let them turn into the frozen sea under our feet, which may make different surprises for us. That is why people's skills to feel free and confident to apply computer and Internet are relevant help in the process of world's cognition and expanding of their horizons.

The information literacy is a rather new concept. This concept is defined as the ability and skill to find, select, assess, manage and use information; skills to assess the obtained information and its sources critically, connect the selected information with the existing knowledge; skill to use the obtained information efficiently also for solution of other problems.

The thoughts of society and realization of knowledge change under the influence of processes, currently taking place in the world, as well as change the needs of people regarding the education. All circumstances mentioned before influence the eduction and determine the reaction of educational establishments. Therefore all over the world the problems of improvement of education system and quality are the topics of the day.

As the development takes place alongside with continuous introductions of innovations in all spheres of human activities the dynamic proceses of development notably influences the profesionāl qualification and competence necessary for the new specialist emphasizing the need of continuous education, profesional perfection and social mobility. The rapid development of technologies defines the necessity for reclassifying in different age groups. The profession qualification and demanded competence change. Due to the rapid changes cause the situation that not any member of society is sufficiently educated. In this situation it is important to learn how to obtain new knowledge constantly. Currently students have to learn independently how to find out information, process, analyze and apply it, accept responsibility, take decisions, organize and manage its execution, have a self-assessment about the acquired results. Therefore ICT express as a resource of development in the process of education, where the establishment of human's self-confidence and employment potential is the final aim.

On the other hand, after assessing the previously described influence of global and local risks caused by ICT and globalization processes, on the individual's security, it has to be marked that employment and unemployment are the most essential factors. Almost every individual directly faces this risk.

One of the most essential preconditions for the improvement of residents' level of employment is preparing of qualified and educated specialists. The low level of education, professional qualification, that is outdated for nowadays demands, insufficient skills and knowledge to perform qualified job are the main factors that foster enduring unemployment. Moreover – insufficient knowledge of official language, disablement, reaching of pre-retirement age and the line of other factors increase the risk of unemployment. This is why it is essential to improve the quality of education, availability and compliance with the demands of labour market in all stages and kinds of education.However the research gives evidence that ICT skills are the limiting factor for 35% of all searchers for employment.

Therefore currently changes in education, which are based on information communication technologies, are of special attention. The process of education should be directed towards future needs – creation of a person who is mobile, capable of continuous changes. This process is dividend in two aspects:

1. Development of global information society – guide of changes;
2. Information communication technology – instrument for facilitating of changes, as in n this area individual's personal interest coincides with the needs of society.

IV. SUMMARY

1. The development of any country nowadays is determined by ICT progress and deepening of globalization. Constantly increasing development and distribution of ICT in the world set new tasks.

Therefore the problem of introduction and application of information technologies in all spheres of life has become the topic of the day. It can successfully develop alongside with the creation of the appropriate infrastructure and performing of activities for educating of the residents in the area of ICT application.

2. The consequences of ICT development – globalization causes new kinds of various risks, which influence safety and security of every individual. New technologies give possibilities both to improve and destroy humans' safety and welfare. Unemployment is one of the most essential factors that influence individuals' security (the objective reasons of the local and individual problems are the problems of global scale).

3. Knowledge is the crucial factor to diminish the influence of global and local risks on the safety of individuals. Information literacy (ability to use social activities and possibilities provided by society) is one of the most significant conditions. Information literacy is clearly connected with information communication technologies. Peoples' skills of knowledgeable and safe computer and Internet application are a significant aid in the process of the world's exploration and in the use of possibilities of social activities provided by society. Therefore ICT is expressed as a resource of development in the process of education where establishment of human's self-confidence and employment potential are the final aims.

Currently changes in education, which are based on information communication technologies, are of great importance. The process of education should be directed towards future needs – creation of a person who is mobile and capable of continuous changes.

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An LSI Circuit Education System Using Remote Controllable Equipment Network

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***Abstract*— A unique Large Scale Integration (LSI) circuit education system was constructed by using a remote controllable equipment network. The equipment network was realized by using an open-source server software, Virtual Network Computing (VNC). In the teaching of the design and measurements of the LSI circuits, the VNC enables the students to remotely control the equipments. Therefore the students are able to use various advanced equipments by using the equipments network system**.

Keywords- LSI circuit education, equipment network, VNC

I. Introduction

Many of colleges and universities aim at a production education of the LSI devices and at cooperation with the LSI industrial society. It is therefore a big subject for the LSI circuit-related education to take in effectively the high technology of the LSI developed in the industrial society.

However, the LSI circuit technology is the comprehensive technology of the devices, the subsystems, the designs, and the measurements [1]. Therefore, since the construction of the educational environment of the advanced LSI circuitry design and measurement has restrictions on budget, equipments, and a space, its realization is not easy. This paper describes that a new LSI circuit education system was realized by using the following solutions.

1) The use of advanced measurement equipments.
2) Integration of the design and the simulation, and the measurements.
3) Construction of a consistent system of the design and the measurement from device to the system.

II. Construction of Equipment Network

A technical trend in LSI circuitry is higher speed and higher frequency, since it reflects technical innovation, such as a next-generation cellular phone (4G), Worldwide Interoperability for Microwave Access (WiMAX), and multi-core Central Process Unit (CPU). Related design and measurement equipments for the devices and the subsystems are diversified and highly efficient. However, it is difficult to arrange many of these advanced equipments, and to make all students operate them directly in the LSI circuit related subjects.

However, by building a unique equipment network, many students are able to access the equipments simultaneously. Therefore the number of equipments to be used for the education is minimized. The introduced equipments were selected on a condition of consistency with the industry top class measurement performance, in addition to the network controllability, circuit co-simulation, and measurements ability from the devices to the subsystems.

In order to realize that the student can have the presence which they are directly operating the equipments, a free-software, Ultra-Virtual Network Computing (UVNC) is used [2], and its server function is installed in each PC and equipment (see Fig.1). Thereby, the student is able to remotely control the equipments, and to display the measurement result on their PC at real time. A teacher and two or more students can simultaneously control the equipments and design together a circuitry on their PCs. Moreover, the teacher even in another room is able to remotely control the students' PCs and the equipments simultaneously.

III. Major Equipments

The equipments for new education system are selected on the condition of consistency with the following specifications.

1) a top class performance in the industry,
2) flexibility in the measurements,
3) Windows OS inclusion,
4) network controllability,
5) circuit and measurement co-simulation,
6) evaluation from device to a subsystem.

The list of the main equipments introduced is shown in Table Ⅰ to Ⅲ.

TABLE I

MAJOR EQUIPMENTS INTRODUCED FOR THE EQUIPMENT NETWORK.

Equipment	Application	Spec.
Wafer Prober (Cascade Summit 9000)	On wafer measurements	20 GHz
Spectrum Analyzer (E4407B, Agilent)	Oscillator, Filter	26.5 GHz
Network Analyzer (N5230A, E4407B,Agilent)	Amp., Filter, Antenna	26 GHz
Vector Signal Analyzer (E4438C,89600S,Agilent)	Wireless LAN	8 GHz
Error Rate Tester (N4901B,86100C,Agilent)	BERT	13 Gb/s
Real Time Digital Oscilloscope (DSO81204A, Agilent)	Digital waveform analysis	12 GHz
Mixed Signal Oscilloscope (MSO6104A,Agilent)	Analog, logic circuitry	4+16ch,4GHz
Logic Analyzer (16902A,Agilent)	Multi Channel logic analysis	68ch,600Mb/s
Function Generator (81130A,Agilent)	Logic circuitry	660MHz
LCR Meter (4284A,Agilent)	Components	1MHz
Semiconductor Parameter Tester (E5270B,Agilent)	Transistor	8-Slot
Power Meter (E4418EPM/8481D)	Signal power	18GHz,-70dBm

Although there are several equipments which are not Windows OS inclusion, the equipments are remotely controlled by using General Purpose – Interface Bus (GP-IB).

Since, in the LSI circuitry design, design tools of UNIX have been used abundantly, UNIX servers and workstations are prepared.

The number of workstations is minimized, since Windows PC of the students remotely operates the UNIX workstations on an X-server.

Table II

COMPUTERS ARRANGED FOR THE EQUIPMENT NETWORK

Computer	Unit	Application	Major spec.
WorkStation (Sun Blade 1500)	6	Simulation	1.5GHz,Ultra Spark IIIi, Solaris10
Server (Sun Fire V240)	1	EDA tools	1.5GHz,Ultra Spark IIIi, Solaris10
PC (HPdc5100SFF)	43	PCs for Students	Pen4(2.8GHz), 2.5GB Memory, Win-XP Pro
Raid Unit (Sun Store Edge)	1	File	365GB HDD

TABLE III

DESIGN TOOLS ARRANGED FOR THE EQUIPMENT NETWORK

EDA	Units	Application
ADS 2006A	4	RF Circuitry, Wireless system
Microwave Office	20	Analog, RF
Visual System Simulator	20	System Design
OrCad PCB Designer With Pspice	2	Analog, Digital Circuitry
ANSOFT HFSS 10	3	Electromagnetic Analysis
Altium Designer 6	5	PCB design

IV. EQUIPMENT NETWORK

A classroom space layout is designed to perform the lecture, the circuit-design, and the measurement at one place. The students are, in the same room , able to perform a series of work of the circuit-design, the remote operation of the workstation, the measurements, the view of the equipment and the evaluation of a printed circuit board, and the data output. In addition to them the students also learn circuitry technology closer, not only through keyboard operation but through making the circuit board in the room. The view of the classroom constructed with equipments network is shown in Fig.1.

Fig. 1. The view of the classroom constructed with equipment network

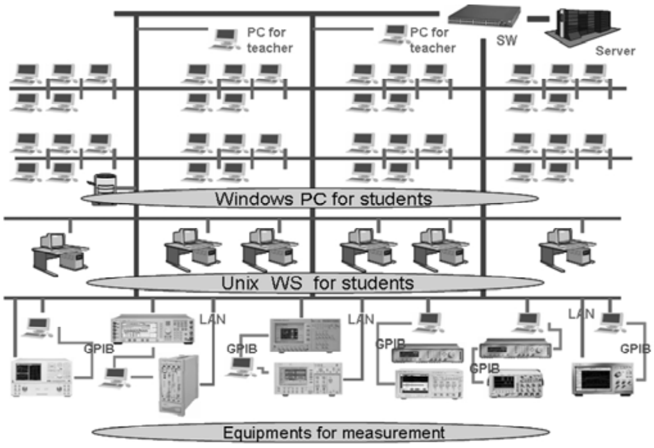

Fig. 2. The equipment network connecting students' PCs, UNIX workstations, and measurement equipments.

The students' PCs, UNIX workstations, equipments, and external servers are connected by a 1 Gb/s Local Area Network (LAN), as shown in Fig.2.

In order to realize that the students operate directly the equipments, the UVNC software is used and its server function is installed in each PC and equipment. Thereby, the remote control of the equipment and the monitor of the measurements are performed in real time on each PC.

Moreover, a teacher and two or more students are able to work for a circuitry design and an equipment control on the same PC simultaneously.

When a student is not allowed to directly access one of the equipments, the student is able to view on its PC the PC of the teacher who is controlling the equipment. Even teacher is in another laboratory, the teacher is able to remotely control the students' PCs and the equipments simultaneously. All of these connections are controlled by using a VNC controller, which is developed to manage the equipment network. Some of the students' PCs and an equipment are grouped so that the group is allowed to control the equipment, and the other students are restricted to the viewing of the equipment. The grouping is managed using the map of the PCs and equipments, as shown in Fig. 3.

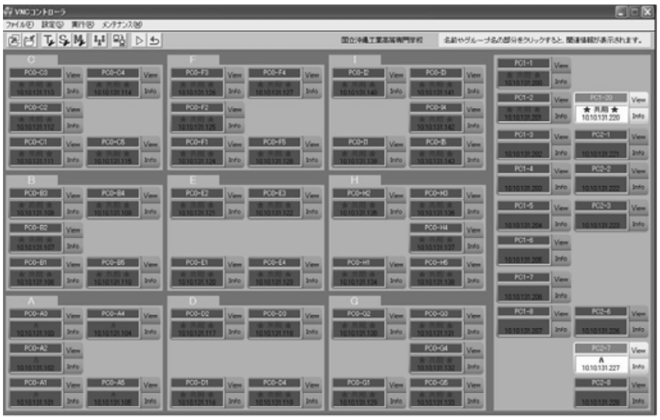

Fig. 3. The VNC control software is able to view all the PCs and equipments and to control them simultaneously

V. Example of the Application of the Equipment Network

A Low Noise Amplification (LNA) circuit for wireless Local Area Network (LAN) is evaluated as an example of the equipment network application.

The LNA is designed by using advanced circuit design tools, such as Advance Design System (ADS) and Microwave Office. Fig.4 shows the circuit schematic of the LNA.

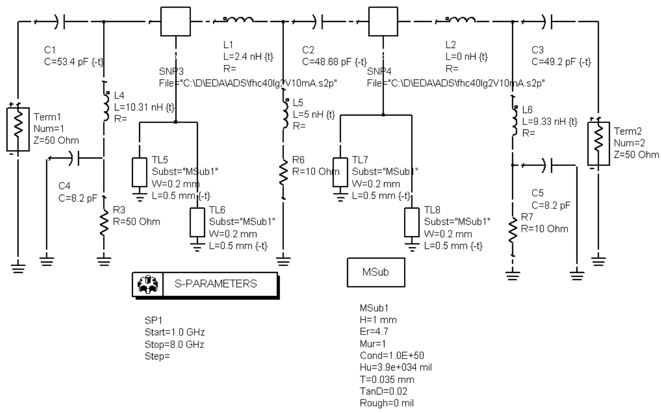

Fig. 4. A Low Noise Amplifier Designed with ADS simulator.

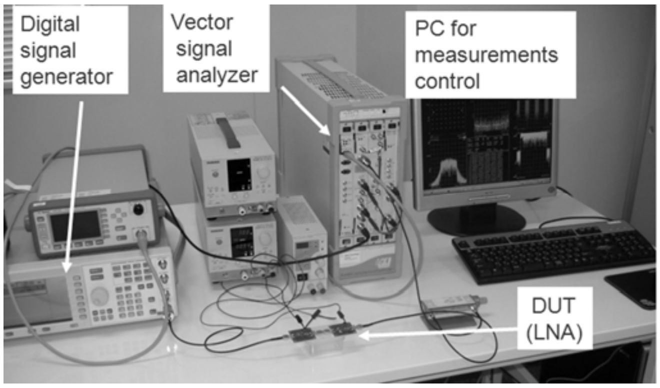

Fig. 5. The digital wireless measurement setup consists of the digital signal generator, the vector signal analyzer, and the PC for the measurement control.

The measurements system of a digital wireless communication consists of GPIB, IEEE1394, a signal generator, a vector signal analyzer, and a PC connected by the LAN for the measurement control (Fig.5). The remote control of the setup in the equipment network is performed through the PC.

A modulation signal of IEEE802-11 b/g/a for Wireless LAN is generated with a career frequency in the range of 1.5 to 2.4 GHz, and is inputted to the LNA. The output signal of the LNA is demodulated with the vector signal analyzer.

The students remotely change the condition of the modulation and measure its Error Vector Magnitude (EVM) and constellation. Fig.6 shows the students' PCs that display the measurement result. The teacher operates the students' PCs on the screen of the teacher's PC, and the teacher and the student together remotely control the equipments, as shown in Fig.7.

Fig. 6. The view of the test result and the remote control of the digital wireless measurement setup are performed on the students' PCs.

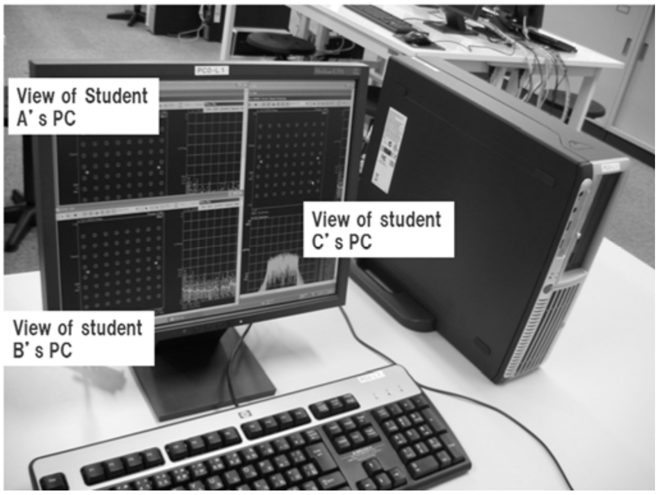

Fig.7. The teacher's PC views several students' PCs simultaneously.

Since the ADS simulates a device and a system on the design using existing equipments being used for the measurement, the student is able to study the advanced integration co-design technique of the design and measurement.

Another example of the measurement system is for an optical fiber communication, which consists of the pulse pattern generator and a digital communication analyzer connected by the LAN (Fig.8).

Since the Windows OS is included in the equipments, the equipments are accessed directly, without using any PC for the control. The students view on their PCs the measurement result of a recovered eye diagram and the Bit Error Rate (BER).

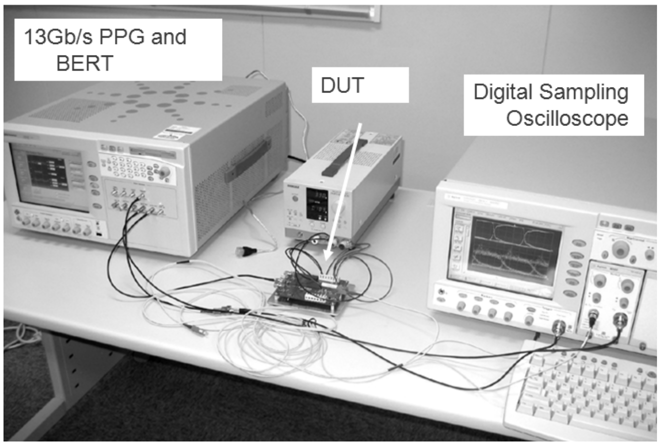

Fig. 8. The BER measurement equipment consists of a 13 Gb/s pulse pattern generator and a digital sampling oscilloscope that the UVNC is installed in.

VI. CONCLUSION

A unique LSI circuit education system using an advanced technology developed in the industrial society was constructed by the followings.

1) An efficient classroom layout which makes students design and measure the LSI circuits, simultaneously.
2) The equipment network which has a server and client function in all the PCs and equipments.
3) The use of the equipments which integrate design and measurement from the device to the system.
4) The use of the design tools for high-speed and high-frequency performance.

An advanced education was realized by using the advanced LSI technology developed in the industrial society.

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Intellectual Capacity of Custom-built Fast Retransmission Procedure for Wireless Sensor Protection Network Scheme

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***Abstract*: In the wireless sensor network when using the SCTP the node sending all retransmissions to an alternate peer IP address is useful, when the primary IP address becomes unreachable, but often degrades performance if the loss rate of alternate path is higher. This degradation is owing to the stale retransmission time out [RTO] problem that causing some amount of deficiency in the performance in the network. So here it is proposed to implement a wireless sensor network for mobile nodes that sends fast retransmission to the same peer IP address as the original transmission and sends timeout retransmission to an alternate peer IP address for the better performance in the way of implementing modified FrsameRtoAlt policy**.

Keywords: *SCTP, FrsameRtoAlt, IP address, TCP, RTO, RTT.*

I. INTRODUCTION

Since SCTP supports multihoming and multistreaming the congestion in the sensor network is at least to be minimized or eliminated. In such case an association allows data transmission from Host A to Host B to be sent to either B1 or B2 in the sensor sender SCTP node to receiver SCTP node and sensor nodes do have the properties of sensing, communication and transmission. The sensor network does contain the nodes, which have been interconnected and embedded with each other. During transmission at any given time, the data sender must not transmit new data to any destination transport address if its peer's round indicates that the peer has no buffer space. When the time comes for the sender to transmit, before standing new data chunks, the sender must first transmit any outstanding data chunks which are marketed for retransmission. So it is best to send fast retransmission to the same peer IP address by implementing modified 'FrsameRtoAlt ' in the way of timeout transmission to alternate peer IP address to enable better performance.

II EXISTING ALLRTXALT'S PROBLEM

AllRTXAlt is the retransmission policy specified for SCTP in RFC2960.This policy attempts to bypass transient network congestion and path failures by sending all retransmissions to an alternate destination. Intuitively, the sending retransmissions to an alternate path would be beneficial, particularly when the alternate path's quality is better.

A Stale RTO's Problem

Due to successful retransmissions on their alternate path cannot be used to update the RTT estimation of the alternate path. Timeouts on retransmissions, however, exponentially increase the RTO[1].The only traffic on the alternate path which updates the RTT estimate are the periodic heartbeat probes used to determine destination reach ability and these heartbeats are transmitted relatively in frequently. In many cases the RTOs is exponentially increased more frequently than it can be reduced by an RTT estimate. The result is an overly conservative RTO on the alternate path for the majority of the association. Thus, anytime a retransmission on the alternate path is lost, a timeout occurs and the timeout is likely to be unnecessarily long. In addition, each timeout further contributes to the problem by doubling the RTO value.

The dynamics of the RTO values for the primary path (8% loss rate) and the alternate path (5% loss rate) during a 4MB file transfer using AllRTXAlt .The specific transfer sent a total of 2,889 original transmissions on the primary path, of which 229 had to be retransmitted on the alternate path. The RTO value of the primary path stays relatively low (average is 2.3 seconds) during most of the transfer, because successful new transmission on the primary path updates the RTT estimation and reduces the

RTO value (most likely to back to the minimum of 1 second).On the other hand, the alternate path with a lower loss rate maintains as an average RTO value of 5.9 seconds more than double the primary's. In the other words, only three heartbeats are successfully acknowledged and used to measure the alternate path's RTT.The existing result tells seven timeouts exponentially increasing the RTO value of the alternate path.

III OVERALL VIEW OF THE PROPOSED SENSOR NETWORKS

The intelligence of the sensor network completely depends on event to be sensed and passing the event packet neighbour through the neighbour node to take over to the control node. In that, the communication is said to be successful one than the sender sensor node must have received the acknowledgement from the control node irrespective of congestion, retransmission rate and slow response [2].

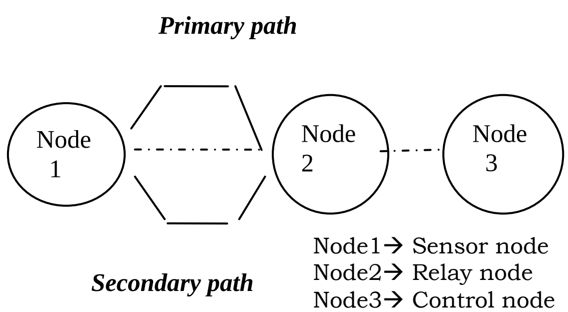

Figure 1: Proposed System

IV NEED OF SCTP

SCTP combines the datagram orientation of UDP with the sequencing and reliability of TCP. Mainly, SCTP avoids the Head-of-Line Blocking problems.

A Head-of-Line Blocking

TCP requires a reliable transfer of user data and the strict in order delivery. If the packet in the stream gets lost the remaining packets in those streams get stored in receiver buffer until the lost packet has to be retransmitted and arrives at receiver. During this period applications can not get data and do suffer from bad delay. If the receiver buffer becomes full, the sender can not retransmit the lost data. This is called Head-of-Line Blocking [3 & 4].

B Multistreaming

The Multistreaming feature of SCTP overcomes the Head-of-Line Blocking problem. SCTP supports multiple, independent logical streams of messages within an SCTP association. The number of streams is negotiated when the association is made. Each message sent over an SCTP association is assigned to a particular stream. All data with in a stream is delivered in order with respect to other data in that stream. Data in different streams have no order constraints. SCTP's resulting parallel ordered streams provide a specific instance of 'parallel ordered' delivery. It is SCTP's multistreaming service that prevents the Head-of -Line blocking problem.

C Multihoming

As SCTP end point is considered to be multihomed if there is more than one transport address, that can be used as a destination address to reach that end point.TCP creates a single transmission path from host to host and transmits over that line. If packets are dropped, it must resend those slowing down the transmission. If the path gets failure, it has to wait until the path recovers. SCTP avoids these with the extra path as soon as the primary line is lost and another path of IP address is used [5]. If packets are in need of retransmission, a secondary line can be delegated to transmit it and so that the primary link can continue with its current transmission without the delay of transmitting a past packet and the delays of the context switch to past data. By default, an endpoint select one IP address as primary path and should always transmit to the primary path, unless the SCTP user explicitly specifies the destination transport address to use.

V SOLUTION

The existing degrade performance in ALLrtx's modified policy could be improved by the followings

A FrSameRtoAlt's policy

The current retransmission ALLrtxSame may improve performance if the alternate path's loss rate is low enough to overcome the stale RTO problem. The difficulty in practice is that a sender generally has no prior knowledge about the path's condition. Without such information, the best a sender can do is balance the tradeoffs. To do so, the proposed the 'modifiedFrSameRtoAlt's policy 'uses both the primary and secondary path for the retransmission.

B Modified FrSameRtoAlt's policy

(a) Fast retransmission to the same destination as their original transmission,(i.e.) through the primary path.

(b) imeout retransmissions to an alternate destination.(i.e.) through secondary path.

As the alternate path's loss rate increases this policy give better performance since alternate path's loss rate influences less, when compared to the AllRtxAlt and this balances the stale RTO problem. As a result modified FrSameRtoAlt's performance depend more on the alternate's path loss rate.However,since FrSameRtoAlt does not send fast retransmissions to the

alternate destination, where the alternate path's loss rate influences FrSameRtoAlt's performance less than AllRtxAlt's value.

C SCTP Slow Start and Congestion Avoidance

As SCTP endpoint uses the following four control variables to regulate its transmission rate.

1. Receiver advertised window size (rwnd, in bytes), which is set by the receiver based on its available buffer space for incoming packets. This variable is kept on the entire association.
2. Congestion control window (rwnd, in bytes), which is set by the sender based on observed network conditions. This variable is maintained on a per destination address basis.
3. Slow Start threshold (ssthresh, inbytes), which is used by the sender to distinguish Slow Start and congestion avoidance phases. This variable is maintained on a per destination address basis.
4. Partial_bytes_acked, which is used during congestion avoidance phase to facilitate cwnd adjustment.

An SCTP sender must keep a set of these variables cwnd, ssthresh and Partial_bytes_acked for each destination address of its peer when its peer is multihomed.Only one rwnd is kept for the whole association no matter if the peer is multihomed or has a single address.

D Slow Start algorithm for Timeout Retransmission

Beginning data transmission in to a network with unknown conditions or after a sufficient long idle period requires SCTP to probe the network to determine the available capacity. The 'Slow Start algorithm' is used for this purpose at the beginning of a transfer, or after repairing loss detected by the retransmission timer.

- The initial cwnd before DATA transmission or after a sufficiently long idle period must be <=2*MTU.
- The initial cwnd after a retransmission timeout must be no more than 1*MTU.
- The initial value of ssthresh may be arbitrarily high.
- Whenever cwnd is greater than zero, the end point is allowed to have cwnd bytes of data outstanding on than transport address.
- When cwnd is less than or equal to ssthresh an SCTP endpoint must use the slow start algorithm to increase cwnd.

E Modified Fast Retransmission on Gap Reports

In the absence of data loss, an endpoint performs delayed acknowledgement. However, whenever an endpoint notices a hole in the arriving TSN (Transmission sequence Number)sequence, it should start sending a SACK(Selective Acknowledgement) back every time a packet arrives carrying data until the hole is filled. Whenever an endpoint receives a sack that indicates some TSN(s) missing, it should wait for 3 further miss indications (via subsequent Sack's) on the

same TSN's before taking action with regard to fast Retransmit. When the TSN's is reported as missing in the fourth consecutive SACK, the data sender shall:

- Mark the missing DATA chunk(s) for retransmission.
- Adjust the ssthresh and cwnd of the destination address to which the missing DATA chunks were last sent.
- Determine how many of the earliest DATA chunks marked for retransmission will fit in to a single packet is being sent. Call this value k.Retransmit those 'K DATA' chunks in a single packet[6].
- Restart T3-rtx timer only if the last SACK acknowledged the lowest outstanding TSN number sent to that address, or the endpoint is retransmitting the first outstanding DATA chunk sent to that address.

A straightforward implementation of the above keeps a counter for each TSN hole reported by a SACK. The counter increments for each consecutive SACK reporting the TSN hole. After reaching 4 and starting the fast retransmit procedure, the counter resets to 0.Because cwnd in SCTP indirectly bounds the number of outstanding TSN's, the effect of TCP fast recovery is achieved automatically with no adjustment to the congestion control window size.

VI EXPERIMENTAL RESULT

At first experiment of the proposed network starts by transmitting data from sensor sender node primary path to receiver node and the transmission incompletes owing to primary IP address becomes unreachable.

Secondly, the sensor sender node sends all retransmissions to an alternate path and fails in completing the transmission which degrader the performance in the network.

Thirdly, the sender sensor node sends 'fast retransmission' through the primary path after timeout retransmission in the secondary path.

Finally the comparisons of ALLrtxAlt and frSameRtoAlt have been studied. The result shows that the modified fast retransmission policy renders a congestion free situation in wireless sensor network.

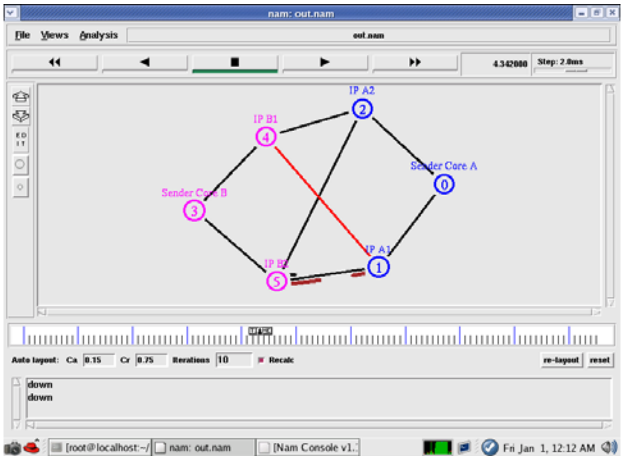

Figure 2: Data moving from Primary path A1 to B1

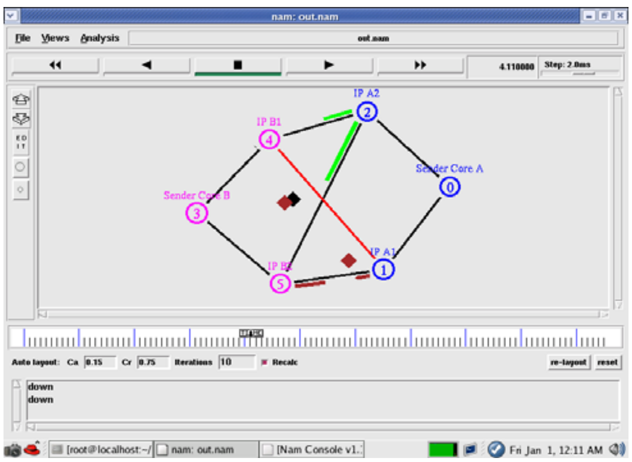

Figure3: Data moving from secondary path A2 to B2.

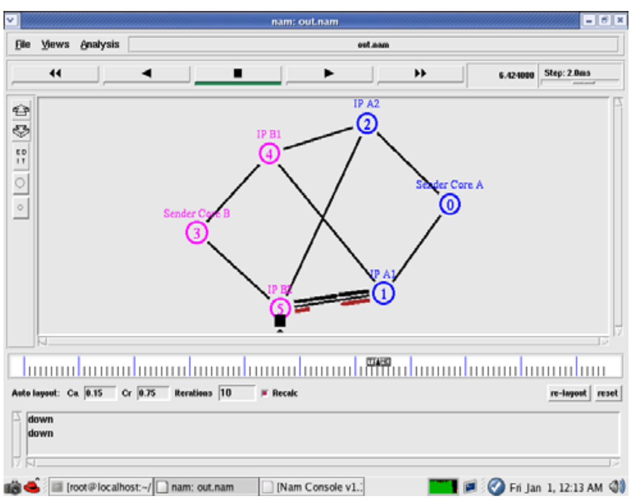

Figure 4: Data moving from primary path A1

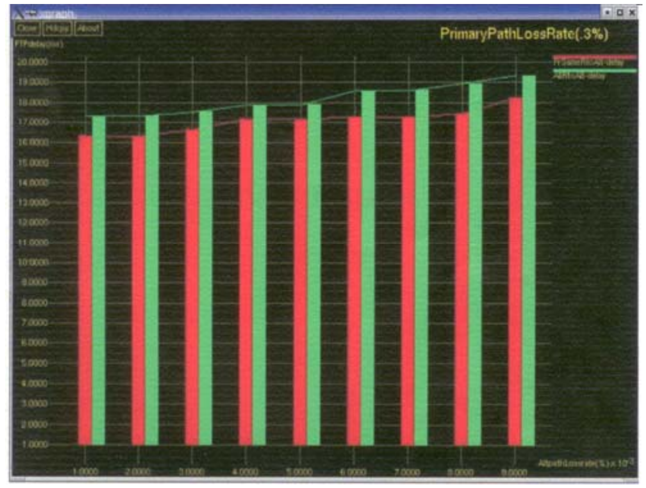

Figure 5: Xgraph output comparison between two to secondary path B2. Policies (ALLrtxAlt and modified FrSameRtoAlt)

VII CONCLUSION

The wireless sensor network does take the advantage of modified fast retransmission policy of SCTP, which best balances the tradeoffs is send fast transmission to the same peer IP address as the original transmission and send timeout retransmission to an alternate peer IP address instead retransmitting all data to the secondary path, whose performance depends upon the alternate path's loss rate. As a result from a experimental work, the efficiency of the proposed wireless sensor network has been improved by means of fast retransmission policy.

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M-Learning elevation & Enhancement through Newly Designed Crawler

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Abstract-Today's modernity is the outcome of the unbounded access to the mother of all the information to be the "data" [11] by any one any where without any discrimination to the race, color, creed or sex. Although this is readily available on the web, however it is not that easy to get the required data/information from the internet because of its complexity and mammoth size. The evolution of mobile, PDA and smart phone revolution has made all this come true. This is the reason that these sophisticated gadgets have influenced the educational environment as well.

Web crawler, an essential support or more precisely "backbone"(of the search engine), primarily used to find and download data from the web through search engine. The newly designed and architectured crawler in the local domain with certain hardware constraints. It provides the access to the metadata and links of the documents that can be used to guide the crawling process effectively and hence facilitates the M-Learning environment by removing the dead ends and by providing the required learning information for stronger mobility and agility.

Keywords: *M-Learning, Information retrieval Crawler, WWW, Search engine, Meta data, Browsing.*

I. INTRODUCTION

The global house scenario compels oneself to share the most common human asset". The data or more precisely the information" through the web. Automated software agents known as web crawler, a spider, an ant or web bot etc. serve as the backbone for the search engine and are of two types i.e. Server side and the Client side. This basically facilitates the search engine on the user request for learning or information of something and hence can be for sure useful in the learning environment called M-Learning. This learning has its own merits and of course, demerits as well.

Mobile learning is not intended to replace the classroom learning, just like the relationship between e-Learning and classroom instruction. In fact, mobile learning offers another way to deliver content and to embed learning into daily life. The learning materials need to be developed in small, consumable bytes of format, which can be delivered through wireless network. Hence, the fundamental belief of mobile learning is not to convert all PC-based learning content into the mobile format, but to consider how the mobile devices can be used to strengthen and harmonize overall learning strategy.

The overall advantages provided by the mobile learning are more flexible, accessible and personalized learning activities. Such advantages are hoped to keep the learners engaged in ongoing learning activities and further enhance their productivity and effectiveness. Mobile learning applications have to be designed with special care and sometimes different to a technology- enhanced learning system that is used in office environment. The mobile

learning system must be adaptive to the learner contexts, i.e., movement, motivation, style, background, etc. The recent development of mobile adaptively in learning has focused towards building systems that are both location aware and use an open learner model for consultation by a student, and away from a intelligent tutoring system in which the learner model was generated [12].

II. REVIEW OF LITERATURE

The first published web crawler namely RBSE was the work of Eichmann in the year 1994, while the latter in the same year were Web Crawler and World Wide Web Worm by Pinkerton and McBryan respectively. The Google Crawler was introduced by Brin and Page in 1998 where as CobWeb by da Silva et al. and Mercator by Heydon and Najork came to the sight during 1999. Edwards et al., 2001 came forward
with Web Fountain, next year 2002 saw the addition of three more with the names as PolyBot by Shkapenyuk and Suel, WebRACE by Zeinalipour-Yazti and Dikaiakos, and FAST Crawler by Risvik and Michelsen. Boldi et al., shared his contribution in 2004, in the form of a distributed crawler written in Java called Ubicrawler.

Carlos Castillo's work [3] in 2005 on the effective web crawling considers Data Retrieval, in the context of documents
to be consisting mainly of the documents containing the keywords of a user query, while the data/ information retrieval system must interpret the contents of the information items (documents) in a collection and rank them according to the degree of relevance to the user query [8]. Since the web crawlers are used to download the text based information from the web on the user query. Running a web crawler is a challenging task.

A crawler begins its task of harvesting the Web collecting the contents of an initial set of URLs, called the seeds. Then it iteratively extracts links to new URLs and collects their contents. Crawlers are configured or developed according to the purpose of the data they gather. A crawler of a large scale search engine aims to collect pages with the highest Page Rank [4, 7]. On the other hand, archive crawlers focus on crawling the most pages on a given partition [5].

An illustration of an effective crawler site visits in specific time period is given in the form of Table No.1 below, this table illustrates various kind of outcomes when different sites were visited during the specific period returning a success of about 84% site finding with 5% of the site moved temporarily while the remaining 12 catagories 11% in total stand for different status.

TABLE 1. STATUS CODE SUMMARY

Duration April 1 - May 15 ,2003 Sites visited ~ .132 Million URLprocessed ~ 4 Million Data Downloaded 78 GB.		
URL State	**Number**	**%**
Success(200)*	3235140	83.9
Moved temporarily(302)*	193870	5.0
File not found(404)*	132834	3.4
Timed out (-8)**	45486	1.2
Moved- permanently (301)*	39920	1.0
Excluded By REP (-2)**	35596	0.9
Internal server Error(500)*	33247	0.9
Not Allowed Type (-5)**	25976	0.7
Un fulfilled request(403)*	18598	0.5
Unknown Host (-14)**	17842	0.5
Size Too Big (-4)**	17453	0.5
Conversion Error (-11)**	13986	0.4
Unidentified, socket and connection errors etc (Others)*	23244	0.6
Total	**3856436**	**100**

***-** Represents the HTTP response codes

**- Represents Virtual Network special codes

III. HIGH PERFORMANCECRAWLER DESGIN AND ARCHITECTURE

The categorizing and indexing module introduced here in the context diagram below help the search engine to perform faster towards specific results. The crawler extracts the documents from the World Wide Web and passes them on to the categorization module which later is submitted to the indexer to store it for future retrieval.

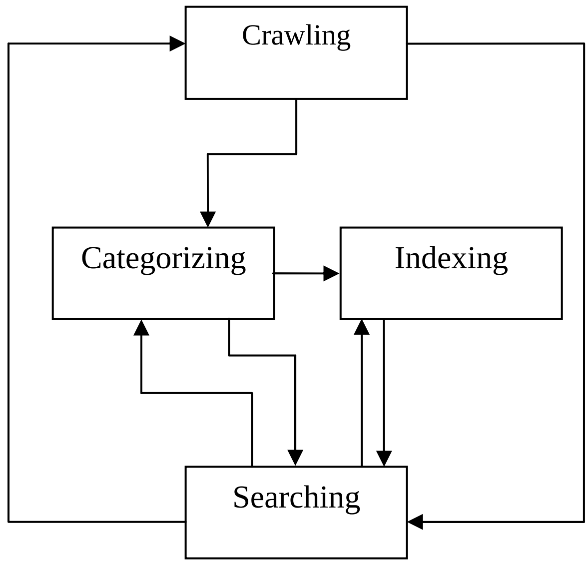


Figure 1: Cyclic Architecture for search engine, showing how different components use the information generated by other components

IV. CRAWLER'S GENERAL PROCEDURE

The Web search process has two main parts: off-line and on-line. The off-line part is executed periodically by the search engine, works by downloading a sub-set of the Web to build a collection of pages, which is then transformed into a searchable index. The on-line part is executed every time a user query is executed, and uses the index to select some candidate documents that are sorted according to an estimation of relevant for the user. This process is depicted in Figure No.2

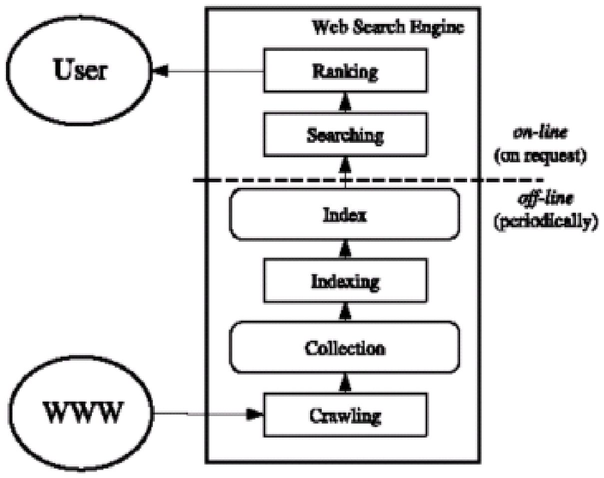


Figure 2: A Web search engine periodically downloads and indexes a sub-set of Web pages

(Off-line. This index is used for searching and ranking in response to user queries (on-line).

Web pages come in a variety of different formats such as plain text, HTML pages, PDF documents, and other proprietary formats. The first stage for indexing Web pages is to extract a standard logical view from the documents. The most used logical view for documents in search engines is the "bag of words" model, in which each document is seen only as an unordered set of words [9].

Now the application architecture of the fore mentioned high performance crawler is given underneath in the form of Figure No.3.

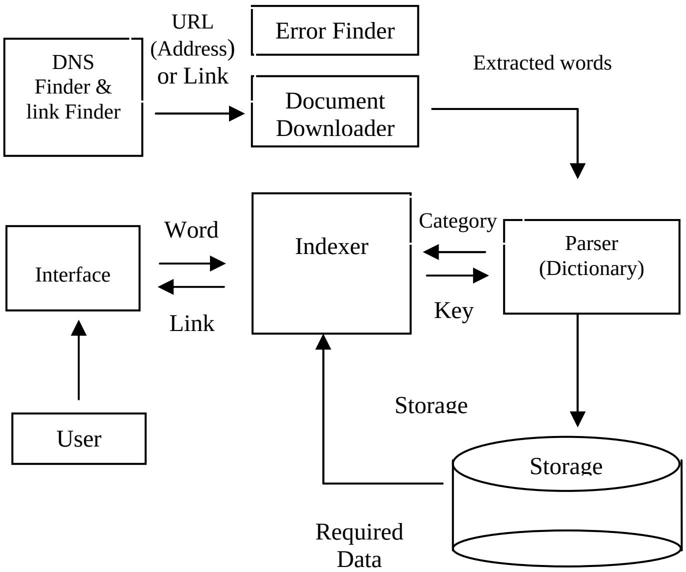


Figure 3: Application architecture of the High Performance Crawler

V. DOMAIN & METHODOLOGY

This research work has been conducted by bringing into use the following hardware and software. Intel Xion 4 processor machine with 1 GB RAM along with "Microsoft .NET technology" and use the VB.NET for this particular research, because it is hard to handle hundreds of threads manually so we choose the ".NET technology" because there is built-in handling of threads in the tool. Although we can design and handle the threads manually but the chance of occuring the exception is minimum because of built-in support it is also very helpful and easy to monitor all the process in the windows environment as well as in Linux.

We proceed with an example i.e. if we want to find the information about the body cells and we will write only the cells in the searching area then the search engine provides us with results regarding all the cells available on the internet whether they are the body cells, battery cells or the cells of the excel sheet? Means to say that sometimes we do not get the required results due to the multiple meaning for a particular word or phrase (a very vague example of this is that if we want to know abut the Hollywood film XXX then the results would almost be upside down, funny isn't it ?).

The purpose of this project is to open the research area in the field of Information Storage & Retrieval for its utilization in the mobile learning environment. The second aim especially is for Pakistani students and the researchers to motivate them in the area. It is totally general purpose and can extract information from any domain from the world wide web but currently we have focused on few of the domains for testing purpose such as .pt, .com.pk, edu.pk and .org etc because of the scarcity of the sources in-terms of hardware and software.

We have designed the URL finder which finds the available URLs on the hosted servers by generating the patterns of characters. Due to this module we are also able to make partially intelligent and automated dictionary on the basis of categorization. Once URL finder finds an available URL, it stores that URL in the available URL list and if the generated pattern is not found on the internet, URL finder saves it to the Unavailable list.

The downloader picks the address from the available list and downloads the available information on the particular address. After downloading, it tries to find the links available with in the document and make a link list. For downloading these links it will download all the available but unique links. The records of the downloaded links are stored in a database for avoiding the downloading of same link again. In some sense we can say after completing this job we are able to browse the World Wide Web offline but actually we can not because we have

designed the crawler for effective web searching not for the downloading the whole web on the PC, any mobile gadget or hand held device .

The downloader passes the downloaded document to the parser (Dictionary) and then actual job starts for which this crawler has been designed for. The parser extracts the words which are available in the dictionary and also categorize for the specification, so that a user can easily search the specific word from the search engine without any problem.

VI. ANALYSIS

Today every internet and wireless user wants to retrieve the information just with the first click from any search engine. This is even more correct in the M-learning environment. There are many good search engines on the World Wide Web doing this job sufficiently. Figure No.4 [9] shows how every search engine shares the DNS database of the other search engines or directories for their data to update the search engine along with their dependencies amongst the search engines and the web directories.

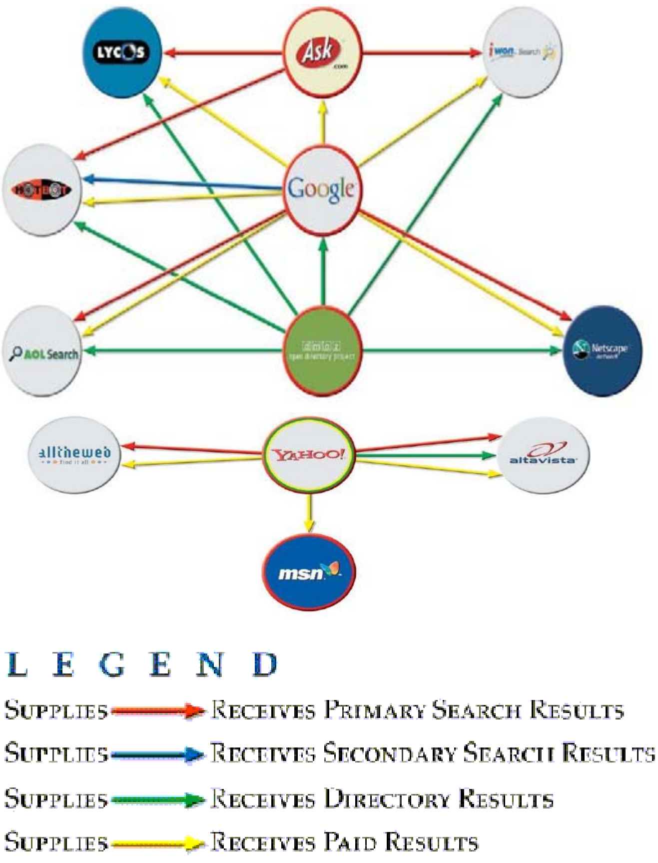


Figure 4: Search engine Sharing Mechanism for DNS database.

Already available web directories do not have all the information on the World Wide Web because many directories are being categorized manually so it is hard to enter all the information in directories because of the scalability of the internet web sites and the documents but there is a problem of dead link even with the market's top search engine. It is very difficult to handle this problem because of large volume of the documents on the internet. Sometimes the crawler is misled by the metadata to produce wrong results; if it does not take care of it.

Crawling is the most fragile application since it involves interacting with hundreds of thousands of web and various name servers which are all beyond the control of the system. In order to handle the millions of pages on the web we have designed a distributed crawler. For this purpose we have introduced a new technique for finding and saving the information from the internet.

We have configured, the web crawler of a search engine to get the most information possible about the Pakistan Web. We imposed on it the minimum constraints that ensure an acceptable performance of the crawler, considering the resources available and the need to overcome existing pathological situations on the Web, making it usable for the mobile learning. A document was considered to be valid if it was:

1. Part of the specific domain.
2. Of the type text or convertible to text type.
3. URLs depth less than 6.
4. Downloadable in less than 1 minute.

For running 200 threads simultaneously we have used a high downloading and uploading link with each request and the acknowledgement requiring 1.2 KB

For each request 512 bytes of uplink and 650 bytes for downlink (assuming the average size required for the web connection for each site to be.)

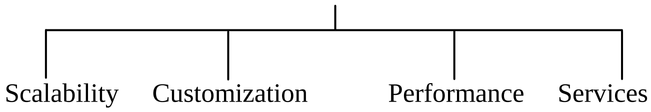
200 * 512 = 800 Kbps Uplink
200 * 650 = 1015 Kbps Downlink

Page downloader can download the 20 pages simultaneously and assume that the average of each page size is 30 KB so if we have the 8Mbps link for downloading and there are 3 parallel servers and initially we are considering the only ".com" domain. If we have 10Mps downlink for each server then the time required for downloading the whole ".com" will be Total documents on the ".com" domain ; are to be 100 millions

100 million * 30 = 3000 million
Each connection is of 10mbps = 1280 Kbytes per second
1280 * 3 = 3840 Kbytes per second
3000 million / 3840 = 781250 sec.
781250 / 60 = 13020 mins.
13020 / 60 = 217 hrs
54 days

Finally we conclude that the designed and architectured crawler facilitated the mobile users in the M-Learning by providing direct access to the internet even in the wireless environment with relatively no dead ends. This was tested and gave the following features.

VII. CHARACTERISTICS & FEATURE OF OUR CRAWLER



A. Scalability:

This Crawler is designed for the large number of documentation storing and retrieving information from the World Wide Web using the PDAs, Smartphones and the Mobiles phone devices as well..

B. Customization:

The category list in the Crawler is dependent on the parser so if we want to add more information we only need to change the parse table. So it is Highly Customizable at run time.

C. Performance

This research has been completed using the Microsoft .NET platform so it is highly portable, efficient, fast, secure and most reliable.

D. Services

This research provides services (web services) to other organizations in the M-Learning offering institutions to embed it in their applications in future.

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On The Implementation of The Virtual Universities Models

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***Abstract*—this paper provides an overview of virtual universities studies pertaining to issues, concepts and trends. Although numerous papers, reports and booklets are published with respect to that, there is still a need for an overview of virtual universities models. In this paper, we try to draw basic directions of the virtual university studies and developments. These basic directions grasp virtual universities' issues, concepts and trends in general, model, definition and basic characteristics of virtual universities in particular. Besides some educational and financial features of future higher education were stated. The paper discuses the virtual universities and distance learning are currently lacking in some areas that need to be paid attention to in the future. The paper concludes with some recommendations for the future designers of virtual universities and distance learning programs.**

Keywords- Virtual university, Distance learning, Distributed environment, Internet, Intranet

I. Introduction

Numerous papers, books, seminars workshops and conferences are dedicated to the introduction and study of virtual universities (VUs). However, there is still lacking a profound concept and overall view of VUs, and their related issues and aspects. This paper is a starting work to present an overview of important aspects of VUs, where most related issues and aspects are categorized, classified, defined and briefly studied. Recently many universities have started projects, written papers, and organized meetings and workshops dealing with the development of "virtual university." Analyzing what is really done or meant with this, you may find the following activities:

1- Teaching materials programs, syllabi, courses, assignments, etc. are posted to the intranet/Internet in a way that allows students to access them from anywhere at any time.

2- All the course and teaching materials could be accessible by all branches of the university and other partner universities in order to deliver them simultaneously to different students at different locations.

3- Study programs could be as selectable and flexible, as they on one hand meet the demands of quality education; on the other hand, they meet exactly the needs and goals of the students.

4- All university services and functions (such as administration, library, social life, meetings with staff and lecturers, cafes and so on) are simulated on the Internet so that no physical interaction will be needed any more to complete a study program.

5- A central institution offers combinations of study programs or courses from different universities to create one's own curriculum (*broker institution*).

The above mentioned are just some representative features of a VU. They don't claim to be complete coverage of such features. In reality, VUs and related features progress and change so dynamically that it is hard to make any ultimate list of features. The Information Age and the ICT developments provided an opportunity for new levels of multi-institutional, multistate and multinational collaboration to provide postsecondary education and training through existing and emerging global networks. Collaborating institutions can deliver modules, courses and degrees to individuals and groups of learners who interact with faculty and with organized learning materials, in both real-time and delayed-time (asynchronous) modes. This enriched educational environment envisioned by many academic leaders is captured in the phrase "the virtual university" [1].

This paper is designed as three sections, each dedicated to one of three key directions of the virtual university study. The first section focuses on the virtual university ISSUES (problems, obstacles, lacks). The second section covers the virtual university CONCEPTS (basic definitions, concepts and ideas behind a virtual university). In addition, the section introduces some models of VU. The third section is dedicated to current TRENDS of virtual universities from educational and technical perspectives. It concludes with brief information about some existing VU. The conclusion summarizes results of this paper and indicates future research related to the topic.

II. ISSUES

This section addresses some social, legal and technical problems, obstacles and lacks in virtual learning. In order to

disclose these issues, let's start this section from a healthy skepticism. Doing this, we cite the following question from [2]: Will management pundit Peter Drucker's prediction that the residential university will cease to exist within 30 years come true? Will "virtual instruction" replace face-to-face lectures, office hours and review sessions? How will the expanding, interactive computer networks of today change the global market for higher education? And more importantly, will the new technologies expand opportunities for those who have been traditionally underrepresented in higher education or deepen the divide between the educational haves and have-nots?

Answers to these questions depend on how the idea of "virtual university" is implemented, how "virtual instruction" takes place and what will be the range of an average virtual university. Most virtual universities are limited to the boundary of their own state or country. Many virtual universities, at the present stage, serve only a limited population, which makes it unfair to state that they have reached the basic goal, *"learning anytime and from anyplace."*

An important issue is recognition of diplomas and degrees achieved through "virtual universities." There is a great distrust about the quality of education via "virtual universities." Concerning this issue, very little progress is made to grant recognition of degrees awarded through virtual universities. Definitely, first of all, there should be developed, defined and established clear and sound criteria for degrees to be recognized. Probably, there is also a need for classification of fields, where students are allowed to get degrees, and fields where it is not possible to completely study via virtual universities i.e., fields of study like medicine, biology, chemistry, etc., where virtual education is very hard, if not impossible.

Another issue is social justice. With total emphasis on ICT and Internet access, again education remains a privilege of children with better family income, support and technological awareness, especially in countries where the Internet is still treated as a privilege rather than a daily means of communications.

Very little is known about the number of students and employers who make use of online course offerings. However, individuals who are poor, minority and whose parents are less educated have less access to the Internet either at home or at school; thus, disparity between those who can benefit from virtual education and training and those who cannot is created. In addition to having limited experience with technology, traditionally underrepresented students may benefit more from the traditional delivery systems than the virtual campus [2].

As of yet, no one is regulating the quality and relative utility of each of these providers, and as such, whether or not virtual education and training truly "levels the playing field" is yet to be determined.

Another serious issue is social, cultural and psychological aspects such as how to prevent that distance learning will not cause further isolation of a human being from the society. Just recall your college years spent at a traditional university environment and remember how much you have benefited from attending courses along with other fellow students; how much you have learned about various cultures, people and countries studying along with other fellow students from different countries; how you mastered teamwork through joint assignments and projects.

Though it should be also understandable that virtual universities are demands of the time, it is dictated by tremendous demand for facilities and possibilities for adults to participate in ever-lasting education without disrupting from industry. The best thing in this respect is to take advantage of both traditional and virtual universities. So, the above statement by Peter Drucker could be interpreted as: traditional universities have to undergo serious changes to meet the requirements of our time. It means to mix the traditional education system with a virtual one. Here, probably, it is necessary to distinguish between continuing/distance education for adults, and college education for young students. At this stage, virtual universities are directed more towards an adult population rather than young college students.

Despite healthy skepticism stated at the beginning of this section, there are very promising results created by virtual universities and distance learning in this short period. Some experiments which directly compare Web-based learning with traditional institutions have been conducted within academic settings in recent years. These experiments consistently indicate that students can learn via the Web just as effectively, or in some cases more effectively, than those in traditional classroom [3].

Distance learning has gotten a bad rap. The perception of the public is that online courses are easier (e-learning). Ed Klonoski, Executive Director of the Connecticut Distance Learning Consortium, concurs with Gunn: "The public does not understand distance education. What does distance learning mean? The Net is like a giant elephant. Everyone touches one part of it. Some use e-mail. Some use other delivery forms." As in the parable of the blind men and the elephant, people promulgate opinions concerning e-learning and whether or not it ought to be trusted based on the isolated part of the beast that they have touched.

So, summarizing all above, virtual universities' specialists need to worry about the standards for virtual education, appropriate interactive technologies, public awareness, etc. It must be stressed that despite the all existing obstacles and problems, the future dictates in favor of distance and virtual education.

III. CONCEPTS

If, just a few years ago, VU was discussed as an idea, now it is a reality. Today there exist hundreds of VUs in almost all continents, every state of the USA and many European countries. The VU system is designed for working adults who cannot afford the time away from jobs and families, people who want to study in the USA from their home country Africa or in Europe for their home country in Asia. Finally, this system is designed for those who want to make education their lifelong learning business. Furthermore, this system is designed to transform your life experience and practical skills into academic credits and achieve your goal faster, easier and better. In a word, the VU idea is to bring the university to students

instead of calling on students to universities, to adapt the university to students instead of adapting students to the university—this is not anymore an instructor-centric process, but student-centric. To use the power of modern information technologies to dramatically increase access to global educational resources throughout the world: this must be top priority in the mission of virtual universities.

Online learning gives you the flexibility to meet your education goals at your convenience anyplace, anytime! All you need is access to a computer and the Internet, and you're ready to take advantage of the many online programs and courses offered by the best colleges and universities and other providers.

A. VU Models

An important role in the success and growth of VUs is information technology. It is technology that makes it possible for distance learning universities to be successful, just in time and up-to-date. Some of these technological components, that comprise a technical environment for virtual universities, are graphically represented in Figure 1. These components are the most important technological aspects of a virtual university system that together provide a Distance Learning Support System (DLSS).

Model: The African Virtual University

The African Virtual University's (AVU's) delivery model combines a creative integration of satellite and Internet technologies that allows it to provide quality educational content from all over the world at an affordable cost, while taking into account the technological and infrastructure limitations that currently prevail in Africa. AVU places a high premium on interactivity and local learner support so as to ensure pedagogical effectiveness.

World-class professors from universities around the globe deliver classes from a studio classroom. The course is transmitted to AVU's central uplink facilities in Clarksburg, Maryland, and then beamed by satellite to its learning centers all across Africa, which are each equipped with an inexpensive satellite dish required to receive the signal.

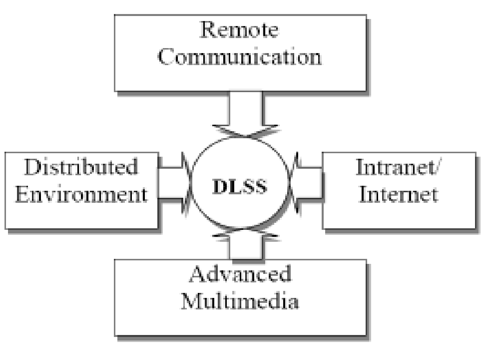

Figure 1. A Model and Components of a Virtual University

The typical AVU classroom has between 25-30 students, sitting at their desks watching the broadcast on large-screen projectors, television monitors or computers. During the class, students have the opportunity for real-time interaction with the instructor using phone lines or e-mail. This framework allows a student in Rwanda, for example, to pose a question to a professor in Togo or Paris that can be heard and commented upon by students in Benin and Senegal. At each participating AVU learning center, on-site moderators guide the students through the materials and act as liaison with course instructors.

Model: New Jersey Virtual University

Distance learning opportunities available through New Jersey Virtual University (NJVU) are designed to meet the varied educational needs of a broad range of students using a mix of methods and technologies. You should consider what delivery methods are best suited to your individual educational needs and learning style. For example, if you need the flexibility to work at odd hours and enjoy using your computer to interact with others electronically, then asynchronous online courses may work well for you. If you are interested in regular feedback and discussion, you should seek out offerings that will afford the greatest opportunity to interact with faculty and other students, such as courses delivered over the Internet or via interactive television.

B. Types of VU

- Granting a degree

- Mediating for a degree/serving as a Web-based clearinghouse for courses and degrees offered by member institutions.

C. Basic Concepts

Listed below are primary considerations for any institution desiring to become information age [8]:

- *Customized education*, where each individual receives basics, then tailors the educational experience to meet their own needs and learning style.
- *Just-in-time education*, where knowledge is sought at a time and location relevant to the learner's need.
- *Facilitated learning options*, where the teacher structures the learning environment/ resources/activities.
- *Learning organizations*, where new, timely information constantly forces the reevaluation and restructuring of processes, fundamental beliefs and databases.
- *Collaborative efforts*, where individuals interact in such forums as town meetings or virtual conferences.
- *Connectivity*, where individuals have open access to a variety of information and databases (LANs, WANs, internets, extract) as well as experts and other students.

The following are the most important opportunities that a VU provides:

Variety of programs/extensive curricula/great choice

You don't need to wait until next semester for the desired course. You are not forced to get the required amount of credits within the curricula of one university. You are free to choose the cheapest courses, from the favorite colleges and professors.

Usually, virtual universities consist of numerous member institutions, in which case they serve as clearinghouse for courses and programs. When you enroll in one of these programs, you can select courses offered by any of the participating universities. For example, just for the sake of comparison, here we look at some facts of virtual universities.

1. *The California Virtual Campus* has 131 schools, 3,692 courses and 170 programs.
2. *The Canadian Virtual University*, comprising 13 universities, offers 2,000 courses to choose from, and the list is growing.
3. *The New Jersey Virtual University* (provides an easy-touse index to over 1,300 credit and noncredit distance learning courses offered by 42 of the state's public and independent higher education institutions.
4. *Virtual University* claims to be the world's largest online learning community, serving half a million students and alumni in 128 countries.

VU Web Manager Richard Dean says, "Nearly 60% of our students at Virtual University are in the 40-59 age bracket, and this is by far our largest audience." None of the traditional universities can afford such a great opportunity, variety of program and extensive curricula including the world largest universities.

Here's what to expect as a student at a VU:

- *Program Convenience* Earn your master's or doctoral degree from the convenience of your home or workplace. The WIDU degree programs make it easy for you to further educational goals and professional objectives.
- *Rigorous, Flexible Curricula* Guide your own course of study with the help of the faculty mentors. Relate research to your personal interest and design projects that satisfy curriculum requirements and your professional objectives.
- *Personalized Support* Expect regular and frequent one-on-one interaction with faculty mentors, who provide mentorship and collegial guidance.
- *Strong Faculty Mentors* Carefully recruited scholars, highly skilled academicians and working professionals, our faculty members bring strong credentials and practical experience to the development of each student.

Global learning community

A good distance learning program should adhere to the same academic standards as the institution's traditional courses and programs. The institution should provide students with complete information regarding: the course and degree requirements, the nature of faculty/student interaction, assumptions about technological competence and skills, technical equipment requirements, and any difference between on-campus and distance learning tuition and fee charges.

Students should also expect equivalent access to academic and administrative support services, such as library and learning resources, advisement and counseling, registration, financial aid resources and other appropriate services. Distance learning offerings that provide for discussion groups and other opportunities for participants to share ideas and learn from each other further enrich the academic experience, as does timely interaction with faculty. In most cases, distance education is learner-centered, with faculty functioning as a facilitator or moderator rather than a lecturer. It is a mistake, however, to think that distance learning will be easier than learning in conventional classes; you may find it requires more work, and it certainly requires self-discipline.

To summarize all the mentioned concepts, definitions and features related to virtual universities, the following statement can be made: each institution strictly following the following characteristics can be considered as an information age university, consequently as a virtual university.

D. Main Characteristics of a VU

- The university is completely based on ICT facilities with constant access to the Internet.
- The university provides selectable and flexible study programs everywhere and at any time in the range of its coverage (city, state, country or continent).
- Students, staff and faculty are IT competent…on the desktop, in the classroom and lecture hall, and in the simulation "center."
- State-of-the-art hardware and software are at hand [4].
- Institutional IT infrastructure (classroom, lecture hall, campus) is state-of-theart[4].
- Academic programs are IT-based,"as appropriate" [4].
- University is a "learning organization"…shared vision…shared situational awareness…everyone contributes…is flat, seamless, tailorable and virtual [4].
- Students are taught and practiced in the art and science of "thinking in the information age" [4].

E. Delivery Methods/Modes, Means, Technology

The courses and programs in virtual universities are offered using various means of technology. In some cases, courses are provided online, requiring access to a computer with a modem. Others may need a VCR, access to an interactive classroom or other technology. The following are the most used terms for delivery methods/modes.

Audio Tapes—Taking a class by listening to all or part of it on your tape cassette machine.

Video Tapes—Taking a class by listening to all or part of it on your VCR player.

CD/Multimedia—A class, some or all of whose content is stored on a CD-ROM disk. This content can contain text, sound, video, graphics, animations and files to be downloaded (which means to receive a file into your computer from a remote computer and store it there).

Interactive TV—A class where you are seated in a specially equipped room where you can see, hear and converse back and forth with your professor and fellow classmates who may be located in one or more similarly equipped rooms nowhere near yours.

TV/Cable TV/Public TV/Satellite TV—Taking a class by watching all or part of it on your television set.

Correspondence Mail—Taking a class, some or all of whose content and discussions between you and your professor are carried out via printed communications, which are largely exchanged through surface mail.

E-Mail—Taking a class by communicating in part or entirely by using electronic mail or messages sent from one person, such as your professor, to another via computer networks.

Internet/Web—Taking a class where you will be asked to find information on numerous topics including, for example, your course curriculum, course content and course notes by visiting designated websites.

PC-Based Interactive—Taking a class, which involves your taking part in computer-based electronic discussions and dialogs among yourself, your professor and your classmates.

IV. TRENDS

Generally, there are three trends that must be mentioned as virtual universities progress. These are educational, technical and legal (social cultural) trends. The last trend is about how virtual universities are accepted by the society and people. How progresses recognition of this type of universities? Do these universities represent the actual future of the higher education system? For further discussions, we take a look at some works by other authors.

[5] introduces Clyde Virtual University as Europe's first virtual university. Although this article is focused on this particular university, some results and conclusions can be extended to any VU. For example, in this work we define VU trends in two aspects—educational and technical trends having a profound influence on higher education.

I. Educational Trends

- Increasing student numbers
- Wider diversity of student backgrounds
- Reaching out to the wider community—lifelong learning
- Tighter funding
- Movement towards a standard curriculum

II. Technical Trends

- Increased bandwidth
- Massive increase in the use of the Internet
- The development of 'virtual' libraries, laboratories and campuses

Some other important trends in the development of virtual universities are as follows; however, due to limited space and scope of the paper, they are listed without detailed description. For a detailed list and description, interested readers are referred to [1].

1) Lifelong learning: Due to rapid changes taking place in business and industry, in addition to the rightsizing of corporations, the average worker can anticipate having six or seven different careers in the course of a lifetime. Reskilling is becoming a requirement for employees. Companies are reengineering themselves and revamping fundamental work processes, resulting in fewer people left to do more things.

2) New competencies: Proficiency in using technology is now, for all practical purposes, a required competency in the workforce; it is becoming another basic skill. Ninety-five, if not 100% of all workers use some type of information technology in their jobs. The capacity for individuals to use technology both independently and collaboratively in their work is increasingly required. No one person has all the competencies needed in today's high-performance workplace; collaboration is essential. Is higher education staying abreast of these new competencies?

3) Telecommuting or telework: Millions of people around the world work from a home office. This number dramatically grows with each month and year. In a near future, most of working population of our society will be employed in home-based businesses. Telecommuting/teleworking is becoming a way of life.

4) Changing demographics: The changing demographics of higher education are placing new demands on institutions. A million working adults are currently enrolled part time in American and European colleges and universities.

5) Increasing demand: Current studies show an incredible growth in older and employed students seeking skills enhancement and continuing education, and the numbers go much higher each month and year.

6) Knowledge explosion: The world's volume of new information is increasing at such a rapid pace that a class of this year will be exposed to more new data in a year than their grandparents encountered in a lifetime. Knowledge doubles every seven years.

7) Globalization: Globalization of the world's economies is leading to increased emphasis on internationalization of the curriculum.

8) Productivity: With declining budgets and increasing enrollments in higher education, there is a continuing push to find ways to get more scholars for the Dollar/Euro. Demands

for greater productivity in higher education continue to be heard with greater frequency than any time in the past.

The following are some features of future higher education:

*Most students are not seeking degrees***.** Instead, modularization enables them to meet their particular learning needs, often tied to job or career goals.

*Curricular materials are outcome oriented***.** Some outcomes relate to the *goals of a liberal arts education;* others are defined more along the lines of *skills.*

*The faculty role has changed***.** As a greater amount of codified knowledge is captured in courseware, the role of the faculty member is increasingly that of mentor or leader in the learning process.

Faculty labor is applied at times and in circumstances when it is needed *that is, on-demand* rather than on a fixed schedule such as the three-lectures-perweek model [6].

The *economics of supply and demand* in the new competitive environment keep the *costs of basic courses and programs low***.**

In addition to faculty salaries, *institutional resources are expended on course materials, instructional technologies and academic support.* Some or all of those may be *purchased* from other higher education institutions and from private providers. The proportion of the budget allocated to faculty salaries is declining.

The move away from site-based educational delivery has required *different kinds of capital investments* for infrastructure. Educational *funding now follows the learner* rather than the institution. Because employers have continued to reduce their numbers of core, benefited employees in favor of part-time workers or contracted/outsourced services, most students pay directly for the education they need. Because more students are in the workforce than in the initial college-going population, more *students pay directly* for the education they need. Public institutions *no longer receive a substantial amount of state funding***.** Revenue sources include tuition, contracts with employers and other agencies of state government for training, sale of courses and courseware to other institutions, and low-interest state loans [7].

A. Methodology

An evaluation must always be done in relation to a set of criteria. Figure 2 shows the central criteria of this evaluation. These include firstly the resources reserved for promoting ICT in educational use and the implementation of the virtual university project [8]. The efficiency factors influencing the input/output ratio constitute the second theme. Performance factors created through the virtual universities are the third theme. The fourth theme is the impact that can be seen as benefits produced for the clientele, such as students or, more generally, the population [9]. The concepts of the evaluation framework have been tested in conjunction to the evaluation of the virtual universities of the University of Tampere and the Tampere University of Technology in 2006.

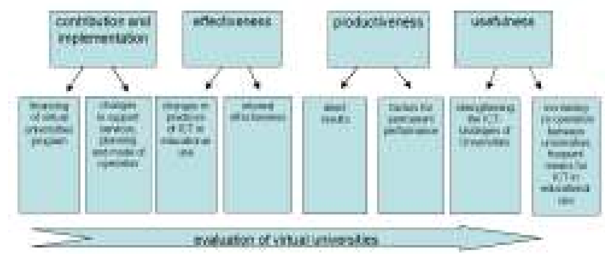

Figure 2. Four segments of evaluation for the virtual universities.

B. Some information age universities

The following are some of virtual universities spread all over the world. Information about these universities are retrieved from their websites, therefore some facts could be valid only at the moment of retrieval—for example, number of courses, programs, collaborative institutions, etc. Although the choice of these virtual universities was mainly dictated by Internet search engines, they do represent leading virtual universities at the moment [10]. It should be noted immediately that due to space restriction, just a few universities are introduced in this part. The purpose is to give readers an idea and brief information about some virtual universities, without interrupting the reading by visiting the sites in search of such information. However, for interested readers the website addresses are provided for further investigation.

1) University of Phoenix Founded in 1976, the University of Phoenix is now one of the United States' largest private accredited universities. It provides a relevant, real-world education to working adults at more than 107 campuses and learning centers in the U.S., Puerto Rico and Canada, and via the Internet. Currently, the university enroll 103,200 degree-seeking students.

2) DeVry Institutes: DeVry's historical roots lie in the technical education movement of the early 1900s. In 1931, Dr. Herman DeVry established DeForest Training School in Chicago to prepare students for technical work in electronics, motion pictures, radio and, later, television. The name was changed to DeVry Technical Institute in 1953, and it became the flagship of the current system of campuses. In 1968, the name was once again changed, to DeVry Institute of Technology. The 21 DeVry campuses in the United States and Canada compose one of the largest private higher education systems in North America. Currently, DeVry campuses are located in Arizona, California, Florida, Georgia, Illinois, Missouri, New Jersey, New York, Ohio, Texas, Virginia, Washington, Alberta and Ontario, Canada, serving some 47,000 students. The DeVry system has expanded in curriculum and degree offerings as well. In 1957, the DeVry Institutes achieved associate-degree-granting status in electronics engineering technology and 12 years later were authorized to grant bachelor's degrees in the same discipline. Computer Science for Business (later renamed Computer Information Systems) was introduced in 1979 as DeVry's second bachelor's degree program. U.S. DeVry campuses are

accredited by The Higher Learning Commission and are members of the North Central Association (NCA).

3) The California Virtual Campus: The California Virtual Campus was created under the auspices of the Chancellor's Office for the California Community Colleges [11]. One of its major responsibilities is the continuation of the Web-based distance-education catalog developed by the California Virtual University. CVU ceased operations in March 1999. CVC is maintained by El Camino College and Santa Monica College. The CVC has 131 schools, 3,692 courses and 170 programs. The California Virtual Campus does not grant degrees or certificates. Through its service, learners can find out about courses and certificate or degree programs offered at a distance by California's leading institutions of higher education; and it connects learners to the appropriate campus to enroll and find out more information.

The mission of the California Virtual Campus (CVC) is to bring the best of California higher education to full- and part-time students in California, the United States and throughout the world. CVC is intended to expand access within California to post-secondary education and assist the state in meeting the needs of a significant portion of the nearly 500,000 additional students projected to enter California's higher education institutions over the next decade.

Additionally, CVC seeks to provide to California employers a means by which they can improve the productivity of their workforce through an extensive network of high-quality, distance-education programs and services. As California's large corporations launch sophisticated intranets and small businesses utilize the Internet, CVC can provide access to a wide range of courses and programs delivered over these new platforms.

4) New Jersey Virtual University: NJVU provides an easy-to-use index to over 1,300 credit and noncredit distance learning courses offered by 42 of the state's public and independent higher education institutions. The index also includes more than 40 complete degree and certificate programs, at the undergraduate and graduate level. NJVU coordinates distance learning for the state, but is not a degree granting institution. After finding the right course or program for you, registration takes place at the host institution. The index allows users to search for desired courses or programs by institution, subject area, mode of instruction or other criteria. It enables users to combine criteria to locate the precise offerings that best meet their needs. The index also enables users to link directly to an institution's distance learning Web page or online catalogue for specific information regarding courses, admission, registration, cost and other facts about the institution. In addition to course and program information, NJVU provides valuable resources to faculty members interested in online teaching and technology-mediated instruction.

Distance learning through New Jersey's colleges and universities provides flexibility and an increased opportunity to meet individual and workforce needs. The courses and programs offered by New Jersey higher education institutions respond to the needs of a diverse population of learners requiring flexible timeframes and convenient ways to access education.

5) The African Virtual University: The African Virtual University (AVU) is a "university without walls" that uses modern information and communication technologies to give the countries of sub-Saharan Africa direct access to some of the highest quality academic faculty and learning resources throughout the world [12]. AVU is bridging the digital divide by training world-class scientists, engineers, technicians, business managers and other professionals who will promote economic and social development and help Africa leapfrog into the Knowledge Age. Since the launch of its pilot phase in 1997, AVU has provided students and professionals in 15 African countries with more than 2,500 hours of interactive instruction in English and in French. More than 12,000 students have completed semester-long courses in engineering and in the sciences, and over 2,500 professionals have attended executive and professional management seminars on topics such as strategy and innovation, entrepreneurship, global competencies, e-commerce and Y2K.

6) Kentucky Virtual University: The Kentucky Virtual University (KYVU) was created in 1997 with passage of the Kentucky Postsecondary Education Improvement Act [13]. Opening its doors to 235 students in the inaugural Fall 1999 term, the virtual university grew quickly to over 3,200 students by Spring 2001. KYVU plays a critical role in achieving the goals for 2020 outlined in that legislation. The virtual university is dedicated to playing a major role in fulfilling the Council on Postsecondary's goal of adding 80,000 more students to the college ranks by the Year 2020.

7) Western Governors Universit: In late 1998, Western Governors University (WGU) began operation as the United States' first exclusively virtual university. WGU was formed by the governors of 17 states (plus Guam), along with a number of business partners including Microsoft, Sun Systems, IBM and AT&T. It has no plans to hire faculty, but will procure its online academic materials from businesses and institutions of higher education in the U.S. or other countries. Students anywhere in the world can enroll.

WGU's mission is to "expand educational opportunities for learners everywhere" and provide access to a "dispersed population of students who might not otherwise have access to higher education and to those needing workplace training." On June 6, 2001, the Accrediting Commission of the Distance Education and Training Council (DETC) announced that WGU has been granted accreditation. There are more than 50 institutions offering courses or degrees through WGU.

8) Canadian Virtual Universit: Canadian Virtual University (CVU) is a partnership of universities across Canada, committed to delivering university-level programs that can be completed from anywhere in the country or beyond. CVU comprises 13 Canadian universities offering over 175 programs available through the Internet or by distance education.

9) Clyde Virtual University: Clyde Virtual University (CVU) was founded in 1995 with funding from the Scottish Higher Education Funding Council to develop and deliver Internet-based teaching materials to students registered at five institutions in the West of Scotland [14]. Founded in 1995 as Europe's first virtual university, CVU combines the academic and technical strengths of Glasgow, Strathclyde, Glasgow Caledonian and Paisley universities, together with the Glasgow School of Art. It has become the central repository for learning material for these institutions.

10) Virtual University: Virtual University claims to be the world's largest online learning community, serving half a million students and alumni in 128 countries. VU Web Manager Richard Dean says, "Nearly 60% of our students at Virtual University are in the 40-59 age bracket, and this is by far our largest audience."

11) The World Information Distributed University: WIDU takes advantage of both VU and conventional universities. VU means that WIDU has professors from other universities, collaboration with other universities, distance learning opportunity, etc. Conventional means that WIDU has campuses, departments, educational sites, etc. Another big difference, WIDU confers degrees upon outstanding personalities, political and public figures. It also awards honorary degrees to outstanding professors. But, what is most important, WIDU is a degree-granting institution that offers degrees at all high levels—MSc, PhD and Grand PhD (this is a Postdoctoral Degree, equivalent to Doctor of Science, or German Habilitation).

V. CONCLUSION

From the study in this paper, the first important conclusion that can be derived is, distance learning will not replace the traditional classroom setting, but it provides extraordinary opportunities for students, particularly those constrained by time or location. Concerning quality programs, the programs should include a number of the same elements contained in a traditional university: technical support, individualized attention to students, mentoring and faculty-student exchanges. Based on the view of various authors and experts, the following recommendation could be helpful for the designers of future virtual university systems, curricula and programs; makers and providers of technology; and public policymakers: make access a central concern, keep the allure of technology in perspective and learn from past ventures in distance education. Try to keep traditional universities open for those who will prefer to get their degrees in the traditional environment and enjoy studying along with other fellow students. As future work, we are planning to capture the mentioned issues and aspects in separate and in more detail. Each of the mentioned issues is a topic for a profound research work.

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A new vision of Open Source based e-learning Portal

The development of innovative web technologies for e-learning

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Abstract— **The aim of the project is the development of an innovative, Open Source-based eLearning portal, which provides high scalability and versatility, as well as it is easy to upgrade; it aims at meeting some changeable requirement in the field of distance learning (yearly or even monthly innovation). The modular structure and flexibility provided by the portal makes this system adaptable to any kind of educational and/or academic situation, allowing also the development in step with innovative and specific Web Technologies. The main aim of this project is the realization of an e-Learning portal with collaborative organization of contents and with a section dedicated to collaborative distance learning. Integration between software and learning structure will improve portal features, and teaching/learning process.**

Distance learning, collaborative learning, open source platform, teaching/learning process. (key words)

I. eLearning Portal Project *(Heading 1)*

The aim of our project is the development of an innovative Open Source eLearning portal, with some distinctive features: (1) scalability; (2) high versatility; (3) easy to upgrade; (4) suitable for many environments. The portal will provide a collaborative managing contents structure, and social networking instruments for distance learning. In order to meet these basic topics, our project provides a modular system, looking towards mobile learning technologies, thanks to MobilED software. Developing and planning new methods and modules will represent the future of the present research project.

A. Application fields

The possible scenarios of this flexible website are various: we can successfully manage a university department, or even e-Learning courses. It is possible to manage "virtual classes" or organize "workgroups" involving foreign students. The possible scenarios are: (1) Classrooms: Fle is suitable for "virtual classrooms". (2) Universities. (3) Postgraduate specialization course: (there is an actual example represented by comedudida.org: this experience has guided our work in this project). (4) Administration of entire university departments: thanks to the *zope+plone* structure, we are even able to manage many bureaucratic issues in a course. (5) Blended learning project. (6) Simplify collaboration in research groups. (7) Build new collaborative structures: thanks to a collaborative learning approach, this portal is also suitable to build other collaborative-based activities. (8) And so on... the extreme flexibility of this structure can adapt the platform according to specific needs.

B. A specific situation

The project has been developed thanks to the experience obtained in managing a postgraduate specialization course promoted by University of Bari (http://www.comedudida.org) and it keeps developing as suitable tools for proper online formation are designed. We found that a specific PHP/Mysql platform, especially designed for our course, was too difficult to upgrade and too rigid to be managed and it is problematical to follow educational technologies innovations. We need a flexible structure in order to upgrade the course every year and add some new features, as well as we need powerful control in course activities, in order to follow students accurately. We need to upgrade learning methodologies, improving collaborative technologies, and following the approach proposed by Web 2.0. There is a well-established trend dealing with updating and improvement of teaching methodologies, using Web 2.0 tools.

The main aim is to apply the "e-Learning 2.0" concept with collaborative activities and tools created in order to "create knowledge", instead of using traditional tools. This methodology focuses on collaborative activities, the latter meant as the basis of "knowledge creation".

Fle educational approach is based on a social-constructivist theory, giving prominence to experience-based learning. Fle is considered as a single tool: it does not provide the "bureaucratic + back office" requirements of an online course. The structure provided by Zope + Plone allows administrators to manage different scenarios, such as an online secretariat both for a single course or an entire department. The structure of this portal allows the differentiation of specific roles for the secretarial staff, thus enabling managing functions for their organizational activity.

II. Main Features

A data-based management system (DBMS) provides users data storing, privileging the existing contents, and even the modification of each user on this contents. This is useful to preserve every version of didactical object, to do a “come back” to previous content status. The flexible modular structure makes this system adaptable to many educational and/or academic situations. Updating possibility and flexibility towards the necessity of implementing innovation into technology as well as educational and meta-cognitive methodologies were the basic criteria for choosing the software used to build and develop the portal. The innovative nature of this project will also help the development of Mobile Learning, thanks to MobileED project. The model focuses on student-centered collaborative activities aiming at producing knowledge and designing artifacts by embedding meaningful tools and involving the use of information and Communication Technology (network computers and mobile devices) in the learning process. We managed to apply the concept of “eLearning 2.0” with collaborative activities and tools designed to “create knowledge” instead of following the traditional learning method.

Fle is the acronym for “Future Learning Environment”: the theoretical background of FLE is located in the social-constructivist theory, which considers learning as participation in social process of knowledge construction. Our attention is also focused towards bureaucratic issues, but FLE is not adequate to carry out this kind of activities. In our environment we need to streamline bureaucracy issues. The platform aims at solving some administrative problems that may be encountered throughout the course. The Zope+Plone structure provides a strong and flexible office and course administration solution with specific “office/staff-users” different from other roles (such as tutors or professors.)

A. *Software Tools*

This portal project is based on Open Source software and tools: (1) Linux Server (gentoo). (2) Client (any OS) + Browser. (3) Zope. (4) Plone. (5) Fle. (6) MobilED. (7) LeMill.

Zope is an open source application server for building content management systems, intranets, portals, and custom applications. The Zope community consists of hundreds of companies and thousands of developers all over the world, working on building the platform and Zope applications. Zope is written in Python, a highly-productive, object-oriented scripting language. Zope stands for “Z Object Publishing Environment”. It can almost full manage with web-based user interface. Zope publishes on the web, python objects that are typically persisted in an object database called ZODB. These objects could be documents, images, page templates, and so on... and are available to users to create and manage them trough the web. Specialized object types, such as wikis, blogs, and photo galleries, are available as third-party add-ons (called products), and there is a thriving community of small businesses creating custom web applications as Zope products.

Plone is an open-source content management system/framework that works hand-in-hand and sits on top of Zope. It is a free software and is designed to be extensible. It is suited for an internal website or may be used as a server on the Internet, playing such roles as a document publishing system and groupware collaboration tool. Plone is written in Python. This programming language, can be used to add new features to Plone, and used to understand or make changes to the way that Zope and Plone work. By default, Plone stores its contents in Zope's built in transactional object database, the ZODB. There are products and techniques, however, that share information with other sources, such as relational databases, LDAP, filesystem files, and so on… Several Products may be combined by Plone in order to provide additional functionality; these products are distributed through the Plone website or otherwise. Plone's strong points are accessibility and multi-linguality. It's secure, but has heavy resource dependencies. Plone is noted as a good intranet software. It is suitable for high-load production internet sites using caching via Apache/Squid in front, combined with the CacheFu Plone product.

FLE is a web-based learning environment: a server software for computer supported collaborative learning. Fle is a Zope product, written in Python. This project is an open source and free software released under the GNU General Public Licence (GPL). Fle user interface is translated into more than 20 languages including most of the European languages and Chinese. It is used in more than 70 countries. Fle is designed to support learner and groups centered work that concentrates on creating and developing expressions of knowledge (i.e. knowledge artifacts) and design, in fact it is focused on collaborative learning and teamwork. With FLE instruments, we can create virtual classes, giving them the possibility to create and develop knowledge artifacts and design.

The MobilED initiative is aimed at designing teaching and learning environments that are meaningfully enhanced with mobile technologies and services. MobilED deliverables are to develop a set of scenarios and guidelines of how mobile technologies could be used for teaching, learning and empowerment of students within and outside the school context. A set of concepts and prototypes that will be developed into a MobilED platform that facilitates and supports the scenarios and guidelines developed and testing, evaluation, dissemination and sustainability strategies for the MobilED platform in real contexts with real people. MobilED Server is a set of mobile services targeted for mobile learners. In the first stage MobilED experimenting with SMS gateways, and wiki engine; but future developments also include moblogging (text, audio, images and video) or mobwiki (uploading audio, images and videos to Wiki), as well as knowledge building and problem solving tools and simulations.

LeMill is a web community for finding, authoring and sharing open and free learning resources. Its main target group are teachers and learning content authors, but anyone is free to join. It's an Open Source server software. All learning resources in LeMill must render properly in modern web browsers. There are two kinds of content in LeMill: media pieces and learning resources. A media piece can be a single image, short audio file, or short video clip. A media piece is something that is probably not very useful in such a learning

situation but can be used as part of a larger resource. Learning resource is a larger unit of content. For instance a learning resource can be the complete lesson material used in a course. The idea is that you can build learning resources from the media pieces.

B. *Software Structure*

The software structure is modular / onion-skin, in fact we can see that the core is the programming language (Python), so that we have Zope, which works as a strong and stable web server and then, at the upper level, we can find Plone and Fle which are the effective user interface.

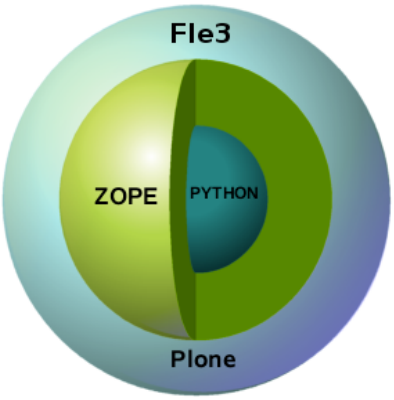

Figure 1: The software's modular structure

III. THE DIDACTIC ENVIRONMENT: FLE

To use Fle you need a computer connected to a computer network. The network you will be using is most likely, the Internet. However, a connection to "public Internet" is not a requirement as it is possible to use Fle in a local area network or Intranet using the Internet protocol. Contact your administration to establish the most suitable connection. Fle works with every standard web-browser. In your web browser you just have to point to the location of your Fle server installation and log in. Fle contains three learning tools for collaborative learning and several administration tools.

Fle WebTop can be used by teachers and students to store different items (documents, files, links, knowledge building notes) related to their studies, organize them into folders and share them with other users. WebTop also includes a shared "course folder" for each course. The same shared "course folder" is available in the Knowledge Building and Jamming tools as well. The items in the WebTops can be called learning objects.

With Fle Knowledge Building tool groups may carry out knowledge building dialogues, theory building and debates by storing their thoughts into a shared database. In the Knowledge Building study group may use Knowledge Types to scaffold and structure their dialogues. The Knowledge Type sets are fully editable and one may export and import them from one Fle to another. Fle comes with two default Knowledge Type sets: (1) Progressive Inquiry, and (2) Design Thinking.

Fle Jamming tool is a shared space for collaborative construction of digital artifacts (pictures, text, audio, video). A study group may work together with some digital artifacts by simply uploading and downloading files. Versions are tracked automatically and different versions are displayed graphically. Jamming can be used for many kind of collaborative work requiring versioning.

For teachers and administrators Fle offers tools to manage users and courses / study projects. The administrator may also export and import courses or the full content of Fle database in XML format (compatible with the Educational Modeling Language – EML). Access to common users is forbidden for this instrument.

IV. FLE SCENARIOS

A. *In a classroom*

Two teachers in a secondary school decide to carry out a study project with the classes they are both teaching together, on the production and use of solar energy. One teacher is a science teacher and the other teaches history, economics and social sciences. Together the teachers plan the major phases of the project, search for materials and discuss what are the main concepts, ideas, and skills they want their students to master by the end of the project. To enrich the students learning process the teachers invite two parents to join the online class. One parent is a locally known Green activist that supports alternative energy sources whereas the other parent is working as a researcher in a power company, maintaining nuclear power stations.

Once the study period starts the teachers give a tour of Fle to the students and explain what kinds of modules, tools and materials are available. Furthermore the teachers explain to the students how the work is supposed to progress in Fle, and remind them to be active producers of their own study problems, explanations and deeper knowledge found from different sources. For the participating parents the teachers explain that their role is mainly to act as external experts, from whom students may get scientific information and references to information sources. The study group starts the work in Fle's Knowledge Building module by presenting questions and problems related to solar energy. Some of the problems presented in the first stage are such as "why all the roofs of all houses are not covered with solar panels to gain as much solar power as possible?" Students also present their own explanation and prior understanding of the topic. For instance, a student's own explanation of the previous problem could be: "there are not enough factories to produce all the needed solar panels". After several hours of working with the Knowledge Building students are divided into teams. The teams define for themselves their inquiry tasks and goals. In order to find scientific knowledge on solar power and the economics of energy, students use their school books and books from the library. Students also have access to several article databases on the Internet and the expert parents offer them a lot of new information. Some of the groups want to try some experiments, so they decide to use the school's science lab and some simulation software available in the classroom computers. For instance one group does a comparative study on the costs of the production and use of solar energy compared to nuclear energy.

As a primary source of their study, they use case studies found from the Internet. At the end of the project the groups present the progress of their work to others and publish it in the form of a study report and poster. The posters are presented in a closing conference organized at the school. At the end of the project all the works are available at the school's digital library on the Internet.

B. In a blended learning project

Three students coming from Bangalore, Johannesburg and Helsinki meet in the queue to the new Bibliotheca Alexandrina in Egypt. While waiting to get into the library building they chat about their experiences in Egypt. All of them have noticed that the air quality in Cairo is not very good. On the other hand all admit that it is not that good in their home towns either. The engineering student from Bangalore has just read about different new techniques and materials for filtering air pollution. The business management student from Johannesburg, who drives a scooter himself, is wondering why there are no motorcycle helmets where these kinds of filters are attached. The industrial designer student points out that it would be better to filter the air earlier than in front of people's mouths, but still agrees that the protection device could also protect people from pollution. After visiting the library the students exchange and share e-mail addresses and disappears into the bazaars of Alexandria and Cairo.

A month later the student from Bangalore writes an email to the students he met in Egypt. He proposes that they could make a study project about a filtering system for motorcycle helmets. The student from Johannesburg is very interested in the idea but definitely wants to have his friend who's studying environmental politics to take part in the project, as well. The industrial designer student from Helsinki is at first very skeptical and wonders if they will ever get any credits from the work. Finally he goes and introduces the study project idea for his professor who thinks it is a brilliant idea, and wants to be the tutor of the study project. To strengthen the team the student from Bangalore proposes that his sister, who uses a motorcycle daily to go shopping, could also take part in the team. The students believe that the sister is able to contribute with relevant information based on her experience of using a helmet. Before starting the project the students still make sure that they can compensate some studies in their study programs with this study project.

To start working in the study project the student in Bangalore sets up the Fle server. He invites all the participants to the server and they start to have a general discussion in Fle's Knowledge Building module. In the first stage of the project all the participants introduced themselves and get familiar with each other. In the second stage the participants collect information related to filtering technologies, motorcycle helmets, city life and air pollution in big cities and share their findings in Fle. In the third stage of the project all the team members define the design challenges from users, engineering, design, manufacturing and business points of view. The process moves on by presenting different design ideas and evaluating them. After five weeks of intensive work in the Fle Knowledge Building, the group has an initial concept idea for a helmet with a filter. To elaborate the idea and to put it in more concrete form, they move to work in Jamming. One of the students makes a draft sketch and blueprint of the design, to start the jam session. The members of the team provide different variations that derived from that starting point.

V. Educational and Teaching Effects

A. Student centered collaborative production of knowledge and desing artifacts.

Fle software is based on the concept of a 'Future Learning Environment' developed since 1998 by University of Art and Design Media Lab in cooperation with the Center for Research on Networked Learning and Knowledge Building, Department of Psychology at the University of Helsinki.

The term 'Future Learning Environments' is a loose conception of learning which differs from traditional content, teacher, and didactic-based teaching by emphasizing meta-cognitive, problem solving and cooperation skills. The concept stresses student centered collaborative activities aiming to the production of knowledge and design artifacts by embedding meaningful tools and involving the use of information and communication technology (network computers and mobile devices) in the learning process.

B. New ways of working and new kind of curriculum thinking

The theoretical background of the 'Future Learning Environment' concept is located in social constructivist theory that sees learning as a participation in social processes of knowledge construction. Future Learning Environment should not be understood only as Fle software. The whole concept includes certain pedagogical thinking, hypothetical use cases and situations where Fle software could be useful. The role of Fle software is to be the learning tool of the 'Future Learning Environment'. This means that the 'Future Learning Environment' requires much more than Fle software. Traditional school communities utilizing a teacher-centered approach, with 45-minute lessons and strict division of school subjects must carry out organizational changes, such as new ways of working, new kinds of scheduling and new kinds of curriculum thinking in order to become 'Future Learning Environments'.

C. The Italian scenario

It is interesting to note that many relevant investigations have been carried out in order to verify and certify online formation. Some organizations, in particular, have performed studies in this field: the CERFAD Committee (Certificazione dei materiali e dei servizi per la Formazione a Distanza) supported by Regione Emilia Romagna; project IPERION (Servizi Telematici per la formazione continua e la sua certificazione) as part of the initiative called Adapt and funded by Ministero del Lavoro e della Commissione, European Community; the model developed by the inter-planning group NetEnterprise-Andromeda, coordinated by Cefal in collaboration with Department of Electronics, Information Technology and Systems, University of Bologna; the local research Unity, University of Palermo; the Open Trainer

project, supported by partnerships such as the Department of Educational Sciences, University of Padova.

D. *Fle3 is a tool for group centered work*

In the field of learning technology solutions Fle has very specific aims. We hope that Fle will be useful in constructive and inquiry-like learning processes. We know that, for traditional teachers, concentrating on instruction and didactic-based training, Fle might not be the right tool. Fle does not lend itself easily to ‘material based learning’, where obligatory course material is delivered and then questioned. Neither does Fle offer much support for teacher-centered models, where the teacher tells learners exactly what to do and when to do it. Fle is a good tool for group-centered work that concentrates on creating and developing expressions of knowledge (i.e. knowledge artifacts). Fle is a software for computer supported collaborative learning (CSCL) taking place in a ‘Future Learning Environment’.

E. *The actors (roles) in the didactic environment*

As to technological and educational solutions, Fle has a specific goal. We think of Fle as a useful tool for a constructive learning process, as well as research fields. We are also aware that Fle is not the right tool for “traditional” teachers. Fle cannot be adapted to standard, traditional materials, the latter being simply provided and verified. Similarly, Fle does not provide an useful contribution to teacher-centered approaches (teachers tells what to do, and when). Fle is a valid tool for knowledge-creation development workgroups. Fle is a CSCL (Computer Supported Collaborative Learning) software developed for a “Future Learning Environment” .

F. *Defined roles in educational platform*

In the Constructivist teaching methodology and the situationist perspective, the teaching environment includes not only technological tools but also the cultural, social, psychological and affective scenarios behind every participant, as attitudes, moods, participations, suggestions, aids are negotiated and shared.

A learning environment is determined [1] by a series of conditioning occurrences: the physical space or the set of participants (even in a distant environment) which interact, as to fixed behaviours, rules and bonds, operating (shared) activities, objects to be observed, manipulation of reading activities, relations established among participants, the atmosphere created within the group, self-expectations, mental efforts in learning processes turned to sharing activities and negotiation.

The new theoretical learning frame, represented by social-constructivist theories of thought, that is knowledge formed through interaction and learning that act as the interpretation of personal natural experiences [2] [3], or learning as a participation process [4] and a cognitive apprenticeship in an active community [5], suggest a learning method which has to be supported both by teaching/learning relationships (teachers, tutors, coaching, mentoring) and a negotiation of meanings, in which listening and participating act as major roles.

Interaction becomes a basic educational requisite only if teachers [6] become ethnographers, developing work experiences aimed at promoting listening activities and research perspectives among participants within the activities of the studying process.

A self-regulated and active methodology has been the basic guide for our approach. Our knowledge is self-built and shared [7] [8].

By default there are three different categories of users in an Fle system: fle admin, staff and user. Fle admin is the most powerful and can access all functions within the Fle system. The staff user is a bit more restricted and cannot administrate an Fle system itself, but can create and manage courses, students and so forth. Finally user is a restricted user who can take part in courses, but can’t create courses or new users (nor remove existing ones). In most cases students are defined in the system as users and teachers hold the staff users’ rights. The staff user account can also be given to a secretary of the department and she will be the person, responsible for giving user accounts, for including users to courses and managing courses etc. Additionally each user gets a role within every course. On a particular course a user can be a ‘teacher’, ‘tutor’ or ‘student’. Each level has less access rights for that course only. As an example you might be a fleadmin and still be defined as a ‘student’ on a particular course. Additionally somebody from the user class might be a teacher on one course and have more rights to manage that course (for that course only).

The multi-user management is fully integrated with other modules of the portal (Zope + Plone): this is because all products are based on same database management system ZDBMS (Zope Data Base Management System).

VI. FUTURE DEVELOPMENTS

A. *Fle3 becomes Fle5*

Our development team is in contact with Helsinki University (that began fle development and lead the releases roadmap) to test, and develop new version of Fle which will be probably called “Fle5” (fle3 + 2.0 = fle5). FLE5 is built on top of the “Kala framework”. It aims at beign a reimplementation of FLE3. The main design changes deal with the transition from DTML to ZPT (Zope Page Templates), the integration of “ImaNote” into knowledge building and jamming views modules, and transition from table-based page layout to CSS-based layout. Minor improvements include replacing the state-incapsulating urls of FLE3 with relatively clean and intuitive plaintext URLs and streamlining the management interface by combining the courses and users management tabs. An added layer of Python Script files has been added for interfacing with the new modules in FLE5 to keep the interfaces of the Python modules cleaner. The previous Kala style of interfaces which operate directly with REQUEST objects is somewhat opaque and makes unit testing difficult.

B. *Integration between Fle and LeMill*

New publishing methods require new approach to traditional copyright laws: all resources are freely usable by anyone in any context (we can imagine Youtube videos or Slideshare slides). All the content in LeMill platform is released under Creative Commons Attribution-ShareAlike 2.5

What are the success factors and obstacles for collaborative authoring of learning resources by communities of practice? What are the emerging patterns in social software that support collaborative authoring of learning resources? Integration bewteen Fle and LeMill is the next step for improving platform features. Users will easly access to all LeMill contents, directly from Fle environment. In the future, we could imagine a system that provides personalized set of learning contents for each user, depending on his own skill level.

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Creativity in Remote Laboratory and Virtual Instrumentation

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***Abstract*— This paper presents some results in the field of Remote Laboratory (RL) and Virtual Instrumentation (VI) developed at the Creativity Laboratory (CL) which is a part of the Center for Valorization and Transfer of Competence CVTC from "Transylvania" University of Brasov – Romania.**

Students and university teachers creatively implemented remote controlled systems and different virtual instruments which allow users to perform and control experiments using Internet.

These systems are based on the remote controlled equipments, data acquisition (DAQ) interface cards, sensors and all the necessary software in Laboratory Virtual Instrument Engineering Workbench (LabVIEW) and AppletVIEW.

Keywords - Remote Laboratory, Virtual Instrumentation, Wi-TAG, Creativity

I. Introduction

We should start our paper using different definitions for "creativity" and our motivation for this can be the place where all the developments were done – the Creativity Laboratory [1] founded at the CVTC Center.

Common definition from Webster's: Creativity is marked by the ability or power to create, to bring into existence, to invest with a new form, to produce through imaginative skill, to make or bring into existence something new.

This definition reflects a lot of insights of creativity but we prefer a definition given by Henry Miller (writer): the occurrence of a composition which is both new and valuable.

Obviously, creativity means various things to different people and can be defined in several ways. Creativity can also be defined at many distinct levels - cognitively, intellectually, socially, economically, spiritually and from the perspective of different disciplines - business, science, music, art, dance, theater, etc...

In creative production both processes of thinking (divergent and convergent thinking) are necessary as at first the ideas diverge in numerous quantities and then their array is narrowed and refined using convergence.

Definitions of divergent thinking usually include the ability to elaborate and think to different and original ideas with fluency and speed. Ideating and brainstorming are first examples of this type of thinking.

Convergent thinking is defined as the ability to use logical and evaluative thinking to criticize and narrow ideas to ones best suited for given situations, or set criteria. We use this type of thinking when we make crucial and well-formed decisions after appraising an array of ideas, information, or alternatives.

In the Creativity Center we try to implement all the new devices, sensors, systems and concepts in order to be able to develop new and valuable remote laboratory technologies based on the real physical instruments (devices) and also to implement creatively new virtual instruments and create flexible Remote Engineering (RE) technologies.

Based on the actual developments and fast growing market of remote controlled devices and systems, mobile communication technologies and computer systems, we believe that this century will be a "remote one" and so, Remote Engineering will be one of the future trends in education and industrial developments.

II. Creativity and Remote Laboratories

Generally speaking, the school doesn't have as main preoccupation creativity. For a long time it was considered a natural gift, which one has it or not. Serious studies regarding creativity have contradicted this opinion, but not entirely. The main reason of this ambiguity was the impossibility to measure the human creativity. It can be estimated based on its effects and results but it cannot be anticipated and determined.

There are several attempts to stimulate creativity in schools. There is speaking about the researches which are referred to as **divergent thinking** ones in comparison with the **convergent** ones, the last ones dominating quite exclusively the teaching / learning systems. But exaggerated cultivation of the convergent thinking which conducts to unique answers, used for hundred of years in schools, didn't succeed to "kill" human being creativity, the evidence being the permanent progress in knowledge and in inventiveness of the mankind.

The new teaching / learning technology called "**remote laboratory"** is, from the pedagogical point of view, a part of the classic teaching system. It means that convergent thinking is dominating the concept of laboratory works. It means that all

of the student's efforts are concentrated towards a unique answer, the only one existing and to which is arriving by using the gradual elimination of all of the other answers. Many times the convergent thinking is confounded with the human intelligence.

For which reason, do we consider that "**remote laboratory"** will encourage the creativity? This is due to the fact that the remote teaching system contains a group of creativity factors as **fluency**, **flexibility** and **originality** which belong to divergent thinking. Divergent thinking provides the production, from an information group, not of a unique answer but of many solutions (many outputs) which will provide the appearance of some original answers and solutions.

The exclusive orientation towards divergent thinking, do not provide at all creativity, as it was discovered even by their supporters. A dower of knowledge acquired using convergent thinking methods is absolutely necessary for those gifted with creativity.

Guilford and Lowenfeld have demonstrated conclusively that the gift to restructure and redefine the possessed knowledge, in one word the thinking flexibility, is an essential condition for creativity. Also, the flexibility is the one that provides the alternative using the convergent-reproductive with divergent-associative-combinative-creative thinking processes.

Remote laboratory will make the student face so many experimental solutions, that the flexibility in thinking will become compulsory. The combination between divergent and convergent thinking will be the result of analyzing these solutions. This system will educate the student's capacity of quick adaptability to new situations and the quick and adequate reaction to changes.

There will remain a peculiar characteristic of the creativity, the fact that it can't be measured but it can be determined only using indirect methods. The final success of the education oriented on creativity depends more on the intellectual capacities of the subjects than on the stimulations methodic used. As a result we can conclude that the gift called creativity can be stimulated but not be imposed. **Remote laboratory** is one of the very new methodologies dedicated to creativity stimulation.

III. REMOTE LABORATORY

Once with the rapid development of the Internet in recent years in conjunction with the TCP/IP transmission protocol and the latest version of the hypertext (HTML) facilities, new possibilities have come into existence for the use of the network for remote control of experiments in educational, research and industrial environments.

Using graphical software languages (such as LabVIEW from National Instruments [2] and VEE-Pro from Agilent Technologies [3]) secure client-server systems can be easily designed and implemented.

Client-server systems have some general advantages when compared with remote-access systems (RAS) or proprietary (single-solution) systems. The disadvantage of http-based client-systems is the need for a minimum stable transmission rate. Router, hub and switch technologies reduce the effective transmission rate of high speed Internet connections. In recent years gateway systems for remote control have become available for most measurements and instrumentation bus systems and this effectively allows direct access via LAN/Internet with a minimum of transfer data-rates needed for control.

For example the LAN extension for Instrumentation (LXI) - Standard for Test & Measurement - was introduced in 2005 [4]. This LXI Standard has been rapidly adopted by test and measurements companies as the natural successor of GPIB.

LXI, the LAN-based successor to GPIB, combines the advantages of Ethernet with the simplicity and familiarity of GPIB and it is the next generation of test systems combining state-of-the-art measurements in a small package at a cost-effective price.

LXI reduces the time needed to set up, configure and debug test systems. It offers six distinct advantages over GPIB-based systems:

1. The speed, simplicity, worldwide reach, low cost, ongoing enhancement and backward compatibility of LAN.
2. Quick, easy configuration through the intuitive web interface built into compliant instruments.
3. Simplified programming and greater software reuse through IVI drivers.
4. The ability to create hybrid systems that include LXI, GPIB, VXI, PXI, CANbus, etc.
5. Enhanced system performance and event handling via hardware - and LAN -based triggering modes.
6. Synchronization of local and remote instruments through the IEEE 1588 precision time protocol.

Some years ago, at "Transylvania" University of Brasov-Romania, we started the preliminary research to build using Graphical Programming Languages (LabVIEW and/or VEE-Pro) one Remote Controlled Laboratory. Our main idea was to use an easy programming language for all our fast developments needed in Physics Department (research, education, laboratory, testing...).

To achieve these objectives we have developed a high range of applications:

- Equipment controlling via different type of interfaces (GPIB, LXI, Wireless, Serial, Parallel...);
- Programming and data calculations for research;
- Simulated applications for teaching use;
- Remote controlled works (in research and education);
- Visual and remote controlled laboratory.

All of these applications were developed in the Creativity Laboratory of CVTC. Now - with the new and easy to use Web Publishing Tools from the last releases of LabVIEW and using a small price USB WebCam (able to create web pages and to

broadcast the data) we can develop nice Web controlled applications. These applications put together the force tasks of the LabVIEW instrument control and development with the possibility to do "on-line" application monitoring.

The first developments were done in the field of education by developing different simulated applications for teaching use. Graphical Programming Languages allows a fast accomplishment and an implementation of didactical applications. These applications can be molded then as modules, gradually accomplishing a virtual lab, which is able to accompany the courses, being the necessary applications' support: at a low price and top quality. So, a system easy to exploit can be founded even within the ODL (Open and Distance Learning) project.

Why do we begin to use LabVIEW and VEE-Pro? There is a very simple answer to this question: because of the numerous variants of creating some interfaces of communication resembled to the real one, the very simple way of programming that requires minimum knowledge and a little goodwill. For those who are passionate, graphical programming gives the possibility to create some real experiments controlled by the computer [5].

In the range of didactical applications we covered the fields of laboratory applications from: Laboratory of Mechanics, Optics Laboratory and Signal Analyze [6].

In Fig.1 we present one LabVIEW application to control using the Keithley SourceMeter 2400 the DC characteristic for a bulb. In the right side there can be seen two steps of the control:

1. When the control was started the DC SourceMeter display indicates REMOTE CONTROLLED (and can display also the IP address of the controller or any useful message);

2. When were selected the necessary parameters for DC control (from the LabVIEW VI Panel) we start the I=f(V) characteristics and the bulb light function of the tension evolution.

All of these applications were developed in cooperation with our students from Physics and Physical Engineering and some of the ideas were adopted from their diploma work. These students received the development idea and a list of equipments, devices, software and sensors. We selected some students from different years of study with mixed abilities from the fields of: design, electronics, computer science, engineering, etc. and we put them all together to create and implement new things in our existing labs.

In the same time, we integrated these students (who worked together in educational research) also in development and implementation of some industrial applications. Combining their knowledge with the facility to integrate some new and exciting devices (see Fig.1) we obtained some extremely good ideas and we have good and creative results.

In Fig.2(a) we present the CORES ELECTRONIC SRL wireless sensor data acquisition solutions. The Wireless Node (WN) family of measurement modules – deliver information in real-time from environments and processes where data collection is impossible or impractical using wired sensors. The WN-family (extremely useful in remote laboratories) utilizes the 802.15.4 (ZigBee) protocol and provides small size, compact and low-cost modules for both measurement and connectivity to the PC [7].

Recently the asset tracking market gave us the low power 802.11 System on Chip (SoC). This SoC contains a radio part, a microcontroller part, and sensor conditioning elements, all in one small silicon package. The WiTAG device (presented in Fig.2(b)) architecture is designed around the 802.11 SoC and use an emerging market technology for the building of a low-cost, low-power wireless sensor [8].

This new and unique WiTAG system was launched by our collaborators in this year at the International Conference on Wireless Networks – ICWN'07, USA, June 25-28, 2007.

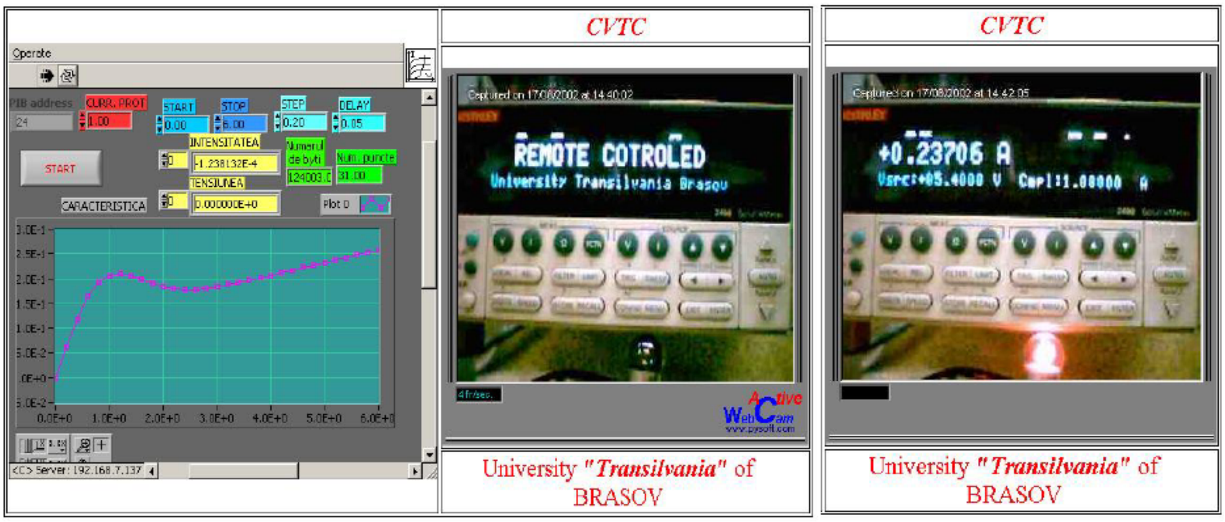
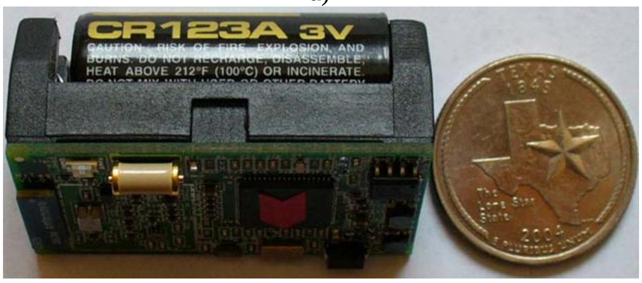


Fig.1 Control panels of different Laboratory applications (remote control)

a)



b)

Fig.2 a) ZigBee modules; b) The new Wi-TAG sensor

The WiTAG contains a 32-bit processor (or CPU) that runs on a 44MHz external clock. The slower and lower power sensor measurement operation is controlled by an external 32 KHz oscillator. The CPU incorporates full 802.11 PHY, MAC and encryption engine. The WiTAG CPU has internal 80Kbytes of RAM and 320Kbytes of ROM that comes loaded with:

- Boot loader
- eCos OS
- TCP/IP stack
- 802.11b stack
- Encryption and decryption support
- Application/deployment specific sensor drivers and communication protocol
- Power-saving support

User applications can be downloaded in external Flash memory that is controlled by the CPU using an SPI interface. The current version WiTAG has 1Mbit external flash memory. 802.11b communication capability of the WiTAG operates autonomously from the CPU and it can execute direct reading / writing data to the system RAM.

Using these two technologies, in the creativity laboratory, we designed together with the student teams some scenarios for possible applications and we implemented some of them.

In Fig.3 we present one application dedicated to the monitoring and controlling temperature and pollution with CO_2 in a conference room. In order to determine the CO_2 level, a STEINEL sensor in combination with the VN ZigBee wireless nodes was used and for determining the temperature, a K type thermocouple. The software was developed in LabVIEW.

The following example, developed with WiTAG sensing system, can be used in any remote laboratory (or be the basis of one industrial application):

- We need to collect some quantities (light level, humidity, temperature, vibration, etc.) measured using a WiTAG system
- User opens a Web Browser (or one LabVIEW application) on the Data Client PC (this PC received the access rights trough the laboratory server)
- User browses to the IP address of the AP Data Server (a link offered by the lab server)
- Data Server sends data to a web page containing controls that allows the user to configure each WiTAG node for measurement related parameters including alarms to parameters that are monitored and frequency of data transmission to the AP
- User sets measurement, alarm and transmission parameters using controls displayed by the web page and integrated with other Virtual Instruments in his “laboratory work” (or part of industrial automation)
- Data from WiTAG sensors appears in indicators and graphs displayed by the web page panel.

In Fig.4 we present a picture of the physical setup that will run this application.

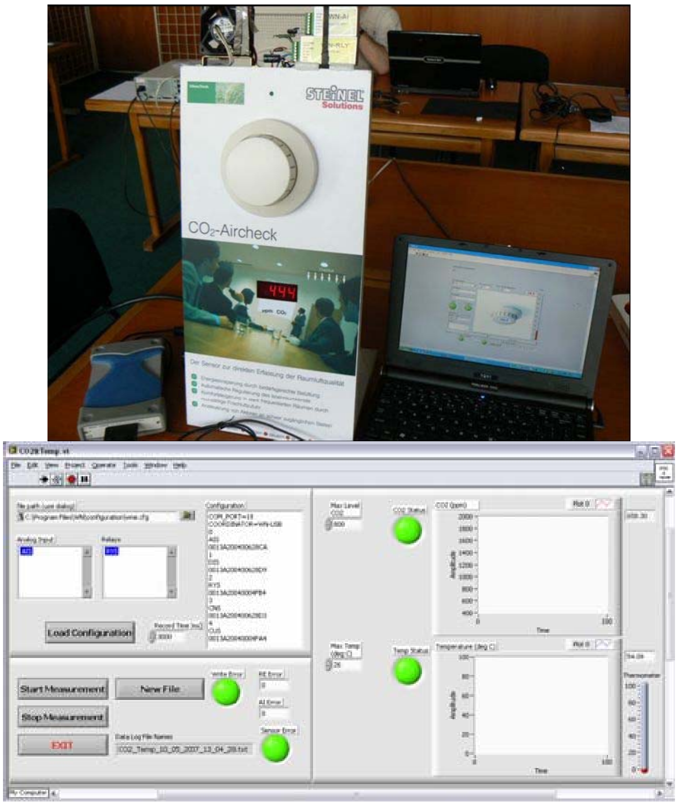


Fig.3 Industrial CO_2 monitoring systems using STEINEL sensors

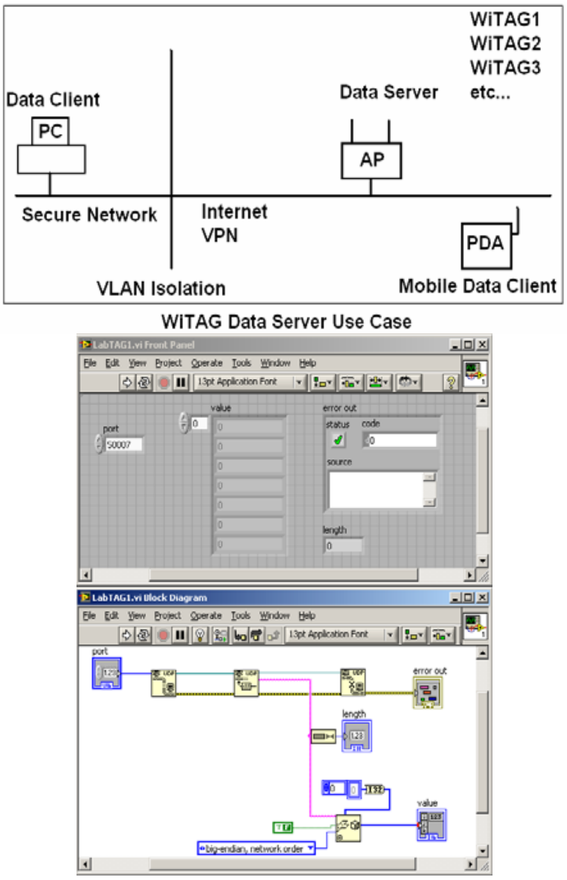


Fig.4 WiTAG application and LabVIEW interface

IV. Mobile Applications

An important direction of development for distance controlled laboratories is represented by the usage in this field of the mobile technologies. The nowadays development of PDA type devices and of smart phones allows their usage in the distance control of systems.

The software applications that run on these devices allow the implementation of teaching learning courses useful for the ODL educational system using software such as web browser, e-mail client, TCP/IP communication so on, but at the same time also allow the controlling and monitoring from distance of useful systems both in creating distance control laboratories and also in creating industrial applications.

On this line, in the creativity centre we have created an application dedicated to the medical field presented at the IMCL [9] conference. The application is dedicated to the education and monitoring the health status of pregnant women. The application allows the on-line communication or the sending of messages between the patient and the doctor and also the monitoring of foetus' status. In Fig.5 are presented few of the application's interfaces. The creating of the application is based on graphical programming language LabVIEW using the TCP/IP communication protocol (client-server type application) and SMTP for sending e-mails.

To create applications controlled by the network, the sharing variables technology from LabVIEW can also be used. This technology allows the sharing of data between two parallel sequences of the same application or between applications across the network. The advantage of this technology over other technologies of data sharing from LabVIEW (UDP/TCP, LabVIEW queues, and Real-Time FIFOs) is represented by the fact that the configuration of the shared variables is done at the time of editing using property dialogs, and there is not need to include configuration code in the application [12].

There are three types of shared variables that can be created: single-process, network-published, and time-triggered.

The single-process variables are used to transfer data between two parallel parts of an application or two parallel applications which cannot be connected by wires.

The network-published shared variables are used for writing to and reading from shared variables across an Ethernet network.

The time-triggered shared variables are used for sophisticated applications that imply a deterministic transfer of data across the applications or across the Ethernet networks.

The communication across the Ethernet network using the shared variables method uses the Shared Variable Engine (SVE), which is a software framework that enables a networked-published shared variable to send values through

Fig.5 PDA in medical field
a) Application interface on a PDA b) Server interface for on-line communication c) PDA interface for on-line communication

the network. The protocol used for transferring the data across

the network is NI Publish and Subscribe Protocol (NI-PSP), which is a networking protocol optimized to be the transport for Network Shared Variables.

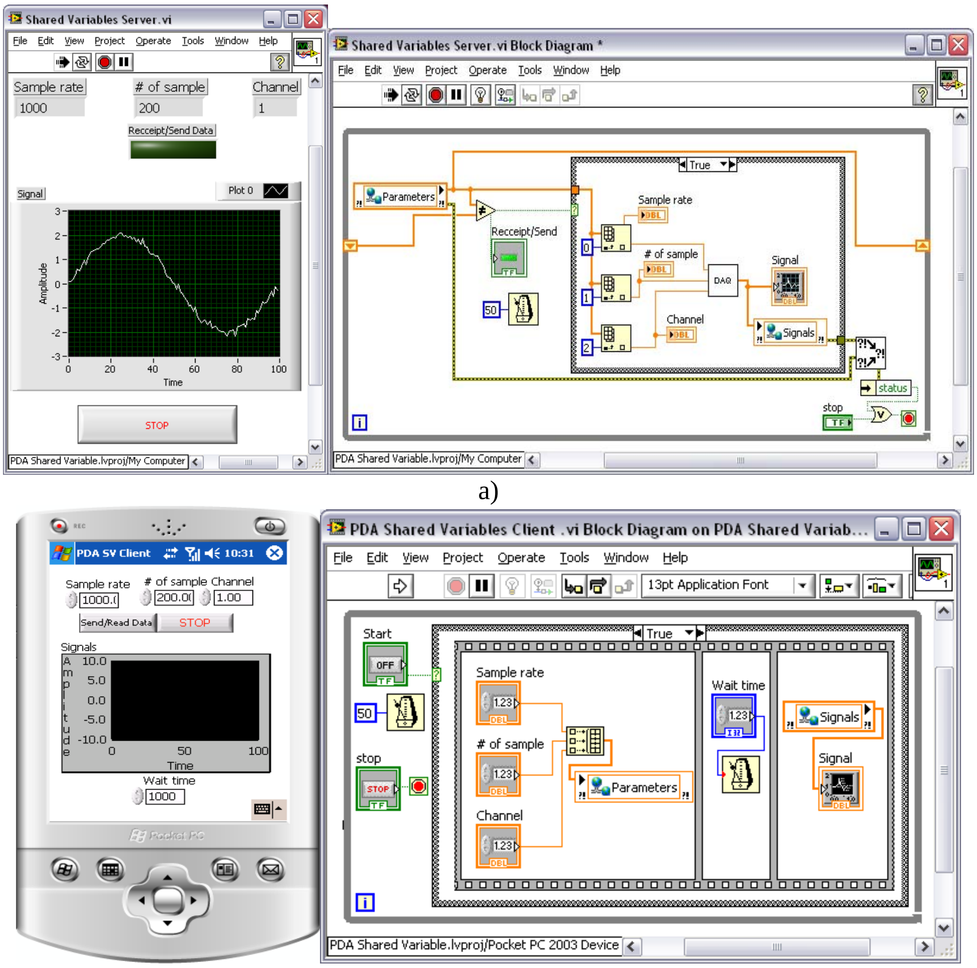
In collaboration with Carinthia University of Applied Sciences from Villach-Austria, the implementation of this technology was done using PDA. Fujitsu Simens Loox 610 system was used and also an Acer n300. In fig.6 are presented the applications' interfaces that use the sharing variables technology.

The application allows the bidirectional data transfer from client to server and backwards. After creating the connection between the application that runs on PDA and the application that runs on the server, the client sends the data for configuration of the measurement system. Then, the application that runs on the server will configure the measurement system conform to the data received from the client and will perform the measurements. The obtained results will be transmitted to the client, closing the communication cycle.

V. Conclusions

In this paper are presented a few applications that were developed in our Creativity Laboratory. These applications are from different fields. The common parts of them are the virtual instrumentation and the possibility of remote control.

The nowadays development of computers, DAQ systems and of communication on the Ethernet network and the easy way to learn and use them determine that the Virtual Instrumentation and Remote Control become a new and very powerful methodology for creativity stimulations.



a)

b)

Fig.6 Interfaces of Shared Variables applications
a) Server interface and diagram b) PDA interfaces and diagram

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Customizable Collaborative Virtual Learning Environments: A Layered Framework Approach

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Abstract— **This paper presents a generalized approach for the design of Virtual Learning Environments that must be customizable to culturally specific contexts. A layered framework is used to present both high-level abstractions and low-level details, along with the mappings between them. A concrete example of an environment for e-learners in Computer Science is presented, along with illustrations of key concepts such as language, visualization, collaboration and constructivism within this application.**

I. Introduction

E-learning is a pedagogical approach that takes advantage of the unique attributes of information and communication technologies (ICT) to enhance traditional approaches to teaching and learning. In recent years, e-learning has become a highly practicable strategy for distributing instructional material both across geographical distances and to diverse populations of learners. It is uniquely suited to delivering analogous content to a wide variety of learners whom it would often not be possible to gather together in a traditional learning environment. One of the strengths of e-learning is that it can encompass a wide variety of pedagogical approaches and address a wide range of learning styles. It is also highly adaptable; content and material can be easily created or manipulated by those responsible for delivering the program to best meet the needs of their learners. This is supported by the wide range of technologies that can be employed under the umbrella of e-learning; diverse types of hardware and software can be employed or developed to fit specific contexts, thereby personalizing and enhancing learning. This type of flexible learning environment is becoming increasingly important, as personalised learning environments are becoming increasingly sought after, especially with the advent of programs such as the One Laptop Per Child[1] (OLPC) initiative.

Currently, a great deal of e-learning consists simply of using technology to present content to learners. Examples of this include the use of bulletin boards, employed by many organisations to distribute material to students, either as online courses or in support of more traditional campus based programs. While this can enhance learning, it does not make the leap from the read-only web in which learners are passive receptacles of information to the emerging read-write web where learners interact with material (and each other) to create and manage their own learning. It has been frequently demonstrated that collaboration and interaction enhance students' internalisation of material they engage with. Structuring e-learning programs to take advantage of the inherent ability of technology to support collaboration is essential to make such learning experiences as powerful as possible. This requires a paradigm shift from both those developing applications for educational settings, as well as from educators themselves.

Emergence of programs such as the OLPC carried along the need for a feasible software environment to facilitate an optimal medium that melds together the particularly important ideas such as visualization, interaction, collaboration and constructivism. Specifically, this e-learning environment needs to be customizable according to culturally specific contexts, and flexible enough to cover both high-level and low-level educational concepts. In the case of topics such as computer science, this is particularly challenging in a virtual environment without any instructional support. We believe that by providing the right kind of customizable framework for ICT infrastructure, it may be possible to build a wide spectrum of collaborative Virtual Learning Environments (VLEs) applicable to a wide variety of topics in science and engineering. By leveraging a layered approach, we further believe that e-learners can naturally explore both high-level concepts and low-level details, along with the mapping between them.

In this paper we present the design of such a framework, and provide a concrete example of a layered approach in the context of a VLE associated with introductory topics of programming and computer architecture. The rest of the paper is organized as follows. In Section 2, we discuss the design of high quality VLEs and clarify how the requirements set for our proposed framework, GlassOnion[2][3], support such designs. Section 3 focuses on the details of the functional components of this framework. We finally identify future directions and summarize our ideas.

II. Design of Virtual Learning Environment

To make the potential benefits of virtual learning a reality, there are necessarily multiple considerations that have to be addressed. One of the most important of these is the scaffolding required to support learners in constructing such personalised learning environments. Simply delivering the technology and

content into the hands of learners is not adequate to ensure meaningful learning experiences. Educators, and others responsible for overseeing student learning, are often unaware of, or uncomfortable with, many of the newer or more specific technologies. Technical support and reliable infrastructure are integral aspects of creating viable learning environments. With this in place, even those who are relative neophytes with regards to technology can effectively implement well designed e-learning modules. Other considerations include the need for management of the educational environment: tutors who can interact with learners, addressing questions and concerns and monitoring progress and interaction of the learners. This could take the form of live tutors participating in the classroom environment with students, or of digital, distributed tutoring environments in which tutors and students engage through methods such as synchronous online collaboration or real-time audio/video conferencing. E-learning environments with such built in collaborative functionality are powerful tools for supporting remote learning and enhancing student engagement and understanding.

A key strength of e-learning methodologies is that they can be applied to nearly any discipline, and in almost any learning situation, from established curricular areas in traditional school settings to cutting edge course work distributed to learners across the globe. This, however, brings with it the need to consider context when developing e-learning materials, so that they best fit with particular pedagogic strategies, specific course content, and unique cultural situations. This has been illustrated in a recent project undertaken through the University of Victoria in which the specific needs of aboriginal learners in remote communities have been examined, and pilot programs built around the resulting data have begun to be implemented in a staged deployment.

Aboriginal groups located on the west coast of Vancouver Island have a distinct and unique cultural heritage, key features of which include the respect for elders who serve as both cultural and administrative leaders, the importance of social interaction and inter-dependence between community members, and the retention of traditional cultural language and practices whilst keeping pace with the modern world. To be accepted by the groups, educational initiatives must be sensitively integrated with such cultural issues, as sustainability will be a function of both cultural and educational support within a community. For example, the traditional role of elders as leaders in aboriginal communities is clear. However, not surprisingly, the youth in the community are generally more technically savvy. Hence, in the context of technology, there is actually an important inversion taking place. By working with community members to develop a program where youth in the community can both serve as teaching-assistants for elders and also be offered enriched programs involving computer science, we believe we can effectively harness this dynamic and reconnect the two groups in a collaborative initiative. By targeting the youth and stimulating their inherent interest in technology, we believe we can create demand for more advanced educational offerings than otherwise might be considered.

To this end, building on needs specifically identified by the aboriginal communities during our research, an extra-curricular program for aboriginal students was created and implemented. In the summer of 2007, a camp for a group of fifteen aboriginal youths (ages twelve to seventeen) was hosted on three days, distributed over a period of three weeks. These students came from a community where access to computers in schools is scarce. At this camp, they were introduced to programming through graphical languages and IDEs such as those used by Lego Mindstorms[4] and Scratch[5]. The students proved to be interested in the projects and became intensely engaged in programming. They appeared to be focused, and particularly enjoyed sharing the artifacts of their learning with parents and friends. However, during the process, it was garnered through anecdotal commentary that, for many students, unanticipated challenges along the way were enough to discourage efforts to complete the task. Encountering problems often led to disengagement, with students instead shifting to engage in on-line social interactions through mediums such as email, chat interfaces, or networking applications. This reinforces the need for continuous support of e-learning applications, making sure students have access to support, either through online collaboration or face to face tutoring.

GlassOnion is a project that has, in part, been guided by both our successes in and challenges with deploying e-learning computer programming instruction within aboriginal communities. It has been designed to meet needs such as the inclusion of real time collaboration and the provision of a transparent transition from highly abstracted graphical representations to different layers computation. To do this, GlassOnion has to satisfy a specific set of requirements. The five major requirements we considered as vital during the design of this framework were: (1) visualizing or animating graphically based activities in order to provide a more concrete exhibition of conventional settings, (2) facilitating and encouraging exploration to motivate learning in a more efficient manner, (3) providing collaboration to support early exposure to team work, and (4) supporting different spoken languages to ease the cultural adaptation of the framework within remote communities.

A. Language Support

One of the struggles faced by many aboriginal communities is the fact that their languages, which, by nature, are unwritten, are quickly disappearing as native speakers die out. There has been interest from communities to use technology and computers as a means of preserving their languages[6].

Creating a simple framework that allows translations of other languages to be easily plugged in could provide these communities with an opportunity to modify a tool to represent their own languages. Remote communities often face the struggle of having limited computing resources, meaning that there can be a vast discrepancy in terms of computer experience across age ranges. This means that there is usually a steep learning curve for some age cohorts, and unfortunately the elders of the community, who usually have the most

comprehensive knowledge of the language, do not possess the computer skills which could help preserve it.

In Tsawout, an aboriginal community just outside of Victoria, we have had great success empowering youth with knowledge and skills in several key computer science concepts. We hope that, using the knowledge gained in these workshops, the youth will work together with elders to preserve knowledge of the language, perhaps using traditional aboriginal customs such as storytelling. Since several graphical programming languages that target story telling(Alice[7] and Scratch[5] are examples), it is possible to use computer science to not only have students learn their native language, but also to pass on the traditional stories that go with them.

The frame work of GlassOnion will be set up to allow easy transition of language though a predefined plug in that allows people in the community to "fill in the blanks" with their own languages. This plug-in will, in essence, take the form of a document that has the English word (for example *if*) and a space for the word in the given language. GlassOnion will then be able to create a new language set from that file. This means that all the technical parts of the implementation can be done just once, and people in their respective communities can provide the translations. In the true nature of the GlassOnion, these language updates will be made publically available so if a language has already been input it will not need to be done a second time. plug-in will in essence take the form of a document that has the English word, for example *if* and a space for the word in the given language. GlassOnion will then be able to take that file, and create a new language set out of it. This means that all the technical parts of that implementation can be done once, and people in their respective communities can provide the translations. In the true nature of

the GlassOnion, these language updates will be made available so if there is a language already done, it does not have to be done again.

GlassOnion will not only support restoration of languages that may be in danger of becoming extinct, but it could also indirectly allow the stories of the elders to be passed down to the new generation, in a culturally traditional manner. Therefore the community will not only continue to pass on knowledge and language to youth, they will do so while they are concurrently learning key computer science concepts.

B. Visualization

In order to engage learners, virtual learning content must be presented in a manner that is engaging and somewhat intuitive, allowing learners to quickly and easily interact with the material without needing to learn to use an entirely foreign interface. An important point in developing GlassOnion is to decide on an optimum way of presenting visualizations which will not overwhelm the user with extremely busy content. Instead, we envision a customizable outlook that is based on the encapsulation of different views in a hide/show manner which has been thoroughly utilised by former simulators. The three options that we consider for the component display are: 1) different visualizations on different tabs that are attached to the same interface, 2) different visualizations on different display consoles attached to the same interface, and 3) different visualizations on different display windows independent from the main interface. In order to have a fine customization, the user should have the ability to choose from this option set. Furthermore, the user should have a full control over the visualization tabs, consoles, or windows (e.g. reordering tabs, displacing consoles, closing and reopening tabs, consoles, or windows). Through this view based, customizable display approach, we aim to give the user the flexibility to hide or show any view at any time during usage.

C. Collaboration

Collaboration is a key feature of successful virtual learning environments. Learning is a social activity, being developed both through independent engagement with material, followed by refinement of understanding and building of comprehension through discussion and debate with colleagues. This is supported by several studies, notably an examination of distributed video instruction by Smith[8] which found that the use of a tutor to encourage and moderate interaction between students receiving instruction through video tutorials to have a statistically significant positive effect on the students comprehension and retention of material.

Promoting student collaboration is a goal of our group, and one that has been reinforced by observing student interaction during our outreach activities. These interactions between students, such as explanations and error corrections, provide an obvious increase to their understanding of the material. However, how to provide this benefit to students in remote locations remains a challenge. To address this, we propose to integrate both graphical awareness cues and voice over IP technologies into GlassOnion to simulate a collaborative classroom experience over a distance.

As part of the BRICS[9] design, functional code blocks are outlined, giving the ability to provide code overviews. To extend this design allowing collaboration, large code overview areas are used to present awareness information regarding the activities of other students. Combined with voice over IP, the students can indicate specific areas of code and discuss problems or insights, all with the reassurance that their colleagues are looking at the correct location. In many ways this experience is analogous to being physically together in a lab setting.

D. Exploration and Constructivism

The construction of knowledge is an active process, requiring learners to engage with material, brining to it their own background and methods of understanding, and interacting with it in a personal way that makes it meaningful to them. E-learning environments that are cognizant of this fact will allow students to interact with material, encouraging learning through exploration of content. Being able to see the results of their engagement with material provides instantaneous feedback to students who can then use this to scaffold their further learning.

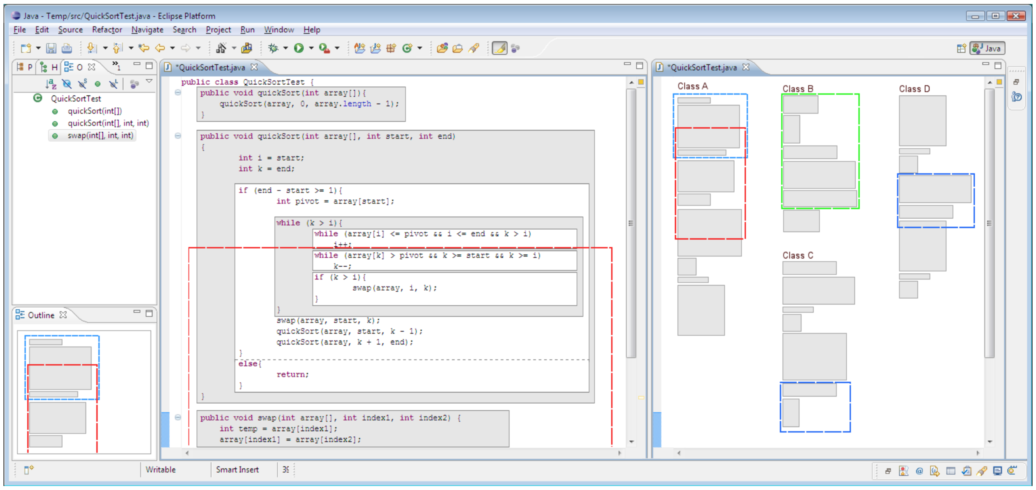

Fig. 1. The BRICS vision of collaboration as an Eclipse plug-in, showing the source code and overview windows, and what the rest of the team is viewing.

To meet these requirements, the GlassOnion framework should also be customizable at the functional layers. For instance, students should be able to add extra processors or units to the pipeline, increase or decrease maximum physical memory, be able to alter caching strategies used along with cache sizes, be able to add remove extra layers of cache, etc. This will help them understand the trade offs of computational choices in a more visual way, where they can learn through exploring themselves.

III. Design of GlassOnion

The central purpose of the GlassOnion is to expose the mechanics of computational concepts. In order to achieve this goal, the framework separates computation in to three different layers: (1) the graphical environment, (2) the textual environment, and (3) the physical environment.

A. Background and Related Work

The modern world is immersed in Information and Communication Technologies (ICT), but at the same time only a minority of people have more than a minimal understanding of ICT and its contribution to society[10][11]. As a result of these findings, primary and secondary school education became a major focus within educational software communities. Attempts to introduce technology to youth expanded to after-school activities where students had a chance to work with popular audio-visual tools in informal, relaxed environments[12]. However, students were often barely introduced to computer programming which arguably motivates key concepts such as algorithmic thinking[13][14].The intuition behind this kind of introduction stemmed from the fact that many early attempts were plagued with the difficulty of making programming in plain text intriguing to students. Given the high learning curve from computer illiteracy to successful programming in text based environments, the appeal of software development was limited to a minority.

Accordingly, many efforts within the educational software communities started to focus on the use of graphical building blocks, where students could become comfortable with graphical objects rather than the ordinary textual instructions. Several graphical languages and their corresponding platforms have been introduced according to this theme of hiding syntax from the programmer. For instance, Squeak[15], Scratch[5] and Alice[7] have been heavily used in both after-school and summer activities as educational development platforms. In addition, LEGO Mindstorms[4] and Pico Crickets[16] have introduced their own graphical environments to ease the use of hardware entities such as sensors and motors. To the average student, these graphical programming environments introduce programming as an interesting activity. Throughout our research we have used most of the languages mentioned above for various outreach activities[17][18] at the University of Victoria and we have witnessed their remarkable impact on introducing information technology to youth.

However, these graphical platforms abstract many of the difficulties of programming to enhance learning, but they also abstract many of the fundamental concepts required by the conventional environments. We believe, the new ICT aware generation will need a smooth transition from these easy-to-use graphical platforms to the traditional settings. Past research have shown that this transition can be very difficult and problematic[19].

In this section, we introduce the design of an educational software framework currently being developed at the University of Victoria, the GlassOnion. The main goals of this framework are threefold: (1) to facilitate an easy and transparent transition from graphical to textual environments, (2) to provide visual representations of how basic computation works at the physical layers, and (3) to support active collaboration.

B. Layer 1: Graphical Environment

The graphical environment is the top layer of the GlassOnion that provides a familiar setting for the new generation of

students that are trained through graphical programming tools. In this layer, we provide a specific set of programming blocks that represent basic control and data structures.

Programming blocks will be represented similarly to former approaches such as Scratch[5] or Squeak[15] where the control blocks will expand as other blocks are placed inside them. In addition, the environment will include customizable blocks which are particularly important in the cases where the user can create functionality segments(such as methods or functions) and encapsulate them in new blocks. This also aids the students in understanding ideas such as modularization and abstraction.

It is important to note that the graphical layer of GlassOnion will not aim to provide a complete set of functionality. Instead, its purpose is to provide an introduction to the basic concepts of programming that can be easily mapped to textual representations accordingly. Instead of having concurrently animated objects, we focus on basic ideas, such as control and data structures, and transition from their graphical representations to more traditional syntax based settings.

C. Layer 2: Textual Environment

The second layer of the framework is the textual environment, where we provide a direct mapping from a program created at the graphical layer to various popular textual programming languages such as C, C++, Java, Python, Perl, etc.

As a user programs at the graphical layer, the corresponding textual representations will immediately appear at the textual layer. Similarly, changes made at the textual layer will synchronize with the graphical layer. This will facilitate an intuitive mapping between the graphical and textual layers, and introduce syntax to the students who are trained through the usage of graphical environments.

D. Layer 3: Physical Environment

The architectural visualization component is to instrument two subcomponents: 1) storage visualization component, and 2) process visualization component. The storage visualization component consists of memory, cache and virtual memory views, while the process visualization component consists of on chip storage and chip activity views. In memory view, the user can follow the activity in specific memory locations depending on how the allocation is performed. On one end the stack sub view simulates static memory usage, while on the other heap sub view outlines the dynamic memory allocations performed by the program. Through these views, the user can actively follow the usage of memory through assignments, modifications, allocations and disposals. Visualization of memory can be particularly effective in teaching concepts such as variables and data structures. Furthermore, visualization of memory related concepts that are considered to be somewhat complex, such as pointers in C programming language, can be thought through visually at the runtime of a program.

Cache view is the subcomponent that visualizes the storage and traffic in cache through different and well known caching strategies. Cache view will have sub views that illustrate the cache activity under the usage of currently used caching strategies. Three major strategies we aim to focus on are: 1) direct mapping, 2) fully associative, 3) set associative. Since the rate of collisions, hits and misses will be transparent, the user will have the chance to analyze the pros and cons of different strategies under different conditions. Through this subcomponent, students can become familiar with the underlying structure of data storage and observe the usage of well known algorithms at the lower levels of computation.

Virtual memory view is a complementary subcomponent where the user can see how the entire storage subsystem of modern computers works through instrumenting transfers between disk, memory, and cache. Moreover, the user can view how the virtual memory extends the available physical space and performs logical to physical address translations. The user can also follow the activities at the hardware and software entities like memory management unit (MMU) and translation look aside buffer (TLB).

Processor view is the subcomponent that visualizes how the CPU performs the execution of programs. It includes two sub views: 1) on chip storage view, and 2) chip activity view.

On chip storage view is the sub view where user can follow how the registers on the CPU are instrumented. Special and general purpose registers will be fully included to provide a complete picture of on chip storage. The user will be able to view the contents of the registers in hexadecimal, binary, and decimal number systems while a program is running.

Activity view is the component where the cooperation, working and utilization details of CPU subunits are visualized. Chip activity view includes two sub views: 1) processing units view, and 2) pipelining view.

Processing units view is to visualize the function and cooperation of units in CPU. By default, this view will have a minimal set of units which includes a control unit, a fetch unit, a decode/dispatch unit, an instruction queue and an ALU. User can view how instructions in a program are executed through the usage of these units.

The user can see how the throughput is increased in a computing system in the pipelining view. The view will visualize how the pipelining generally works in a CPU. In addition, this sub view will include various branch prediction algorithms, and will give the user the chance to switch between them.

IV. Future Work

The next step in this project is the implemention of GlassOnion and its application in remote communities. Furthermore, if the functionality provided for Computer Science concepts is successful, we are going to explore ways of providing modules for other areas such physics and math through the same open framework. In addition to conventional use cases, a tangible interface is in our list for future considerations to provide ways for students with disabilities to use the framework.

V. Conclusion

In this paper, we have underlined the key requirements–gathered through our experiences with the Aboriginal communities on the west coast of British Columbia–for a VLE that can be deployed in remote communities. Furthermore, we have focused on the functional aspects of the framework central to our envisioned VLE, called GlassOnion. We believe we can provide a sustainable educational package through GlassOnion's ability to support transparency and collaboration at different levels of computation. The incremental mapping between high-level software development processes and low-level computational elements can help students have a more concrete understanding of computer science, while the collaboration aspect can support active teamwork and mentoring. Finally, by deploying this package within cultural contexts, we believe this VLE can plant initiatives that take hold in remote communities.

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E–Learning Platform for Software Engineering Education

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***Abstract*—Complexities in developing software product has increased manifold, and in recent years, tremendous technical changes are happening in software development. Businesses are now regularly deploying systems that employ and integrate a wide range of computing technologies and paradigms; and software engineers need to adapt themselves to these evolving changes. Thus, it is inevitable for academia to educate software professionals apart from their regular students. Offering effective online courses using e–Learning platform can fulfill this unique challenge. Due to inherent complexities and evolving nature, developing software engineering (SE) programs is a difficult & daunting task. In Bangladesh, curricula of undergraduate and graduate SE programs are not very old and maturing at a slower pace as compared to other curricula. Moreover, online courses are relatively new in Bangladesh; and maturity has not reached at expected level, as far as designing curricula and course content of such online courses are concerned. In this paper, the authors studied the current status of SE curriculum in Bangladesh and abroad, and proposed guidelines for developing such online curriculum adaptable by local academia and industry.**

Keywords- e–Learning; curriculum; software engineering; blended learning

I. INTRODUCTION

With newer inventions and improved economic conditions citizens of developed countries are offered with numerous and better ICT enabled services than ever. As a result, there is an exponential rise of software development. However, there arc severe problems with the quality of software and the cost of producing it [1]; and often the employers complain about the knowledge and skills of graduates in some of key areas of SE such as: a) development models; b) requirements engineering; c) high-level design; d) software processes; e) quality assurance; f) working in teams; g) project management; h) software testing, etc. These issues have produced a strong demand for software developers that speak of education and experience in SE.

Software engineering is a maturing discipline of engineering and due to its dynamic nature, it is almost impossible to develop static and sustainable curriculum and courseware for such discipline. However, due to increasing need of software professional, it is required to look beyond regular on-campus SE courses and consider to offer e-learning based online courses on SE. In the context of Bangladesh, though there exist severe problems (for developing regular programs) like: a) the SE profession in Bangladesh is immature; b) confusion about the difference between Computer Science (CS) and SE; c) lack of understanding and appreciation among CS faculty members about the need for SE education; d) little available material on SE curriculum guideline; e) absence of local accreditation mechanism for SE programs, etc; we cannot ignore the necessity of identifying the remedies and introducing online SE courses.

A. Motivation behind the Online Curriculum

As a developing country, Bangladesh declared ICT (particularly, software export) as a thrust sector. To promote proper nourishment of the sector, a commission named "JRC Commission" was formed by the government in 1997 to identify and propose necessary recommendations; of which the second author is an expert member. [In June 1997, the Government of Bangladesh appointed a Committee to look into the problems and prospects of export of software from Bangladesh. The Committee submitted its report in September, 1997. http://www.sdnbd.org/sdi/issues/IT-computer/expartsoft-report.htm.] The second author is also an expert member of the "National ICT Policy of Bangladesh (NICTP)" [2] and an Expert Group responsible for preparing report on "Strategic Planning for ICT in Higher Education" [3].

While closely working with JRC commission and NICTP project, it is felt that the demand of efficient human resources (especially SE professionals) are significantly high, and the universities could not properly meet the industry requirements. The report of the JRC commission highlighted on human resource development as one of the key issues needs to be addressed. As a result, the necessity to review current SE curriculum leading to introducing online SE curriculum was felt, which worked as the motivation of this paper. Developing and conducting such online program will certainly contribute in producing ready-to-serve software professionals across the region. The purpose of this paper is to propose an online SE curriculum.

II. METHODOLOGY

In section-3, we discuss the current status of SE education and the necessity and impact of online SE curriculum. Section-4 describes the good practices of curriculum development. In section-5, the proposed SE curriculum is elaborated. Section-6 illustrates the challenges–involved in developing and

conducting such online program. Finally, section-7 presents the concluding remarks.

III. Background

A. Current Status of SE Curriculum

Though most of the universities in Bangladesh offer a three credit SE course (or six credit two courses) in CS degree programs; in recent past, only one of them (Independent University, Bangladesh) offers comprehensive SE curriculum at graduate level [4]. Another university (American International University, Bangladesh) just announced about B.Sc in Software Engineering degree. However, there exist no online courses on SE (neither at undergraduate nor at graduate level). Our observations show that the designs of these curricula are more closely related to the intuition and judgment of the universities. Though these curricula are approved by the UGC, Bangladesh (UGCB) [5], they neither developed a standard guideline to follow, nor accredited by an accreditation authority; and not suitable for an online program. Here, our objective is to propose an online SE curriculum suitable for fresh graduates as well as for working software professionals. In Bangladesh, the Bangladesh Open University (BOU) has the mandate only to run education in distance mode or in electronic form. But to the knowledge of the authors, the BOU does not run any such program

B. Engineering Curricula and their Feasibility for e–Learning

As typical e–learning does not facilitate face–to–face interaction between the instructor and the learners, it is more suitable for social science and humanity courses where face–to–face interaction and especially the laboratory experiments are not vital. On the other hand, science and engineering courses require extensive laboratory experiments, face–to–face interaction, group discussion, etc. Thus, typically designed online courses may not be suitable for all subjects and disciplines.

C. Necessity of e–Learning Based SE Curriculum

Considering the education system, cultural and socio-economic background of a country like Bangladesh, it is evident that, pure computer science graduates alone cannot meet the increasing number of software professionals. In Bangladesh and other developing countries, many of the software professionals are from non computer science background. Many of them lack sound conceptual foundation on SE principles. Often, it is not feasible for them to enroll themselves in regular degree programs to keep themselves updated. Online SE courses can help them in this regard. The appeal of such courses has far reaching impact on personal knowledge management, as it provides flexibility and ease to the participants in following learning modules at their own pace.

D. Necessity of Blended Learning

The effectiveness of e–Learning will be effective; if the curriculum is designed by blending of didactic and instructional design models. The proposed blend consists of: a) Online as well as classroom based face–to–face lectures (at least 20 to 30 percent), b) On–campus activities at resource centers like lab experiments, c) Online activities like simulated lab experiments supported with interactive learning components, video conferencing, group discussion with instructor using white/black board, participating in interactive forum, analysis of work done, etc., d) Self learning & preparation of homework/presentations at home, e) Online assessment and evaluation.

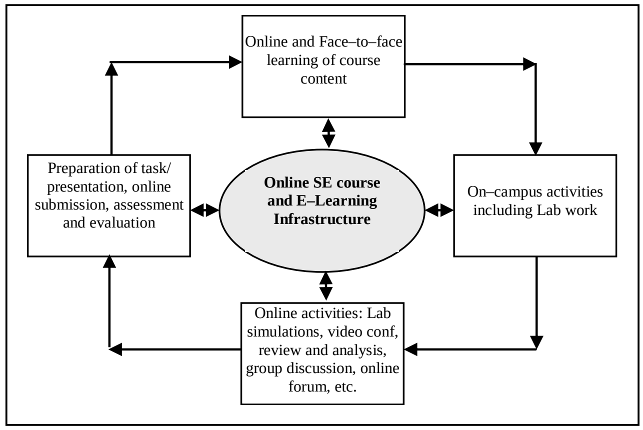

Figure 1. E-learning based Blended Didactic Approach

Figure 1 illustrates the blended model. In face–to–face lectures, in addition to classical teacher–centered approach, the instructors need to use e–Learning components having enough animation and simulation to disseminate SE concepts to the students.

IV. Models of Good Practices in Curriculm Development

A. Learner–Centered Case–Based Learning

In case-based approach [6], students are engaged in discussion of specific situations, typically real-world examples. This method is learner-centered, and involves intense interaction among the participants. Case-based learning focuses on building of knowledge and group works together to examine the case. The instructor's role here is of a facilitator and the students collaboratively address problems from a perspective that requires analysis. Much of case-based learning involves learners striving to resolve questions that have no single right answer.

Case-based approach can be helpful for online courses due to following reasons: a) Use of case studies holds great promise as a pedagogical technique for teaching. Many faculty use case studies in their curriculum to teach content involve students with real life data or provide opportunities for students to put themselves in the decision maker's shoes; b) Cases add meaning by providing students with the opportunity to see theory in practice. Real world or authentic contexts expose students to viewpoints from multiple sources and see why people may want different outcomes. Students can also see how a decision will impact different participants, both

positively and negatively; c) Cases usually require students to analyze data in order to reach a conclusion. Since many assignments are open-ended, students can practice choosing appropriate analytic techniques as well. Instructors who use case-based learning say that their students are more engaged, interested, and involved in the class; d) In their effort to find solutions and reach decisions through discussion, students sort out factual data, apply analytic tools, articulate issues, reflect on their relevant experiences, and draw conclusions they can relate to new situations. In the process, they acquire substantive knowledge and develop analytic, collaborative, and communication skills, etc.

While developing case-based learning modules, the following strategies [7] need to be followed: a) Strategies for formation of cases; b) Strategies for managing case assignments; c) Strategies for designing case study questions; d) managing discussion and debates, etc.

B. Self–Directed Inquiry–Based Learning

Laboratories are unique aids for teaching and learning science and engineering. They provide students opportunities to think, discuss, and solve real problems. Lab-based teaching assumes that first-hand experience in observation and manipulation of materials of science and engineering, which is superior to other methods of developing understanding and appreciation. Laboratory training is also frequently used to develop skills necessary for more advanced study or research. Major objectives [10] of Lab-based learning are: a) Skill development; b) Intensifying concepts; c) Developing cognitive abilities; d) understanding the nature of science; e) Developing positive attitudes of learning.

The strategies for Lab-based learning modules include: a) Feasibility study and identification of experimental goals; b) Preparing lab sections; c) Managing lab sections; d) Evaluation of real and simulated lab work, etc.

C. Learner–Centered Problem–Based Learning

Problem-based learning [11] is a pathway to better learning, helping students to learn how to learn. This method challenges students to develop the ability to think critically, analyze problems, find and use appropriate learning resources. It is a learner-centered educational method**.** Learners are progressively given more and more responsibility for their own education and become increasingly independent of the teacher for their education. Problem-based learning is based on real world problems. Learning is based on the messy, complex problems encountered in the real world as a stimulus for learning and for integrating and organizing learned information in ways, which will ensure its recall and application to future problems. It is also a motivating way of learning. Learners are involved in active learning, working with real problems and what they have to learn is seen as important and relevant to their own works. This approach is highly suitable for soft professionals and need to be adopted in a SE curriculum.

D. Service–Based Learning

Service or community-based learning [12] is a method which promotes student learning through participation in thoughtfully organized service experiences. These experiences are defined, planned, implemented, and coordinated collaboratively by students, the university, and the community. They offer students an opportunity for an application of their education in service to the community which enhances their appreciation. For an online course of SE, service-based approach may help software professionals and students participate together in sharing their experiences from diversified location and background.

V. Proposed Online SE Curriculm

Though many ideal SE curriculums are suggested by many universities followed SE-Book-of-Knowledge (SE-BoK) [13]; as per authors' investigation, no Bangladeshi university offers an online course on SE using e-learning platform. However, it is found that in Bangladesh, only Independent University, Bangladesh (IUB) offers a dedicated graduate course on SE (M.Sc. in Software Engineering). While proposing their online SE graduate program, the authors chosen only a subset of the Knowledge Components (KC) [14][15][16] suggested by SE-BoK, suitable for working software professionals as well as fresh graduates; and suitable for Bangladeshi industry need; whose contents, in many ways resembles with IUB curriculum (Master of Science in Software Engineering). The KCs selected are: a) Software Requirements, b) Software Design, c) Software Construction, d) Software Project Management, e) Software Evolution, f) Application Domains, g) Ethics and Professionalism, h) Software Quality, i) Tools and Environments. As the participant can either be a fresh graduate already having a CSE/CS/SE/CIS background at undergraduate level or a working software professional with varying background; the proposed curriculum consists of two different tracks. Track-1 focuses on fresh graduates and track-2 focuses on existing software professionals from the industry. Surveys [13] on Bangladeshi software industry shown that, many of the professionals especially working on small enterprises are ignorant about the global conventions and standards (such as CMMi, IEEE, SDLCs, etc). Specialized online course on SE will certainly help them. As there exist wide range of real time lab experiments for fresh graduates in track-1, in this customized version of track-2, more emphasis may be given on software development process and relevant software metrics rather than programming languages and tools.

After completing certain number of pre-requisite credits, both track-1 and track-2 syllabus converges to common curriculum which consists of 33 credits and decomposition of courses is shown in tables 1, 2 and 3. To ensure industry participation and meet the expected outcome, in addition to teacher–centered classroom based learning (20 to 30 percent), learner-centered approaches (cognitive and constructivist) are adopted for developing e-learning components (learning objects). In this approach, the students collaborates with each other using interactive LMS and working professionals shares and allow inexperienced students to understand working culture and enterprise environment. After understanding the concept and application areas of various software metrics, participants relate knowledge gathered through online learning with real software engineering practices followed by local industry.

TABLE I. BASIC SOFTWARE ENGINEERING COURSES (COMPULSORY)

Course Title	Credits: 21
Software Engineering Concepts	3
Software Architecture and Component-Based Design	3
Software Requirements Engineering	3
Software Project Management	3
Software Engineering Process	3
Software Marketing	3
Software Quality Assurance, Testing and Reliability	3
Sub Total	21

TABLE II. ADVANCED SOFTWARE ENGINEERING COURSES (ELECTIVES)

Course Title	Credits: 6
User Interface Design and Development	Any two courses
Data Mining and Warehousing	
Advanced Internet Computing	
Distributed Database System	
Analysis and Organization of Information Systems	
Image Analysis and Pattern Recognition	
Advanced Topics in Computer Networking	
Software Technology and Innovation Management	
Business Process Reengineering (BPR) and Software	
Embedded and Real-time Software Engineering	
Computer Animation and Virtual Reality	
Computer Ethics and Cyber Law	
Sub Total	6

TABLE III. INDUSTRY BASED SOFTWARE ENGINEERING PROJECT

Course Title	Credits
Industrial Project	6

VI. CHALLENGES IN INCORPORATING PROPOSED CURRICULM

A. *Ensuring Industry Participation in Curriculum Development*

As regular on-campus course are often criticized by the industry for not producing software engineers of their expected quality, it is very difficult for an online SE course to be recognized and accepted by the industry. For the success of such online course, it is very important to disseminate the usability of the course to the target audience and potential employers, especially by highlighting its motivational components and industry representation.

Thus, while developing such online course, it is important to determine the curriculum's objectives and expected outcome. At this fundamental level, all the stakeholders (instructional designers, potential participants, industry expert as well as regulatory authorities) need to collaborate with each other in setting the curriculum and deciding its content. At later stage of the curriculum development, it also involves another participatory group, the accreditation body.

In Bangladesh, typically, UGC approves the programs for private universities. New programs of public universities are approved by their own course committees. However, prior collaboration with local accreditation body like BAETE [17][18] or international body like IEEE/ACM can tremendously help the universities at the early stage of the curriculum development. This accreditation bodies can disseminate latest development/updates of their research/regulations to the universities aligned with the curriculum development.

B. *Accreditation Issues*

Accreditation is one of the major concerns to judge the merit of a program. Accreditation encourages universities to review their programs periodically to keep pace with the fast growing requirement changes in business & technology. However, for online curricula on SE, which require continuous assessment and changes, it’s not easy for such curricula to be accredited. In following discussion, we describe various accreditation bodies and highlight on challenges faced during their activities on SE curricula.

Ac*creditation Board for Engineering and Technology*— In late 1990's, the Accreditation Board for Engineering and Technology (ABET), approved criteria for accrediting software engineering under the Engineering Accreditation Commission (EAC). The ABET/EAC criteria [19][20] contains eight general criteria, of which Criterion 4 and Criterion 8 specifically address requirements for specific curriculum content.

ABET Engineering Criteria 2000 — ABET engineering criteria 2000 [19] says that the students must be prepared for engineering practice through the curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work.

IEEE-CS/ACM Education Task Force Accreditation Guidelines — The IEEE-CS/ACM Education Task Force Accreditation Guidelines [18] state that, graduates of a SE degree program must demonstrate the ability to analyze, design, verify, validate, implement, and maintain software systems, using appropriate quality assurance techniques/methods in all of these.

AICTE and PEC— The All India Council for Technical Education (AICTE) is the apex body for accreditation of technical education curricula. Among many programs, it accredited MS program in IT and Software Engineering [21]. In Pakistan, the Pakistan National Accreditation Council (PNAC) is the authority to accredit technical degree curriculum [22]. However, as per our investigation, no SE curriculum is accredited by PNAC, so far.

C. *Inadequate Expertise in e–Component Development*

For a university lacking e-component development infrastructure may wish to outsource the development process. In developed countries, especially in Europe, software

companies [23] having specialized expertise in educational software and e-component development. However, in Bangladesh, most of the local software enterprises lack the required expertise to develop competent e-components [13].

D. Teacher's Training for e-Learning

Conducting an online course is different from conducting a on-campus regular courses. In case of online courses, the instructors does not have face-to-face meeting on a regular basis, yet need to understand student's psychology better and motivate them most. The instructors also need to be familiar with modern and post-modern instructional design models to effectively conduct the course. As a result, a specialized teacher's training program is required.

E. Courseware Development for e–Learning of the Proposed Curriculum

Though the online course is just proposed, it is required to develop the learning objects (e-components) for various modules and test it as a pilot course before commercially launching it. Though there exist no courseware development centre and employed instructional designers at IUB, it remains as a challenging task for the authors to develop the e-components and integrate with interactive LMS.

VII. CONCLUSION

SE is a maturing discipline, and the demand for well educated software engineers is increasing. However, adequate and efficient software engineers do not exist to support the industry demand. Introduction of online SE course (e-learning based) can contribute in producing necessary software professionals. In this paper, the authors proposed a customized online curriculum at postgraduate level suitable for fresh graduate and software professionals with varying background, catering SE education for wide range of participants in a developing country like Bangladesh. The proposed curriculum requires approval of academic council and University Grants Commission; development of learning objects/e-components; and run the pilot course before commercially launching the program.

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Student Experiences of Online Conversation Spaces in an Undergraduate IT Course

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***Abstract*—Research in e-learning interactions have mainly focused on engagement facilitated by asynchronous computer-mediated communication (CMC) technologies, while less is known about the impact of synchronous CMC (chat) technologies on e-learning processes. This paper introduces an innovative case of the instructional application of chat technology to support interaction in virtual tutorials of an undergraduate IT course. Survey results reveal student satisfaction with participation opportunities in chat tutorial discussions and the enhancement of online learning experience with chat tutorials. The conclusion discusses implications of the findings and evaluates possible recommendations for more pedagogically effective design of the chat tutorial activity.**

Keywords-e- learning technology; synchronous computer-mediated communication; case study; student experiences.

I. Introduction

The sociocultural constructivist view on learning regards interaction as essential to knowledge building processes. In e-learning contexts, most studies have examined interactions facilitated by asynchronous computer-mediated communication (CMC) technologies while less is known about the impact of synchronous CMC technologies on e-learning processes. This paper presents a qualitative case study of a distant undergraduate IT course exemplifying the innovative instructional application of the synchronous CMC (chat) technology to support interaction in virtual tutorials that constitute online conversational spaces for the congregation of e-learners. The paper reports web survey results on student satisfaction with factors of participation opportunities in chat tutorial discussions and the enhancement of their overall online learning experience with chat tutorials. The conclusion discusses implications of the findings and possible recommendations for more pedagogically effective design of the chat tutorial activity.

II. BACKGROUND

A. Interaction and the E-Learning Process

The sociocultural constructivist perspective [1] considers interaction as vital to learning experiences and assumes that participation in discursive practices of the learning community supports knowledge construction. In other words, dialogic interactions between learning parties are crucial for supporting negotiation of meaning that leads to knowledge building from which there could be learner *appropriation* [2] of the shared understandings.

When extended to e-learning contexts, the sociocultural constructivist view holds that individual and group knowledge construction processes are supported by interaction in online instructional events such as virtual lectures/tutorials. Engagement between e-learning parties is largely facilitated by a variety of computer-mediated communication (CMC) technologies such as e-mail, discussion forums and chat rooms. This move from construing conversation spaces for learning as brick-and-mortar classrooms to virtual instructional settings presents benefits and challenges to educators since the range of educational interactions has been extended yet limited by technological choices.

B. Computer-Mediated Communication Technologies and Educational Interaction

Online interactions between e-learning parties are largely supported by asynchronous and/or synchronous CMC media offering different capabilities and constraints. The *asynchronous* CMC mode facilitates delayed-time dialogue through applications such as e-mail and bulletin boards. The interactions are usually text-based messages (discussion threads) that could be composed, sent, and accessed anytime/anywhere.

In contrast, the *synchronous* CMC mode enables real-time dialogue, whilst communicating parties are ‘present’ at the same time, through services and applications such as Voice over IP (VoIP), desktop video conferencing, and Internet Relay Chat (IRC). Online synchronous (*chat*) interactions are mainly manifested as text-based messages, composed and sent by parties who are simultaneously logged in chat rooms. Instead of a topical or temporal ordering of messages, as in the case of asynchronous discussion threads, chat messages appear chronologically on-screen with preceding exchanges scrolling up and then off each party’s computer screen at a speed corresponding to the conversation’s pace [3], offering a semi-permanent record of the exchanges which is generally not retrievable unless deliberately saved by the user.

Most research on educational CMC interaction have focused on the asynchronous mode which is widely held to free e-learners from constraints of time for critical reflection [4, 5] and competition for participation opportunities [6] that tend to be evident in synchronous interactions. The synchronicity and conversational characteristics [7] of the real-time CMC mode have led to unfavourable comparisons with the asynchronous mode on aspects of time constraints and competition for *turn-allocation* [8] during chat interaction.

The fewer studies on the synchronous CMC mode have contended that real-time online interaction conveys a stronger sense of communicative presence that reduces *transactional distance* [9] between distant learners and enhances socio-emotional aspects of online collaborative group learning processes [10, 11]. Also, the capability of the synchronous CMC mode to 'contract' time makes it particularly appropriate for instructional activities requiring fast decision-making and spontaneity [12]. Furthermore, the largely text-based chat medium is assumed to filter out visual and social cues [13] enabling e-learners to have (or perceive to have) equal opportunities for contributing to discussions.

C. Research on E-Learning Experiences

Studies on student e-learning experiences have generally yielded mixed findings. Current online learning environments, supported by better technologies, are held to offer high quality interaction and a wide range of teaching approaches to enhance learning. The networked learning model for higher education [4] would move students from physical settings to virtual global learning communities, offer interactive instructional activities, support communication between e-learners, and lead ultimately to improved cognition and social interaction. Research on e-learning experiences afforded by synchronous and asynchronous CMC technologies have found student satisfaction over factors of convenience; availability of socio-emotional and learning support from tutors/peers [14, 15]; critical thinking development [16]; and collaborative knowledge construction [17].

However, [18] highlighted e-learner frustrations over problems related to the characteristics of CMC technologies that could be major impediments to learning: the nature of online interactions (lack of visual cues) and technical problems that contributed to learner anxiety. Although [18] examined asynchronous CMC interactions specifically, it is not inconceivable that such problems identified could also be manifested in interactions facilitated by synchronous CMC technologies.

Even as both CMC modes offer different capabilities and constraints to facilitate interaction in e-learning environments, efforts in research and application have mainly concentrated on the asynchronous mode at higher education level. This could partly be attributed to perceptions that the delayed-time CMC medium is more conducive for extended reflection on learning and democratizes participation opportunities. In contrast, the synchronous CMC mode has largely been under-utilized for supporting interaction in distance higher education, with most research focusing on its impact on building socio-emotional ties in learning groups.

Given the sociocultural constructivist assumption that interaction supports meaning negotiation that builds new knowledge, such a situation highlights the need to further current understandings on the impact of synchronous CMC technology on learning interactions, particularly, in facilitating opportunities for participation in learning conversations and enhancing the overall e-learning experience. Such knowledge could contribute to more pedagogically effective integration of CMC technologies into course design and activities. The next section describes a rare yet innovative case of the instructional application of synchronous CMC technology in a distance undergraduate IT course, which forms the research context for this qualitative study into student perceptions of participation opportunities and learning experiences in online synchronous tutorials.

III. THE CASE STUDY

The case is a unit of study (*Organisational Informatics*) available to third-year undergraduates through the School of Information Technology (Murdoch University, Australia). The case study, first reported in [19], was two tutorial groups engaged in collaborative learning in a series of 11 one-hour online tutorial sessions over a 13-week semester in 2005.

A. About Organisational Informatics

The *Organisational Informatics* (OI) unit aims to develop skills associated with organizational aspects of information systems design and development, including skills in critical assessment and management of issues related to knowledge building organizations [20]. The course content topics include organizational design, CMC processes, computer-mediated collaborative work group processes, and management of information and IT. The OI unit adopts a hybrid course delivery design that offers lectures (as face-to-face lectures and streamed audio files) and online tutorials (in chat rooms) to *internal* and *external* students who, respectively, undergo the course on-campus and via a distance learning mode. Course materials comprise print (a course reader) and electronic resources, with the latter accessible from the unit home page hosted on WebCT, which is Murdoch University's campus-wide virtual learning environment.

The OI unit's pedagogical framework is based on social constructivism [1], hence its instructional strategies emphasize "collaboration, personal autonomy, generativity, reflectivity, active engagement, personal relevance, and pluralism"[20]. In congruence with the unit's constructivist basis, the main learning activity of interest to this study, namely, the chat tutorial discussions, is designed to facilitate knowledge construction through participation and reflection.

B. The Participants

The participants comprised students and tutors of two tutorial groups (G1, G4), including the author who was a participant observer in G4. Both tutorial groups were involved in equivalent learning activities covering the same content areas but there were some differences in student profile, group size, and tutors (Table 1). The names used here are

pseudonyms except for *Fay* (G4 tutor, unit coordinator) who had waived her privacy rights in this research context.

TABLE I. CHARACTERISTICS OF TUTORIAL GROUPS 1 AND 4

Characteristics	Group 1	Group 4
Group tutor	Rachel[a] (Part-time)	Fay[a] (Full-time)
Group size	15 students, 1 tutor	9 students, 1 tutor, 1 researcher[b]
Enrolment status	13 Internal, 2 External students	4 Internal, 5 External students
Nationality	Mostly international students	Mostly Australian students
English Language proficiency	Mostly ESL/EFL speakers	All native English speakers
Gender	3 female and 12 male students	1 female and 8 male students

[a] Names in this study are pseudonyms except for Fay (tutor, unit co-ordinator) who had waived her privacy rights in this research context.

[b] The author was a participant observer/researcher in Group 4.

C. *The Online Synchronous (Chat) Tutorial Activity*

The weekly chat tutorials are held in WebCT chat rooms that constitute online conversation spaces where students gather for specific pedagogical purposes. The tutorials are designed to facilitate students' knowledge building processes through participation and reflection [20]. The chat tutorials are conducted in a seminar style, with a tutor-facilitator and one or two student presenters moderating the discussion. The presenter role is rotated among all the students in each tutorial group. In more detail, the presenter moderates the discussion based on his/her critiques of the week's readings. The tutor is present as a facilitator throughout the session, evaluates the presenter's performance and the extent of participation by other students in the discussion. The other students are expected to participate actively during discussions and evaluate the presenter as part of *peer assessment of participation* with the aid of archived chat discussion logs. Essentially, the constructivist pedagogical framework of the OI unit is reflected in the tutorial activity that involves critical review of readings, dialogic exchange of multiple perspectives, and student reflection on learning using archived logs.

Hence, the OI unit could be regarded as a single, *information rich* case [21] from which one could potentially learn most [22] regarding the impact of the synchronous CMC technology on facilitating learner participation in discussions and enhancing the e-learning experience.

IV. RESULTS

At the end of the semester, a web survey was administered to 23 student respondents from both tutorial groups with return rates of 93% (G1) and 89% (G4). The web questionnaire comprised closed and open-ended questions. Responses to closed questions were pre-coded by the survey software; hence minimal data processing was necessary before the application of simple descriptive statistical analysis. Data from open-ended questions were post-coded using categories that emerged from interpretive content analysis of the responses. The units of analysis are the tutorial group and individual participants.

While the whole survey [19] covered different aspects of the e-learning experience, this paper presents a subset of findings on student satisfaction with two factors: (a) participation opportunities in chat tutorial discussions (Q.9a); and (b) enhancement of their online learning experience with chat tutorials (Q.9e). These aspects of the e-learning process are assumed to be empirically observable through examining participant self-reflections on learning experiences in chat tutorials. The quantitative results from Q.9a/e are elaborated upon by qualitative responses, where provided by respondents, from an open-ended question: Q.17-Please share any other comments about your online learning experience in this unit *ICT329*.

A. *Participation Opportunities*

Results in Table 2 show that most respondents were satisfied (VS&S) with their experiences of *participation opportunities* in the chat tutorial discussions (G1=92.3%; G4=87.5%).

Responses in Q.17 from both groups provided more insight into respondents' experiences of participation in chat tutorials that may account for their ratings of the factor. The opportunity to participate in chat tutorial discussions was held to be a positive experience by some respondents. The text-based medium and sense of immediacy afforded by chat encouraged spontaneity of expression, sharing of individual knowledge, and developed agility of thought.

I have learnt how to identify my ideas online by using chat room because while during face-to-face I usually don't share that much as I shared in this unit using chat room … [Max]

… I think another online learning experiences i felt was that i was made to think on the spot in away... with chat you have to think quick to write responses. [Robin]

TABLE II. SATISFACTION WITH PARTICIPATION OPPORTUNITIES AND LEARNING EXPERIENCE

From your experience of online tutorials in this unit, how satisfied are you with each of the given factors? Rate each factor from *Very Satisfied* to *Not Satisfied*.			
		VS&S[c]	***SS&NS***[c]
Q.9a. Opportunity to participate in discussions	**G1**	92.3% (12)	7.7% (1)
	G4	87.5% (7)	12.5% (1)
Q.9e.Online learning experience is enhanced with chat tutorials	**G1**	76.9% (10)	23.1% (3)
	G4	71.4%(5)[d]	28.6% (2)[d]

[c] VS&S=Very Satisfied & Satisfied; SS&NS= Somewhat Satisfied & Not Satisfied

[d] One G4 respondent submitted a blank response to Q.9e.

However, other respondents highlighted difficulties experienced when participating in chat tutorials. In particular, difficulties in complete expression of thought attributed to the rapid speed of exchanges and lack of non-verbal cues that are characteristic of the text-based chat medium.

… It made it hard to participate and share views because the speed of the discussion was too fast for me. [Bill]

…an online chat doesn't quite have the same dynamic as a live tutorial ... [Pete]

B. Enhancement of Online Learning Experience

Regarding the *enhancement of online learning experience* with chat tutorials, Table 2 shows that while most respondents were satisfied (VS&S) with their experience of the factor (G1=76.9%; G4=71.4%), there was greater dissatisfaction compared to their experiences of participation opportunities in tutorial discussions.

Responses in Q.17 elaborated on respondents' mixed experiences with this factor. Some respondents explained that their learning experiences was enhanced by the novelty of the learning activity, and development of CMC skills that are directly relevant to the course content and grounded in real-life experiences.

It was good fun communicating over a communication chat medium overall, a new experience doing for the tutorials. [Eric]

I think given the topics that are covered in this unit, using online tutorials to talk about them is the best way to learn, as it provides a more practical or hands-on experience which the students can identify with. [Jack]

I loved the online learning experiences in this unit. I think its great, being able to communicate this way via online because i chat everyday online on yahoo, msn, icq, paltalk ... [Robin]

Even as there were less positive experiences with this factor, respondents suggested that the learning experience could be improved by a greater availability of face-to-face interaction in tandem with online synchronous communication in the tutorial activity design.

It was a very interesting experience.However I still feel that there has to be a combination of face to face and CMC styles. [Diane]

I would have preffered meeting face to face as tutorial group in the first week before doing online tutorials. [Alan]

V. DISCUSSION AND CONCLUSION

Given the sociocultural constructivist view that interaction is an essential aspect of the learning process and the scarce research on the synchronous CMC technology in enabling engagement in online learning processes, the OI unit constituted a particularly informative case for this qualitative study on the impact of the synchronous CMC technology on participation opportunities and student e-learning experiences in chat tutorials.

Web survey results from two tutorial groups showed that most students were satisfied with *participation opportunities* afforded by the synchronous CMC medium, with positive experiences mainly attributed to the sense of immediacy and text-based characteristics of the chat medium that encouraged greater agility of thought and sharing of individual knowledge.

Compared to the previous factor, there was greater dissatisfaction with the *enhancement of online learning experiences* through chat tutorials. This finding is of concern when the chat tutorials are designed to introduce students, in an active and experiential way, to the theory and practice of CMC processes that are directly relevant to the OI unit content. Hence, greater dissatisfaction with this factor signals a potential source of student frustrations over the nature of interaction facilitated by the synchronous CMC technology that may impede learning.

While the OI unit's hybrid course delivery design enables educational interaction to be experienced via face-to-face and online contexts, the chat tutorials are solely held in online conversation spaces. A possible recommendation for the design of the tutorial activity is to provide opportunities for face-to-face contact among the chat tutorial members, as suggested by the respondents. However, this would naturally exclude external students who undergo the course via a distance learning mode. Furthermore, unless framed by formal learning objectives, providing such recourse to face-to-face contact would be incongruent with the chat tutorial activity's aim to develop CMC skills in a virtual setting that reflects real-world practices where interactions between distant collaborative work groups are largely facilitated by CMC technologies that present both benefits and constraints in communication. Nevertheless, it may be possible to recommend that the tutorial activity incorporates a brief sharing session whereby group members share strategies for effective CMC use which is consistent with the tutorial aims and may minimize student frustration over the text-based chat medium.

In conclusion, this study found that the synchronous CMC technology had a largely positive impact on learning interactions as the students were mainly satisfied with the participation opportunities and enhancement of their e-learning experiences through chat tutorial discussions. Finally, even as the knowledge gained from this single case study is not claimed to be generalizable to wider populations, the findings and recommendation presented here may be of interest to researchers concerned with the use of technology for online learning and higher education professionals responsible for designing distance learning programmes who may gain greater understanding of the impact of the synchronous CMC technology on supporting interaction in e-learning groups.

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Cost Optimization in E-Learning Based Educational Systems

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***Abstract*- The increasing use of an internet improved internet technologies as well as web-based applications. Also, increasing effectiveness of the e-Learning has become one of the most practically and theoretically important issues in both educational engineering and information system fields.**
The development of information technologies has contributed to the growth in online training as an important education method. The online training environment enables learners to undertake customized training at any time and any place. Moreover, information technology allows both the trainers and learners to be decoupled in terms of time, place, and space. This paper concerns with identification of varied cost elements in e-learning educational system and optimization by the means of mathematical programming.

Keywords: E-learning systems; Cost elements; Optimization; Mathematical programming

1- INTRODUCTION

E-Learning system is an internet based service like the application system or the internet based virtual course study service (Parikh, M., and Verma, S., 2002). This system is able to be interpreted in various ways such as ‘‘computer based, education delivery system which is provided through the Internet’’, or ‘‘an educational method that is able to provide opportunities for the needed people, at the right place, with the right contents, and the right time’’ (Song, 2000).
The e-Learning system is one of many methods of the education (the teaching and learning procedure) that allows flexible learner-centered education. It is an information system based on the World Wide Web (Zhang, J.K. Nunamaker, 2003). E-Learning provides an inter-disciplinary approach to information technology and educational engineering, and an assessment of e-Learning effectiveness could also be achieved (Hiltz, S.R., Turoff. M., 2002). As of IT, the end user assessment, the quality of the information system, and the system's user satisfaction could be measured. As of educational engineering, however, the learner's academic achievement or the degrees of self-study ability could be measured.
The academic achievement is an assessment of the learner's e-Learning environment, while self-study ability is an assessment of one's aptitude regarding his or her self-study (Neville, K., Heavin, C., & Walsh, E., 2005).
This approach reveals the extensive and effective trends resulting from an e-Learning research (Zhang, D., Zhou, L., Briggs, R., & Nunamaker, J., 2006). Many researchers are quite divided over the various views regarding educational engineering and information systems. Many researchers are on exploratory level trying to get explanations regarding the variations of e-Learning effectiveness (i.e., Wang, 2003).
The tendency of educational engineering to introduce theoretical variables in order to explain e-Learning effectiveness is insufficient except for limited numbers of information systems (i.e., Piccoli, Ahmad, & Ives, 2001). Moreover, this approach of putting together information systems and educational engineering is rarely observed. An e-learning educational system is illustrated in Figure 1.

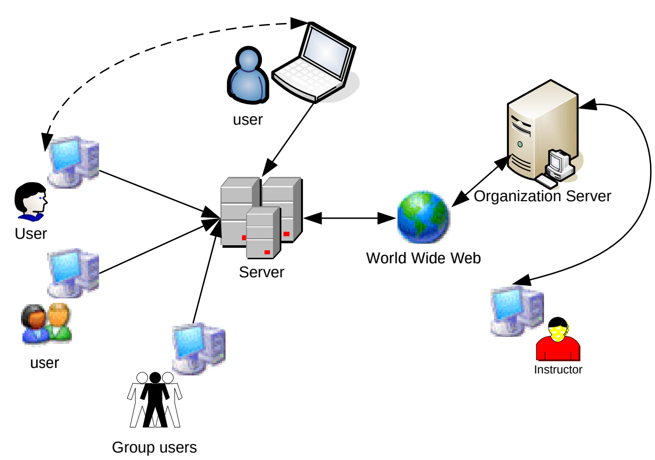

Figure 1. E-Learning Educational System

2- COSTS FACTOR IDENTIFICATION

Definitely cost analysis and budget allocation is a complicated task for e-learning (Liao,Y-K.C., 2004). Because of the pace of thrive of technologies and innovations and also the increase of functionality and effectiveness (Duffy, V.G., Parry, P. W. Ng., and Ramakrishnan, A., 2004) for the time factors of new technologies in establishing e-learning has its own cost affects (Lohmann, J.R., and Corradini, M.L., 2002). While you can expect e-learning to deliver an attractive return on investment, start-up costs for an enterprise-wide implementation are significant, and so is the cost of developing custom content. Cost issues can be mitigated, for example, by a phased implementation, using a hosted e-learning application instead of building one inside the firewall, developing a curriculum based on generic content with only a limited number of essential custom-built courses.

2.1- DEFINING COST

To find out whether the monetary value of the results exceed the cost of the training or not we need to know three items:

- The cost of both developing and delivering e-learning.
- The return or benefits.
- The period over which benefits accrue.

We analyze learning development and delivery costs under three headings: direct, indirect and opportunity.

2.1.1- DIRECT COSTS

Direct costs are those which are spent in the implementation of a learning system and are almost fixed during the serviceability of such a system. Major items of direct learning costs are presented in Table 1.

2.1.2- INDIRECT COSTS

Indirect costs are defined as: ‘‘compensation the wages and benefits paid to learners while they are learning as well as the overhead costs associated with both the direct and indirect costs’’. A researcher points out a relationship between direct and indirect costs and in so doing signposts the cost advantage of e-learning over classroom learning: ‘‘The available evidence suggests that the indirect, compensation costs of traditional learning are typically at least as great as the direct costs. When overhead (which also applies against the direct cost) is added in, the indirect costs of traditional learning are likely to be twice the direct costs. And that is one of the major attractions of e-learning; it holds the promise of reducing all three categories of costs, but perhaps most significantly, the indirect and opportunity costs of learning. Under some circumstances, firms have estimated the total cost of e-learning to be less than half the costs of traditional learning.

2.1.3- OPPORTUNITY COSTS

Opportunity costs are business opportunities lost because employees are busy learning and not available for other responsibilities. A conservative estimate of opportunity costs is that they are equal to indirect costs. They can turn out to be dramatically higher, especially when the learner works in sales and marketing.

Because e-learning (1) is so time-effective, and (2) avoids learning-related travel, it incurs much lower opportunity costs than classroom learning.

2.2- FIXED COSTS

The fixed cost of learning includes content development, that is, intellectual property development and licenses, instructional design, studio costs and programming costs. Occasionally, e-learning fixed costs will include extending or upgrading the network. These occasional costs should not be carried by one course but spread across a number of courses that all benefit from an improved infrastructure. Fixed costs for e-learning are significantly higher than for classroom learning reflecting the higher number and value of resources required to author an e-learning course compared with a classroom course.

TABLE1: Direct learning costs comparison

Direct Learning Costs	
Face to face system	**E-learning system**
• Wages and salaries of trainers	• Development
• Payments to outside vendors	• Purchase and/or licensing of materials
• Facilities expenses	• Hardware for delivery
• Development	
• Production and distribution of materials	
• Travel expenses	
• Administrative and support costs	

2.3- VARIABLE COSTS

The variable or marginal costs of learning delivered in a classroom are significantly impacted by the number of learners. In contrast, the variable costs of e-learning are negligible. That is because certain cost items will remain *fixed* for a given course delivery regardless of the number of students, up to the delivery capacity of that item. Beyond that point, an additional cost would be incurred by adding a student to the course. For example, if an instructor books a classroom that holds 15 learners, whether one learner or 15 register, the variable cost remains the same of course, indirect costs will vary. However if 20 learners register, the cost of delivering the course doubles because two classrooms are required with an instructor in each. Fixed and Variable costs per number of students are represented in Figure 2.

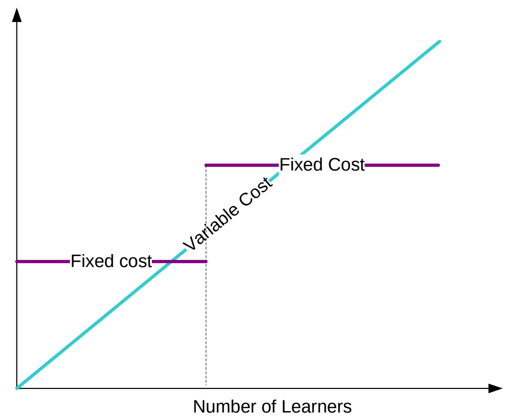

Figure 2. Fixed and Variable costs per number of students

So long as the overall size of a workforce remains constant, e-learning is not usually subject to stepped costs. An acquisition, on the other hand, could generate stepped indirect costs for e-learning, for example, distributed content management and server upgrades. Large virtual classes can also generate stepped costs. One instructor to 20 learners is the rule of thumb for keeping virtual classes effective and interactive. With larger classes, adding one assistant instructor for each additional 20 learners maintains effectiveness and interactivity.

3- COST OPTIMIZATION

Considering the stated costs, to make the implementation and administration of an e-learning system of education more economic an optimization is essential. In this paper this optimization is done by mathematical programming. The notations are as follows:

Notations:

C_F	*Fixed costs*
C_V	*Variable costs*
C_D	*Direct costs*
C_I	*Indirect costs*
C_O	*Opportunity costs*
$C_{Development}$	*Cost of development*
$C_{Purchase\ Material}$	*Cost of purchasing material*
$C_{Hardware}$	*Cost of hardwares*
t	*Time unit (Hour)*
t'	*Period of time per month unit*
E_1	*Initial Expense of development*
E_2	*Expense of Purchasing materials*
E_3	*Expense of Hardwares*
R	*Revenue of a user per hour*
F	*Facility payment to students*
φ	*User's ability level*
i	*Interest rate*
X_V	*Variable cost per each user limited to* B_2
X_F	*Fixed cost per an appropriate number of user limited to* B_1
N	*Total number of users* $N=1,2,3,\ldots,N$
M	*Subset of users* $M=1,2,3,\ldots,S$

Number of subsets is defined in levels as follows:

$$M=\begin{cases} 1 & 1\le N\le s \\ 2 & s+1\le N\le 2s \\ 3 & 2s+1\le N\le 3s \\ . & . \\ . & . \\ S & (S-1)s+1\le N\le S\times s \end{cases}$$

User's ability is needed for the educational system to provide facilities, and is defined as follows:

$$\varphi=\begin{cases} 0 & \textit{If student is Weak} \\ 1 & \textit{If student is Normal} \\ 2 & \textit{If student is Strong} \end{cases}$$

The fixed cost would define as follows:

$$C_F = M \times X_F$$

The variable cost is based on the number of students and is shown mathematically as follows:

$$C_V = N \times X_V$$

The direct costs of e-learning are divided into three elements, cost of development- cost of purchasing material- cost of

hardware, that the direct cost is attained by the summation of them.

$$C_D = C_{Development} + C_{Purchasing\,Material} + C_{Hardware} \Rightarrow$$

Cost of development is depend on initial expense of development, period of time that system is active, and the bank interest rate as follows:

$$C_{Development} = t' \times E_1 \times i$$

Cost of purchasing materials depends on the number of users and the expense of purchasing materials:

$$C_{Purchasing\,Material} = N \times E_2$$

Cost of hardwares is related to the number of subsets of users and expense of hardwares as follows:

$$C_{Hardware} = M \times E_3$$

Hence, the direct cost is calculated as bellow:

$$\Rightarrow C_D = (t' \times E_1 \times i) + (N \times E_2) + (M \times E_3)$$

The indirect cost is calculated by the means of facility payment to students and the user's ability level as below:

$$C_I = F \times \varphi$$

The opportunity cost is gained by the time units a user get by not attending face to face educational system and doing an activity (job) to reach a revenue, as follows:

$$C_O = t \times R$$

Corresponding to the stated description, the mathematical programming of our model is achieved as follows:

$$\begin{aligned} &Objective\ \ Function: \\ &Min Z = C_F + C_V + C_D + C_I - C_O \\ &\Rightarrow Min\ \ Z = (M \times X_F) + (N \times X_V) + [(t' \times E_1 \times i) + \\ &(N \times E_2) + (M \times E_3)] + (F \times \varphi) - (t \times R) \end{aligned} \qquad (1)$$

$$S.t.$$

$$1 \le M \le S \qquad (2)$$

$$1 \le N \le S \times s \qquad (3)$$

$$t' \ge 1 \qquad (4)$$

$$t \ge 1 \qquad (5)$$

$$M, N, t, t' \in \text{integer} \qquad (6)$$

Equation (1) is the objective function that is the minimization of the costs. Equation (2) implies that the number of subsets is constrained between 1 and *S* (*S* depends on the number of users and the number of users in each group *s*). Equation (3) indicates the bounds for the number of students. Equation (4) guarantees that period of time per month unit is at least one. Equation (5) shows that the minimum time unit would be one hour. Equation (6) indicates the kind of the variables.

Regarding to the above Equations, the aim is to find the optimal values of M, N, t, t', which are the decision variables. To achieve that goal, softwares such as Lingo package could be used for finding the optimal solutions. Also some sensitivity analysis might be gained for better decision making about future trends of costs.

4- CONCLUSION

The purpose of this paper is the cost optimization in e-learning system of education. To do that, different cost factors have been discussed. The elements of cost are substantial in implementing e-learning systems; therefore identifying them and trying to minimize them lead to advantages in enforcement of educational organizations. The approach which has applied in this paper for cost optimization is mathematical programming. By mathematical programming, the optimal values of decision variables are achieved that are helpful tools in decision making for now and future of educational organizations. For further study, sensitivity analysis and inserting complex and stochastic elements in our cost model is intended.

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Security for Evaluation in Higher Education

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Abstract—**All the different kinds of education are converging to a blended learning and a large list of new applications has appeared using educational platforms (LMS, Learning Management Systems). Even so we have to consider the importance of the security in our applications, in order to get a suitable behavior of our system. One of these possible applications would be in the evaluation procedure. This article describes this huge area for Higher Education considering different technologies where biometric technology will be our cornerstone. Our application will be developed in two different scenes: in traditional and on-line test.**

Keywords-b-learning; security; biometric; enrollment; verification

I. INTRODUCTION

The security has been and still is a main task in many different environments not only in education, just only we can realize the increased number of companies which work developing security devices and applications. One of the most well-known environments where there are large solutions is: the physical control or control the personnel. In this case is used a big variety of technologies or a combination of them, for example smart-card, RFID card, Biometric devices [1], etc. We can ask which of these technologies would be the best or quite better in this environment and the answer we get from the own environment. In this way there is no the best technology if not the best solution (one technology or a combination) per each environment.

Is the education environment a new scene? Why has it become more and more important? The application of one or a combination of these technologies appear when there is a necessity in the education, this could be to protect the validity of the tests as traditional as remote evaluation. But this last way of evaluation is not new, driving test; English test and a large list of tests are doing on line in these days. The necessity of increasing the security [2] depends on the actors and the context of each test. The actors will be students in any case but the context will be secondary, university, civil services, etc. For example in the case of civil services every people around you are your rival so it is logical a student does not help anyone but he probably cheats for his own good. When the context is the higher education the vulnerability will be in the interaction of the actors.

Then, to develop a security technology or not, it will depend on the level of accuracy or value that we want to give to our test.

II. BACKGROUND

Blended learning (b-learning) [3]-[8] has allowed a new way of convergence between distance, on-line and on-site class education. The convergence is going through the mixed model education that has a different percentage of any kind of methodology depending on the student or learner approach.

In this case the new approach is learner-centered instead the previous model of teacher or content oriented. Learners depending on their availability on:

- Time,
- Technology and communication, and
- Human resources,

It will adopt a mix-approach from pure on-site education (traditional Universities) that are including now elements of on-line and on-class tutoring and collaboration tools through classic distance University (as Spanish UNED). Nowadays it is converging using techniques of three models and the learner will develop its final b-learning model.

UNED as a Distance University has to overcome large of problems that others do not have. For example, how to offer the practical knowledge of some subjects or how to motorize the students' improvement. Solutions like web labs or search and answer engines can give us an opportunity to control and back up students' knowledge using educational platforms.

As it is logical although all these tools were used to control or motorize the students' improvement, in every learning process there will have to be tests in order to complete the evaluation. How to do that in Higher Education? As we said it will depend on the context where tests take place. Inside Higher Education there will be, as we said above, traditional, mixed and distance University. So the way of evaluation must be almost the same to these kinds of Universities.

So far tests were doing at University independently what kinds of universities were about. We are developing two scene that can speed up evaluation process as well as make easier the own process. In this way we try to go on converging through all the new techniques and learning models.

III. THE EVALUATION PROCEDURE

The first scene will be traditional test adding new security techniques and the second one will be on-line tests. The choice of the suitable technology must be done carefully in each scene. Biometric Technology [9] can give us the right answer to our necessity. When the number of students is more than 200000 it becomes a problem the identification of everyone but also to control all the interaction that can be generated. These problems are shared in both scenes though on-line test will be more vulnerable so that we must consider other technologies along with biometric.

As it is well-known a biometric characteristic [10] must be: universal, unique, stable, quantitative, acceptable, performance and safe.

According to Fig. 1 the fingerprint is used as the first option in many case, it is the lowest intrusive and has a high level of acceptance. It can be a perfect solution in door access systems and in personnel control systems as it is our case. At the beginning, our security system must be:

- Speed-up enrollment and verification
- User acceptance
- Low-cost
- FAR (False Acceptance Rate) low
- FTER (Failure To Enroll Rate) low
- Enroll more than one sample to assure the access in the face of injuring its biometric characteristics.

Then it will choose fingerprint system to traditional test and on-line test being in both cases the same enrollment process. Logically, at the verification on-line test must be more robust and will need additional techniques that complement our fingerprint system.

A. Enrollment Procedure

Independently of the scene, the enrollment procedure [11] will be shared. In order to reduce the waste of time the capture of the fingerprint will do at the physical registration. The first time when a student goes at university to hand in his or her application forms there will be computer to get a fingerprint sample of each user.

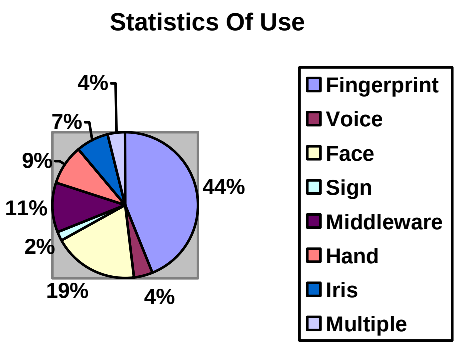

Figure 1. Statistics of use in 2006.

Along with his or her sample, system will ask for his/her ID number, as it shows in Fig. 2.

1) *Description:* It implements this part of the evaluation procedure as follows.

a) *Use the NITGEN biometric solutions.*

b) *eNBSP (NITGEN Biometric Solution Provider) SDK 4.0 (Software Development Kit).*

c) *1:N Algorithm:* Fingerprint Recognition. Two types of algoritms: Indexed Algorithm, small or medium applications; eNSearch Algorithm, medium or big application, which is our case. The Fig. 3 shows the time of search according to the number of users.

d) *It can enroll up to 10 Fingerprints/user:* we assure everyone will be able to check his/her fingerprints despite of some injured finger.

e) *API (Application Programming Interface):* provides us a high level to program. We develop our application in C++ because of this technology does not allow open code.

f) *128-bit encryption for fingerprint samples:* to protect the information facing up to attempted of manipulation [12].

g) *MySQL database on server:* It will store each biometric sample along to its ID number. In this way we could search an ID number and verify (1:1) a sample reducing the time of search a sample in all the database.

Figure 2. Enrollment screen.

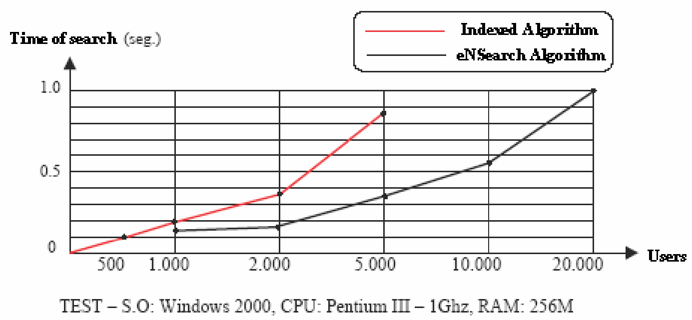

Figure 3. Time of search according to the users.

2) Format Data: Fingerprint data processed in this technology is represented in Fingerprint Identification Record (FIR) format. The FIR includes all types of fingerprint data, including raw image, data, or minutiae data. The FIR is composed of Format, Header and Fingerprint Data as it shows in Fig. 4.

a) Format: The FIR's format field indicates the format of the fingerprint data. The length of the format field is 4 Bytes; header and fingerprint data can be changed depending on format value.

b) Header: The header is 20 bytes in length and comprises the following fields:

- Header length indicates the size of the Header in bytes.
- Data length indicates the size in bytes of the fingerprint data in the FIR.
- Version contains FIR version information.
- Data Types, indicates the types of the fingerprint data stored in the FIR. There are three types of data, raw data (the original imagine data), intermediate data and processed data (minutiae data).
- Purpose specifies the purpose of the FIR (e.g., enrollment, verification or identification).
- Quality indicates the quality value of the fingerprint data with a scale of 0 to 100.
- Reserved, is reserved for later use.

c) Fingerprint Data: This field contains the actual fingerprint data; it has a variable length and the size of the fingerprint data can be affected by the values in the format field. The size of the fingerprint data is stored in the Data Length field of header.

B. Verification in Traditional Test

After the enrollment a database will have been created with all the users in the system. Users do not have to go to the university several times, at the same time they hand in their application forms when they enter in the university they will be registered in the database.

As we said this process is shared in traditional and on-line test but the verification must be more complex in remote test since it is more vulnerable environment.

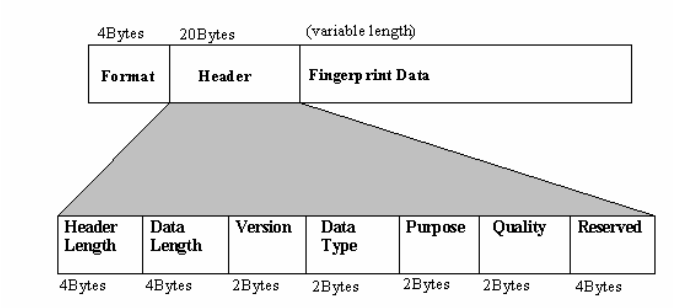

Figure 4. Fingerprint data processed format.

In traditional test it considers the following characteristics of the examination room and the application:

- Test in multimedia rooms.
- Each student will use a computer to do his or her exam.
- At the beginning of the test a screen will ask for capturing the fingerprint's user in order to match the new sample to the sample stored [13] in the database.
- ID number will be necessary, as we said, to match 1:1 and not to the entire database. In this way the comparison will be fast.
- The application will have three different behaviors: the first one, the comparison will be successful in this case it will let do his or her test; the second one will be the opposite, in this case the user will be rejection; and the third case when the correlation between the new and stored sample is not too low, at first user will be rejection but the application will do a manual search by staff. They will decide through his/her ID card, which has a photo and his /her registration if he/she is the right student or he/she is an impostor. As it shows in Fig. 5.
- Two database. The first database will have ID numbers and all the fingerprint samples. After the successful comparison it will access to the second database by each ID number. In this second database will be stored customized test for each user.
- At the end of the test, it will be stored the answers. Then students will be able to go out of the examination room.

1) Considerations: Thank for this application it can reduce the number of staff which means to reduce costs. From now it will not need people to control different situations that in other case it will need them. From now:

a) Each user will look for a free computer where does his/her test.

b) Because of being a customized test it does not make sense to take a look other computers.

c) A timer will be on when each user accesses to his/her own test: When the timer reach the limit the application will be closed salving his/her answers.

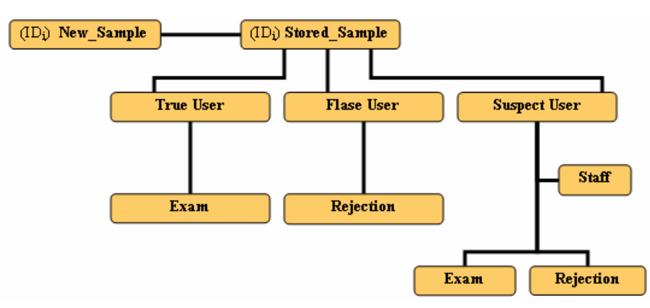

Figure 5. Diagram: Different behaviors of the application.

d) The negative point: The need of the staff's assistance. The full diagram of the verification in traditional test shows in Fig. 6.

C. Verification in Remote Test

This scene will have additional situations that we will have to consider. Starting from there can be many different enclosures where a user chooses to do his/her test. A possibility could be the own room of a user, which means a specific and permanent enclosure. The other possibility could be a changeable enclosure like a friend's house, cyber-café, etc. This last option is really a big goal, just only to think how to control. If we focus on the first option right now, we see it is not so easier than traditional test. A verification system is not enough because we can identity a user at the beginning of the test but in the following minutes, how can we assure the suitable behavior of the users?

In traditional test the staff does not have to pay attention to the users. In many cases they can realize easily if a user tries to use banned information or to speak with others. But in remote test we can not know it. Studying carefully the different interaction or behavior of the user, we have to control the following situations:

- After the verification an impostor [14] takes the place of the real user.
- Students use banned documentation.
- Use the banned devices: mobile, radio frequency devices, etc.
- Use the back-up devices: handy drivers (HDD), others computers, etc.
- Different applications in the own computer of the user.
- People helping the student during his/her exam in the room.

These situations appear in a changeable enclosure too and when this enclosure is a public place the behavior control will become in a titanic task. There will be many people around a user, noise and many mobiles are being used.

The search of solutions for each problematic situation is the first station when we have to get off.

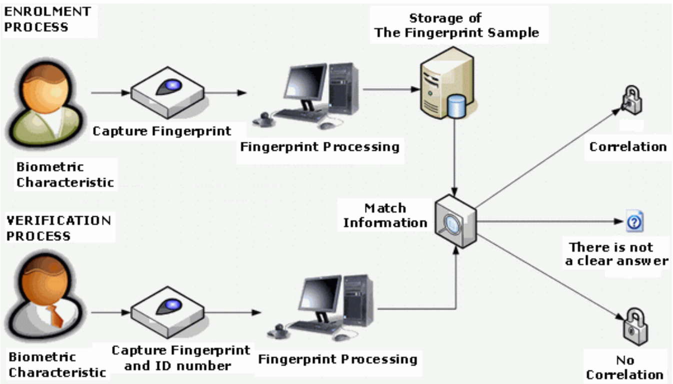

Figure 6. The full diagram of the verification in traditional test.

Analyzing deeply each situation we can get to the following conclusions:

- To assure the identity it must be verified every a few minutes.
- We can not control what documentation is used. In some traditional test the use of documentation is allowed. If we consider that possibility and prepare exam for using books. If students use or not it will not be a big problem.
- To stop working these banned devices we can use cellular inhibition or radio frequency inhibition at the enclosure. But this means we have to provide new devices in the room.
- However, how to control back-up devices. Other computer with much information or internet connection. Also HDD connects to a computer it can be a problem. In this last case it can be solved by embedded applications. If our application locks the computer that just only it can run our application students will not be able to use HDD. But other computer? Here there is a hole that right now we can not solve.
- As we said above if we lock a computer with the only possibility of working our application any attempt of using other application it will be a waste of time.
- To control other people in the room it can put in sensor of proximity or motion sensor.

1) Additional devices: It is possible to integrate other devices that give robustness to the system. For example: microphone to listen if there are people or for calls. If we put in a webcam we will be able to control what students are doing in every moment, so that a student tries to use other computer we will know. The problem is we will need someone to control all the imagens from all the webcams (more than 200000) which is impossible though there would be many people for controlling webcams.

2) Considerations: These solutions also generate new problems, as follows:

a) The cost: if we want to have under control this enclosure we must buy some expensive devices for each student.

b) Installation: It must be put in all the devices for profesional people. If we led students to fit their own devices they can instal wrong on purpose.

c) Intrusive [15]-[16]: There must be a line where technology and security systems can reach. We can not instal devices of surveillance in a private enclosure as it is a room.

3) Hypothetic Design: Although it can be far or when new technologies appear we have designed a hypothetic architecture, it shows in Fig. 7., with all the necessary devices to control this remote enclosure.

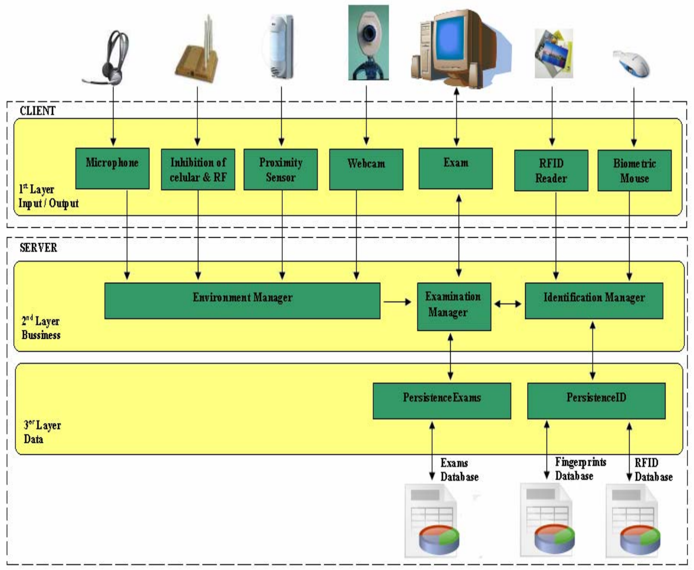

Figure 7. On-line Test. Architecture.

a) Three layers architecture.

b) The First layer: There will be the different devices. As we have proposed, there will be: microphone for noise, calls; Inhibition of celular and radio frequency; Proximity sensor for detecting other people; and Webcam. To verify every user we will have a biometric mouse [17] and RFID reader. This mouse will have a optical scan that will capture the fingerprint without user realizes. In remote test we will use a double way of verification. Every student card will be a RFID card with an unique and personal tag. This layer will be on the client side.

c) The Second layer: will be business or manager layer. It will have to manage all the devices on the first layer to the third layer. This layer and the third layer will be on the server. There are three manager. The identification manager will work to check the identity of each user. The Examination manager will get answers and questions for each user when the user is the right person. To control all the environment and the different devices we will have the environment manager.

d) The Third layer: will access to the databases and will get the information that we need in every moment.

e) There will be three databases: One for RFID tags, other for all the fingerprint samples and the last one for the questions of the test. When a student is identified the system will access to this database to get a customized test.

IV. CONCLUSIONS

New applications are being developed inside Higher Education. We use educational platforms to run our application. Starting from reducing the waste of time, there will be a web lab where students can do their practical subjects without going to the university. These new applications can generate a long physical distance between students and teacher but this does not mean a problem. In the evaluation area we will have to consider new tools to reduce the new problems in the b-learning. How the evaluation area is too big, we divide into two different types: On-class and on-line.

The use of new technologies like biometric give us a good solution for traditional test reducing cost and staff. In the case of remote test, there will be many problems to solve and of course to consider. A combination of different devices can give us a halfway solution though we must go on investigating how to do a complete secure test.

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Clicker: A Personal Response System for Effective Teaching

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Abstract— **The use of a "clicker" (A real-time infra-red (IR) / radio frequency (RF) response system) for effective teaching is a new paradigm for the 21st century that develops higher-order thinking competencies, promotes collaborative learning, and improves communication skills and student instant feedback.**

A "Clicker" is a handheld device that allows students to send information to the instructor's computer. This information can then be displayed as a chart/histogram. Infra-red or Radio frequency clickers allow students to respond to: (i) alpha or numeric multiple choice, (ii) true / false, (iii) numeric/single word response questions. Those responses are anonymous to the student, which provides an environment that encourages student participation. Responses can be easily graded and students can even take self-paced multi-question exams. When they are done with the exam they hit send and their answers are sent to the instructor's computer for easy grading.

It allows a faculty to find out how the class grasps the material as a group and generate classroom discussions. It will allow faculty to check if students understand the concepts during class and to participate in classroom experiments. Professors can utilize this technology in the classroom to evaluate the collective understanding of the entire class and track individual students learning at the point of instruction.

An instructor is able to use a clicker for interactive questions, for reviewing assigned materials, confirming attendance, awarding participation points, and grading tests. The clicker is ideal for encouraging class participation in any size classroom from small enrollments of 10-15 to large enrollments.

Keywords- Clicker; personal response system; effective teaching; paradigm shift

I. Introduction

"In 1997, the Physics department at the University of Illinois embarked on a major reform [1] of all of its 33 introductory classes. Their goal was to integrate all aspects of a course using interactive engagement methods based on physics education research in a team teaching environment. The major change to their lectures was to include active learning segments. These segments were patterned after the concept tests introduced at Harvard University [2]. Carefully chosen multiple-choice conceptual questions are posed to students in these segments. The students are then encouraged to discuss these questions with their neighbors and ultimately convey their answers to the instructor. The lecturer then devotes some time to a resolution of the issues raised by the students' responses.

Initially, the students registered their votes by showing flashcards. Clearly, the quantitative aspects of this system is limited, but, more importantly, the students' votes are not anonymous. In the intervening years, they experimented with various systems to record the students' votes, including a wired system and an infrared-based wireless system. The problems they encountered using these systems led them to develop i-clicker. This development took two years and was generously supported by the Provost's Initiative on Teaching Advancement, the Educational Technology Board, the College of Engineering, and the Department of Physics at the University of Illinois.

In 2005, Hayden-McNeil Publishing acquired *i-clicker*. "The acquisition adds to Macmillan's portfolio of leading higher education publishers which includes Bedford St. Martin's, W.H. Freeman, Worth Publishers, and i-clicker, a leading provider of classroom response systems [3]."

There is overwhelming evidence that students learn more if they actively participate in their learning [4-6]. The use of a personal response system, also known as clickers, in lecture classes is becoming widespread at a large number of universities. I-clicker, the most flexible and most reliable classroom response system, requires no hardware installation, eliminates the frustrating log-in procedure, works with any presentation application, includes a built-in LCD screen, and can be formatted according to style preferences [9].

These devices allow students to respond to questions developed by the instructor and enable the instructor to use a number of activities that promote active learning. The project described in this proposal involves incorporating

clickers into the general chemistry course and all three quarters of the organic chemistry sequence. A trial was performed in the organic chemistry course in the winter quarter of 2006. A more extensive program will be used during the second quarter of organic chemistry in the spring. Because the careful design of questions that focus on key concepts is of critical importance to the use of clickers, considerable effort has been devoted to this, during the summer. Based upon the experience obtained during the winter and spring quarters, a complete program for the fall quarter of 2006 will be developed over the summer for both general chemistry and all three quarters of organic chemistry [8].

After successful implementation of clicker-based learning in NSM and other departments at the Denver University, faculty from science and engineering showed interest to implement personal response system based teaching to enhance students' engagement either in a formal or co-operative learning environment.

This technology will broadly impact thousands of students with a new paradigm for science and engineering education for the 21st century that develops higher-order thinking competencies, promotes collaborative learning, and improves communication skills and student instant feedback.

Fifteen professors attended a workshop in the Summer of 2007, to learn how to use the clickers in different science and engineering classes. With the proper knowledge on how to use the clickers, the professors will be able to implement them in their future courses.

Professors can utilize this technology in the classroom to evaluate the collective understanding of the entire class and track individual student learning at the point of instruction. An instructor will be able to use a clicker for (i) interactive questions, (ii) for reviewing assigned materials, (iii) confirming attendance, (iv) awarding participation points, and (v) grading tests.

The clicker is ideal for encouraging class participation in any size classroom from small enrollments of (5-10) to large enrollment. Harvard University physicist Eric Mazur demonstrates the use of *Peer Instruction* and *Just-in-Time Teaching*- two innovative techniques for lectures that use in-class discussion and immediate feedback to improve student learning. These techniques are now being used successfully in many disciplines [9].

II. IMPLEMENTATION

We have implemented the use of clicker in the Fall quarter for a non science major course, Technology 21. We used Turning Point, Radio frequency response system [9]. There were 150 students. Students received several points for correctly answering questions from the assigned readings. This encouraged their reading of assignments and markedly improved class attendance. In previous year's class attendance varied between 50 and 75%. This year it was near 90%.

III. ASSESSMENT QUESTIONS

The students were to agree or disagree with the following statements concerning the use of the Turning Point.

1.) The use of Clickers in Tech21 improved my ability to learn the material.
2.) The frequency of the use of Clickers in Tech21 was just right.
3.) I wish the professors in my other classes would use the Clicker.
4.) The use of the Clicker in Tech21 encouraged me to attend lectures.
5.) The use of Clickers in Tech21 helped me understand energy, its benefits and problems.

The responses from students are presented in Table 1.

IV. RESULTS

Students from the NATS 1240 Energy class in the fall of 2007 and the NATS 1241 Technology 21, Computer and Communications class during the winter of the 2008 quarter responded to the questions asked.

As a result of the use of clickers, class attendance also improved. There was also a one letter increase in student grades, positive feedback on the relevance and the value of the course was significantly higher than in previous years. Overall, clickers had a major impact on students' education.

TABLE I.

NATS 1240: Energy – Clicker Responses from Students

Questions	***Strongly Agree***	***Agree***	***Disagree***	***Strongly Disagree***
1.)	44.7%	43.6%	9.6%	2.1%
2.)	48.4%	46.3%	3.2%	2.1%
3.)	40.9%	31.2%	18.3%	9.7%
4.)	31.4%	51.2%	16.3%	1.2%
5.)	31.4%	51.2%	16.3%	1.2%

NATS 1241: Technology 21, Computer and Communications

We used this course as a case study for the use of clickers in the classroom. A total of 105 students were asked a total of five questions, responding to the question with a clicker. For the first question, a total of 95 students believe that the clicker has helped them improve their ability to learn the material. The table below shows the break-down of individual responses.

1.) The use of Clickers in Tech21 improved my ability to learn the material.	**Responses**	
Strongly agree	50	47.62%

Agree	45	42.86%
Disagree	5	4.76%
Strongly disagree	5	4.76%
Totals:	**105**	**100%**

At the end of class lectures, 10 basic questions were asked from the lecture notes to see how well students paid attention to the material presented. After the questions, they were asked whether the frequency of the use of the clickers was enough to which 97 of 106 students replied that the frequency was the right amount. The following break-down of how students felt are shown in the table. This is a positive feedback that 10 questions following the lectures are preferred by majority.

2.) The frequency of the use of Clickers in Tech21 was just right.	**Responses**	
Strongly agree	48	45.28%
Agree	49	46.23%
Disagree – it was too often	3	2.83%
Disagree – it was too infrequent	2	1.89%
Strongly disagree – it was too often	4	3.77%
Strongly disagree – it was too infrequent.	0	0%
Totals	**106**	**100%**

With the question of whether or not students would prefer their other classes to use clickers, the responses of 83 of 105 students were an agreement. This shows that the majority of students believe that clickers have a positive impact in their learning. But 22 students out of 105 students responded that they would not encourage the use of clickers in other classes. Refer to the table for a better understanding of detailed responses.

3.) I wish the professors in my other classes would use the Clicker.	**Responses**	
Strongly agree	51	48.57%
Agree	32	30.48%
Disagree	15	14.29%
Strongly disagree	7	6.67%
Totals	**105**	**100%**

Out of 106 students, 103 or 97.17% of students responded that the use of a Clicker encouraged attendance. Not only has the Clicker been preferred among students and helps them retain information, but is an incentive to attend class.

4.) The use of the Clicker in Tech21 encouraged me to attend lectures.	**Responses**	
Strongly agree	62	58.49%
Agree	41	38.68%
Disagree	2	1.89%
Strongly disagree	1	0.94%
Totals	**106**	**100%**

90 students of 104, or 86.54%, said that the use of Clickers also helped the understanding of the course materials.

5.) The use of Clickers in Tech21 helped me understand the course materials, its benefits and problems.	**Responses**	
Strongly agree	40	38.46%
Agree	50	48.08%
Disagree	8	7.69%
Strongly disagree	6	5.77%
Totals	**104**	**100%**

V. CONCLUSION

The use of the Turning Point Clicker improved class attendance, student participation and evaluations. Through the input of students, majority believed that the clicker had not only helped them understand the course materials, but liked the frequency of the use, and believed it encouraged participation.

The clicker provides a method for real-time evaluation of students understanding course material which resulted in better student grades.

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Intensifying Student Skills and Potential for Higher Learning through Outcomes Based Education and Technology Integration

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Abstract- **The 21st century is witnessing tremendous technological advancements which have significantly changed the instructional methods in reflection of the challenges present in today's educational process. The art of effective teaching is being profoundly altered by integrating technology into classroom learning. Concomitantly the leaning is towards outcomes-based education in which the educational outcomes determine the curriculum content, its organisation, teaching strategies and assessment methodologies adopted. The ideologies advocated in the outcomes based education strategy can be well matched through the process of technology integration in classroom teaching and learning. Technology empowers the faculty to design and deliver interactive courses that meet the demanding requirements of the market and also offers a wide range of learning opportunities. Besides, it offers a variety of tools for implementing collaborative approaches in the classroom while emphasizing self supportive learning in its endeavor of enhancing the educational objective. This, indeed, is the contending principle aimed at in outcomes-based education.**

Keywords – Technology integration, outcome based education, curriculum design, measurable outcomes

I. INTRODUCTION

The current paper is a partial case study of a model Higher Education Provider (HEP) in the Sultanate of Oman. While the actual practices in its normal functioning have been carefully studied and incorporated as content matter, some of the future plans concerning technology upgradation, which the HEP envisions as essential for the intensification and upgradation of the learning process, have also been integrated. There is no doubt that the learning and teaching processes are not without glitches; but the HEP is certain of perfecting the use of technology to iron out the creases in the near future

The paper identifies the factors that help to sustain outcomes based curriculum development and technology integration for the education sector in the Sultanate of Oman. The paper analyses the innovative methodologies for imparting knowledge and delves into the effectiveness of curriculum design aimed at outcomes based education, such that the student develops proficiency and skill in the area of study.

Technology is changing rapidly and provides an array of services which can be used to support teaching and thus empower the student. Technology integration has a role to play in education as long as it is appropriately used to support teaching and learning. The classroom should be made student centered with the faculty being the catalyst. The teacher/instructor must encourage cooperative learning so that the module outcomes are met.

At this stage, it is very important to understand the precise meaning of *knowledge of technology* and *outcome based education*:

"Technological literacy is knowledge about what technology is, how it works, what purposes it can serve, and how it can be used efficiently and effectively to achieve specific goals" .

“Outcome based education is a process of core curriculum design and pedagogy that focuses on what the student will be able to do after the completion of selected modules. The desired outcome is selected in advance and the curriculum, instructional materials and assessments are created to support the intended outcome.” (Spady, 1988; 1993). Integrating technology appropriately will enable the faculty to

evaluate the analytical and problem solving skills and also identify higher levels of critical thinking.

II. FACTORS ENABLING THE SUCCESS OF TECHNOLOGY INTEGRATION IN EDUCATION

Indication of an inclusive technology plan: Such a plan should express a clear idea of the goals of the technology integration and provide for continuous up-gradation

Teacher training and continuing education: The benefits accruing from use of technology should be imbibed in the teachers such that they are willing to undergo training as to the variety and benefits of technology in teaching and learning.

Support from the community. Parents and community members can use technology as a springboard to become more involved in the activities of neighborhood educational institutions. Parents can use e-mail to facilitate communication with teachers and administrators. Businesses can use e-mail to help mentor students and help them prepare for the workplace.

III. EVALUATION OF TECHNOLOGY USE

Appraisal of the impact of technology in reality leads to an assessment of the instructional processes enabled by technology, and the outcomes are highly dependent on the quality of implementation of the entire instructional process. Crucial elements include instructional design, content, and teaching strategies associated with both the software and the classroom environment. The very dynamic nature of technology makes it difficult for meaningful evaluation. However, the evaluation process should be undertaken on an ongoing basis.

The challenge for education is to design technologies for learning that draw both from knowledge about human cognition and from practical applications of how technology can facilitate complex tasks in the workplace. These designs use technologies to scaffold thinking and activity, much as training wheels allow young bike riders to practice cycling when they would fall without support. Like training wheels, computer scaffolding enables learners to do more advanced activities and to engage in more advanced thinking and problem solving than they could without such help.

When teachers learn to use a new technology in their classrooms, they model the learning process for students; at the same time, they gain new insights on teaching by watching their students learn. Some children develop a profound involvement with some aspect of the technology or the software, spend considerable time on it, and know more than anyone else in the group, including their teachers. Often both teachers and students are beginners, and the creation of knowledge is a genuinely cooperative endeavor.

IV. PHASES OF IMPLEMENTATION

Technology implementation and use passes through certain distinct stages. They are suitably divided into the following four categories:

a. Technology adaptation

Technology adaptation stage is the primary stage where faculty gets first hand exposure to technology by attending workshops and understands how to use the tools. The teacher learns how to employ the latest versions of the operating system, spreadsheet, editors, presentation software and similar tools. He learns how to make audio/video files and portable documents and also gains knowledge of the basics of using the operating system to run software applications; to use the browser to search for information on the Internet; to manipulate data; and to analyze results and alongside be able to install a printer, scanner and other office applications and image editors. He will then be able to install and configure specific hardware and software components and apply basic trouble-shooting strategies as required from time to time.

b. Technology utilization

This phase occurs when the teacher makes an effort to use the technology or innovation in the classroom. An example of utilization is when a teacher teaching computer networks uses simulations and videos learned in a workshop. It helps him create real world scenarios and lab exercises. At this stage, the teacher will be able to apply the tools learned for increasing productivity and motivating the students to actively participate in the learning process. He uses technology in engaging the students by giving specific tasks to perform as for instance, a case study, a lab exercise using a specific tool, a presentation to compare two entities, an assignment involving research or even a quiz, etc.

c. Technology Incorporation

Incorporating information from multiple points of view increases the durability of instruction. Supportive learning and hypermedia represent technologies with significant potential for developing multiple viewpoints. Two important differences exist between supportive learning and traditional instruction. Firstly, information to be learned by the students is not transmitted by the teacher. Instead, students teach each other in small groups of students.

Secondly, students are made responsible for each other's learning. Students must ensure that every member of their group achieves the lesson's objectives. These experiences are found to benefit students of all abilities. More able students gain from the cognitive restructuring associated with teaching, and less able students benefit from the personalized attention available from group members. Moreover, groups appear to create environments in which all members benefit from exposure to diverse attitudes and opinions that are often unavailable in the traditional classroom.

The teacher uses a combination of scripting languages, Image editing/authoring packages, Audio/Video editing software to create self learning tutorials with online assessments. The delivery methodology and assessment strategy must be suitably changed to measure the outcomes of the module and in turn map to the outcome of the overall programme. This requires proper planning and integrating appropriate learning management software system so that module information, learning materials, lab exercises, presentations and other multimedia content are available online from anywhere.

d. Technology Reformation

This is the stage where the teacher actually applies what he has experienced and re-works on the assessment strategy and delivery methods thus creating a student centered learning environment. The focus is not just transmitting content but to act as a coach in guiding students to achieve pre-determined outcomes. To do this, the teacher will incorporate advanced features of technology-based tools to enhance the delivery methodology, extend communication outside the classroom, improve classroom management, measure outcomes more effectively, promote early exploration of higher level concepts and allow in-depth exploration of key ideas. For example the teacher teaching computer networks will create a network lab using Virtual PC software where the students can run multiple operating systems and perform configurations in a Virtual environment and also use simulators to configure scenarios.

Teachers in the Reformation stage must be open to technologies that enable this knowledge construction process and should not feel threatened for being "replaced" by technology. In reality, these teachers will probably include technology in their classrooms without necessarily feeling the need to be an "expert" themselves.

In today's dynamic environment, technology change is inevitable and essential for success. The teacher will understand the changes in technologies, their effects on the educational process, their potential to address life-long learning and the consequences of misuse. Here the focus will be on improving coordination, efficiency and control to minimize the risks to content availability, integrity, scalability, performance and security of systems.

The final stage is a reminder that technology advancement is so rapid that what is new today may become obsolete in a few months time. So the classroom learning environment must change constantly and encompass the rationale, curriculum, outcomes, assessments, delivery strategy and evaluation methodology can be fine tuned to make it up to date.

V. CURRICULUM DESIGN AND IMPLEMENTATION

According to Kern, et al. (1998), a curriculum is “a planned educational experience”. Hence, the main intention of curriculum design at the tertiary level is to foster the academic development of students. Once a specific group of students is identified for whom the curriculum is to be designed, the purpose for the curriculum design can then be made clear. If a curriculum is to be “a planned educational experience”, curriculum design and implementation should follow a sequence of steps that operates like an upward and downward spiral with an efficient feedback mechanism for the adjustment of each step.

Briefly stated, a curriculum is an academic plan. It is a complete blueprint for action where the objectives, aims and outcomes of the curriculum are clarified; the processes to achieve these are identified; the ways to measure whether success has been achieved; and systematic review and adjustment which are part of the plan.

Curriculum development is crucial to any educational organization and it has to be properly designed by experienced academics in consultation with experts from the industry. It should be designed backwards by using the major outcomes as the focus, and linking all planning, teaching and assessment methods directly to these outcomes. It is developed in such a way that there is scope for every learner to learn at one’s own pace.

The rationale and outcome for the programme is well defined and then the programme structure is formulated providing the logical sequence for modules with increasing complexity. Each Programme is benchmarked with the skill that must be demonstrated by the student. Module description

is then carried out with clear objectives, session plan, learning outcomes, delivery methods and assessment strategy that maps to the defined outcomes. Modules are classified into 4 levels such as level 1, level 2, level 3, and level 4 with increasing complexity and aimed at nurturing the analytical and critical acumen of the students.

VI. DELIVERY METHODS

The classroom lectures are planned in advance and a module information sheet containing week wise session and other policy related information is uploaded on to a web based intranet application that can be accessed by all the students. The instructor makes available the module handouts, presentations, lab exercises, case study and assignments such that the students can access the same from anywhere.

The use of complex multimedia products and advanced networking technologies enables students to learn quickly and interactively. Multimedia classrooms provide a combination of visual as well as audio stimulation that greatly enhance the learning experience. Videos, Virtual libraries and electronic books can all be projected on to the screen in a multimedia classroom. Presentation that inspires the learner must be prepared using various software and authoring tools, while smart boards can be used to create an interactive classroom. A video conference can also be setup whenever appropriate so that teacher in remote locations can present a specific topic. Discussion boards can be integrated in the intranet that allows the faculty members to have online discussions with students and post questions and answers where found appropriate.

In addition, large-enrollment classes often suffer from a dearth of student participation. Online discussion boards provide these classes with a medium through which many-layered conversations may take place more fluidly than in a lecture hall of 100 students. The use of discussion boards is an inherently active method of learning, contrasting the traditional lecture model that is highly passive. As research studies have evidenced, active learning is more powerful than passive learning at getting students to learn, retain, and apply course content to practical situations.

VII. STUDENT EFFORT

The teacher plans and creates a learning environment for the students to learn at their own pace by providing a self paced tutorial. Such tutorial is designed and developed with various technologies that make learning more absorbing. A separate streaming media server, specialized to stream audio/video content in real time, can also inspire the learner if properly used.

Students are encouraged to work in groups either in the labs to solve real life situations or in tutorial sessions to discus case studies. Here the teacher uses technology to create the situations/skill tests allowing students to have more control over their own learning. It helps them think critically and analytically and work collaboratively thus encouraging cooperative learning. Students, on the other hand, will have sufficient access to software and hardware outside classrooms to do their exercises and assignments.

A college intranet is made available that can be accessed at anytime from anywhere which hosts a variety of information related to the course such as lesson plans, presentations, web based materials and interactive multimedia tutorials. Information is represented in many different forms and when communicated more effectively makes the student an independent learner.

One of the greatest facilitators of Internet use on college campuses has been the growing use of course management software (CMS), provided by companies such as Blackboard and WebCT, among others. These products allow automated or semi-automated creation of course web pages, allowing faculty to easily post syllabi, class announcements, resources and reading material, and to communicate with students in the class. Studies reveal that the number of courses that take advantage of course management software in institutions is constantly growing.

The way students learn has advanced tremendously in the last 25-30 years; but research on the impact of educational technology on learning is lagging. A review of the literature by several groups has concluded that technology has a great potential to enhance student achievement and teacher learning, but only if it is used appropriately.

Specifically, technology can be used to:

- bring exciting curricula based on real-world problems into the classroom;
- provide scaffolds and tools to enhance learning;
- give students and teachers more opportunities for feedback, reflection, and revision;
- build local and global communities that include teachers, administrators, students, parents, and other interested people; and
- expand opportunities for teacher learning.

VIII. MEASURABLE OUTCOMES

An outcome is simply a result or consequence of an action or process. A learning outcome is what results from a learning process. Intended learning outcomes are statements that predict what learners will have gained as a result of learning.

In order to demonstrate how to assess students learning, one has to develop an assessment process that will test the learning that is intended. One has to check back on the provisional list of learning outcomes and design a new set that are more useful for evaluating learning, viz. to see that the intended learning outcomes are influenced by what one finally decides to assess.

Then an assessment task is created using one's own design as the basis for the problem. Here, the assessment should involve both forms: formative and summative. Formative Assessment emphasises on on-going assessments of different types used to judge how best to help pupils learn further. In its purist form, formative tests are not graded and are used as an ongoing diagnostic tool; hence, the instructor employs the results of formative assessment solely to modify and adjust his or her teaching practices to reflect the needs and progress of his or her students. Summative Assessment is the formal testing of what has been learned in order to produce marks or grades which may be used for reports of various types. These assessments will then be introduced as a class learning activity and involve students in (a) designing a range of assessment strategies and (b) generating criteria to evaluate these strategies (c) assessing the results of the task and (d) drawing out the principles they used to assess learning. It serves to provide them with experiential learning geared to evaluating learning.

The teacher must be clear what he is assessing and how to effectively measure the outcome. The assessments actually measure the cognitive skills which include designing, developing and analyzing with proper reasoning. Assessment aims at the continuing improvement of student development, and is generally consistent with a "value-added" concept of education; note that the rationale for having better programs is to ensure better student outcomes.

Instructional technology assessment is the systematic examination of a particular aspect of instructional technology use (e.g., content delivery, method, testing approach, technological innovation) to determine its effect and/or how it can be improved. Assessment should focus on improving student learning and/or teaching practices and inform planning decisions on what to do differently the next time technology is used. Common assessment questions include how the use of instructional technology increased student performance, improved attitude and confidence, facilitated content mastery, improved problem solving skills, or promoted student-centered learning.

The following guidelines are helpful when assessing instructional technology:

- Assessment should be driven by instructional purposes.
- When assessing instructional technology, focus should be on the stated instructional objectives and learning outcomes. The best objectives and outcomes are both specific and measurable.
- Assessment should reflect a comprehensive concept of learning. Because learning is a complex process, involving values and attitudes as well as content knowledge, assessment may also include other aspects of the instructional experience such as student acquisition of learning strategies or confidence levels.
- Assessment should focus on learning processes as well as learning outcomes. Which students learn best under what conditions should be assessed, as well as how they organize and learn the content?
- Assessment should be an ongoing process. It should be conducted continuously to keep track of instructional effectiveness and student progress over time.

IX. RELATIONSHIP BETWEEN INSTRUCTIONAL BEST PRACTICES AND ASSESSMENT

Instructors often use technology in their classroom without making a significant connection between technology use, their teaching, and student learning, because they simply assume that using technology will automatically improve students' learning. Without assessing its appropriateness and effectiveness, it is not possible to know whether instructional technology is helping students learn better or improving instruction (Ehrmann, 1999).

To make reasonable judgments about the impact of instructional technology, instructors should have clearly set criteria for assessment. The decision to use instructional technology should be based on the degree to which it supports instructional objectives and learning outcomes, not just its availability.

X. CONCLUSION

Just as the *industrial revolution* created tools that served to off-load the physical labour previously carried by both 'man and beast,' the *information revolution* is creating tools that promise assistance in the intellectual dimensions of human lives. Just as the technologies of the industrial revolution were at times misused and misapplied, the technologies of the computer-generation too can find erroneous utility if proper care and precaution are not instilled into the standardised system.

Today, technology is changing the very instructional process. But to be effective, technology cannot exist in a vacuum; it must become part of the whole educational environment. Computer-based technologies hold great promise both for increasing access to knowledge and as a means of promoting learning. What has not yet been fully understood is that computer-based technologies can be powerful pedagogical tools - not just rich sources of information, but also extensions of human capabilities and contexts for social interactions supporting learning. New measures of evaluation are being developed which would help to better define the role of technology in its wider context. Judging by the technological trends in the educational process, the future of education is bound to witness a shift towards outcome-based education which will transform:

- traditional learning to new learning environments,
- teacher-centered instruction to student-centered learning,
- single media to multimedia,
- passive learning to active and inquiry-based learning,
- factual and knowledge-based learning to critical thinking, and
- isolated, artificial context to authentic, real, world context.

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Conception, Implementation and Evaluation of Self-Assessments

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Abstract— **Selecting the right field of study is one of the most important prerequisite for a successful study and career advancement. In order to choose the appropriate field of study, a good match between interests and abilities on the one hand and study requests on the other, are of considerable relevance for future students.**

This can contribute to decreasing dropout rates and increasing student's satisfaction. The prospective student's expectations often vary considerably from actual contents and demands. One of the reasons is many people's reluctance to inform themselves about the actual relevance of personal strengths and weaknesses concerning their success in their studies and career. Self-assessments can be used as an instrument to give the potential student a realistic idea about the nature of the subject in question and can indicate him what cognitive and non-cognitive abilities are expected.

In this paper we present a generic and extensible concept for developing a multidisciplinary self-assessment, which can be implemented for any subject, in any language by any academic institution.

Keywords: Self-Assessment, decreasing the dropout rate, predictors of succes of studs, evaluation

I. INTRODUCTION

The student's selection of his field of study is not only influenced by criteria concerning the subject but also by many other factors such as supposed career opportunities or the reputation of the field of study and the reputation of the university itself. Thus, the student's preferences and abilities often play a minor roll. The prospective student's expectations often vary considerably from the actual contents and demands. One reason is often the potential student's reluctance to inform themselves about the actual importance of personal strengths and weaknesses concerning their success in their studies and career. A lack of knowledge and proper judgment often results in the student's expectations not meeting the actual content and demands of the chosen subjects. Although universities do offer orientation activities, they usually take place after the student is registered and has made his course selection. Wrong perceptions of one's personal strengths, an unrealistic estimation of one's capacity and competencies, and wrong expectations of the course's content, are in many cases the cause for an inappropriate selection.

Self-assessments concerning the choice of studies are geared toward achieving a better match between the prospective student's interests, abilities and the study requests. Different personal features are analyzed by criteria of suitability with regard to the given demands. Subsequently the results are communicated to the student. Self-assessments are conducted individually and their results are only available to the participant himself. They are to enhance the candidate's personal progress and provide a base to support a deliberate decision for or against a certain course of studies. Offering such advice leads to a higher proportion of suitable applicants and student satisfaction. This in turn will also decrease the dropout rate that is particularly high in science courses especially in computer science.

A Self-assessment provides the student a comparison between his expectations and the real course contents and tells him what performance and cognitive abilities the university expects of him in this specific program. A student's well thought-out and reasonable selection should not only reduce dropout rates but can also shorten the time required for completing the study program. This is therefore of economical gain to the student and the university. The self-assessment's feedback indicates remaining gaps of knowledge and will hopefully ensure a greater acknowledgement of a common basic knowledge, thus counteracting a "first year shock". In this we will introduce a generic concept for developing and evaluation of self-assessments and describe a pilot implementation in the department of computer science at the

Johann Wolfgang Goethe-University Frankfurt in Germany. So far, such a tool is implemented only at a few German universities.

II. SPECIFICATION

An analysis of a self-assessment's specification showed the need for multiple requirements of which generic applicability is first and foremost. In this context 'generic' implies the concept of being so universal as to meet various demands depending on the field of study, university or language. According to its multidisciplinary application, the concept is to allow different types of exercises so each field of study is not bound by a certain form of use. Moreover the concept is not only to afford the flexibility of expanding and transforming single exercises, but also the insertion, removal and modification of entire test units at a minimum effort. Having acquired the data and results a meaningful evaluation of the student's study qualification and a personal profile are displayed instantaneously after the test. Thus the tests' evaluation must be executed automatically. Non-serious test runs are to be omitted in the computation of the average values. The participant's anonymity is preserved in order to ensure a trust and „freedom of fear". The collected data is only stored for reasons of further planning and evaluation. The data not only alludes to the participant's proficiency level but also to the self-assessment's aptitude (after comparing it with exam results) [5].

III. THE CONCEPT

In the e-learning project ***mega**digitale* (*www.megadigitale.de*) the department of computer science and mathematics developed in cooperation with the department of psychology a generic concept for the realization of multidisciplinary self-assessments. Below, its structure, content and realization are illustrated.

A. Structure and Content

According to the concept, a self-assessment tool consists of three parts: organization, content and evaluation. The organizational part entails the starting, the describing and the registering units, as it does the user management. The actual areas of editing and their meaning pertaining to the study course are presented in the organizational part. The content part follows a bottom-up-structure (see figure 1). Several logically related exercises create one test unit called block. Several blocks together form a test module. An arbitrary number of modules compose an assessment posing questions about different areas. Due to a specification analysis, certain principles concerning the testing of abilities and capabilities were developed and implemented into the concept. These proved relevant in preparatory studies. The assessments' exercises can be divided into cognitive and non-cognitive exercises [6]. Scientific inquests show that non-cognitive psychological test methods are efficient ways of predicting success in studies and career [5], [6]. Among the non-cognitive field "study behavior and study motivation" refer to the ability to make decisions, being success-oriented, target-oriented, performance-oriented and the willingness to learn, the attitude to work and existing learning techniques. The cognitive part includes e.g. in computer science exercises knowledge about logic, mathematics, algorithmic, abstract and analytical thinking and text comprehension. While the cognitive exercises are designed specific in reference to the study course, the psychological non-cognitive exercises concerning "study behavior and study motivation" are independent of the subject. Thus they can be used for all assessments without being changed. The evaluation combines the results of the different dimensions into one individual profile that can be compared to average values of all students and those of experts. The values of experts are those of lecturers and research assistants. Here, three profiles are generated which are graphically shown side by side: One profile for the participant's achievement, one for the average achievement of all users and one so-called expert's profile (see paragraph C. Evaluation below).

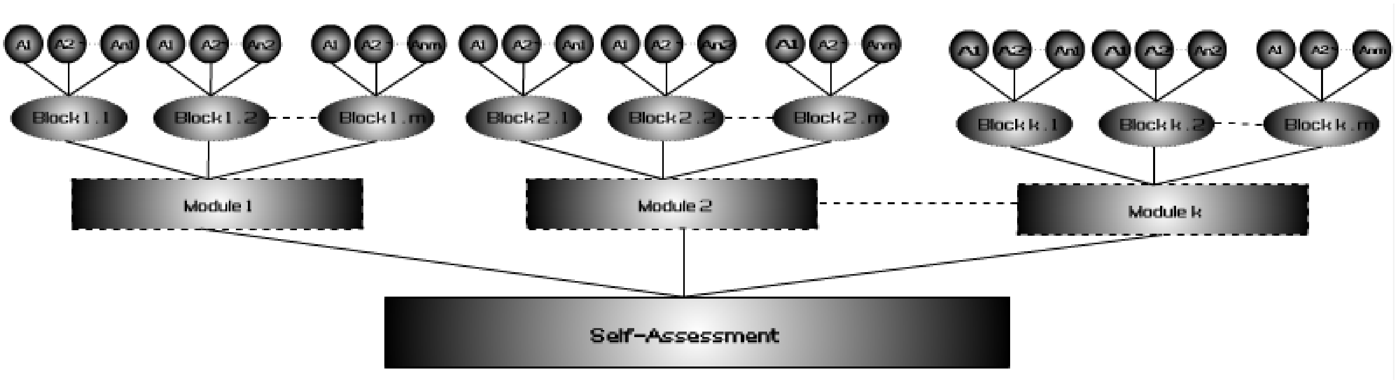

Figure 1. The structure of a self-assessment

B. The Self-Assessment's Procedure

First an anonymous registration is necessary by creating a pseudonym. After that an activation link is sent to the e-mail address the participant used in this registration, which enables him to access the self-assessment. The modules can be used in an online and an offline mode. When working offline the exercises are downloaded from the assessment-server and subsequently the evaluation is conveyed back to the server. Only after the completion of all modules an individual evaluation is created and the result statistics are updated. Non-serious workings are automatically filtered and not incorporated in the total valuation.

The author may choose the modules' order. This proves importance when certain exercises infer one another. Though it's also possible to have the participant choose the order.

Modules interrupted in the process may be continued by the user at the exercise last worked on. This ensures that every exercise is performed only once which is essential for the evaluation of the self-assessment results. After such an interruption the user finds guidance in an integrated tutorial.

Further runs through a module are possible after the first completion but will be marked as such in the database and not evaluated. The concept also supports a limitation of the number of runs to a certain maximum amount.

Timers are used to set a maximum of time allotted to an exercise or a break in-between. The timer works regardless of the system being online or offline.

C. Evaluation

After completing the self-assessment the participant receives a feedback which shows the scores achieved in each part of the test and compares them to the average of users and the expert's profile, which is built of the test results of professors and their research assistants.

Each working area's demands and subjects are shown, which allows the student to identify his weaknesses himself and to know specifically how to prepare for his studies. Thus the self-assessment's feedback and comments supplement the conventional study counselling. A final assessment about the study ability is intentionally omitted. Nevertheless, it points out problematic areas. At the end the decision whether to study a certain field or not is the candidate's choice. So the self-assessment is not intended to tell the candidate whether he is qualified or unqualified for studying a certain field.

D. Technical implementation

This new, flexible and extensible concept was implemented under the usage of platform-independent web-technology and is based on a modern client-server-architecture. Thus it is available on every computer at any time and in a user-friendly way. All data being transferred back and forth between client and server are encrypted (e.g. sensible data such as passwords). The platform-independence ensures the self-assessment's portability and its operation in various systems.

A procedure for filtering non-serious runs and test runs has been implemented. It shows a module's total working time and the achieved score and discards certain runs accordingly. Thus the statistics are not falsified.

IV. Case-Study: The Implementation of an Online-Self-Assessment for Computer Science

According to statistics of several German universities, only 35% of all beginning students of computer science successfully complete their studies. Besides those that abort, there are long-term students who often only realise after several years of study that they have chosen the wrong course [3]. Notwithstanding, some nevertheless try to finish their studies and after quite some years achieve predominantly weak scores.

In sight of limited resources, the high dropout rates and extensive study careers call for improvement. Besides a general study counselling in the computer science department of the J.W. Goethe-University of Frankfurt, there have hardly been any instruments for applicants confronting them on-site with the course's actual contents and demands even before their admittance. With the course's self-assessment being online the hope arises for a better first-hand selection of university and course. Those actually taking on their studies on-site should thereby find a better match of the university's demands and their own capacities and knowledge resulting in less dropouts and shorter study time. The resources thus saved should be used for an improvement in quality of teaching and could support the implementation of innovative teaching concepts.

The target audience consists of those interested in studying computer science at the J.W. Goethe-University. Every year of the 400, who apply, 150 are admitted to the computer science program. Nevertheless, the self-assessment is not limited to computer science. It may be integrated into the consultation program offered by any course at any university or comparable institution. Thus it has been adopted successfully in the courses of psychology and sport science since 2006.

Analyses [3], [4] brought about the implementation of study-relevant skills and abilities into the tool. For the field of computer science these are study motivation, interest in the field of computer science, German and English text comprehension, mathematical competencies, algorithmic,

abstract, analytical and logical thinking. At all universities throughout Germany the requirements for studying computer science were seen to be almost the same. These requirements were adopted at the national conference of computer science.

By doing these exercises and answering non-cognitive questions the student may receive a picture of the demands that await him. At the same time he gets graphical feedback on his personal profile, the comparison with the "typical" student, and that of an accounted expert.

The self-assessment for the computer science department consists of 3 modules:

* Module 1 which consists of logical, mathematical and motivational exercises

* Module 2 contains exercises for algorithmic thinking and text comprehension

* Module 3 is directed at figural matrix exercises and questions on interests

See figure 2 for an example for a mathematical thinking [2].

Maths-Excercise 7

A jeweller wants to manufacture different looking necklaces.
How many different necklaces can he make under the following condition:
Each two pyramids must be seperated by at least one ball.

6 necklaces

5 necklaces

3 necklaces

none of the anwers is correct

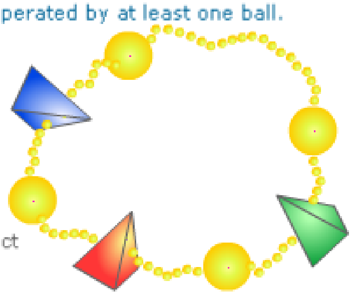

Figure 2. Mathematical thinking exercise

Exercises of logic examine elementary logical thinking [7] which is a basic requirement for studying computer science.

Here is an example:

Logic-Excercise 4

Alex cleans the car or is sun-bathing.
If Alex cleans the car, Claudia does not water the flowers.
Which of the following statements can't be derived from the former sentences?

- If Claudia waters the flowers, then Alex is sun-bathing
- If Alex does not clean the car, then Claudia waters the flowers
- Alex does not clean the car or Claudia does not water the flowers
- All the above are correct

Figure 3. Example of logical thinking exercise

One of the most important concepts in computer science is the precept of algorithms [1]. In the corresponding part of the test, algorithmic thinking is examined. Here the student uses sequences and repetition of actions as an instrument of logical expression.

Another essential requirement for studying computer science is the ability to understand scientific texts in German and English language. This is tested by displaying such texts and posing comprehension questions.

Figural matrix exercises are recognised as an established method of detecting reasoning abilities. This is tested independent of language, culture and prior education.

In the section concerning study motivation, behaviour and interests, the student grades the applicability of statements of self-characterisation by choosing a number on a Likert scale of 0 („does not apply at all") to 5 („absolutely applies").

For purposes of evaluation, several hundred computer science students completed the self-assessment in their first year. The chosen pseudonym at registration was again asked for at examinations in order to allow for a comparison between the respective results. Thus, the self-assessment's quality could be evaluated. At first the aptitude of questions and exercises were checked statistically (item analysis). Because of the immeasurability of complex personality features such as resilience or decision-making abilities, they are acquired through self-evaluation tests. Each dimension (resilience, mathematical understanding, etc.) is represented by five to eight questions or exercises, which are compiled on a homogenous scale. We used factor analysis to measure the homogeneity of the scales. The factor analysis method can be used to identify those exercises and question, which don't contribute to the homogeneity of the dimension.

A. *How reliable are the test?*

A test's reliability indicates how accurately it measures a feature of personality. High reliability is noticed when test results are not influenced by possible disruptive factors (e.g. a high probability of guessing) or coincidental mistakes. Furthermore a high coefficient (alpha-coefficient by Cronbach) indicates that the better part of the students also passes the individual exercises uniformly better than the weaker half.

A statistical analysis helped in deciding which questions and exercises are to be used in the deduction of personal features and abilities. Additionally those questions were omitted which were too hard to answer, denied or affirmed by 80% of interviewees. This was the case when 85% could not solve the problem.

All psychological testing scales were homogenous and examined reliably (after erasing single questions). In the performance part, single exercises pertaining to logical thinking and text comprehension were replaced and will be evaluated again in the coming semesters.

B. Good assessment results = good exam results?

In pursuit of this question, the data were enquired for systematically coherences. In the performance part significant coherences were found among cognitive exercises and test results, altogether with an average strength of correlation coefficient φ between 0.35 and 0.49 and a significance level $\pi < 0.05$ for 76 participant ($\psi = 76$).

The results can be interpreted as a satisfying external validation criterion. The most significant coherence was found between exercises on algorithmic thinking and the exam for „Introduction to Programming I" ($\varphi = 0.5$, $\psi = 76$, $\pi < 0.01$).

A significant correlation presented itself between the motivational part and test results of questions on locus of control, confidence, decision-making abilities, performance-oriented thinking, and willingness to learn and work behaviour. At least for passing the exams in the beginning of one's studies these dimensions seem to be especially meaningful.

Each year is to be another cycle of the self-assessment's re-evaluation as far as its quality in relation to study time length and success. Also regular lasting and dynamic adjustments are provided for.

The Implementation of the self-assessment can be seen under:

https://www.gdv.informatik.uni-frankfurt.de/self-assessment/Informatik/ for the department of computer science and mathematics (in German) or under:

https://www.gdv.informatik.uni-frankfurt.de/self-assessment/Psychologie/ for the department of Psychology (also in German).

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Towards Estimating Projects' Risks deviations in Time, Cost and Performance

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Abstract-- **This paper presents an empirical approach for project risk evaluation. The paper is thematically structured to identify the most important risks inherent to project management, specifies the risks impact on the project constraints, and develops estimates on the amount of project deviations in time, cost, and performance. The findings may be applied for generally any type of project.**

I. AN OVERVIEW

Many projects have been executed in the past and in most cases we face a series of problems and challenges. These problems range from the initiating stage to planning, executing, monitoring and controlling, and closing stages. Top executives have become more involved in project management and the reason is simple: strategic objectives are realized through projects [27]. Some projects failed before realizing their benefits. Many reasons are attributable to lack of planning or erroneous planning in which concealed risks are evolved and realized at later stages. Risks can not be totally removed from any subsequent stage, but rather can be extrapolated through precise observation. However, any observation should be addressed to a number of parameters, where these parameters can be monitored against predetermined threshold values so that the threshold can act as a trigger to alert project manager when the project is approaching a risk. Conceptually, risk for each event can be defined as a function of likelihood and impact. Assessing risks would require to identify and analyze each potential risk in terms of its likelihood (or probability) and its impact (or severity). However, identifying and analyzing risks do not prevent them from occurring unless proper and feasible measures are put in place. There is no single textbook answer on how to manage risk [12]. This is the most difficult issue after identifying and analyzing those potential risks. Other challenges that many project managers face are uncertainties and unknowns which again bring us back to how to manage risk. Therefore, for known risks, project manager may mitigate project risk by either reducing probability of occurrence (i.e. cause-oriented measures) or reducing the impact when occurred (i.e. effect-oriented measures). However, facing the unknowns is the real challenge. The problem is that if you know where exactly you are going then you are more likely to be lost if not properly prepared, but if you don't know then all ways are the same and probably correct. So knowing the early triggers and taking appropriate measures at the right time will eventually narrow the space for the risk from expansion and preserve the time, cost, and performance within acceptable limits. When the project managers know the early trigger of risks, this will enable managers to be proactive, rather than reactive. In this context, skills of project management have become increasingly recognized as highly desirable for managers at all levels in an organization [29]. We believe that no project can be executed with zero risks. However, being skilled enough to identify and analyze those potential risks can enable project managers to mitigate their consequences to a far extent. We have heard a lot about companies delivered several projects with zero losses, but this doesn't mean that there was no risk. Actually, the projects have been delivered without accidents, incidents, over budget, delay, poor performance, and etcetera. When the anticipated events are undesirable project managers should wisely observe them to prevent their occurrence, but desirable events are always seen as opportunities where in fact, opportunities bear risk as well. We intend to build a framework equipped with techniques to uncover all possible triggers of risks in project management to take a stand and observe deviation in an early stage to assure that risks are never growing and benefits are always almost optimized. Many project managers do not meet project objectives without deviations whether in cost, time, or performance. This paper focuses on the pre-input triggers that may lead to create deviations in terms of examining various aspects in project management tools and techniques, applications, approaches and methods to reveal what lies behind them.

II. RESEARCH METHODOLOGY

In order to meet the research objectives, some carefully designed tools have been prepared to help investigating potential causes. The research tools basically encompass literature review, interviews, online survey questionnaires,

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and software. The questionnaires have been developed based on the knowledge obtained from literature review, interviews and discussions. The research sample includes carefully selected project managers of 34 professionals. In order to be able to demonstrate this, it would require examining different consequences of cases which have already been occurred and drive them back to the original causes from which they have been initiated and observe the pre-input triggers. Research survey has been developed from literature review and primary data were collected for further analysis, dissection and validation. Data have been analyzed using imbedded software to assure high level of accuracy and precision in data testing and analysis. The research is intended to reveal the most important risks in projects and furthermore, the magnitude of their impact to project constraints. This will eventually allow us to assess risks triggers and arrive to a practical technique in minimizing project deviations.

The sample was approached by online emails. The total sample contacted was 57 individuals from which eligible response was 34 only. In addition, one of the responses was incomplete and thus, considered ineligible response. Hence, the response rate can be calculated as follows:

$$\text{Total Response Rate} = \frac{\textit{total number of responses}}{\textit{total number in sample} - \textit{ineligible}}$$

$$\text{Total Response Rate} = \frac{34}{57-1} = 60.7\ \%$$

The questionnaires have been structured in three parts with the aim to gather respondents' inputs as to reveal findings into three approaches. The first approach is to emphasize on the importance on the common risks; the second approach is to assess those risks in terms of impact on project constraints and their likelihood; the third approach is to encourage respondents to elicit specific risks they believe the most important elements driving risks. The main research variables are deviations in the project constraints, that is, time, cost, and performance or symbolically ΔT, ΔC, and ΔP. The survey has been designed so that to uncover the contributing factors to which these main variables are influenced. The common 14 risks elements are (1) Undertaking a project with unclear vision, mission, strategic need, and project objectives to project team members. (2) Undertaking a project without having a detailed communicated risk management plan, (3) Undertaking a project with low level of technical experience and skills, (4) Undertaking a project with low level of leadership skills, (5) Undertaking a project without having well-trained and qualified project team, (6) Undertaking a project without paying attention to employees resistance to change, cultural differences, values, and norms, (7) Undertaking a project with low level of administrative experience and skills, (8) Undertaking a project without depending on specialized consultants and expert judgment, (9) Undertaking a project without having legal, regulatory, and legislative awareness e.g. obtain permits, environmental laws, occupational health & safety, coordination with external concerned bodies, …etc, (10) Undertaking a project without exploiting project management tools and techniques e.g. PERT, CPM, Gantt chart, software, etc., (11) Undertaking a project without having system for risk monitoring, controlling, and performance measurements, (12) Undertaking a project with low level of senior management 's support and shareholders' confidence, (13) Undertaking a project without paying attention to technological advancements and changes, and (14) Undertaking a project with inferior quality of resources; other than human, e.g. unclear documents, poor equipment, insufficient tools and materials, inadequate facilities and infrastructure, and limited access to information. The research is centered on the concept of estimating risks inherent to projects. Because no one takes estimates seriously, no one gives serious estimates [19]. This leads us to find ways and means to estimate tiny risks and sum them up to estimate the overall risks in terms of time, costs, and performance. The concept is stem from our approach to project risks in the sense that project risk leads to desirable or undesirable project deviations. Now, if project deviations have been properly estimated, then the contingency reserves would be equivalently prepared to represent the project risk. Thus, to absorb project risks, project deviations should be equivalent to contingency reserves.

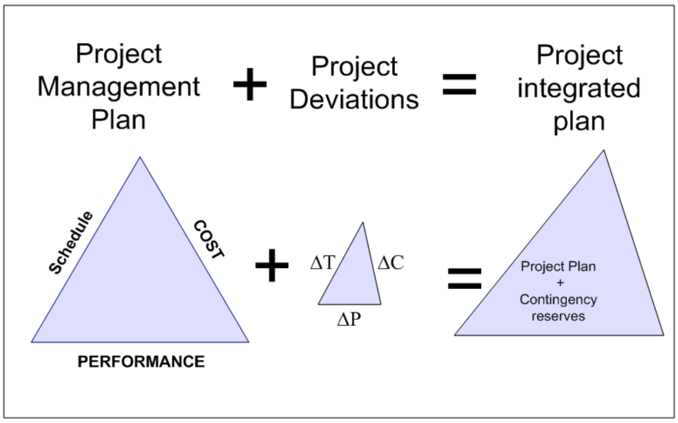

Figure 1: Project Integrated Plan

III. MATHEMATICAL APPROACH TO RISK

Since known risks are identifiable, we can consider a certain process, activity, task, action, test, or any other situation or event as a stand alone risk where its probability can be estimated and its impact can be assessed. Therefore, we may say that each risk is a discrete function. Let's recall equation 1, and use probability instead of likelihood for convenience:

Risk = *f*(Probability, Impact) ....(1)

Let the probability be denoted as P, and impact as M; let the individual risk be presented as a discrete function yields with a probability and an impact,

$$Risk_1 = P_1 \times M_1$$
$$Risk_2 = P_2 \times M_2$$
$$\vdots$$
$$Risk_n = P_n \times M_n$$

The total risks are the total of individual risk, that is;

$$Risk_{total} = P_1 \times M_1 + P_2 \times M_2 + \cdots + P_n \times M_n$$

So,

$$Risk_{total} = \sum_{i=1}^{n} P_i \times M_i \quad \text{……………………… (2)}$$

But we may notice that the impact has different consequences and can cause delay in time, incur additional costs, affect the performance, or a combination of them. Let's redefine the impact M of a risk as an impact on time, cost, and performance; as follows:

Let:

M_t: be the impact on time, expressed in units of time (e.g. hrs, days, weeks)

M_c: be the impact on cost, expressed in units of currency (e.g. KD, \$, €)

M_p: be the impact on performance, expressed in units of performance (e.g. %)

The total impact of an individual risk can then be represented as follows

$$M = M_t + M_c + M_p \quad \text{………………… (3)}$$

Substituting equation 3 into 2; yields,

$$Risk_{total} = \sum_{i=1}^{n} P_i \times (M_t + M_c + M_p)_i \quad \text{… (4)}$$

It is true that each individual risk has its own probability to happen, but we need to know what the specific impact is on time, schedule and performance. So, we need to define a coefficient of the specific impact if it is going to happen. This coefficient represents the degree of the impact on an individual risk with respect to time, cost, and performance. Thus, the following coefficients are defined:

C_t: the coefficient of impact on time,

C_c: the coefficient of impact on cost,

C_p: the coefficient of impact on performance,

Where, each coefficient is a fraction and ranges from 0 (no impact) to 1 (maximum impact).

Now, M represents the magnitude of the impact on a specific activity in a project. It is therefore necessary to recall the work breakdown structure WBS to investigate the work package constraints. Each work package within the WBS has an estimated duration, cost, and performance. Note that we don't mention resources here because we presumably say that the constraints of the work package are based on adequacy of resources, so we assume commensurate allocation of resources to each work package. Thus, let the work package be denoted as W. Now the work package W has three dimensions i.e. time, cost, and performance.

Let:

W_t: be the planned time duration of the work package

W_C: be the budgeted cost of the work package

W_p: be the expected performance level of the work package

We now can define the individual impact of risk in terms of time, cost, and performance as a product of work package and risk coefficient, thus;

$$M_t = C_t \times W_t \quad \text{……………………….. (5a)}$$
$$M_c = C_c \times W_c \quad \text{……………………… (5b)}$$
$$M_p = C_p \times W_p \quad \text{…………………….. (5c)}$$

Using equation 5 and equation 4, the risk of each work package can be represented as follows:

$$Risk(W_1) = P_1 x (C_{t1} x W_{t1} + C_{c1} x W_{c1} + C_{p1} x W_{p1}) \text{... (6a)}$$
$$Risk(W_2) = P_2 x (C_{t2} x W_{t2} + C_{c2} x W_{c2} + C_{p2} x W_{p2}) \text{... (6b)}$$
$$Risk(W_n) = P_n x (C_{tn} x W_{tn} + C_{cn} x W_{cn} + C_{pn} x W_{pn}) \text{... (6c)}$$

Therefore, for n number of work packages the total risk in a project becomes;

$$\text{Risk}_{\text{total}} = \sum_{i=1}^{n} P_i \times (C_{ti} \times W_{ti} + C_{ci} \times W_{ci} + C_{pi} \times W_{pi}) \text{… (7)}$$

We have a problem here with the combination of different base units; therefore, equation 7 must be restructured into three equations representing risk on time, on cost, and on performance, thus let's express these equations as project schedule risk (PSR), project cost risk (PCR), and Project performance risk (PPR) as follows:

$$PSR = \sum_{i=1}^{n} P_i \times (C_{ti} \times W_{ti}) \quad \text{………………… (8)}$$
$$PCR = \sum_{i=1}^{n} P_i \times (C_{ci} \times W_{ci}) \quad \text{……………..… (9)}$$
$$PPR = \sum_{i=1}^{n} P_i \times (C_{pi} \times W_{pi}) \quad \text{……………… (10)}$$

The benefit we can reap from equations 8, 9, 10 is to evaluate risk on the project constraints so that contingency reserve can be specified and offset at the beginning of the project. Once the risk has been analyzed and assessed on each work package, contingency plan can be based on specific risk that is attached to each work package and hence, the offset is accordingly determined. The triple-constraints and risks of a project include the contingency reserves to the constraints. Adding the project deviations to its constraints, the triple-constraints will look like Figure 2:

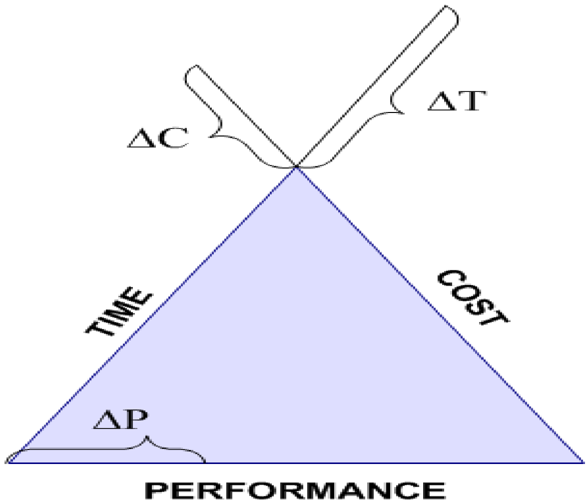

Figure 02: Triple-constraints with risk offset
(Source: Kerzner, 2003)

ΔT, ΔC, and ΔP are the deviations from original estimates. These deviations could have been anticipated early in the risks analysis process. If we attribute the deviations to the risk encountered in a project, then ΔT = PSR, ΔC = PCR, ΔP = PPR.

IV. THE RESEARCH FINDINGS

The research findings were fundamentally based on literature review including secondary data and then primary data obtained from online questionnaires. The secondary data were used as a guide and to structure the survey questionnaires. It has been evidenced from literature that projects include many types of risks, however, the survey questionnaires were screened down to encompass the most common risks in which any project may encounter.

A. Project Risks Importance Analysis

The respondents of the sample have shown considerable agreement on all of the risks stated in one part of the questionnaires and provided valuable insight into risks ranking in terms of their importance. The resultant percentages of the respondents to risk are collectively shown in Figure 3.

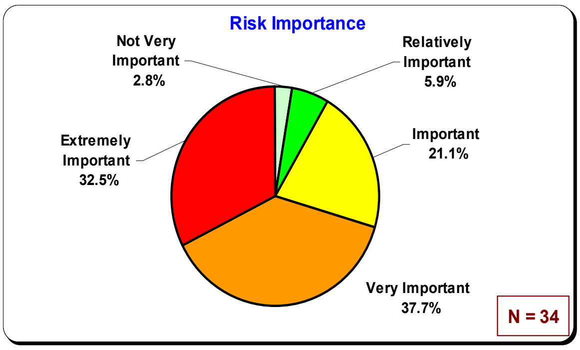

Figure 3: Resultant risk importance response

Using the weighted average, Table 1 ranks the 16 risks in terms of importance starting from highest to the least important one. It could be seen from Table 1 that the leadership skills ranked first amongst the 16 risks. This full endorsement on leadership emphasizes on the fact that there is no substitute for good leaders. It follows that respondents perceive this as decisively important, and its absence may adversely affect project success. On the other side, although the least important risk is still considered important, but surprisingly, to see the expert and consultant judgment (i.e. Risk 10) scores the least. This is attributable to many reasons among which the majority of respondents have got long experience in the field of project management. The average overall experience is about 16 years and the average specific experience in project management is about 9 years. Thus, long experience increases the confidence and reduces the reliance on expert judgment.

B. Project Risk Impact Analysis

The respondents to the second part of the questionnaires were guided to assess the impact of the 14 elements, determine how often such event or situation has occurred, which was the prime impact on the project constraints, that is, the impact on schedule, cost, or performance. These 14 elements have been derived from the 16 risks mentioned earlier. The 14 elements are risks, but this part aims to find out their individual impacts on the project constraints. The particular finding of this part of the questionnaires is that the majority of respondents agree to scale these elements as significant and dangerous effect. The resultant percentages of the respondents to these elements are collectively shown in Figure 4.

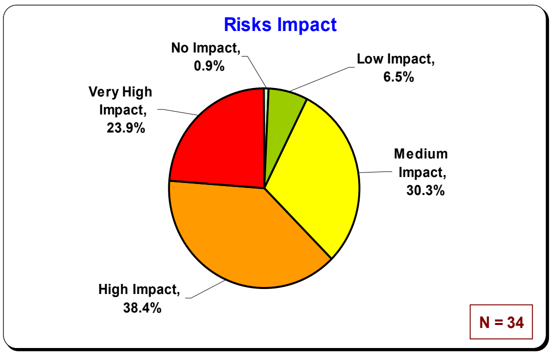

Figure 4: Resultant risk impact response

As shown in the Figure above, the majority of respondents' believe in these risks and they have given significant rate to most of these risks.

Now, if the 14 risk elements are all applicable, then the project risk on schedule, cost, and performance may be evaluated using probability and impact of individual risks and then sum them up to find out their coefficients of deviation in schedule, cost, and performance as follows:

Project Schedule Risk becomes;

$PSR(A_t) = (A_t)\ [P_1\ C_{t1} + P_2\ C_{t2} + \ldots + P_{14}\ C_{t14}]$

$= (A_t)\ [0.279 \times 0.260 + 0.385 \times 0.315 + \ldots + 0.300 \times 0.170] = 1.054 A_t$

This means that the project risk will impact schedule by 105.4% than the expected duration. There must be no surprise that the project is extended in time for more than twice as much because we consider the applicability of the 14 risk elements which is the worst case scenario.
Similarly, Project Cost Risk becomes;

$$PCR(A_c) = (A_c)\ [P_1\ C_{c1} + P_2\ C_{c2} + \ldots + P_{14}\ C_{c14}]$$
$$= (A_c)\ [0.279 \times 0.182 + 0.385 \times 0.247 + \ldots + 0.300 \times 0.194] = 0.695\ A_c$$

Again, this means that the project will incur 69.5% additional costs than the planned budgeted cost.
Finally, Project Performance Risk becomes;

$$PPR(A_p) = (A_p)\ [P_1\ C_{p1} + P_2\ C_{p2} + \ldots + P_{14}\ C_{p14}]$$
$$= (A_p)\ [0.279 \times 0.441 + 0.385 \times 0.202 + \ldots + 0.300 \times 0.460] = 1.677\ A_p$$

This means for the organization to meet the expectation level of performance, it should create leverage in performance by 167.7%. The 14 risk elements calculations are shown in Table 2.

TABLE 1: Risk Importance Ranking

Importance Rank	Risk No.	Description	Weighted Average
1	Risk 5	Project manager's leadership skills	**0.900**
2	Risk 2	Project management plan is established and communicated to key personnel	**0.865**
3	Risk 7	Senior managements' support and shareholders' trust	**0.841**
4	Risk 16	Legal, regulatory and legislative requirements and relevant standards	**0.818**
5	Risk 8	Health, safety, and environmental issues	**0.806**
6	Risk 13	Quality and integrity of resources; other than human, including documents, equipment, tools, materials, facilities, information	**0.800**
7	Risk 15	Setting up performance measures and risk indicators and keep monitoring frequently	**0.794**
8	Risk 11	Managerial skills of key personnel	**0.788**
9	Risk 4	Project team's practical experience, and field knowledge	**0.782**
10	Risk 12	Technical skills of key personnel	**0.782**
11	Risk 1	Project risk is an integral part of the thinking of its key people and part of their responsibilities.	**0.765**
12	Risk 3	Risk management plan for a project is established and communicated to key personnel and all involved workers	**0.735**
13	Risk 14	The use of project management tools and techniques e.g. Primavera software, MS project, scheduling tools (e.g. PERT/CPM) and the like	**0.735**
14	Risk 6	Organizational change; including cultural change, resistance level of employees, and communications.	**0.724**
15	Risk 9	Technological advancements and changes	**0.706**
16	Risk 10	External expert and consultant judgment	**0.682**

TABLE 2: Risk Elements Findings

Impact Rank	Elements of Risks	Risks Calculations						
		P_{ML}	C_t	C_c	C_p	$P_{ML}xC_t$	$P_{ML}xC_c$	$P_{ML}xC_p$
1	Element 1	0.267	0.260	0.182	0.441	0.069	0.048	0.118
2	Element 9	0.388	0.315	0.247	0.202	0.122	0.096	0.079
3	Element 14	0.329	0.118	0.141	0.541	0.039	0.046	0.178
4	Element 5	0.352	0.332	0.047	0.427	0.117	0.017	0.150
5	Element 4	0.317	0.170	0.097	0.557	0.054	0.031	0.176
6	Element 3	0.408	0.125	0.021	0.561	0.051	0.008	0.228
7	Element 2	0.350	0.252	0.126	0.234	0.088	0.044	0.082
8	Element 11	0.324	0.155	0.194	0.310	0.050	0.063	0.101
9	Element 12	0.265	0.344	0.270	0.221	0.091	0.072	0.059
10	Element 13	0.279	0.484	0.039	0.136	0.135	0.011	0.038
11	Element 6	0.348	0.268	0.201	0.290	0.093	0.070	0.101
12	Element 8	0.271	0.242	0.176	0.330	0.066	0.048	0.089
13	Element 10	0.376	0.084	0.230	0.398	0.031	0.087	0.149
14	Element 7	0.280	0.170	0.194	0.460	0.048	0.054	0.129
					ΣP*C	**1.054**	**0.695**	**1.677**

VI. CONCLUSION

The empirical model has shown how to estimate the project deviations based on the identified 14 risk elements. The model provides a meaningful approach in estimating the project risks. The model also helps in determining the necessary contingency reserves in terms of time, cost, and performance which are required to execute a project. The research findings show first, the surveyed risks elements have got strong advocate by the majority of respondents. This has not only enlightened the area of important risks but also shown its specific impact on a project. Second, the estimation process for project contingency reserves has become risk-based estimated quantity. The specific finding in the calculation is that the maximum possible deviations in schedule, cost, and performance, provided that the 14 elements are applicable, are 105.4% in project schedule, 69.5% in project cost, and 167.7% in project performance. I believe, however, if the 14 risk elements were scrutinized and their applicability was determined, project deviations may be calculated and the contingency reserves are accordingly specified. Finally, the outcome is an integrated project management plan.

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Online Collaborative Problem-based Learning Environment

from theory to practice

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Abstract— **The general hypothesis guiding our work consists in considering that applying the distributed Problem Based Learning (d-PBL) requires computerized environments developed on a strong theoretical basis. Therefore there are two chosen theories: the activity theory and the action theory. Our goal was to study these two theories effects on learning environments design, and to see if they could propose fields for educational exploitation of the d-PBL method.**

Keywords; PBL; Activity Theory; LMS

I. Method Keys

There are four keys to achieve successfully the PBL method:

First, the problems are presented to learners, as they really exist, as ill-structured unsolved problems, stimulating so the generation of many hypotheses about dealing with causes and solutions. These problems stimulations are conceived in a way allowing learners to know by themselves how to get more given information in order to understand and reach the solution, by applying and enhancing abilities to solve a problem.

Second, learners have to assume the responsibility of their own learning, to determine their needs for learning and to find appropriate resources in order to acquire given information (texts, libraries, websites and experts). Moreover, learners must assume the responsibility of controlling and evaluating their own performance and their colleagues'; the PBL is a learning method focusing on the learner.

Third, in order to reach this goal, the teacher's role is to guide or to facilitate the learning process; he's designated by "tutor" of the PBL. The tutor is a guide who stands beside learners and not a wise person standing on the platform in front of his students.

Fourth, chosen problems are the most convenient ones to be confronted by the learner during his life, his career. The required abilities and activities of the learner are those enhanced during real life – this makes the PBL method an authentic learning process.

II. Construction of an Analysis Chart

A. Prior and posterior operation modes

The main challenge for a conception process based on theory is to make a prior successful study for its value in terms of quality. The problem becomes more serious when there is a formation device, since priorities for designers (technology, computer graphic, ergonomics …) are not always the same for evaluators (education, cognition …). In this sense, it would be important to do a prior evaluation for these devices and platforms, as great efforts of conception were made. Once educational requirements are well identified, the study of a d-PBL system is applicable as a prior study not only a posterior one. In an article about cognition and experience, Nahas[1] says: "*The importance of a prior evaluation doesn't negatively affect the posterior evaluation which will keep all its importance relatively to technological criteria of speed, operating simplicity, permeability etc. While methodological aspects can rather be subject to a prior evaluation, operational aspects will be subject to a posterior evaluation. According to this point of view, we can enhance one or more aspects. The fact remains that the educational quality of formation prevails evidently the methodological aspect.*"

In this perspective, we propose certain analysis' elements elaborated from definition's elements presented in the first part. These elements will be the driving force which will allow judging systems efficiency towards the absolute intended by educational objectives of formation on one hand, and by technical performances on the other hand, and will allow us answering the initial question: is really the d-BL possible?

B. From the problem to the situation-problem: the 3C3R model

In PBL method, the problem is the starting point of learning process. A problem is not an exercise or an application of techniques or an immediate and exclusive application of notions recently theoretically demonstrated. It's rather a situation inspired from real life (thus it's contextualized), ill-

structured, relatively complex (defined by many parameters), appealing to previous knowledge (integration, transfer …) and requiring a deep investigation to be solved. In this sense, it's better to use situation-problem rather than problem, since it clearly refers to a concrete context and suggests a more global investigation during the analysis and solving process.

These elements constitute a theoretical framework to formulate a problem-to-solve within a PBL process conception. Now practically, how can one judge objectively a problem quality? Is there any method one can follow to confirm the situation-problem's authenticity, and what are its tools? This operation must be prior for not exposing learners to "fruitless roads".

Woei Hung[2] answered to these needs through proposing the 3C3R model which is a conceptual framework and a tool for conceiving systematically an appropriate problem for the PBL method. This model is divided into 2 classes of components:

- Core Components (3C) which contain the following elements: "Content", "Context", "Connection" and support the content and the concepts learning.
- The 3C3R model helps the designer in going beyond such obstacles:
- How to join between learning's objectives and content?
- How will the degree of "contextualization" be able to affect researching and reasoning in PBL learners?
- How will the information quantity given in the PBL problem be able to affect cognitive processes relative to researching and reasoning in learners?
- How to adapt the problem to learning's objectives on one hand and to the cognitive ability in learners on other hand?

Hung concretely suggests many questions relative to elements whose answers will direct the design of ill-structured problems, to adapt them to learners' profiles and abilities. The model can, according to Hung, adjust them in function of the two model dimensions: Researching and reasoning.

C. The tutor role

Since there are no well determined rules for tutors, it would be useful to consider the following elements for the learning's design, as modified by Neville[3], as being tasks for the PBL tutor in order to facilitate working with tutorial group members:

- Climate setting: to create a healthy environment favorable for the autonomous learning.
- Planning: to organize and structure the tutorial.
- Clarifying needs for learning: to specify learning's objectives and goals.
- Setting goals for learning: to help learners in transforming their educational needs into learning objectives.
- Designing a learning plan: to help the learners through the strategies learning and development plan.
- Engaging in learning activities: to make an orientation in order to be sure that learners are on the right path of their learning.
- Evaluating learning outcomes: to include formative reactions and a summative evaluation.

D. Collaboration or cooperation?

The debate "collaboration" versus "cooperation" is more complex. These two terms are often used as having the same meaning. In a context of problem solving, the "cooperation" means the labor division in all tasks and its attribution to "cooperator" in form of activity where each person or group is responsible of a part of the problem solving.
On the contrary, the "collaboration" involves a mutual engagement for the participants in coordinating their efforts to solve the problem together. The definition of collaboration, as being the "non distribution" of labor, is not enough for clarifying ambiguities[4]. Miyake[5] demonstrated that in a collaborative activity, we sometimes notice a spontaneous labor division; for example the participant, who has more things to say about this topic, takes the role of "task-doer" while others become "observant". The observant can contribute though criticizing the topic and giving it other perspectives.
Thus, the difference between collaboration and cooperation does consist in whether the task is distributed or not; it's rather localized at the level of the distribution nature: in cooperation, the task is divided hierarchically into independent subtasks and the coordination occurs on the moment of partial gathering; in the collaboration, the cognitive process can also hierarchically be divided, but into intertwined layers. In this sense, the collaboration is a synchronous coordination resulting from the permanent effort to do and maintain a shared conception of problem.

E. To evaluate: Who, why and how?

In a PBL process, the tutor is not the only one to evaluate learners. The evaluation constitutes a complex system according to its nature level (it's at the same time summative and formative), to its agents (tutor, learner and group), to its final objective which is to develop a criticizing sense in learners. In this sense, the evaluation goes over the general and specific formation objectives which generally are measured through tests. The PBL method originality and efficiency on this level exist in the fact that they require 3 paths to the evaluation:

- Self-Evaluation
- Peer-Evaluation
- Tutor-Evaluation

III. The Experience

A. First approach: learning protocols

The main objective of researches based on this approach is to redevelop new concepts underlying the creation of integral collaboration environments in order to support the d-PBL respecting the cultural and social factors' role. The frame of the activity theory analysis is used as a reference by this approach because it defines the human being relatively to its activity with objects and actors in his environment.

Relying on activity theory and a PBL method analysis, the supporters of this approach suggest a conceptual framework of a d-PBL virtual environment. This conceptual framework identifies eight components: agent, space, tool, language, document, action, work division and rules.

The architecture mentioned above gave birth to a prototype named CROCODILE. This system uses the client's architecture. Each client provides a personal interface for users to interact with the application. Consequently, learners, distributed geographically or localized in the same places, can participate in collaborative PBL activities, whether synchronous or asynchronous, in the virtual learning environments.

B. Second approach: the models of learning situations specification

Since many years, we are assisting to the emergence of pedagogical modeling languages. The essential of these works focuses on language of IMS Learning Design[6] notation which appears to be compatible with largest set of approaches, and which relies on a theatrical metaphor. In this way the scenario of a learning unit is decomposed into pieces, acts and partitions played by a certain number of actors, each one with a role. The elements of the proposed conceptual model were the object of different actions of researching leading to proposing a UML profile for the modeling of cooperative situations-problems: the CPM profile. This profile is applied according to the following elements:

- An abstract syntax represented by the meta-model CPM which defines the concepts and the relations specializing UML;
- A concrete syntax defining the notation of concepts and their relations and the principles of these concepts' use in UML diagrams;
- A semantic defined on terminological level and notation level.

The architecture mentioned above gave birth to a prototype named SMASH.

C. Third approach: Virtual Documents Repository (VDR)

According to this approach, an on-line PBL application is composed of 3 paths:

- A set of resources containing tools, documents, etc. which can be accessible to learners, tutors and educational responsible persons.
- A set of problems created by teachers for their courses.
- A PBL method helping learners to organize the access to different steps, actions and resources.

To answer the specifications of this model and the needs in question of adaptation, a Virtual Documents Repository (VDR) was adopted as a support for the on-line PBL. SCARCE (Semantic and Adaptative Retrieval and Composition Environment) is a flexible environment of adaptative hypermedia based on virtual document approach and the semantic web evolution. Therefore we are able, through it, to create and maintain the service in which we solve the selection problem, the organization and the filtering on semantic level.

IV. Experience Results

The application of educational chart based on these three devices gave the following results :

- The three examples didn't success in bringing the problem's opening to the critical thinking. This factor affects the situation-problem's nature and its objective, and transforms the PBL method to a better version of problem solving method.
- The collaboration's problem exists on theoretical level. Despite the efforts made to take out the difference between "collaboration" and "cooperation", the designer of the three platforms didn't success in translating collaboration in term of tools and learning activities. On one hand, many terms are used in the same sense: collaboration, cooperation, coordination … On the other hand, the cognitive aspect of collaboration was not sufficiently studied in theoretical parts of these approaches.
- The failures on the level of situation-problem and collaboration will affect the process of the PBL tutorial. In addition to groups' animation, the tutor is essentially charged of maintaining the situation-problem, which is the nucleus of PBL, and facilitating the collaboration. Moreover, it's clear that he has lost his role of evaluator.
- Finally, we notice a total absence of evaluation in the three platforms.
- If there is a comparison between these 3 platforms, it's difficult, through this analysis, to recommend one of them. An evaluation leading to such conclusion must be based on a more detailed evaluation chart and an items' equilibration. This task can only be done by relying on case studies.

V. Conclusion

Finally, can we answer our initial question: can the PBL be possible? This study offers many elements that we judge as important to propose an objective answer:

1) The activity theory can serve as conceptual framework for the systems design supporting the d-PBL for the following reasons:

a) In this theory, the problem's nature doesn't affect the activity process. For example, the solving of a well-structured problem can be a goal for an activity knowing that such a problem can't release a PBL in any circumstances.

b) The cooperation is an authentic practice in the activity theory, in condition that it respects the other poles of triangles (rules, work division, object, subject ...), but it's essential to achieve successfully the PBL method.

c) The activity theory doesn't integrate the PBL evaluation in learning process (knowing that learning as an activity). However evaluation plays the role of a trainer in PBL.

d) The object (the learning objectives) in activity theory is limited to the problem solving, while the learning's objective in PBL surpasses the problem.

e) Te tutor's role is so limited in the activity theory. He's in charge of organizing and coordinating activities and operations. PBL gives also the tutor the task of evaluation.

f) On the contrary, the activity theory can interfere in specific and important tasks in the process of designing and the d-PBL systems' evaluation, like in system's components identification (subjects, objects, rules ...) and work division…

2) Action theory:

a) According to the software engineers, the human processor's model defines a theoretical work as useful for the quantitative comprehension and evaluation of general man-system interaction mechanisms. The behaviorist perspective of models treating learning as being a task has to be completed with cognitivist and constructivist perspectives .

b) The implementation of task's model in terms of learning's computerized environments focuses on information (research, organization, presentation…). The focus in d-PBL is put rather on learning's absolute objective, not on its steps and modalities.

3) The difficulty in d-PBL exists in tools and technologies, but rather in situations-problems' conception and in educative engineering. The information and communication technologies offer a set of efficient and diversified tools supporting an ill-structured problem's steps. The d-PBL successful result depends on content, tutor, and instructional design more than in computerized system and technology.

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Analytical Hierarchy Procedure Approach for Finding Optimal Learning Path in Distance Learning

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Abstract- **Internet evolution has affected all industrial, commercial, and especially learning activities in the new context of e-learning. Due to cost, time, or flexibility, e-learning has been adopted by participators as an alternative training method. By development of computer-based devices and new methods of teaching, distance learning has been emerged. The effectiveness of such program is depended on powerful learning management systems. In this paper, Analytical Hierarchy Procedure (AHP) approach is used to obtain an optimal learning path for each learner in a e-learning network.**

Keywords: E-learning; Optimal path; Distance learning; Analytical Hierarchy Procedure

1. INTRODUCTION

Internet has significantly impacted the establishment of Internet-based education, or e-learning. Internet technology evolution and e-business has affected all industrial and commercial activity and accelerated e-learning industry growth. It has also fostered the collaboration of education and Internet technology by increasing the volume and speed of information transfer and simplifying knowledge management and exchange tasks [Raaij, E.M.van., and Schepersa, J.J.L.,2006]. E-learning could become an alternative way to deliver on-the-job training for many companies, saving money, employee transportation time, and other expenditures [Chen, H-m., Yu, C., and Chang, C-s., 2005]. An e-learning platform is an emerging tool to corporate training [Fresena, J.W., and Boydb, L.G., 2005]. Employees can acquire competences and problem solving abilities via Internet learning for benefits among business enterprises, employees, and societies while at work [Munenea, I., 2007].

Currently e-Learning is based on complex virtual collaborative environments where the learners can interact with other learners and with the tutors or the teacher [Ngaia, E.W.T., Poonb, J.K.L., and Chana, Y.H.C., 2005]. It is possible to give to the learner's different synchronous and asynchronous services. The former group includes virtual classrooms and individual sessions with the teacher or tutors. The latter group includes the classic didactic materials as well as Web-based seminars or simulations always online [Duffy, V.G., Parry, P. W. Ng., and Ramakrishnan, A., 2004]. These functions can be usually accessed by the means of software platforms called Learning Management Systems (LMSs). Among the other functions, the LMS manages learners, keeping track of their progress and performance across all types of training activities [Carrillo, C.I.P.d., 2004]. It also manages and allocates learning resources such as registration, classroom and instructor availability, monitors instructional material fulfillment, and provides the online delivery of learning resources [Raaij, E.M.van., and Schepersa, J.J.L.,2006].

User and student modeling is a fundamental mechanism to achieve individualized interaction between computer systems and humans [Paiva, A., 1995]. It is usually concerned with modeling several user related issues, such as goals, plans, preferences, attitudes, knowledge or beliefs. The most difficult task in this context is the process of interpreting the information gathered during interaction in order to generate hypotheses about users and students behavior [Paiva, A., 1995], and involves managing a good deal of uncertainty. Interactive computer systems deal in general with more meager and haphazardly collected users' data than it usually happens when humans are engaged in face-to-face interaction [Jameson, A., 1996]. Thus, the gap between the nature of the available evidence and the conclusions that are to be drawn is often much greater [Jameson, A., 1996]. Numerical techniques have been employed in several cases in order to manage uncertainty, [Conati, C., Gertner, A., Vanlehn, K., 2002; Herzog, C., 2005; Lascio, L.D., Gisolfi, A., Loia, V., 1998], and neural networks have been used in order to add learning and generalization abilities in user models and draw conclusions from existing user profiles [Chen, Q., Norcio, A.F., Wang, J., 2000; Magoulas, G.D., Papanikolaou, K.A., Grigoriadou, M., 2001; Stathacopoulou, R., G.D. Magoulas, M. Grigoriadou, 1999; Yasdi, R., 2000]. In this paper a learning management system is designed and AHP approach is used to identify the weights of each path in the e-learning network to evaluate the optimal path for users by mathematical programming.

2. THE PROPOSED LEARNING MANAGEMENT SYSTEM

Automatic definition of a model starting from of numerical data can be done efficiently through methodologies in the area of Soft-Computing, a new computing paradigm which synergically integrates different information processing methods, such as neural networks, fuzzy systems and evolutionary programming, in order to deal with uncertainty, typical of real-world domains, while preserving characteristics of processing and robustness. Especially, considerable work has been done to integrate the learning capabilities of neural network with explicit knowledge representation given by fuzzy systems, resulting in the neuro-fuzzy modeling approach [Arons, A.B., 1990].

As it is represented in Figure 1 in this model, students are considered to choose the best curriculum for themselves regarding to the profile of each course and their requirements. The neural network is used to obtain student's curriculum within a distance learning educational system. In the former system a learning management system (LMS) system is applied for the qualitative items in order to reach the optimal learning path for a student in such a system. The first layer, which is considered as the input layer, is the number of students who want to select the courses for a semester. The second layer is the number of courses that are offered in a semester. Those courses have instructors for varied levels of students, Strong; Moderate; Weak, i.e. students can choose a course with one of those instructors regarding to their capability as the following (if …. then) fuzzy rules that are being constructed in the management system:

- *If a student chooses instructor with "strong" title then the weight is 3,*
- *If a student chooses instructor with "moderate" title then the weight is 2,*
- *If a student chooses instructor with "weak" title then the weight is 1,*

And also students choose their courses regarding to the criteria such as capabilities, attitudes, knowledge level, motivation and learning style by their preferences according to Table1:

Table 1: Course Preferences and Their Related Numerical Values

Preferences	Numerical value
Extremely Preferred	9
Very Strongly Preferred	7
Strongly Preferred	5
Moderately Preferred	3
Equally Preferred	1
Preferences among the above preferences	2,4,6,8

The fourth layer shows the excessive facilities that the educational system provides for the students, such as e-library, e-lab, different workshops, and etc. The next layer is a learning management system that is used to analyze the qualitative items. The last layer shows the optimal path for each student according to their own profiles.

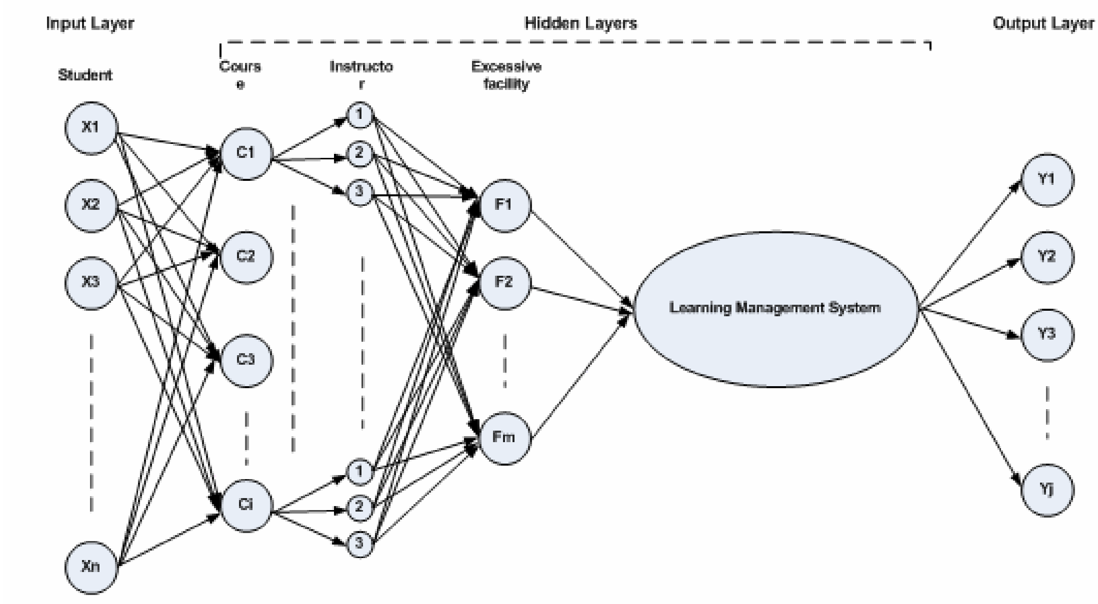

Figure 1: The Learning Management System

Considering the above descriptions the optimal path for student is a path that enables a student to use the maximum amount of services that the educational system provides considering the students requirements and criteria.

2.1. Mathematical model

Subscriptions:

N	Number of students	$n=1,2,3,\ldots, N$
i	Number of courses	$i=1,2,3,\ldots, I$
m	Number of excessive facilities	$m=1,2,3, \ldots, M$
j	Learning paths for each students	$j=1,2,3, \ldots, J$
P	Level of instructor	p=*Strong, Moderate, Weak*

Notations:

X_n	The n^{th} student
C_i	The i^{th} course
F_m	The m^{th} facility
Y_j	The j^{th} path
W_i	The weight for course i^{th}
W_p	The weight for instructor p^{th}

Decision variables:

$$\psi_{ni} = \begin{cases} 1 & \text{If student } n \text{ choose the course } i \\ 0 & \text{O.W} \end{cases}$$

$$\varphi_{nm} = \begin{cases} 1 & \text{If student } n \text{ use facility } m \\ 0 & \text{O.W} \end{cases}$$

$$Max \sum_{i} \sum_{p} \left(\sum_{n} W_i \psi_{ni} W_p + \sum_{m} \varphi_{nm} \right) \qquad (1)$$

S.t:

$$X_1 + X_2 + \ldots + X_n = A \qquad (2)$$

$$L \leq C_i \leq U \qquad (3)$$

$$0 \leq F_m \leq M \qquad (4)$$

Equation (1) is the objective function which presents the maximum service of the educational system that is the optimal learning path. Equation (2) specifies the number of students who try the course selection. Equation (3) identifies the lower and upper bound for course numbers. Equation (4) presents the number of facilities that the educational system prepare for being used by the students.

The noticeable parameters are W_i and W_p that are the weights of the criteria in the course selection. The W_p is based on the fuzzy rule-base engine that explained before but W_i s will be identified by a multi criteria decision making approach. In this paper the analytical hierarchy procedure (AHP) is applied to find the weights.

2.2. Determining weights by AHP approach

The analytical hierarchy procedure (AHP) is proposed by Saaty (1980). AHP was originally applied to uncertain decision problems with multiple criteria, and has been widely used in solving problems of ranking, selection, evaluation, optimization, and prediction decisions. Harker and Vargas stated that ''AHP is a comprehensive framework designed to cope with the intuitive, rational, and the irrational when we make multi-objective, multi-criteria, and multi-factor decisions with and without certainty for any number of alternatives.''

The AHP method is expressed by a unidirectional hierarchical relationship among decision levels. The top element of the hierarchy is the overall goal for the decision model. The hierarchy decomposes to a more specific criterion a level of manageable decision criteria is met [Meade & Presley, 2002]. Under each criterion, sub-criteria elements relative to the criterion can be constructed. The AHP separates complex decision problems into elements within a simplified hierarchical system [Shee, D. Y., Tzeng, G. H., & Tang, T. I., 2003].

The purpose of the AHP enquiry in this paper is to construct a hierarchical evaluation system based on the independent factors as capabilities, attitudes, knowledge level, motivation and learning style, the AHP method could gain factor weights and criteria, and then obtain the final effectiveness of each course.

The AHP usually consists of three stages of problem solving: decomposition, comparative judgments, and synthesis of priority. The decomposition stage aims at the construction of a hierarchical network to represent a decision problem, with the top level representing overall objectives and the lower levels representing criteria, sub-criteria, and alternatives. With comparative judgments, users are requested to set up a comparison matrix at each hierarchy by comparing pairs of criteria or sub-criteria. A scale of values ranging from 1 (Equally Preferred) to 9 (Extremely Preferred) see Table 1, is used to express the users preference. Finally, in the synthesis of priority stage, each comparison matrix is then solved by an eigenvector method for determining the criteria importance

and alternative performance. The following list provides a brief summary of all processes involved in AHP applications:

1. Specify a concept hierarchy of interrelated decision criteria to form the decision hierarchy.
2. For each hierarchy, collect input data by performing a pair wise comparison of the decision criteria.
3. Estimate the relative weightings of decision criteria by using an eigenvector method.
4. Aggregate the relative weights up the hierarchy to obtain a composite weight which represents the relative importance of each alternative according to the decision-maker's assessment.

One major advantage of AHP is that it is applicable to the problem of group decision-making. In group decision setting, each participant is required to set up the preference of each alternative by following the AHP method and all the views of the participants are used to obtain an average weighting of each alternative.

In this paper regarding to the stated criteria, the following hierarchy is proposed. The aim is to obtain the weight for each course to be used in the objective function of optimal path. The hierarchy is presented in Figure 2.

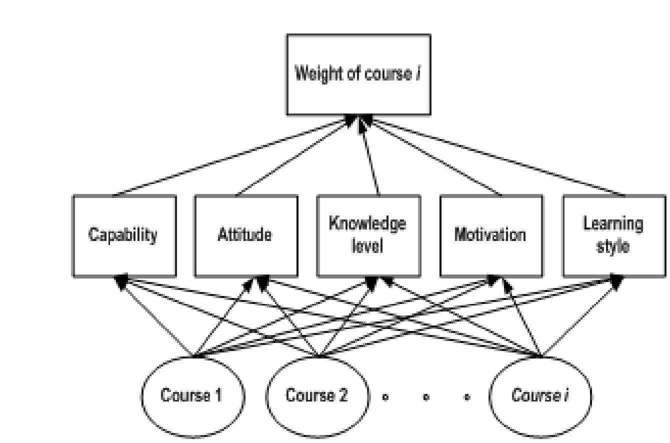

Figure 2: The Hierarchy of the Proposed Model

According to Figure 2 the following matrix is used to calculate the weights ratio each of the criteria i.e. courses are evaluated ratio capabilities, attitudes, knowledge level, motivation and learning style based on the preference numbers (A_{bc}) of the courses considering Table 1:

Matrix 1

Capability	Course 1	Course 2	Course *i*
Course 1	1	A_{12}	A_{1i}
Course 2	$1/A_{12}$	1	A_{2i}
.	.	.	.
.	.	.	.
Course *i*	$A_{1i}=1/A_{i1}$	$A_{2i}=1/A_{i2}$	1

The same matrix is used for other criteria (attitudes, knowledge level, motivation and learning style) we call this dual comparison of courses. After calculating the above matrixes, a matrix that indicates the weights (W_{bc}) of the courses for the mentioned criteria is formed as follows:

Matrix 2

	Capability	Attitude	Knowledge level	Motivation	Learning style
Course 1	W_{11}	W_{12}	W_{13}	W_{14}	W_{15}
Course 2	W_{21}	W22	W_{23}	W_{24}	W_{25}
.	.	.	.	.	.
.	.	.	.	.	.
Course *i*	W_{i1}	W_{i2}	W_{i3}	W_{i4}	W_{i5}

After that the criteria dual comparison matrix is configured as follows:

Matrix 3

	Capability	Attitude	Knowledge level	Motivation	Learning style
Capability	1	A12	A13	A14	A15
Attitude	1/A12	1	A23	A24	A25
Knowledge level	1/A13	1/A23	1	A34	A35
Motivation	1/A14	1/A24	1/A34	1	A45
Learning style	1/A15	1/A25	1/A35	1/A45	1

Now we reached the weight of each criterion by the above matrix. Therefore, the weight for each course considering the criteria is achieved as follows:

$$Total\ weight\ for\ course 1 = W_{11} \times W_C + W_{12} \times W_A + W_{13} \times W_K + W_{14} \times W_M + W_{15} \times W_L$$
$$Total\ weight\ for\ course 2 = W_{21} \times W_C + W_{22} \times W_A + W_{23} \times W_K + W_{24} \times W_M + W_{25} \times W_L$$
$$.$$
$$.$$
$$Total\ weight\ for\ course\, i = W_{i1} \times W_C + W_{i2} \times W_A + W_{i3} \times W_K + W_{i4} \times W_M + W_{i5} \times W_L$$

Where W_C= capability's weight, W_A= attitude's weight, W_K= knowledge level's weight, W_M= motivation's weight, W_L= learning style's weight, that are obtained by matrix 3. In this way the weights are calculated to be used in equation (1) and the optimal path for students will be identified after solving the simple mathematical model.

4. CONCLUSION

In this paper a learning management system was proposed for inferring student characteristics and for identifying the optimal path of students in applying distance learning courses based on their profile. A main advantage of the new approach is that the model allows creating an interpretable knowledge representation, which can be developed on the basis of rules when reasoning is well defined, as well as it can be trained when the reasoning strategy is purely intuitive. In addition the model can be easily tailored to a teacher's personal view. This approach can be used to implement an open student model, which will be interactively adjusted by the teacher.

AHP approach is applied to find the optimal path in the proposed virtual learning environment based on the qualitative parameters regarding to the students characteristics. Our current work targets the extraction of knowledge from existing student profiles to drive model's adaptation during operation with the aim to adapt the feedback and pedagogical strategy to students' learning style. Future works will be about the implementation of the model and the experimental results which will represent the pros and cons of our model.

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Toward the factors of E-learning Adoption in High schools: Jordan Case Study

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Abstract—**Innovation in learning is always the main interest of any educational institute to develop their learning models. E-learning is one of the most innovative models in education. This paper investigates and analysis the factors that influence the adoption of e-learning systems in Jordan as one of the third developing countries. The investigation has been done in the high schools, public and private.**
A new model has been presented in this research. The results of this research has been shown that the legislations issues, human factors, infrastructure, economics and web content had a significant impact on learning goals and objectives. Therefore it is difficult to have a complete e-learning system in Jordan schools. The novel contribution of this research is achieved by using the results of investigations and analysis to assist in building of a theory that will be tested through quantitative methods in the future.

Keywords: E-learning; School; Qualitative Research; Jordan

I. INTRODUCTION

The concept of the learning [1, 2] has grown exponentially with the technological era related that today, corporate learning and the corporate learning organization have ascended to a position of strategic status in the context of managing and growing the project. Identification the knowledge-based economy, the paradigm shift in the way education is viewed and delivered, and huge knowledge gaps as significant trends that have given rise to e-learning [3]. The increase in complexity and velocity of the work environment brought about by technological changes are also major issues that have fueled the demand for e-learning. The shift from the industrial to the knowledge era is presented by [2]. Rapid technological change, the ever shortening product developmental cycles, lack of skilled personnel, enterprise resource planning, and migration towards value chain integration and the extended enterprise as being prominent contributors to the e-learning value chain. The robust economy and the increasingly competitive global business environment as central to the e-learning movement is recognized by [2, 4] .

These composed trends which contribute in driving e-learning systems and show the importance and benefits of e-learning which increases the adoption for this new technology and speedup motivation for creating a new e-learning model in Jordan.

Very few researches study the adoption and use of e-learning technology in the third developing countries. It is very important to reveal that the new technology adoption might be completely different from country to country and from nation to nation. Therefore, this research investigates the factors that influence this variety in the adoption of e-learning systems.

This paper begins with the definition of e-learning. The second part explains the diversity of e-learning practices in terms of persons, computer and technology literacy and social factors. The third part explains a comparison between traditional education and e-learning. In addition, the objectives, advantages and disadvantages of e-learning are outlined after the quality and content section.

II. E-LEARNING DEFINITIONS

The term of e-learning involves using the Internet as a communications medium where the instructor and students are separated by physical distance [5].

While''online'',''technologically-integrated'','multimedia-based'',and "e-learning'' are familiar terms that describe a new approach to instructional delivery. Studies show that schools quickly adopt these delivery modes. Analysts of this growth estimate that online learning is increasing 30-40 percent annually [6]. E-learning 'is a complement to other forms of

learning and not a replacement. It should form part of an articulated approach to learning'[7].

III. THE DIVERSITY OF E-LEARNING PRACTICES

No educator will be especially surprised to learn that success in a Web-based learning environment is heavily influenced by what the student brings to the learning situation. There is evidence that students with certain learning styles (e.g., visual) or behavioral types (e.g., independent) do learn better in the Web environment. Conversely, aural, dependent and more passive learners may not do as well. It is this sort of insight that leads some to propose that the potential for maximal learning results when instructional approaches are matched to student learning styles and are supported by appropriate technologies [8]. Furthermore, students with a high motivation to learn can do better by learning online and they will be more independent.

"Our brains may also be the reason why we can become so involved with our computers. As a result of 35 laboratory studies, [9] (1996) concluded that it is the psychology of the relationship between us and the computer that is important, not the fact that one member of this so-called relationship is a piece of technology. They came to this conclusion after experiments where subjects were asked by the computer to evaluation its work. Subjects responded politely and seemed not to want to hurt the computer's feelings. But, when asked by one computer to Evaluation another's work, subjects were more likely to offer criticism"[10].

"Social presence" (i.e., the degree to which a person is perceived as real in an online conversation) is a strong predictor of satisfaction with computer-mediated communications [11]. This skill the production of "immediacy behaviors," since they reduce the "social distance" between teachers and students. In this study, these types of behaviors were positive predictors of student learning and course satisfaction [12].

IV. QUALITY AND CONTENT:

One of the most natural questions that is raised regarding online education (or any educational innovation) is whether it is effective or more effective than what is currently in place? in the case of online education , many comparative studies have been conducted and more are being undertaken to show that online learning produces equivalent or superior educational results to traditional face to face instruction ..., in general the question of whether e-learning is as effective as face-to-face learning has largely been answered by advocates of e-learning with a yes ,''nearly all comparative studies show that e-learning is as effective as classroom instruction'' [13]. In order to make online education work efficiently, large number of students must enroll in courses and degree programs taught by relatively few faculty assisted by teachers aides [14]. Using e-learning technology and innovations in learning methodologies can assist many students to achieve and gain multiple learning goals and objectives.

In any remoteness education situation we need to remember that students are not electronic machines, they are human beings with their proper educational needs and cultural context. E-learning platforms are useful tools to help learners to accomplish their educational and learning activities, to instruct at a distance, to overcome time and space barriers. E-learning platforms do not substitute the human part of the educational process of teaching and learning [15].

Table (1) Description of the Objectives, Advantages and Disadvantages of using E-learning System in school.

Attributes description	Details
E-learning purposes and objectives	Providing a platform to enhance both traditional face-to-face and e-learning system for students. New learning models are needed to bridge the skills gap and demographic changes. Solving Limitations of both time and physical space in the classical learning, Expanding the learning opportunities of students who are facing difficulties that are preventing them from attending traditional one. With the multi platform e-learning environment learning would occur at any time during the day and from any where in the world. Private educational school competitive highly desire Provides flexibility, efficiency and using workflow functionality application [16]. E-Learning as a solution to National Specific Problems [17]: Over-crowded classrooms. High price of traditional educational books. Chance for talented students. Active participation in the international educational community. Enhancing the level of national education .
E-learning advantages	E-learning system advantages for student: Building programmed work for students with the excellent support of educated websites made the task of e-learning easier [18]. Provide guidance for students depends on the level in which this application is integrated in to teaching [18]. Encourage students to become more autonomous learners Encourage students to make a different kind of use of both contact and non-contact time. In order for students to take full advantage of many of the e-learning innovations and technologies

In this work the main problem is building a new educational learning model. The degree of adoption of the new technology and the trends driving e-learning system including the difficulties forces implementation in our country as a part of the Arab region and Middle East are taken into consideration. The model consists of several variables

depending on the real requirements and demands of the schools within the available resources and environment.

It is obvious that e-learning implementation has many factors that can change the attitude of the people to adopt this new model of education. It is so difficult to cover all the factors; the researchers study the factors within public and private school in Jordan in e-learning implementation. The next section explains this case.

V. CASE STUDY: PUBLIC SCHOOL

The growing of technology knowledge underpins schools represented by the ministry of education) to adopt new vision for learning. This vision is implementing the e-learning principles in schools through different phases.

The ministry of education (school) implemented the e-learning project in three phases. The first phase is the establishment of the infrastructure and content.

The second phase is the use of Eduwave (http://elearning.jo) as a supportive tool for the traditional education. It is done through using Internet and other multimedia tools. Finally, the third phase that is:

Migrate from simple supportive e-learning tool using eduwave to a complete content of e-learning system. It provides e-learning content, virtual class system, e-exam, e-video and studio, electronic content management, sharing tools and all the management works for the schools in Jordan.

A. *The ministry of education (school) strategies to migrate to a new e-learning system*:

Establishment of special building centre for the e-learning project. This centre will manage every thing related to that project such as the staff and infrastructure (king Rania center).

Establish of new schools buildings that have all the infrastructure for the e-learning (labs, wireless node) so the teachers and students can access the system from any where inside the school. Purchasing of e-learning system that can basically be operated under windows. Training of teachers (ICDL, Intel, word links, high diploma in IT) during the last years. And this training extended to all whom engaged in the e-leaning system.

VI. THE RESEARCH METHODOLOGY

A qualitative research was used for induction [19, 20]. That is, the qualitative approach to data collection discovers information from the perspective of the interviewee about the phenomena, such as behaviors and attitudes, that are not directly observable, that is, 'in someone else's mind' [21]. The findings of the qualitative research are not used to test a theory and make generalizations about a population; but rather, to build a theory for further testing, through quantitative methods [22, 23, 24, 25].

This induction characteristic of qualitative methods was a requirement for the first stage of this research for two reasons. Firstly, e-Learning systems in an Internet environment are a relatively new topic in Jordan and Arab region public and private school. In the early stages of theory development, where phenomena are not well understood and the relations between phenomena are not known, in advance used quantitative research methods can lead to inconclusive answer [26]). A qualitative method was required to explore this complex topic in depth with experts who have studied and/or applied (teachers, students and technical's) their knowledge practically to generate ideas rather than to evaluate ideas. That is, qualitative research allowed for flexibility in the gathering of information and a Semi-Structured exploration of issues in a less structured format, with a smaller number of respondents than quantitative methods [20, 27]. This information will be used to assist in the building of a theory that will be tested through quantitative methods in the next method of this research. The second reason for using a qualitative method was the type of information this research is intended to gain in the first stage of data collection. The depth and detail of qualitative data required to understand complex phenomena can be obtained only by getting psychologically close to the phenomena under study. 'The closer the researcher gets to the phenomenon, the clearer it is understood [28]. Qualitative research allowed us to a gain semi-structured understanding of underlying reasons and motivations and to obtain 'rich', 'real', and 'deep' information with 'non-statistical' data analysis [29]. In summary, the complexity of the research subject warranted a semi-structured exploration that is only possible through qualitative research in the first stage of this research.

This research utilizes an unstructured interview with the Information and Communication technology in Education (ICTE) students in Jordan University. They are teachers in high schools and professional. They are using the e-learning system that is implemented by the ministry of education in their schools.

The researchers use each interview for collecting the information required from the respondents and in explaining the data results [28, 30]. The unstructured interview is often seen as an informal interview that is not structured by the standard list of questions. Field-workers are free to deal with the topics of interest in any order, and to phrase their questions as they think is best suited [31]. An unstructured interview is particularly useful for a preliminary study in order to test what the responses might be to a particular issue [32]. In this phase, the researchers asked those teachers who are content developers and users of e-learning system open-ended questions. Although the researchers knew what they wanted, the open-ended questions enabled the researchers to obtain what they were looking for.

The interview questions in this research are classified to six parts: technical, infrastructure/support services, social, prerequisite skills, motivation, and time/interruptions.

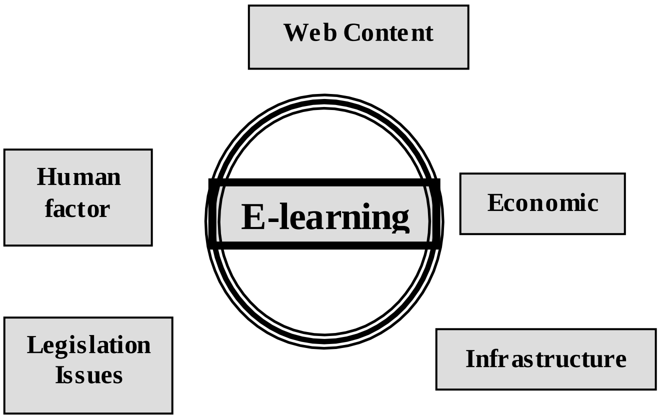
The answers of these questions are summarized and analyzed with the cooperation of the interviewed teachers. The analysis focused on the frequencies of concepts in answers and how they are related to each other. Again, the derived concepts are discussed with the interviewed teachers and filtered.

The result is a framework depicts the main factors that influence the e-learning adoption in high schools. This

framework is being discussed and approved by the interviewed teachers.

VII. The Result of Analysis

The Factors of E-learning Adoption Model in Jordan schools.



The results of this research has been shown that the legislations issues, human factors, infrastructure, economics and web content had a significant impact on learning goals and objectives.

VIII. Discussion:

This research represents a practical investigation into factors and characteristics that influence the new e-learning model.

As seen in our new model in, the legislations issues, human factors (training, resistance), Infrastructure, Economic and web content (Language option, Multimedia, Content quality) had a significant impact on learning goals and objectives in our study.

The rare of legislations that control the use of Internet and guarantee the security and privacy of whom use the Internet were restrict the access of students to the e-learning system. Moreover, the students have not always a reliable access to the Internet. The reliable access is a coherent connection to Internet, continually web site updating, and reasonable server on-line service.

The legislations of the Ministry of Education in Jordan require students' attendance to class's requirement for competitions of there study and the teacher can't develop there own e-learning object and if they do they can't use it inside the school. As a result of that, it is difficult to have a complete e-learning system in Jordan schools.

According to both user and developer, the main barrier is the minds and resistance of change to adopt any new technology. They suggest to have enough training to use a system for both students and teachers and we add the technical's persons of the school who response about the labs in each school, as well as have ICDL as basic requirement for a job and promotion...

The technical infrastructure influences the adoption of e-learning in Jordan high schools. There is a shortage in the infrastructure. The numbers of PCs, laptops, and data shows are inadequate. Furthermore, the internet connection in the schools is not reliable, as well as the equipped halls/labs for e-learning are inadequate, for example; in many schools, one computer for three students.

For most of teachers and students, the economic factor influences the e-learning adoption. The economic factor is the income of the both teachers and students. Therefore, these people are not capable to have computers and internet connection in their homes. Nevertheless, very few students and teachers have computers, they are not able to connect them to internet through broadband line or even dial-up connection.

The most common complaint from user view was the English language of application. The majority of e-learning systems do not provide a language options to an end users. Therefore, students and teachers will not be capable to understand the instructions and manuals related to the system and that will influence their attitudes to use the system. The interactive interface is not always available and that will not make the learning process interesting, especially the majority users of such systems who are between 12-18 years old. They are used to play games with many interaction options and when they use the e-learning system with few or non interaction options, they feel bored. Course's content and materials which are shown on the web are neither high quality nor new. The high quality courses content is the newest edition books, chapters' slides, online practice exams, paper practice exams, courses' timetables, and interactive tools related to courses such as animations, pictures, and sounds.

Our study yield information that may be useful in guiding for extra and future research. It addresses the realistic key factors that are essential to adoption and effective integration of e-learning strategies, initiatives, and programs for schools in our country.

IX. Conclusion

By incorporating e-learning innovations and technologies, students have other learning ways and alternatives. They assist them in meeting the changing demands of the marketplace where complex problems and uncertainty are ever present. Just as ministry of education must find creative ways to continue their competitive edge through the introduction of new technologies and services, schools should take practical steps towards meeting the needs of their students. Introducing e-learning tools and resources may be one way that assists students in achieving the multiple learning goals of exploration, communication, and collaboration beyond the framework and boundaries of the traditional classroom. Our research is preliminary an investigation for the factors that influence the adoption of e-learning systems, as well as seeking information about fact which has not been tested yet in the study domain literature. For that reasons, this information will be used to assist in building of a theory that will be tested through quantitative methods in the future.

X. 10. LIMITATIONS OF THE RESEARCH

As results for this research, there is a list of limitations for adopting of e-learning in Jordan schools

- Process of integration of the e-learning system is still at the beginning.
- E-learning systems within the Jordanian schools are almost not used as it proposed to be used.
- The teachers teaching load is high and thus slow down the adoption of e-learning system.
- The limited budgets and experts of such projects lead into implementation delay, insufficient training, and late adoption.
- Most of the Learning Objects LO of e-learning is not tested well.

The limitations are opening new opportunities for new researches that can contribute more to our knowledge. This section suggests related areas of research where additional investigation may be rich. It will be a good contribution, if the factors of e-learning adoptions model are validated with all schools, public and private in Jordan. In addition, this model can be checked with any adoption theory. Therefore, we can test to what extent these factors affect the adoption.

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Student Attitudes Towards Discussion Forums as a Publishing Medium

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***Abstract*—Learning content generated by students is often used as a resource for other students along with more traditional resources such as text books and articles. This paper is concerned with understanding how students perceive student generated learning content, particularly learning content that is produced as a by-product of some learning activity. A previous study defined this as being disposable learning content as opposed to durable learning content that is the intended product of some learning activity. Further, the previous study identified discussion forums as being a useful environment in which to test this distinction.**

This study is based on a focus group that had discussion forums as its topic. Thirteen computer science undergraduates were asked about different features of a discussion forum format used in the previous study and also generally about how they used discussion forums.

The results indicate that students do not make a distinction between disposable learning content and durable learning content in the context of discussion forums. They use the discussion forum as a publishing medium whereby messages that are posted to the discussion forum are treated as durable learning content. In other words, they are retained in the medium to long term and used extensively by students during their studies.

Keywords: discussion forums, student attitude, disposable learning content, durable learning content

I. INTRODUCTION

The importance of collaboration and educational dialogues in learning is well established [1] and the use of technology in education offers a wide range of ways to support students in engaging in such collaborative activities. Almost exclusively this involves the storage of information resulting from these activities, often in the form of text. This information is then subsumed into the existing information available to students and used as a resource.

It seems that there are some potentially important implications of this behaviour, particularly when the publication of such information may be a means to an end rather than the end in itself. In essence, it may have an impact on students' education, this impact may be negative and, given the prevalence of this approach in contemporary tertiary education, it may be substantial.

In a previous study conducted by the authors [2], a distinction was made between two types of learning content: durable learning content and disposable learning content. Specifically: "durable learning content is the intended product of learning activity whereas disposable learning content is a by-product of learning activity" [2, p23].

The information, or learning content, is almost always retained even when it is disposable because that is what the technology inherently does, but it may be that this is not desirable. Considering discussion forums, a discussion forum may contain a number of threads, each of which may contain a number of posts yet the participants still may not reach any resolution. A student who is looking through a discussion thread for a solution to a problem may have to read through the whole thread, and potentially others, in their efforts to find a solution. Once they have done this they may conclude that they would not find their answer in the forum and then post their question separately. Anecdotally many students do not persevere with their search and duplicate threads are a common feature of discussions forums.

The focus of this paper is on student attitudes to discussion forums because in the previous study [2] discussion forums were identified as being particularly useful in detecting whether or not students are treating disposable learning content as durable learning content. The role of discussion forums may be perceived as somewhat ambiguous when compared with e.g. wikis or messenger programs. Wikis are clearly intended to support publication whereas messenger programs clearly are not. The contention is that given this ambiguity, the way in which students use forums may offer an insight into whether or

not they are treating disposable learning content as durable learning content.

If students do not make the distinction between learning content that has been intentionally published and that which has been published out of necessity- not intentionally- then it may have a negative impact on their education. Content that is not intentionally produced for publication is less likely to have attributes that make it usable as durable learning content.

The technology involved is also of importance. The functionality of discussion forums and instant messenger programs for example are informed by their intended use. Discussion forums do not lend themselves to being used as a resource, they are intended to support discussions that may ramble, be inaccurate, have a lot of social content (e.g. "thanks for your help" etc). Nonetheless, discussion forums could still be used to produce and publish an essay for example, so it is the motivation behind the production of the learning content that seems to be of most importance.

The previous study [2] identified four features of a discussion forum format that may demonstrate a distinction between durable and disposable learning content. Specifically, the format involved discussions with a limited duration, the deletion of the discussion forum after students had been given time to summarise it and anonymous postings.

The duration of the forums was limited because an important property of durable learning content is its longevity. Durable learning content is intended to be stored somehow, whether that is hard or soft copy. Since the aim would be to create an environment that only had one form of durable learning content, the summary, it is important that it is the summary that is seen as the means of publication rather than the discussion forum itself.

The imposition of a duration ties in with the use of summaries, since limiting the duration of the forums also limited the amount of posts. It should be noted however that the duration of a discussion forum is not the sole determinant of the amount of postings made; rather it is a contributory factor.

Consistent with limited duration was the deletion of the forums after a published date. This was perhaps the strongest indication for the students that the content of the forums was not considered to be the important aspect of their work. Rather, their understanding of the topics discussed, as represented in their summaries, was of most interest.

Anonymous postings were required because it was thought that when students post under their own names, they may be more inclined to treat their contribution as something that is being published. Further, when publishing anonymously students may be less inclined to expend effort on creating well crafted posts. This in turn is intended to place the students focus on the process rather than the output of their discussions. In other words, the emphasis of this format is on the discussion itself rather than the content of the posts.

An implication of this is that it would not be possible to determine who is actively engaged in the discussion. However, given the requirement of a summary at the conclusion of a discussion, it would clearly be possible to assess students' level of understanding. This study, however, has a different focus and makes use of discussion forums as an environment to examine the concepts of disposable and durable learning content; discussion forums themselves are not the focus of the study.

The study [2] indicated that the format previously described did allow for the distinction of disposable and durable learning content, and also that students treat discussion forums as if they are durable learning content. However, the study was based on students' anonymous contributions to discussion forums that had the discussion forum format as their topic. Indicative though this was, it was considered that a focus group would allow for a fuller understanding of students' attitudes to discussion forums, particularly in respect of their use of them as a source of durable learning content.

This is what the study reported here was designed to do. The aim of the study is to elicit student attitudes to discussion forums in general and also, more specifically, how they view their use in terms of durable and disposable learning content types. This also involved exploring the attitudes of participants towards the discussion forum format used in the previous study [2].

II. THE STUDY

A focus group was conducted in order to explore student attitude towards discussion forums. Thirteen students from a final year BSc in Computer Science module volunteered to participate; all participants were male, with an average age of 21.

The duration of the focus group session was 1 hour. In order to facilitate later analysis, the session was recorded with the permission of all participants.

In general, participants exhibited a positive attitude towards discussion forums. Discussion forums were valued by the participants, and some of the benefits of using discussion forums include:

- the opportunity to discuss views and ideas with the entire group (as opposed to limiting the discussion to their immediate group of friends);
- the opportunity to ask questions relating to non-academic issues (e.g. timetable changes);
- the prospect of sharing concerns about the course with other students (and potentially discovering that "you are not alone").

In this study, we were interested in students' general attitude towards discussion forums as a publishing medium. This was subdivided into the following topics:

- their approach to posting messages on the forum;
- their assessment of their current discussion forum;
- their views on proposed features of discussion forums in the format reported in [2] including: duration, deletion, anonymity and summary.

A. Participants' approach to posting messages on discussion forums

Most participants reported that they used a word processor to prepare their messages before posting; the main motivation for this was to use the spelling and grammar tool. Once the message was prepared in the word processor, participants would copy and paste their postings into the discussion forum editor.

A few participants took a different approach, using a word processor for longer posts but not for the shorter ones. Shorter posts were entered directly using the standard discussion forum editor. Only one participant reported that he used the standard discussion forum editor, regardless of the length of the message.

B. Participants' assessment of the current discussion forum format

All participants were able to use the discussion forum. However, participants reported a series of features that they would like to see added to the format of the discussion forum.

File attachment. In general, participants felt that it would be useful if all discussion threads allowed the attachment of files (e.g. images).

Layout. It was suggested that some form of colour coding could be employed to differentiate between different contributors in a discussion thread, and the sequence in which the postings were added to the thread.

Monitor activity. Participants were concerned about identifying the most active discussion threads, and suggested the addition of a "view counter". It should be noted that information about the level of activity of discussion threads is already available (e.g. number of postings, time and date of postings etc).

Search facility. Participants reported that they often used the discussion forum to "find stuff" to support their academic studies. When asked how easy it was for them to find such information on a forum, participants replied that they have to resort to a linear search, as all postings look the same. Participants felt that the absence of a search facility often leads to duplicate postings. One search method currently being used by the participants was to skim through the different threads and read the postings from known contributors and course tutors in particular. Participants also reported that some contributors are considered to be "not worth reading".

Timeout. After 20 minutes of inactivity, discussion forum users are automatically logged out. One participant reported that this was an undesirable feature, as sometimes he spent longer periods of time preparing his postings.

C. Participants' views on: duration, deletion, anonymity and summary.

Duration. In general, participants felt that discussion threads should not have a fixed duration, as new useful postings could be added to a thread at any time during the academic year. One participant reported that a fixed duration for a discussion thread would only be acceptable if the thread was associated with some form of assignment (which had a set deadline). There is no clear reason to impose a duration on a given discussion "…there is no reason for it to stop".

Deletion. The idea of deleting discussion threads was not well received by the group. According to the participants, reasons for not deleting discussion threads include:

- latecomers might find previous discussion forums helpful;
- there might be "something useful" in a thread, and students might want to go back to it a "couple of months later";
- the idea that "something useful" can be posted to the discussion forum at any given point during the academic year.

One participant also asked "why would you like to run discussion forums different from other courses?" However, participants reported that too many inactive discussion threads (or in other words, discussions that "are there for no reason") could cause confusion. Participants added that inactive threads should be archived, but not deleted.

Summary. In general, participants did not support the idea of writing summaries of discussion threads. There were two main reasons for this:

- "writing a summary takes a lot of time";
- the discussion thread can be updated at any time (and, in such as scenario, the summary will no longer be relevant).

In addition, they expressed a preference for "reading through a couple of times". One participant, however, reported that writing a summary of a discussion threads can support reflection.

Anonymity. Participants agreed that when anonymous postings are permitted, this could encourage postings from students who otherwise would not normally participate by fear of:

- "feeling stupid";
- initiating a thread that generates no replies.

There was a general assumption that "you can say what you like" if the discussion forum allows anonymous postings, and also that students would be less likely to "hesitate if discussion is anonymous". One participant reported that he did not care whether or not the discussion was anonymous. When asked how they would feel if some people posted anonymously, and they posted under their own names, participants responded that this would not concern them.

III. DISCUSSION

The focus group was guided through a number of topics that were intended to provide an insight into the extent to which discussion forums are viewed as a publishing medium. If students view discussion forums as a publishing medium, it is taken to indicate that they are seeing discussions as containing

durable learning content. The effect of this would be to lead students to take greater care over the content and presentation of their posts as they feel that their work is going to be stored and available to others over a long time.

A striking aspect of the focus group was the number of participants who prepare posts using a word processor, specifically Microsoft Word. A possible interpretation of this is that students are indeed taking care to create posts of a publishable standard and therefore do see the discussion forum as a place to publish their work.

To assess participants' general attitudes to their current discussion forum format, they were invited to express their views; interestingly, the features that they would like to be added to the format generated a great amount of discussion. Of the suggested features, two stand out as being of particular interest to the current study. These concerned layout issues and the inclusion of a search facility.

In terms of layout, participants talked about colour coding between contributors in the forum. This would have the effect of making it easier to differentiate between posts. However, if a student is following the discussion as it is taking place, it is not difficult to differentiate between threads and posters. It seems that this is more useful when reviewing an archived discussion as one is presented with an entire forum and this would be more difficult to follow. Additionally, suggesting that the sequence should also be colour coded has a similar effect, the sequence of postings would be clearer if a student was following the discussion as it unfolded. This amendment would be more useful if one is presented with a discussion forum in its completed entirety. So, these suggestions would be of limited usefulness in live discussions, but useful for those that had been archived.

Also of interest is the suggestion that a search facility should be provided. It seems that a search facility is mostly of use in an environment that contains a lot of information. If you treated discussion forums as disposable learning content and used the design outlined here and in more detail in [2] then the only content that would be stored is summaries. This would have been done by the individual participants in a way that was meaningful to them or potentially as a group exercise. The net result would be the production of information formatted in a way intended for publication and in amounts that would be substantially less than raw posts. It seems that participants were seeing the raw posts as being the output produced by the discussion forum rather than the summaries.

A consistent theme amongst all of this is that the suggestions made by participants seem largely to do with making discussions useful when they are stored or archived. In other words, they are amending the format so that it is more appropriate for publication, although it seems the primary role of a discussion forum is to support collaboration and educational dialogues rather than the publication of learning materials.

One participant suggested that discussions should have some form of "view count", in which the number of accesses to the thread is visible to all. It appears that more popular threads (threads being used) are seen as more 'valuable' ones.

In addition to the general discussion, participants were asked what they thought about the features of a discussion forum that was designed to encourage students to treat the posts contained within a discussion forum as disposable learning content with their summaries being the durable learning content.

Overall there was very little support for any of the features suggested. Participants were positive about anonymity, but largely in terms of its social affect. One participant did say that "It is easier to write posts anonymously", another said that when contributing anonymously, he felt "free to put all my views across".

However, the suggestion of anonymity in the context of this study was mainly intended to reduce the importance of the presentation of the posts. If individual students were not posting under their own name, the idea is that they feel freer in how they post i.e. they would not worry so much about how they prepare their posts. This is intended to erode the sense that people posting to a discussion forum may be publishing work.

Equally, limiting the duration of a discussion is intended to have the same effect. Participants were also not positive about this idea. The idea that discussion forums contained useful information that could support subsequent work was well represented.

To emphasise the idea that a discussion forum using this design was not a publishing medium, once the duration had elapsed, all posts would be deleted. Participants did not agree with the inclusion of this feature either. "What if a couple of months later there was something helpful in that thread and I want to go back and look at it?" The general feeling was that there was a lot of useful information contained within discussion forums and that it should be stored in the long term.

In the design for a discussion forum that was made up of disposable learning content, the useful ideas and interactions that came out of a discussion were intended to be recorded in a summary. The summary would be written by individual students, who would go through the discussion once it had been completed, but clearly before it had been deleted, and record their analysis and interpretation of the discussion. This would be the durable learning content that was generated by the discussion forum.

Consistent with the other features of this discussion format, participants in the focus group were not positive about the use of summaries. In terms of the workload involved, one participant commented that "The problem is there's loads of discussions on there so if you write a summary for each one then you're going to be there all day doing summaries and not doing any work." Another participant said "I thought reading through it over and over, well a couple of times . . . generally gives you everything you need to know about what's happening. You can always refer back to it."

IV. Conclusions and Future Work

The study addresses what seems to be a potentially important issue that tertiary education in general is faced with, namely how should resources that are used by students be

prepared. It does seem that there is a distinction between disposable and durable learning content and it also seems that students' attitudes to discussion forums reported in this study are consistent with those reported in a previous study [2]. Specifically, in the discussion forum environment, students do not make a distinction between disposable and durable learning content.

When asked about how they used discussion forums, the views expressed here indicate that the participants see discussion forums as publishing media. Further they talked about some difficulties they had with the discussion forum format available to them and solutions to those problems. It has been argued that these consistently would make the discussion forum a more effective publishing medium. Students would be able to come back to discussion forums at arbitrary times in the future and use them as a resource. The functionality suggested by participants would allow students to do so more effectively.

This attitude was also in evidence when they were asked about the suggested features of a discussion forum that clearly distinguished between disposable and durable learning.

This is a second preliminary study to attempt to understand students' attitudes to discussion forums in relation to disposable and durable learning content. It does seem to indicate that students see discussion forums as a publishing medium, so contain durable learning content. The idea that discussion forums are intended to support collaboration and educational dialogues rather than publish learning materials was advanced. A principle conclusion from this study is that the participants did not concur.

Future work will concentrate on the nature of this perception, particularly in terms of the effect it may have on students' education. This is an important issue, given the increasing use of content generated by students in their educational activities. Perhaps there is an issue of appropriateness whereby in some circumstances, the use of such learning content (described here as disposable learning content) is inappropriate. Instead learning content that is intended for publication should be used in such circumstances.

A further issue that would be interesting to address is that it may be of value for students to learn how to filter such information effectively as this is a key skill given an information rich society. This would also raise the question of whether or not we should avoid adding disposable learning to an already information rich environment.

In terms of the design of this study, future work would need to address any potential gender bias that may have been present in this study. Every member of the focus group was male with an average age of 21 and as such can not be taken to representative of a general student population, even if they are more representative of computer science undergraduates. In addition, the focus group reported in this study consisted of 13 participants and some suggest that the upper size of focus groups should not exceed 12 participants [3]. It should be noted that there is little agreement among researchers with regards to an optimal number of focus group participants [4]; for example, Fern [6] reports on focus group studies conducted with as many as 20 participants. It is argued that in the case of this study, the pre-planned topic guide and the style adopted by the facilitator provided all participants with opportunities to express their views on all topics being discussed. These potential limitations could be addressed in future by varying focus group sizes and the subject domain from which volunteers are recruited. Further, the year in which the undergraduates are studying should be varied as this has been shown to affect the way in which students use discussion forums [6].

So far the work has concentrated on student attitudes and behaviour, but the attitudes and behaviour of members of staff are obviously important too. An important addition to the work would be to run similar studies to understand staff attitude towards discussion forums as a publishing medium.

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E-learning – a Technology of the Future

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Abstract— **The growth and extension of global economy lead to the development of the entire society, with effects in all of its areas. The scientific and technological progress, the achievements in the fields of informatics and biotechnologies, the spread of the means of communication, the development of new sources of energy are only a few of the road-opening achievements. The development of a global economy has implications on all aspects characterizing the new society, one of the most important of them being education.**

Today's education is different from that of yesterday. The dynamism characterizing it shows the need for re-thinking our concepts in this new scenario. Education no longer means merely instruction, but a whole social process connected with work, productivity and economy. Starting from these premises, education is efficient when it ensures valid qualification worldwide and complete formation of human personality.

The aim of the paper is to present general aspects regarding e-learning as a top priority in the knowledge society where new forms and level of competition emerge. Also it refers to the characteristics necessary to a web-based system for ensure the high level of quality, the general steps of implementation an e-learning system and a study case based on "Vasile Goldiş" Western University experience in implementation of such systems. The last part of the paper identifies the main strong and weak points revealed by this experience and some conclusions.

Keywords-e-learning; web-based teaching; e-learning systems, e-learning environments

I. INTRODUCTION

Globalization tendencies, as well as the development of new technologies seem to be essential key in explaining specific phenomena and processes of this beginning of a millennium, as they are becoming the most important challenges of modern society. The impact which these new technologies have on the entire society is particularly powerful and manifests itself in various areas, not only industrially and economically, but also socially and culturally, a leading role being played by education.

In a time when education has become a top priority, in the knowledge society where new forms and levels of competition emerge, together with the development of information and communication technologies which have become a part of our everyday life, a very important role has been played by communication over the Internet, which has gained popularity among adults and students alike. Virtual universities are becoming more and more popular due to the qualifications they offer, based on increasingly innovative curricula. Thus, the educational policy, especially the academic one, can no longer be regarded in a traditional context. The role of universities in the transfer of information, methods and values has changed, in a world were there are no more limits in the circulation of information and communication techniques.

In this context, educational technologies based on e-learning, which are currently used mainly in distance learning, present themselves as an essential moment in the evolution of education, in a time when, due to the development and modernization of society, new forms of education are necessary to emphasize the staff's professional preparation, allowing generalized access to higher education. This new form of learning will lead to a thorough restructuring of the education in Romania, as well.

II. THE CONCEPT OF E-LEARNING

The Open and Distance Learning Quality Council defines e-learning as an „effective learning process created by combining digital transmission with support contents (consultations) and services" [1].

Although many of the definitions of e-learning technology take into consideration the transmission of information with a view to using it in the learning process, on electronic support, this term gradually identifies itself with online education or Internet-based learning. For this reason, I shall refer, in this work, to this technology only.

Starting off as a modern component of distance learning, Internet-based learning is becoming increasingly popular, as compared to other forms of education, such as full- and part-attendance education and especially continual formation of adults. What was it that led to the spreading of this form? First of all, it was the flexibility of such aspects as study time, place, the possibility of accessing countless resources over the Internet, the possibility of synchronic and asynchronous communication with the teachers, with the members of discussion forums studying the same subjects etc.

In over ten years of web development, educational institutions, research centres, libraries, governmental agencies, commercial institutions and numerous individual groups worldwide have become connected to the Internet. One of the consequences of online communication is the rapid

development of e-learning technology, especially within higher education, hence the diversity of programs offered by universities all over the world, in this system. The extraordinary development of web technologies and their infiltration into education has led to the establishment of organizations outlining principles and guidelines for ensuring quality, as well as the launching of pilot projects connected with this form of education.

The Internet has become progressively important and has been integrated in all types of education and instruction. A great number of users of all ages and belonging to all social classes use computer networks for different interests and motivations. The Internet has been successful also due to the fact that it has answered these interests and motivations by providing useful information and new ways of knowledge. At present, the existing resources in traditional educational environment are insufficient, even though the demand for educational resources is continually increasing.

It has been remarked that the Internet can ensure an instantaneous dissemination of information to a wide audience and that distance learning can provide a very efficient alternative to traditional educational and instruction.

The development of web technologies also led to the development of web-based tutorial systems, which became the main research and development area. Such systems installed in one place and with a permanent support can be used by thousands of users (students) worldwide.

By checking out the meaning of e-learning in the sense of „education over the Internet", which comprises instruction, education, rapid information, communication [2], we conceive a tempting image for continual education and learning in virtual environments, first of all because of the advantages it entails: autonomous learning (independent on time and space) and time and money saving.

III. Basic Criteria in Implementation an E-learning System

Following some studies [3], [4], [5] a few characteristics necessary to a web-based learning system have been established, which are essential for ensuring quality and which can be a starting point for those who wish to implement such a system. They fall into several categories:

Existence of institutional concerning:

- System security (use of passwords, back-up system) for ensuring quality standards and information validity;
- System security regarding the transmission of information;
- Provision of support for the creation and maintenance of e-learning infrastructure.

Courses development:

- Tracking of the minimum of standards for course content, design, accessibility;
- Periodical revision of didactic materials, in order for them to be in accordance with educational curricula;
- Conception of courses so that they require the employment of students in analysis, synthesis and evaluation.

Teaching /learning:

- Facilitation of the student-university and student-student interaction through means of communication (e-mail, messenger etc.);
- Provision of real-time, constructive feedback for student's tasks and questions;
- Instruction of students regarding research methods.

Course structure:

- Notification of students on starting an online program in advance, in order to determine whether they are sufficiently motivated, whether they wish to study online and whether they have access to the minimum of technology necessary for going through the courses;
- Availability to students of supplementary information on the course, such as: course objectives, concepts, ideas, results to which one must come;
- Facilitation of the students' access to sufficient bibliographic resources which can be, among others, virtual libraries on the web;
- Existence of a schedule of students' activities, especially concerning deadlines for projects and teachers' time of reply.

Support for students:

- Availability to students of information on study programs, including entry conditions, fees, libraries, support services;
- Creation of a student instruction program, concerning equipment security, use of database, book borrowings, the possibility to access governmental archives, new services provided and other sources of information;
- Provision, throughout the course (program), of technical assistance, including detailed instructions on using networks, multimedia means, even by organizing a practical session to this end.

Support from the faculty:

- Provision of technical assistance in the courses' development process;
- Counseling of teachers passing from "classroom" education to online instruction;
- Experience exchange between tutors in the process of teaching online courses.

Evaluation and efficiency:

- Assessment of the efficiency of educational programs and of the teaching-learning activity through a complex evaluation process, using several methods and applying specific standards;
- Establishment of efficiency considering also the data regarding subscription, costs and innovative use of technology;
- Regular revision of results with a view to verifying the system's clarity, utility and appropriateness.

IV. THE GENERAL STEPS OF IMPLEMENTATION AN E-LEARNING SYSTEM

Implementing an e-learning system using electronic devices and especially Internet requires, in addition to specific stages, some steps related to the use of the Internet [6]. Here are some of the most important steps that are necessary in implementing an e-learning system:

Setting up an Intranet

- Physical connections between locations;
- Network hardware for computers and local networks;
- Software for network connections and application.

Choosing an e-learning platform:

- Decision to use an existent software or to create a brand new system;
- Requirements that the system must provide.

Implementing the chosen platform:

- Technical issues (such as hardware and Operating Systems to be run on the server(s) used for the e-learning system);
- Teaching stuff training and motivating as well.

Creating a department to run the Intranet and e-learning system, too:

- Technical team for upgrading and maintaining the hardware/software infrastructure;
- System managers to develop particularized applications for specific needs and keep the Intranet up and running;
- Security management.

The implementation of an Internet course, which will be hosted on the Internet, must contain the following:

- course guide;
- course objectives;
- course modules based on certain themes;
- summaries and conclusions at the end of each module;
- examples, diagrams and figures for a better understanding of the course;
- applications at the end of each module necessary for the continuous evaluation.

It is also important that the ideas presented in the course should be in logical succession and the level of the course closer to the future students' understanding level, depending to whom the course is addressed to.

In what concerns student tutoring this will be achieved by e-mail, each student having his or her own tutor. Chat programs could also be very helpful, along with discussions groups on the Internet concerning the themes approached during the lectures.

The grading process could be done continuously, each module having at the end a set of tests with key answers. From the educational point of view the continuous evaluation seems to be the best way for the students to consider the questions and come up with possible answers. It is believed that the final evaluation needs to be supervised, but there are cases in which this can be done by the help of the Internet.

V. WEB-BASED TEACHING AT "VASILE GOLDIŞ" WESTERN UNIVERSITY

Several aspects were taken into consideration in the purpose of selecting the e-learning environment. In the first place, the decision that we had to take was either to develop a custom, particularized system by our own IT specialists or to acquire a functional, well tested system made by a trademark company with support and assistance for all possible problems that could appear. In the second place, if we decided to acquire such an environment, we had to look for a developed, well organized one, with enhanced option and possibilities to update future features. Considering the amount of time, the waste of energy and human resources and the urgent need to implement (not to test) a fully functional e-learning system in our university, the decision was an easy one: at first, we had to implement a functional system, so the only thing we had to made was to search the market and compare similar products and only at last, after some experience of using such a system, to proceed in developing a new one [7], [8], [9], [10], [11], [12].

After searching and comparing some known e-learning environments like Blackboard, WebCT and Netschool, our opinion was to use the Blackboard system made by Blackboard Inc. [13]. The operating system we chose was Linux, for its well known characteristics. The Blackboard system for Linux was based on Apache Web server using Perl and MySQL.

Even if Blackboard offers administrators a robust set of tools to customize the appearance, functions and features, being comprehensive and flexible, delivering course management system, customizing institution-wide portal and online communities, it has been used only by the teaching staff from the Computer Science Faculty. This is the reason why, after one year, due to lack of usage and high costs, we studied the possibility of replacing this environment by Open Source one.

In the first stages of choosing an OS e-learning platform different surveys/studies were carried out and the forums related to this topic were closely monitored.

E-learning environments like Ilias [14], Claronline [15] and Moodle [16], [17] have been also tested on the occasion of diploma papers. The criteria for assessment were the following: Student's environment (Ease of use, multilingualism, How to use browser functionality, Compliant with common web technology, Functional environment, Configurable environment, Context sensitive help, etc.), Tutoring and didactics (Ease of use, Forum threaded, Forum searchable, Private workgroup, Instant messaging, Class enrolment by tutor, Class enrolment by student, Activity tracking, Individual performance in tests, Quiz, Assessment, Broad range of quiz types, Extensible quiz engine, etc.) and Course development (Ease of use, Easy to define course structure, Up/download of resources and content, Hypertext linking, Support for client, Developers support, etc.).

We finally had adopted Moodle environment which we can personalize and improve according to our own needs and scope. The existence of a Romanian translation of it was a plus. At present it functions with Linux Gentoo operating system. This environment is modularly developed so it allows both content delivery and students' assessment.

So far, there were included courses for year I and II, initially for Distance Learning Education, but having the possibility of being accessed by full-time students.

In what concern the Computer Science Faculty, many disciplines require specific projects. During the last years, we have tried and have partially succeeded that these projects be uploaded on servers for a better and more transparent evaluation. Visualizing the projects, offers students the possibility for self-assessment comparing their work to that of their colleagues. The desired outcome was to cross over to the virtual lab. One must not forget that by setting up such an environment we offer the chance of designing tests for students' self-assessment, but also for assessment in labs, a project put into practice both at the Faculty of Computer Science and other faculties.

After almost three years of use, it can be seen that the environment meets the demands, being a very useful tool both for teachers and for students.

An important issue was how teachers should set up their courses on the e-learning environment. For better results we decided to organize a few training sessions for those involved in distance learning and interested to use these technologies on a daily bases.

Those willing to learn represented an easy way to solve the problem by organizing training sessions, but a more serious challenge was to motivate teachers who are not so familiar with the use of computers. A simple solution for this matter was to involve the young, computers fan assistants from each department in the courses implementation process on the e-learning system.

In the last year we made also a few specific configurations which are classified in four main categories: users' management and access policy adjustments, course creation and configuration adjustments, organizing on years of study and adjustment of test modules using Ajax technology.

Compared to the standard version of Moodle, in which the users could be organized only in groups, the following fields were added to the registration form: branch, faculty, specialization, form of education, year, group, in order to make users' management easier. These fields were automatically added to database.

Moodle is an open system so that any registered student can have access to any course at any faculty. In the case of our university the option for students organizing was done in such a way that students can have direct access to the courses required in his/her specialization, and to other course only on demand. In the modified version a new course will specify the faculty to which the course belongs to, and the year of study.

One of the most important parts of an e-learning environment is testing module. The changes made on testing modules point out especially to the automatic save of answers for the first two types of questions.

Another environment improvement is the implementation and configuration of additional modules such as: Glossary, Photo Gallery, Blog, Rate calculator, Live statistics, Translator, Clock, Appointment, etc.[18].

VI. Strong and Weak Points Revealed in Using e-LeaRning Systems

Even though e-learning is a relatively new form of education, especially in Romania, and the experience we have in this field is not sufficient, we can still draw some aspects, both positive and negative, which this implies. As positive aspects (strong points), we can mention:

- Right information to the right time and to the right person;
- Flexibility;
- Interactivity;
- Consistency and actuality of information;
- User-oriented solutions;
- Cost effective;
- Allows "spare" time to be used wisely;
- Possibility of rapidly updating course contents;
- Existence of self-assessment tests;
- Immense possibilities of storing information, the Internet having the highest storage capacity;
- Support of cooperative work and communication of the participants;
- Setting up an active working style, self-controlled;
- Simplicity of information management;

- Possibility of assimilating courses in one's own rhythm;
- The possibility of social interaction of persons who had no previous access to education, etc.

Beside the positive aspects regarding the fact that this form of education complies with the requirements of modern society, there are also some negative aspects (weak points), connected either to mentalities leading to inertia in the implementation of an education system as such, or to the perils that might arise during the excessive expansion of this form of education. Some of these aspects are:

- Lack of good e-learning courses in Romanian language;
- Lack of technology (sometimes);
- Limited target group;
- Lack of direct, face-to-face human contact;
- High dropout rate;
- Need of larger computer knowledge;
- Supplementary work that a teacher has to do both for the pedagogical content's changing and for its new layout, in a digital form;
- The final evaluation, even it is online, must be put under surveillance.

The relative reluctance to e-learning is also justified by a series of limitations such as:

- The teacher's presence cannot be totally replaced because their physical attitude, countenance or gesticulation can bring about intellectual or affective reverberations on the students, which often stress out the meanings of the words;
- As human beings, we live and interact in groups. Excessive use of the computer, both in the process of learning and in other activities can lead to isolation in some cases; in others, on the contrary, it leads to the overcoming of a possible shyness in direct relationships with people.

VII. Conclusions

The integration of pedagogical technologies into higher education is due to the fusion of two aspects of contemporary society, technology and education, which represent, especially in the developed countries, the basis of economic development, progress and social cohesion.

Using software applications in developing and presenting course materials over the Internet has raised a series of problems regarding the main question: *to what extent can online education be integrated into the academic programs of higher education institutions*? The answer to this question can only be given after considering the psycho-pedagogical aspects related to this methodological system.

Whereas the traditional educational system is centered on the teacher or the student, the e-learning system is focused on creating a learning community where teachers and students are co-participants. For all parties involved, this represents a change in the existing relationships, by increasing the degree of involvement and responsibility of the students [19].

In order to be successful in the current economy, institutions must develop some competences to deal with the permanent challenges. These competences depend on the employers' ability to think critically, to solve problems, to select their employees and to anticipate the future problems or possibilities.

In this context, the role of instruction and permanent education is increasing continually. Employees must prepare to deal with job requirements, but also with new challenges. E-learning is there precisely to meet their needs by providing them with an individualized preparation, with the possibility of choosing a proper style of learning, of difficulty, of monitoring progress, of establishing the next level of preparation. The learning resources, from individual materials to online communities, specialists in the field, tutors, are available when and where the student needs them.

Taking into account that the future in education will be greatly based on the freedom of choosing an accessible form of education with respect to the needs of each person, which would remove the physical an mental barriers, the development of e-learning is becoming a priority of Romanian education, both in initial formation, and especially in continual formation.

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Learning to Grow

The development of educational groups in a synchronous environment

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Abstract—**This paper analyses the synchronous discourse of group of students engaged in a series of workshops. The results indicate that groups in the educational environment exhibit both short-term and long-term developmental trends, thus providing a better understanding of how online learning communities develop and grow.**

Group development, elearning, synchronous communication

I. INTRODUCTION

Groups, like individuals, experience a cycle of development over time. There is a preponderance of evidence for the existence of developmental phases in face-to-face groups but less is known about how virtual groups develop. Even less is known about the development process of groups in the educational environment. The evidence for developmental phases in face-to-face groups is based, by and large, on either observation or content analyses of verbal communication patterns. In the former case, conceptual categories associated with the stages of group development are determined prior to observation and then the units of analysis (e.g. sentence, utterance, conversation turn) are classified as one or more of the predetermined categories [e.g. 1]. In the latter case, categories or themes emerge as the content of group discussions are examined. Thematic shifts are an indication of turning points in a group's life cycle [2].

Models of group development abound in the literature. Some well-known examples include: Bales' [3] IPA framework, Tuckman's [4] five-stage model; Hare and Naveh's [5] LAIG model; Lacoursiere's [6] five-stage model; Gersick's [7] punctuated equilibrium model; Worchel et al.'s [8] six-stage model; and Wheelan and Hochberger [9] five-stage integrative model. While many of these models may be described as mechanistic and reductionist, there is ample evidence that a characteristic lifespan does exist for face-to-face groups.

Research in the developmental cycle of virtual groups is much more sparse than for their traditional counterparts. Nagel [10], for example, defines a sequential model of six phases. However, most of the research on virtual groups has been carried out with virtual teams in the organisational setting. Virtual teams have been described as "cross-functional teams that operate across space, time and organizational boundaries with members who communicate mainly through electronic technologies" [11].

Whereas groups are, and always have been, an integral part of society, we are now experiencing the most dramatic change in the nature of groups, particularly in the educational environment. Teams of students are moving from being primarily co-located to virtual. Most studies comparing traditional and virtual teams favour the effectiveness of traditional teams, reporting that traditional teams have more interaction and information exchange [12], less misunderstanding among members [13], and superior internal leadership and coordination [14, 15]. Critics of this body of research, though, argue that the findings were limited in that the groups were ad hoc and the time period insufficient to establish effective working relationships. More recent research suggests that if virtual teams have sufficient time to develop strong relationships and adapt to the use of computer-supported collaborative technologies, they may be just as effective as traditional teams [16-19].

In the higher educational environment, virtual teams are similar to the organisational team in that they have a defined but non-routine task, they collaborate over a predetermined length of time, the team has the authority to make decisions regarding the task (albeit somewhat limited) and membership is generally fixed rather than fluid. In online degree programs, virtual learning teams are being used to increase collaboration, communication, learning [20], interaction [21], and knowledge sharing [22]. Landrum and Paris [23] found that virtual teams in higher education do, in fact, pass through developmental stages commonly associated with traditional teams. In their virtual team project across two universities, students found communication difficult. Asynchronous communication was counter-productive and a hindrance to the development of ideas, and synchronous communication was difficult to coordinate across different time zones.

This research attempts to determine through a case study if virtual teams in a synchronous educational setting exhibit a developmental process and, if so, what types of communication are typical in different stages.

II. CASE STUDY

Organisational Informatics was an undergraduate course in an Australian university which examined a range of contemporary information systems topics, concerning organisational, social and cultural aspects of the design and development of information systems. The course materials included a collection of papers covering topics which were

used to inform a series of workshop discussions. Each workshop was devoted to a specific topic. The chat room in the learning management system (WebCT) was used as virtual spaces for the workshops. For each workshop, all students were required to read the same paper(s) related to the corresponding lecture topic, and one student was assigned to lead the discussions (i.e. to act as a moderator). Guidelines for moderating, based on evaluation criteria, were available for the students to download from the web site. The moderating task involved preparing a brief critique of the articles as well as questions, that highlighted the main issues of the articles, to stimulate discussions.

After each workshop, all students were required to submit a journal, reflecting on the readings and discussions. The reflections were an important feature of the workshop design as they reinforced the learning that occurred during the workshop, and provided the opportunity for self-evaluation and thus improvement in subsequent weeks. It also provided a feedback mechanism for the instructor.

There were nine workshops over a period of three months, interspersed with two short study breaks. The workshop series was a novel approach to group work as most of the participants had never met, either online or offline. As group members went through the process of collaborative learning and knowledge construction through discussions and citations, they built a social and intellectual foundation that strengthened and sustained the collaborative activities.

III. Methodology

A. Participants

The course had an enrolment of 99 students who were assigned to seven workshop groups of approximately 16 members. The author was the instructor.

B. Data

The data sources for the analysis and evaluation of the virtual workshops were the discussion transcripts, which were automatically logged by WebCT. At the end of each workshop, the logs were downloaded by the instructor. Extraneous data, such as false entries and program bugs, were deleted. The cleaned file was then uploaded to WebCT. Transcripts were thus available to students immediately following each workshop.

Of the seven workshop groups, the data from three groups were incomplete due to various organisational and technical problems. The remaining four groups were content analysed. The total number of utterances in each of these four workshops was 5,697, 6,328, 4,547 and 3,869. (An *utterance* is defined in this study as "everything said by one speaker before another began to speak" [24]; in a chat room, this means the enter key defines the end of an utterance.) The results of one series of workshops (Group 1) are reported here.

Group 1 had a total of 5,697 utterances. Even though the nine workshops were of the same duration of one hour, the number of utterances in each workshop differed, ranging from 363 utterances in Workshop 3 to 802 utterances in Workshop 2.

A coding scheme was developed to analyse the content of communication (Table 1). The discussion transcripts were transferred to an Excel spreadsheet and each utterance was coded according the presence of one or more categories as described in the coding scheme. The categories provided the means for observing the emergence of *turning points*. Turning points are defined as a point in the discussion at which changes occur in the presence of a combination of dimensions [25]. A turning point, therefore, delineates the beginning and end of a phase in group development.

TABLE I. CODING SCHEME OF COMMUNICATION TYPES

Category	*Code*	*Description*
Task	TSK	Deals with the collaborative activity of the group.
Conceptual	CON	Involves the creation of mutual understandings and meanings among participants, including procedures to follow, work to be completed.
Supportive	SUP	Content having the capacity to support another participant emotionally.
Argument-ative	ARG	Content having the capacity to trigger/maintain an argument or conflict.
Social	SOC	Content dealing with interpersonal relationships and social activities.
Environ-ment	ENV	Content related to use of environment in which communication occurs.
Awareness	AWA	Content about making knowledge of self and other participants(s) explicit to increase social awareness.
Informal	INF	Content about the collective informal creation, management, and enforcement of communication norms.
Formal	FOR	Content about the enforcement of rules or norms.

IV. Results

Since each workshop had the same aim of learning through a collaborative activity, it could be that the nine workshops represent a group's lifecycle repeated nine times. Or it could be that there are some effects over the period of the nine workshops. In other words, developmental effects may be evident both within and across workshops. Therefore, the workshops were analysed for both short-term (within workshops) and long-term (across workshops) developmental characteristics.

All nine workshops were analysed in detail and displayed similar characteristics. An analysis of the short-term developmental characteristics of one workshop (Workshop 1) will be reported followed by a briefer report of the other eight workshops. Data for all nine workshops were then averaged to determine consistent short-term developmental trends. The results of the nine workshops were then analysed for long-term developmental trends.

A. Development Characteristics within Workshops

a) Workshop 1

A total of 474 utterances were exchanged by participants throughout the one-hour topic discussions in the first workshop. This workshop was characterised by a significant amount of task (TSK=39.0%), conceptual (CON=28.1%) and

social (SOC=18.6%) communication. In addition, approximately one in twelve utterances were concerned with explicit self-disclosure or knowledge about other participants (AWA=8.0%). Generally the group was more supportive than confrontational (SUP=4.9% compared with ARG=0.0%). Small but approximately equal amounts of informal and formal management of communication were used (INF=4.6%, FOR=5.1%).

To visualize the communication, the presence of a communication type in each utterance was plotted. A graph was generated to indicate the temporal sequence of combinations of communication types [26] (Fig. 1). The timeline illustrates that, at the commencement and conclusion of the workshop, the participants engaged in social, conceptual and awareness communication. Almost all task-oriented communication was confined to the middle section of the workshop, along with some supportive comments. The timeline therefore indicates two obvious regions which signal a transition from one general style of communication (combination of coding categories) to another combination. These regions are indicated in Fig. 1 by vertical dotted lines.

Subsequent detailed scrutiny of the content of utterances in those transition regions revealed particular utterances that significantly altered the communication of the group. The first transition (i.e. the point between Phase 1 and Phase 2) was at utterance u_{151}. The moderator announced that she would lead the discussions on two articles, thus focusing everyone's attention on the workshop task:

> [Sandy]: Ok...well I have choosen a reading from week 1 ... I'l start with... (u_{151})

The second major transition occurred with the discussions becoming more reflective at utterance u_{338} when a participant made the following comment:

> [Duncan]: Would this disscussion go better if we were all in the same room talking (u_{338})

The changes in the nine communication categories in the three development phases are shown in Fig. 2. The graph represents the percentage of each variable with respect to the total number of utterances in each phase. It can be seen that when the group was engaged in task-related communication, there was almost no conceptual or social communication. In Phase 1 and Phase 3, when task activity was low, there was increased conceptual and social communication.

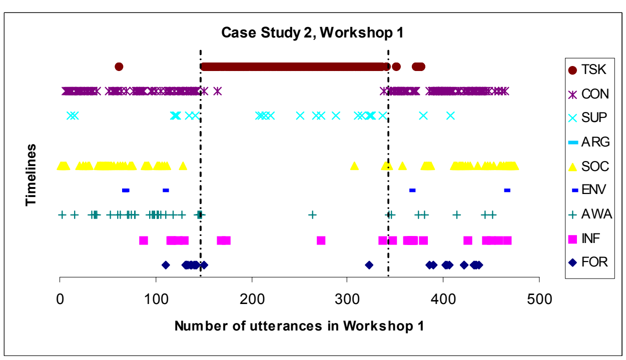


Figure 1. Communication timeline of Workshop 1.

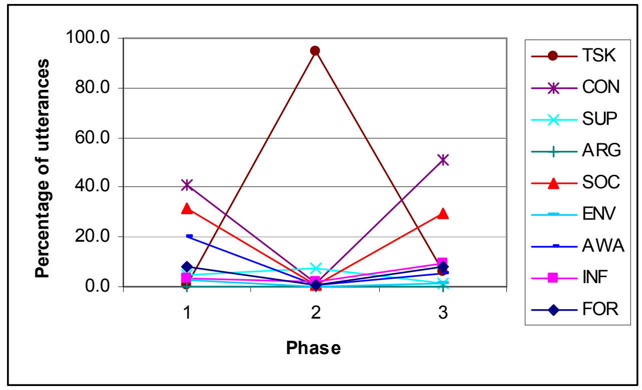


Figure 2. Communication types in three phases of Workshop 1.

As most of the participants had never met each other, the communication included disclosures about themselves to increase social awareness of each other.

> [Kirk]: I love this, i can drink coffee and listen to music whilst attending a tute heheh (u_{75})

> [Duncan]: I am at home...in my pajamas drinking coffee hehehehehe...this is so sweet (u_{102})

> [Kevin]: i am much more comfortable on a pc rather than talking to a group of ppl... (u_{346})

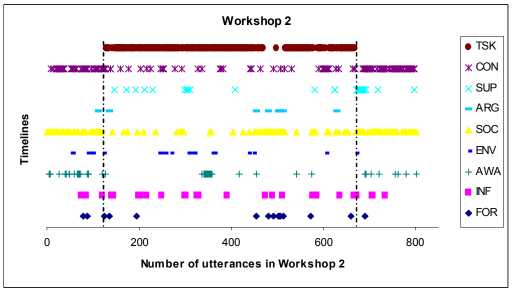
These results demonstrate three developmental phases in the first workshop. Broadly, the first phase was concerned with "getting to know you" (SOC, AWA) and pattern establishment (i.e. establishing norms of communication behaviour) (CON). The second phase was concerned with "getting on with the task" (TSK). The third phase was concerned with "this is what we did"; that is, reflecting on the task process (CON) and social interaction (SOC) to build integration and cohesiveness. There was a small proportion of supportive and no argumentative communication. What little supportive communication there was, occurred mostly in Phase 2, and took the form of concurring with other participants' comments, for example:

> [Adrian]: i think sandy has a point ... (u220)
>
> [Sandy] i agree doug … (u311)
>
> [Doug]: that's a good point duncan (u337)

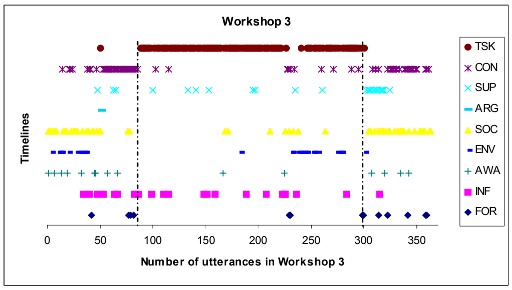
b) *Workshops 2-9*

In this section, a brief analysis of Workshops 2-9 is provided. Figs. 3a-h show timelines for Workshops 2-9 with turning points indicated by dotted lines.

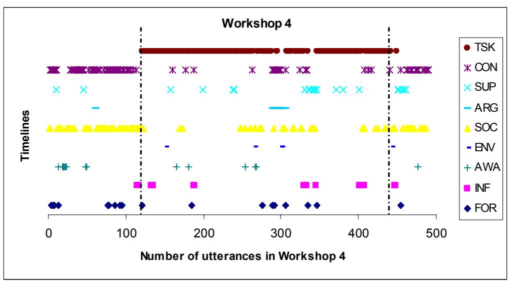
All timelines indicate similar communication patterns to Workshop 1 (Fig. 1); that is, an initial period of mostly social and conceptual type communication; a middle period of mostly task communication; and a final period mostly conceptual and social communication, reflecting on the task processes and social interaction to build integration and cohesiveness.



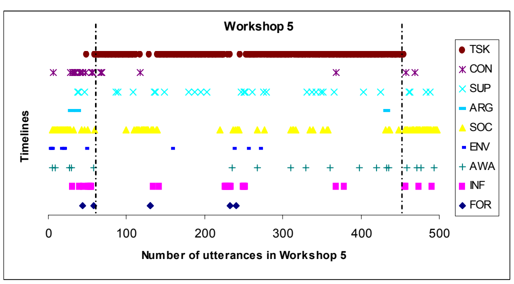
(a) Workshop 2



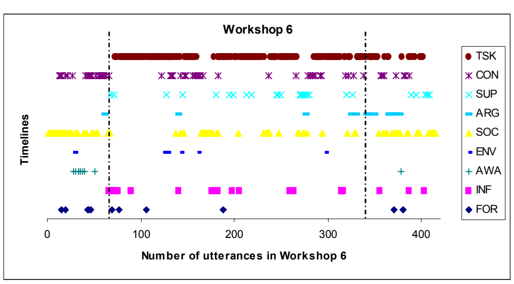
(b) Workshop 3



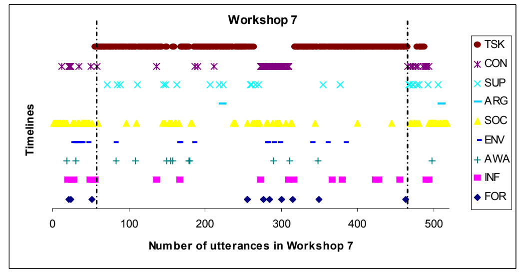
(c) Workshop 4



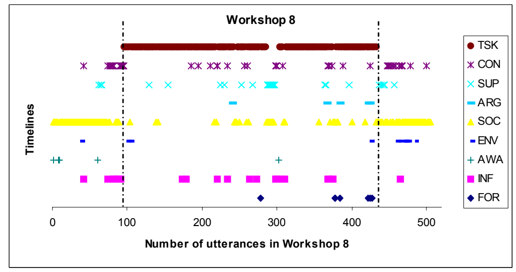
(d) Workshop 5



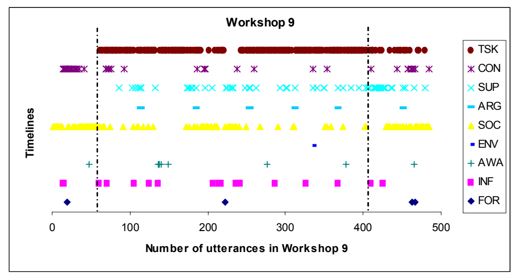
(e) Workshop 6



(f) Workshop 7



(g) Workshop 8



(h) Workshop 9

Figure 3. Communication timelines of Workshops 2-9.

c) Workshops 1-9

In this section, the combined results of the nine workshops are presented. For clarity, the communication types are averaged over all workshops and separated into the three most frequent and the six less frequent communication types.

The means of the three most frequent variables (TSK, CON, SOC) are shown in Fig. 4 and illustrate the average communication pattern in the developmental phases for all nine workshops. The figure shows numerical data supporting the broad description of the development of each phase mentioned earlier.

The means of the six less frequent variables (SUP, ARG, ENV, AWA, INF, FOR) are shown in Fig. 5. The most obvious trends are an increase in supportive communication, a decrease in awareness and environment communication, and a decrease in both formal and informal management of communication.

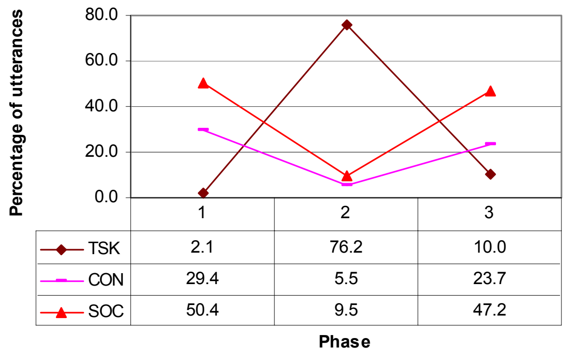


Figure 4. Means of most frequent communication types for nine workshops.

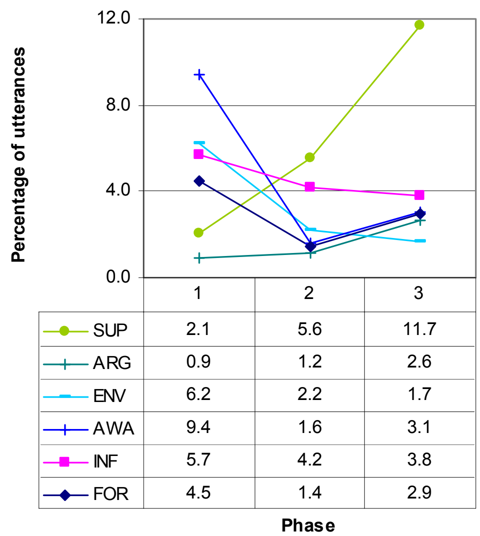


Figure 5. Means of less frequent communication types for nine workshops.

B. Developmental Characteristics across Workshops

In this section, long-term developmental characteristics (across workshops) will be examined. In terms of development across the nine workshops, Fig. 6 shows trends for the three most frequent variables (TSK, CON and SOC) across each workshop. The trend for task communication is to increase over the period, apart from a high point in the middle. The trend for conceptual communication is to decrease over the period, apart from a low point in the middle. The trend for social communication is to increase over the period.

Fig. 7 shows trends for the six less frequent variables (SUP, ARG, AWA, ENV, INF, FOR) across each workshop. The trend for supportive communication is to increase over the period. The trend for awareness communication is to decrease over the period. The trend for formal communication is to decrease over the period. There are no discernible trends for the argumentative, environment and informal communication.

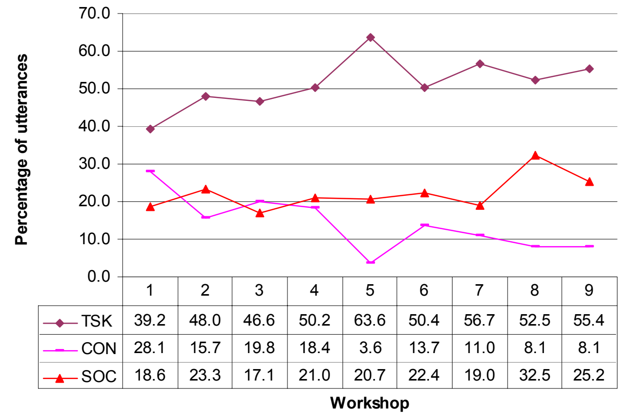


Figure 6. Most frequent communication types across workshops.

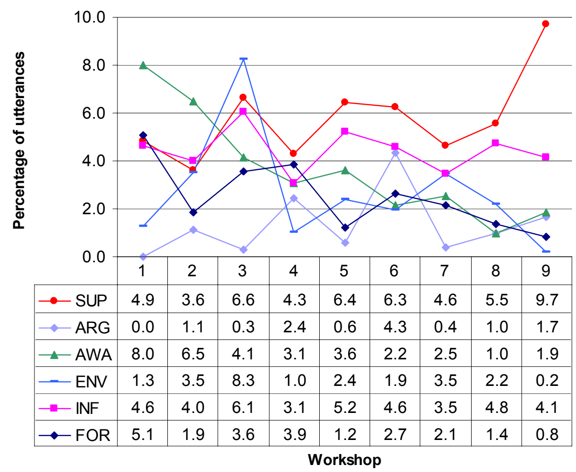


Figure 7. Less frequent communication types across workshops.

Although there is more task communication in all phases (workshops), and there is less social than conceptual communication in the first phase, the ratio of conceptual and task plus social categories (Fig. 8) confirms a definite trend of more conceptual communication in the early phases. Fig. 9 shows that the percentage of task is always higher than social communication. In the early phases, task and social communication follow similar patterns, but in the later workshops, there is a trend for task and social to diverge.

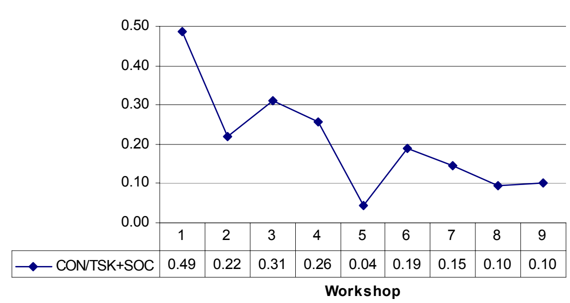


Figure 8. Ratio of CON and TSK+SOC communication categories.

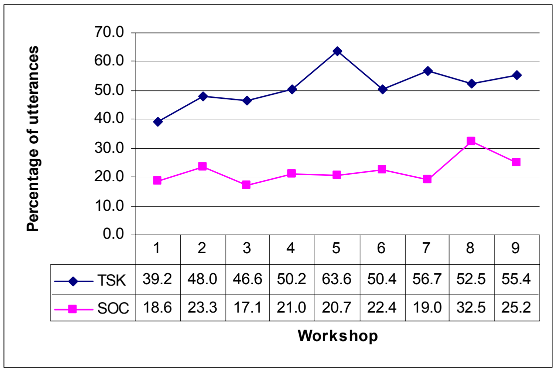


Figure 9. Percentage of TSK and SOC communication across workshops.

V. DISCUSSION AND CONCLUSIONS

The developmental characteristics were analysed for short-term (within workshops) and long-term (across workshops) effects. The analyses demonstrate a strong short-term developmental effect in which the communication in the early and late phases was primarily social and conceptual while the middle phase was task-oriented. In other words, participants tended to focus on conceptual aspects of the group activity and engage in social communication in the early and late phases of development. During periods of high task activity there was minimal social communication.

The developmental effect was not as marked across workshops but there was a definite trend for more task and conceptual communication in the early phases of the workshop series and a trend for more social and supportive communication in the later phases. The weaker effect across workshops is no doubt due to the structured process and environment of the series of nine one-hour workshops. There was a defined commencement and conclusion point for each workshop and very little contact among participants in the time between workshops. This meant that participants needed a short period of "getting to know you (again)" at the start of each workshop. Across all workshops, conceptual communication decreased, and task and social communication increased. However, there was consistently more task than social communication. It appears that having established communication norms and collaborative strategies initially, the participants were able to concentrate more on the collaborative task in the middle and later stages.

While these findings may be specific to the case study analysed in this paper, there is evidence supporting Landrum and Paris's work [23]: that educational groups do exhibit developmental effects.

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Collaborating and learning with annotation in a multimedia environment

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Abstract

This study presents how annotation can be used for evaluation in learning process. It considered annotation as a comment on issues, response to questions, explanation for use or usage. Document was considered from two perspectives as (1) a trace of human activity as (2) as constructed to provoke a transformation in the state of mind of the user whom the document is addressed to. When something is learnt, it is expected to transform the state of mind of the learner. The concept of learning is universally accepted to be an acquisition of unknown. To evaluate such acquisition, several methods have been used as to "examine" expressed understanding of concepts. Annotation can be a way of expressing what has been learnt. The problem is, how do we measure what has been learnt? We propose the use of annotation to resolve some of the problem related to evaluation of learning activities. A model was proposed based on the parameters of the learner, the document, time and the expression of what has been learnt (annotation). A particular emphasis was laid on learning level and learning type.

Keywords: Annotation, collaboration, evaluation, document, multimedia

1. INTRODUCTION

We are considering learning from the perspective of annotation. Our basis for this is to assume that students or a trainee can "report" what he has learnt in a formation system with the use of annotation. We refer to the fact that document is a trace of human activities (Prie, 1999) and that document was constructed to provoke a transformation in the state of mind of the user whom the document is addressed to (Nicholas et al, 1996, page 3). Annotation is interpretation or evaluation of a document expressed on the document (Robert and David, 2006). We believe that a learner can "report" or make annotations of what he/she has learned with the use of annotation. We are considering a case of a system developed to permit "report" of a learning activity with a precise concept and with a purpose to enable an analysis of such report.

2. RELATED WORK

Collaborative studies was identify as a key issues in scientific endeavours (Vannevar, 1945). Several reasons have been put forward as reasons for collaboration. Collaboration is called for if participating individuals have different roles to play or they have different specialization in the collaboration. An interesting work by (Twidale et al, 1995) was adapted for collaborative learning in information search. Learning in this case was specifically considered in the area of information search and not at the global view of knowledge acquisition. The report by (Dillenbourg and Schneider, 1995) focused on measurement and understanding the effects of collaborative learning. It reviewed conditions under which collaborative learning can be efficient. An illustrated work of (Johnson et al, 2000) provided eight methods of learning adapted to classroom environments. Other works in this area are either on evaluation of learning methods or the theory behind the learning methods (Dillenbourg et al, 1994) (Vivekanandan Kumar, 1996). Related to this, (O'Leary et al, 2005) presented how computer tools can be used in collaboratively to provide solution in a learning environment. In our case we are not considering not student-student participation but student-teacher participation in a learning system. The difference in our work is that our emphasis is measuring what has been acquired in a specific way.

3. MULTIMEDIA DOCUMENT IN A LEARNING ENVIRONMENT

We believe that a document is a container of information. A document is conceived to be read, view and to be evaluated. It is expected to transmit information to its potential audience. This means that, a multimedia information management system is the management of content of multimedia documents. We assume that most objects that can be referred to as document in a learning environment has one or more characteristics of a multimedia document. A multimedia document can be defined as any document having one or more of the following: Text, sound and image. In the table below, we give example

Several approaches have been attempted in information extraction from multimedia document.

Table 1: Possible forms of multimedia documents

	Text	Sound	Image	Example
1				Not applicable
2			X	Paints
3		X		Music
4		X	X	Video
5	X			Book
6	X		X	Commented image
7	X	X		Advertisement
8	X	X	X	Commented Video

Some of these approaches are based on imposing additional information layer based on human or machine translation of multimedia document. For example, texts information can be derived from video streams or images (Duygulu and Wactlar, 2003). It must be emphasized that these approaches are not necessarily information extraction but information creation that are subjective to human or machine understanding of events. Sometime these interpretations may be divergent view of what the author of the document intended.

In (Moënne-Loccoz et al, 2005), emphasis was laid on identifying (a) document Information: global information about each document including meta-information and raw-data information (b) document structure: the temporal decomposition of video documents that comes from the temporal segments covered by the description data and (c) document description: the set of description data that is either automatically extracted (feature-based) or entered manually by human operators. This work can be viewed from viewpoint of information creation and not information extraction. It may be assumed that information extraction from multimedia document integrates creating a layer of additional information for its classification and usage. We are not aware of the existence of a system that can "interpret" multimedia documents and generate meaningful information embedded there in.

Works in federated database management proposed two model of information collection in a federated system presented schema integration and schema coordination approach to cooperative query processing (Zhao, 1994). This approach is well suitable to databases or meta-databases that are homogeneous in their format. In the case of heterogeneous multimedia document, a different approach is expected particularly when we know that we are interested in this kind of information for decision making.

Our conception is that all multimedia documents can be classified in one of the category in Table 1. The word multimedia means "more than one", but in our case, we want to include information source with apparently one of the three characteristics. This is because, we assumed the terms "text", "image" and "sound" needed a further clarification that is beyond our considerations here. How can we define image, text or sound? What are the criteria for defining these terms? Definition of image for instance is subjective. If we look at some artistic writings, do we call them text or text and image? For this purpose, we will assume that the frontier of separation between all these elements remain unclear.

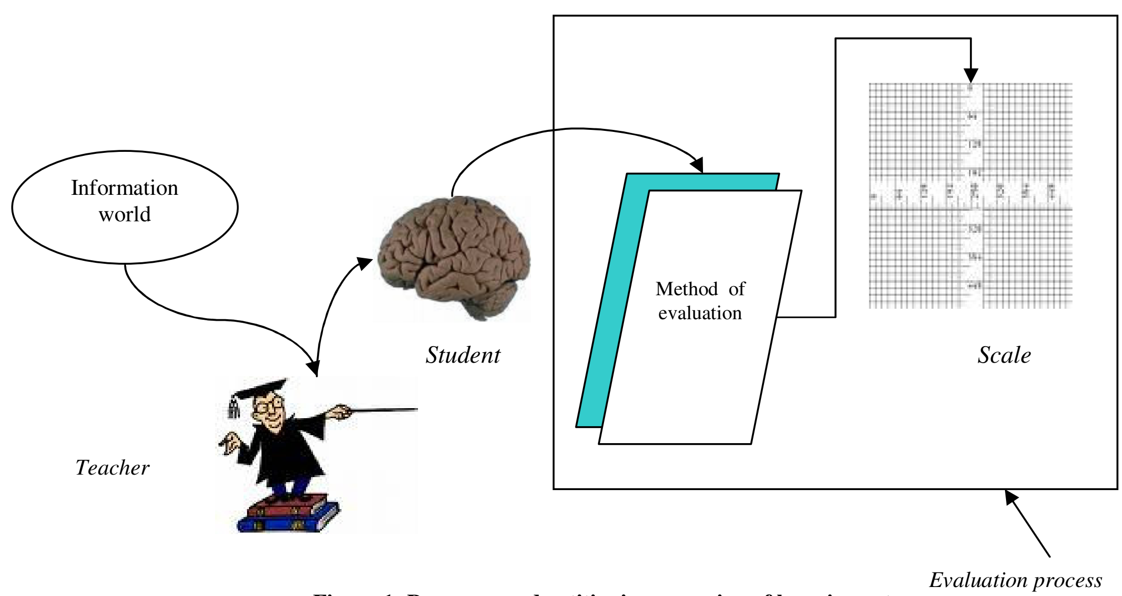

Figure 1: Processes and entities in measuring of learning activities

4. BASIS FOR ANNOTATION IN LEARNING

We will define learning as a system of acquiring and storing information on object, place, event and circumstances that has not been known. Learning can be problem-based or not. Learning has been closely linked to examination. In principle, examination is a measure of what has been learnt. Best method of measuring what has been learnt is yet to be proposed. Methods of measuring what has been learnt include (a) writing essay on acquired knowledge (b) multiple choice questions (c) oral presentation (d) quantitative test (e) quiz. In principle, whatever method used in evaluating what has been learnt, examination permit the learner to express two type of "acquisition": fact or inference. Examination can also be type subjective or objective. There is no way we can assume that one method of measurement is perfect. In the case of objective, it is almost certain that the examination is meant to report same answers for same question from different learners. In the case of subjective examinations, the assessment of result depends on the situation of the state of the examinator and his social circumstances during the process of examination. It is also a function of time. The same examinator may reward the same question differently giving time.

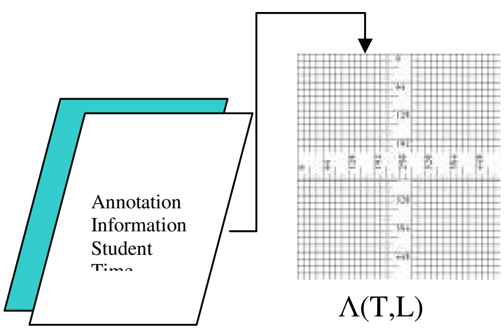

Figure 2: Learning process with annotation

A system for evaluating what has been learnt commonly consists of four entities. The entities are (a) information world (b) teacher (c) student (d) method of evaluation (e) scale of measurement. A teacher identifies a section of the information world and attempt to transfer it to a student. It is interesting to note that only certain percentage of the transferred information is "stored" in the memory of a student. A student here can be a machine. Out of the percentage stored by the student, he is able to express a fraction of this in an evaluation process based on specified methodology. The problem is how do we effectively measure what has been expressed by a student and how do we determine the scale of measurement? Whatever method and scale used, the objective of examination (evaluation process) is to be able to measure certain percentage of what has been expressed in a learning process.

Consideration for annotation as an important tool in learning activities has been diverse and interesting. We can identify six major groups of usages of annotation. These usages are directly related to

- Evaluation systems
- Feedback systems
- Collaboration systems
- Experience sharing systems
- Distributed resource sharing systems
- Decision support systems and
- Document and users' tracking systems

It has been said that annotation may be used to assist in decision making. The question that we may ask is what type of annotation. The general presentation of annotation does not buttress the fact that, we can look at different application of annotation depending on their type and the reason for making them and what cognitive level is associated to the annotator. Annotation made in commercial domain may not have significant domain in academic circles.

In this work, we are interested in adapting annotation to learning system. One of our considerations is rooted in several models proposed in cognitive science, philosophy and intelligence economic. One of the first interesting works is that by Bloom et al in 1956. They proposed six categories in the cognitive domain. We itemize these categories as follows (a) Knowledge (b) Comprehension (c) Application (d) Analysis (e) Synthesis (f) Evaluation. This to us is a generalized way of looking at the stages of learning activities. The work of David et al, presented a related perception in four stages as (a) Exploration (b) Query (c) Analysis and (d) Annotate. Notably, Synthesis and Evaluation in bloom's model were combined as annotate in EQuA²te model. We want to emphasize that EQuA²te model is not a categorization model but a cognitive model applied to information research in databases. Though our work is not supposed to be directed at forging a method of evaluating educational objectives using cognitive categorization implanted in annotation, we will simply use these six levels as they are. The choice of Blooms categorization is not a preference but a simple selection. Choosing other methods or model will satisfy our objectives as well.

Annotation is conceived with document, user and time. Our objective in this work is to detail annotation as much as possible and to specify the class of annotation in the light of cognitive learning categories during its creation. We will want to emphasise that we are interested in the learning type which is generally viewed from three perspectives of:

- **Cognitive**: mental skills (*Knowledge*)

- **Affective**: growth in feelings or emotional areas (*Attitude*)
- **Psychomotor**: manual or physical skills (*Skills*)

We assume evaluation method is a combination of annotation (expressed knowledge), transferred information, Student and time. We do not attempt to express the content in the source information. We are interested in these learning types because we can effectively apply our propositions in annotation to them. It is our imagination that annotation made of type "affective" during an "evaluation" of an event may be different from that of "psychomotor" and "application". It is therefore imperative to include the parameters of annotation type and cognitive categories in annotation creation if annotation is made during learning process.

We present annotation among other parameters as function of type and learning type as

$$\text{Annotation} = \Lambda(T,L) + f(D_{(x)},t,A_{(i)})$$

where Λ typify annotation,
T is the learning type,
L is the learning level,
$D_{(x)}$ are the characteristics of the document involved,
$A_{(i)}$ are annotator's factors
and t is time.

Briefly, we present essential parameters of annotation in the next section.

5. PARAMETERS FOR ANNOTATION IN LEARNING

Document is the basis for source information. Document can be considered from two perspectives of (1) a trace of human activity and (2) as been constructed to provoke a transformation in the state of mind of the user whom the document is addressed to. When something is learnt, it is a manifestation of the transformation in the state of mind of the learner.

a. Annotator (student)

- annotator's reference (*this is a unique reference that is used to identify a student*).
- identity of a student
  - His name (*first name and last name*)
  - Email address
  - postal address (*or sectional address*)
  - region
  - country
  - social class
  - age-group
  - area of activity (*teaching, research, student etc*)
- session (*session is used to identify user's activities in the process with date and time*)

b. Source information

The document consulted is paramount in any annotation process

- document title (*original title of document*)
- descriptors and keywords (*descriptors are words used to describe the document*)
- authors (*are the producers of the document, their names and surnames*)
- date of publication of document
- format of document (PDF, word, html etc)
- abstract / résumé

c. Annotation

- Type of learning (*Affective, Psychomotor, Cognitive*)
- Level of learning (*Knowledge, Comprehension, Application , Analysis, Synthesis, Evaluation*)
- Reference (*is the reference, or code for future reference*)
- Technique (*the type of annotation used*)
  - » marking,
  - » typographic
    - italics , underlining ...
  - » reformatting of text using brackets and braces,
  - » passage numbering,
  - » text
    - in margin, footnotes, endnotes, in the gutter, by icons),
  - » icons
    - stars, question marks, exclamation marks,…
  - » symbols
    - to describe associations, relations between words..
- annotation location
  - left margin, right margin, footer, header, gutter, end of document, additional document

d. Time

- Time when knowledge was acquired
- Time of evaluation

We believe that including time in annotation process is important to be able to compare the time interval between when knowledge was acquired and when it was expressed for evaluation. An expression of understanding immediately knowledge was acquired is not the same as when it is expressed with considerable time lapse. Introduction of time into annotation allow incremental evaluation of student. The absolute evaluation of student without time factor is not a true test of comprehension of trainee or learner.

Affective (A)	Psychomotor (P)	Cognitive (T)
Knowledge (K)	Comprehension (C)	Application (L)
Analysis (Y)	Synthesis (S)	Evaluation (E)

Eg Cognitive Comprehension (TC), Psychomotor Evaluation (PE)

Table 2: Crosstab of learning type and learning level

	Affective	**Psychomotor**	**Cognitive**
Knowledge	(AK)	(PK)	(TK)
Comprehension	(AC)	(PC)	(TC)
Application	(AL)	(PL)	(TL)
Analysis	(AY)	(PY)	(TY)
Synthesis	(AS)	(PS)	(TS)
Evaluation	(AE)	(PE)	(TE)

We are aware of several importance analysis that may be performed by cross-tabulating several of these parameters. It has been reported that much of these parameters can be very useful in the decision support, economic intelligence and for feedback systems. Our specific concern in this work is on the annotation parameters for learning purposes.

6. ANALYSIS

For a detail reflections on relationship between attributes, we can consider an analysis that may include four parameters of document doc(4), with four parameters in annotators parameters U(4) and the parameters of annotation $\Lambda(3,6)$. We are not specifically interested in that kind of analysis here.

In real life situations, we may have an annotation type on learned corpus that encompassed more than one cognitive level or that may not be exactly of one learning type as psychomotor or affective. In this case, it is possible to have multi-level learning of type application-analysis or multi-type learning like cognitive-affective. It is also possible to have combination of level and type like cognitive-analysis-evaluative because an annotation may contain more that single level of educational characteristics. It then means that we are talking about three by six matrix. If we include other parameters of annotation in an analysis, we may have as much as sixteen by sixteen matrices. Analysing this kind of information is not a problem because we can apply some concepts from electronics. We believe that such complex analysis will loose its relevance. We simply assume the discrete state of learning level and learning. This gives us six by three considerations.

Since the cognitive levels are graded, it will be interesting to note that the higher the cognitive level, the more interesting the importance of such annotation. For example, an annotator that annotation of type Λ(Cognitive , Evaluation) will appeal to a university environment than that of Λ(Psychomotor, Comprehension).

7. CONCLUSION AND PERSPECTIVES

We have demonstrated that annotation can be used effectively to measure understanding of students in a learning process. We formalize some parameters that can be included in the measurement with the aim of providing a ground for analysis. We have not provided experimentation of this proposal because, we need to make some considerations that may imply other parameters. We imagine it operation on the Internet without much hassle based on our previous experiences as it regards information system for decision making.

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New Trends in Learning and Training Music Using ICT

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Abstract: **Technology has become more and more prevalent in schools all over the world. There are still many exciting develops in the area of music technology on the horizon and it is essential to emphasize that technology is a tool, and as with any teaching tool it should be carefully evaluated to determine its effectiveness in meeting the teachers' goals.**

The benefits of using ICT in the education process are both in the manifold instruction opportunities it offers and in the transformation of relationships between learners, teachers and the learning equipment.

***Prelude*, an European project in training on ICT in a Music Education Consortium formed by 6 Countries (Greece, UK, Sweden, Spain Estonia and Romania) research the ways for effective integration of ICT in music education through the creation of pool of tools and applications for music education**

Keywords: training, ICT, proffesional skills, technology

I. Introduction

The new technologies can hold the key to improved musical learning and training. Placing the tools of technology into pupils' hands can guide them to active music making. Research indicates that when students become active participants in learning they gain confidence, learn more effectively, and are drawn to further study (Crook, 1998). Music technology can help people learn to become more appreciative of music as an art; link their musical experiences outside the classroom to the learning which takes place inside the classroom and thus become active participants in the joy of music-making.

In addition, technology creates possibilities for performance that may not have existed otherwise. In a sense, a computer can become a musical instrument that people may use for creating or performing music. With the help of ICT, the pupils' learning process becomes more flexible and more active. They learn in a more informal and attractive way, while discovering and acquiring a knowledge of music and at the same time exercising their critical and aesthetic thinking.

In terms of ICT as music teaching tool, teachers must strive to achieve an appropriate blend of musical activities, concepts and technology with technological tools being used correctly and appropriately in order to enhance the music and not diminish it.

II. *Prelude,* an European project in training on ICT in Music Education

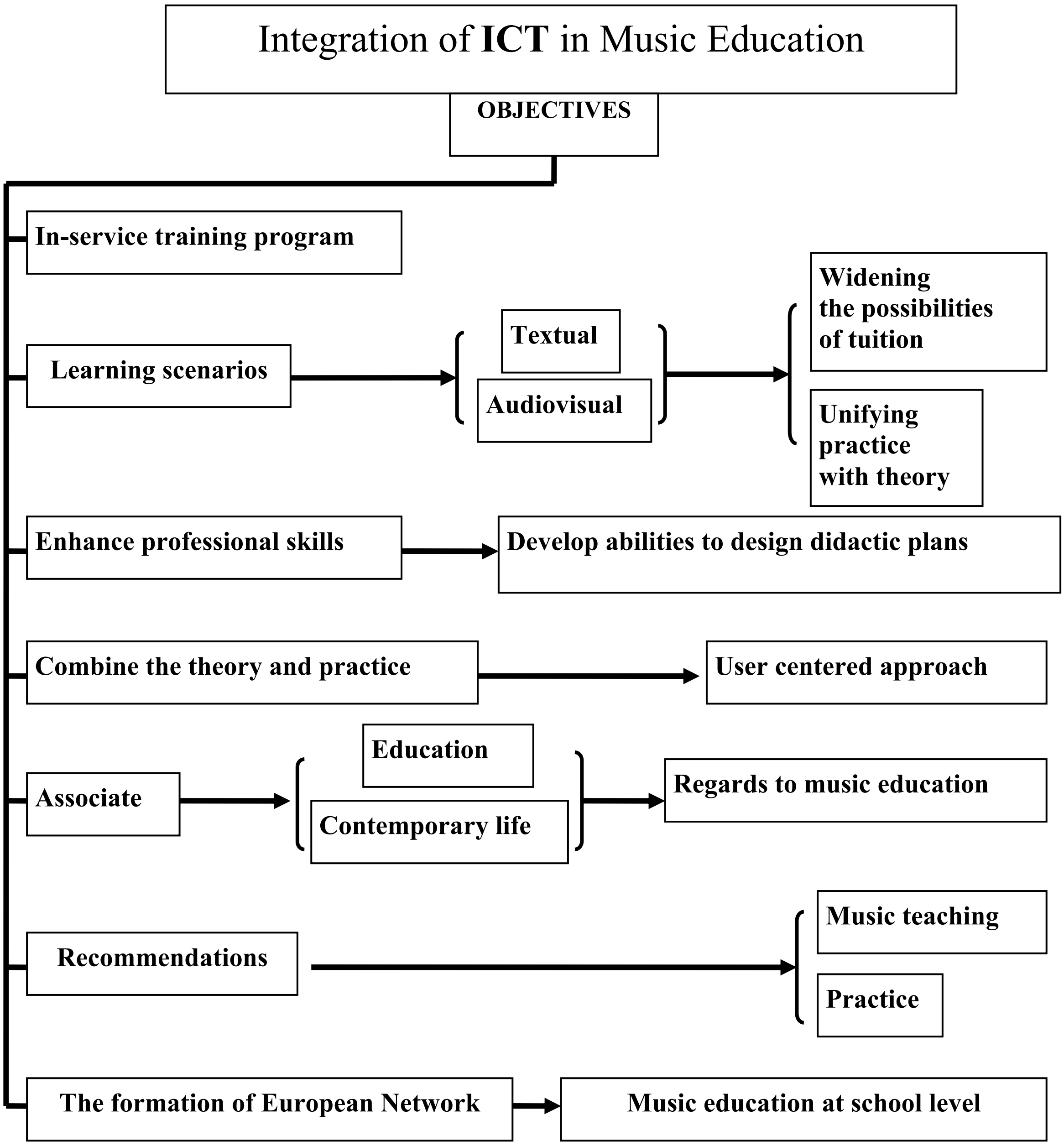
Prelude, an European project in training on ICT in a Music Education Consortium formed by 6 Countries (Greece, UK, Sweden, Spain m Estonia and Romania) research the ways for effective integration of ICT in music education through the creation of pool of tools and applications for music education

The *Prelude* project is designed to address these needs by employing up- to-date findings from the field of music education, as well as computer and web based application of music technology. In the general context of supporting the integration of ICT in music education with on-line professional development seminars and follow- up practice for music teachers the project identifies the following objectives:Prepare Your Paper Before Styling

- Design and develop an in-service training program for music teachers
- Provide learning scenarios with specific technologies, as well as textual and audiovisual material to support home practice, widening the possibilities of teachers-students tuition and unifying practice performance with theory of music
- Enhance professional skills of music teachers and develop their abilities to design didactic plans

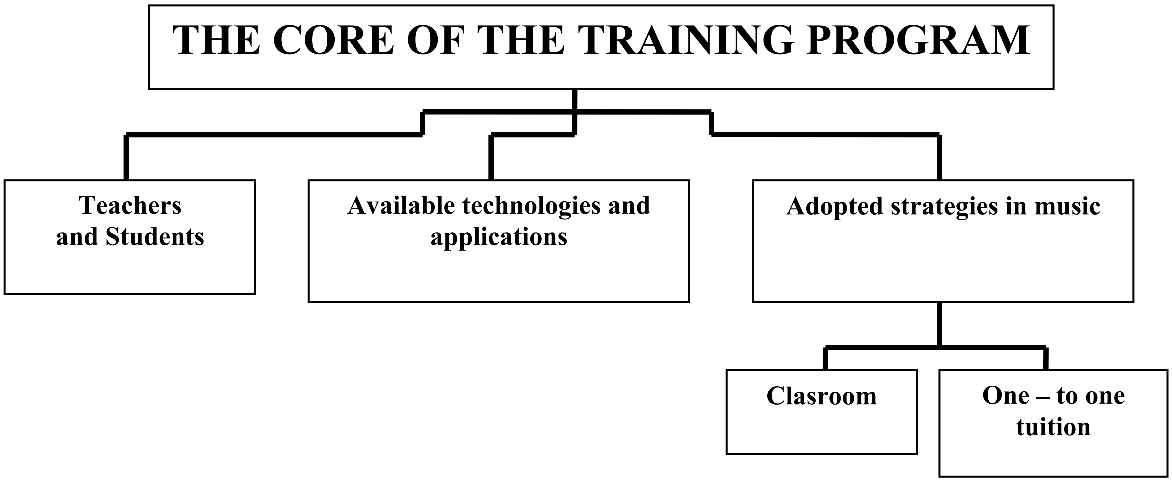
according to the needs of specific school environment and the available technology

- Combine the theory and practice by adopting a user-cantered approach
- Fruitfully associate education and contemporary life with regards to music education.
- Make recommendations on music teaching policy and practice
- Initiate the formation of European network on music education at school level.



An important role for the core of the proposal training program plays the relationship among three major perspectives to music education: teachers and students, available technologies and applications in music tuition, as well as adopted strategies in music for classroom and one – to one tuition. At the beginning of the project a needs surveys was organizing and at the end it will be explored the impact of the training program on music teachers and

learners. Music educational experts with interest or experience in technologies try to construct the proposed training program.



III. TEACHER NEEDS ANALYSIS: AN INITIAL SURVEY

A needs analysis was initially carried out in six countries in order to obtain the views towards and experiences of ICT within each country.

Differences tended to focus around similar themes such as resources, availability of hardware and software, attitudes towards technology and uses of technology in a pedagogical and musical context.

For the music teachers, using the ICT in the classrooms goes far beyond through the interaction of the computer with the musical process. From electronic devices to the manipulation of the recorded sound, music-related ICT covers a wide range of technologies. The aims of ICT introduction should be studied from the following perspectives:

- categorize the scope and range of music-related ICT;
- consider general principles regarding when, when not and how to use ICT in teaching and learning in-service training program;

A total of seven countries provided a total of 25 questionnaires, each giving an overall total population of 175 participants. The research population in each country represented a broad range of schools, locations and taught across the full age range of pupils, represented instrumental, voice and class music teachers. The following conclusions are formulated:

- The attitude of schools towards music and technology appear to be positive within each country. All teachers had positive attitudes towards further levels of training involving new approaches of using technology in music.
- Differences did exist between countries in terms of how technology is used.
- Teachers are well aware of the broad range of training needs they require. There was a wide range of responses suggesting that teachers have a high level of awareness of what types of technology can be used and could be available for use in teaching music.
- Evidence from both the qualitative and quantitative data suggested that teachers often used technology as a motivation tool or simply in order to use technology. It is therefore suggested that any resulting training materials ensure that technology is used at appropriate points in people's learning process.
- Teachers make ample use of Internet and e-mail, both at school and at home. The considerably high level of access to the internet and e-mail in all countries suggests that e-learning materials are an excellent way forward in terms of teacher training.
- Pupils tended to appreciate lessons were they were able to play instruments and to perform. Some form of training materials which would enable teachers to more fully integrate the process of

appraising music into the whole creative process would certainly be of benefit.

- The differences in the availability of technology and use of technology between countries is interesting and might reflect particular strengths in certain musical activities within individual members of the group. It is positive to note that teachers do not simply blame technology or available software which is dependent on popular styles; indeed, they still remain positive to the uses of technology within a music curriculum.

- To this end, training materials should perhaps begin through the use of free software which is available in each country and should detail and exhibit good practice in how this can be used to enhance learning. Notation, as a training need, tended to appear in all measures – self-efficacy rating, most urgent training need and product interest.

IV. Current stage of Music Education and Technology Research

Nowadays, the environment for Information and Communication Technology is changing vividly, leading to an increase of ICT research all over the world, to more open innovation processes, to wider and faster exchanges of ideas, to more complex technology chains, as well as to the involvement of other related disciplines: biotechnology, materials and cognitive sciences.

On a more particular level, music research has developed enormously in the following areas:

A. Sound generation and modeling (timbre)

This concept has been the preponderant research topic focusing on building sound synthesizers and audio processors.

Since the 1990s, Physical and Spectral Models have been developed, but did not meet success on the market place. However, a significant issue consists in Spectral and Signal Processing that need working on the control and expressiveness of synthesizers. Simultaneously, new paradigms for making sounds (timbres) have been initiated, for example physically inspired synthesis, audio mosaicing, etc.

B. Music performance analysis

Although the performer represents a key element in the music-making chain, little consideration has been given to the performer's contribution to this sequence.

C. Music interfaces

By means of electronic instruments we can create controllers and interfaces to catch performance gestures, and sound modules to produce sounds. Since the invention of the first electronic instrument, the concept of performance has received a brand new meaning, and with it the concept of instrument. We are referring to the performer-instrument interface in the general context of human-computer interaction. Some of the active research topics are the study of musical mapping algorithms, development of intelligent controllers and new controllers for collaborative performance. The fundamental change that is taking place is related to the Internet that is becoming a medium for music making and thus a musical interface to be explored.

D. Music and audio listening

At present, music and audio listening is the most animated research area in MT.

Because of the difficulty in understanding the relationship between acoustics, music structure, cognition, and emotion, this association offers a significant ground for scientific and technological research.

In Music Education, the Music Technology is targeted on well-defined directions related to teaching activities that can be expressed by the existing music software.

Briefly in the following area there are musical software:

TEACH PERFORMING INSTRUMENTS	TEACH FUNDAMENTAL OF MUSIC	ANALYSIS	CREATIVE MUSIC	WRITING SOFTWARE
GUITAR	**MUSIC THEORY**	**EAR TRAINING**	**ELEMENTARY CREATIVE MUSIC**	**SIBELIUS**
KEYBOARD	**RHYTM**	**MUSICAL EXAMPLES**	**COMPOSITION**	**FINALE**
VOCAL	**INTERVALS AND SCALES**	**LISTENING ANALISYS**	**MASTERING MUSIC**	**SCORE**
STRINGS	**ASSESMENTS**			**ENCORE**
JAZZ / IMPROVIZATION SKILLS	**GAMES**			**MOZART**
HELP USER PERFORMANCE	**COMPOSERS BIOGRAPHY**			

V. The *Prelude Platform*: Functional Specifications

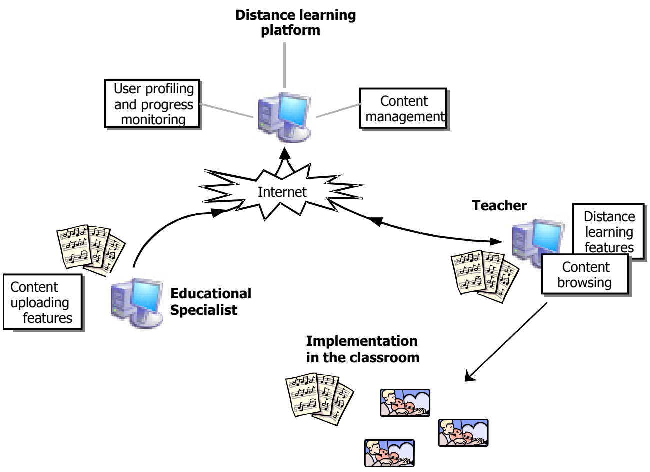
This platform aims at introducing novel technological tools to music education that will allow the exploration of new practices in music and enrich traditional procedures.

More particularly, the platform will offer in-service training to music teachers on the use and effective integration of modern technologies in music education.

The following diagram depicts the flow of information throughout the Prelude project. It is clear that the Prelude platform is the core of this exchange. The platform stores content from the educational specialists, then this content is accessed by the teachers, which in turn implement some aspects of it in their classrooms and then they can upload their experience back to the platform for sharing purposes with other colleagues. The type of information exchanged

can be static content, for instance, videos, documents, presentations etc., interactive content like quizzes for self assessment, assignments and/or exercises and of course communication-type information like the one in forums and/or chats.

Figure 1. Simple data flow diagram (DFD) in the PRELUDE project



By studying this diagram is quite easy to understand PRELUDE's main educational scenario. Of course, other scenarios can also be implemented by taking into account the potentials of the chosen course management system (CMS) on which the platform relies.

From this point on, the term **teacher** refers to the educational specialists who prepare content for the PRELUDE platform, whereas the term **student** refers to musical teachers who want to participate in the PRELUDE platform and the term **course** refers to a set of interactive or non- interactive educational content prepared by the educational specialists.

The following paragraphs formulate the functional specifications of the platform in terms of the user centered approach adopted by the PRELUDE project, and finally explain the choice of the Moodle CMS as the basis of the PRELUDE platform. Then Moodle's features and properties among with its educational philosophy are further described, and final the main technical specifications are presented.

A. Functional specifications

The development of the PRELUDE distance learning platform consists of the following main tasks:

- To develop the PRELUDE distance learning environment by elaborating, adapting and enhancing available distance learning technology
- To provide tools for PRELUDE content authoring and uploading
- To support the PRELUDE user profiling scheme
- Major functionalities required by the PRELUDE distance learning platform include:
- Multi-lingual support (primarily for European languages) at the user interface
- Implementation of asynchronous e-learning
- Support of the main PRELUDE educational scenarios (primarily taught classes with a teacher role, self-managed student groups, possibly international)
- Student management by the teacher
- Course content management by the teacher
- Virtual space availability for students to up/ download content and to share content
- Mechanisms for search of content
- Information sharing and communication among users, by exploiting facilities such as forums and chats.

The user chooses to enter the DLP by providing his credentials using his internet browser. The html code provided by the platform must conform to the appropriate standards, so that the choice of a specific browser wouldn't be an issue for the user. Broadband connection to the Internet over a dial-up telephone line (typical) or an ISDN, ADSL line (preferable) is necessary. After authorization the DLP shows the front page of the site. The user chooses a course, possibly after searching the available courses for material. Subscription to a specific course will be an option for the teacher by providing a course enrolment key to the student. Further navigation through the material of the course is possible from the course main page. There will be instructions included for the extensive use of the material. There will be also questionnaires which will help the user to choose the material he studies according to his level of ICT knowledge and to assess himself after he has seen the material in the course. The data collected shall help the teachers to evaluate the quality of the presented material.

The static content offered by the PRELUDE platform shall be videos, documents, presentations, simple text, images and links to other internet sites. Care must be taken so that the format of the chosen content will be cross browser. This means that there must be no need for the user to download and install additional software to view the content as far as possible. This can be accomplished if, for example, the chosen format for videos will be the Flash format (flv) and for documents the portable document format (pdf). Most browsers can handle the last two formats intrinsic.

PRELUDE's content shall also include interactive material which will help the users to select the course they will attend according to their ICT knowledge level. Interactive material will also be included for self assessment purposes after users have finished their study.

VI. Conclusions: How Can the Use of ICT Raise Standards in Music

There is no doubt that technology has become more and more prevalent in schools all over the world. And there are still many exciting developments in the area of music technology on the horizon. However, it is essential to remember that technology is a tool, and as with any teaching tool it should be carefully evaluated to determine its effectiveness in meeting the teachers' goals.

The benefits of using ICT in the education process are the following:

- improving the lesson design through learning platforms;
- developing tools and resources supporting the creation of a strategic vision for teaching and learning;
- engaging and motivating pupils to access online the learning resources;
- providing opportunities for pupils to learn in alternative and challenging ways, using a wide range of sources
- offering information and techniques to support critical thinking;
- enabling both collaborative and individual work;
- providing pupils with access to sources of information relevant to a particular enquiry by searching web sites on the internet;
- helping pupils to investigate musical alternatives by means of sequencers;
- enabling pupils to improve their compositional skills through the use of sequencers;
- helping pupils to review, refine, redraft and modify work in progress;
- assisting pupils to refine their performances and present them more effectively and in different ways;

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"Affective E-learning by Broadcasting Media The Bangladesh Scenarios."

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Abstract-**Education is the first mandatory phrase of overall development of any country. Education means improving the quality of life of every one to create efficient, active, productive and profitable manpower. Presently we are living in such a world, where every day our life style and mode of thinking is fully modulated by various forms and methods of information and communication technologies and every day new forms are coming. One of the define characteristics of modern social and cultural life has involved living and learning to live in a culture of mediation. These days use of media is an essential component of teaching-learning strategies to achieve various national goals—socioeconomic and cultural. Toady implementation of education fully depends on appropriate use of technology. Education providers, faced with these challenges are seeking new ways of educational technology to impart education. By definition technology means the practice, description and terminology of any or all of the applied sciences of commercial value. It is not possible to educate the Mass people through the institution under a regulatory management. Particularly in the South Asian region where poverty level is extremely very high and very poor literacy rate in contrast with the developed countries, there how could it possible to implement "Education for all"? Now the basic question is what sorts of educational technology would be used on this concern? The revolutionary development of electronic information & communication technology--Radio and television might be used on this process. Other new forms of communication technologies like Internet or mobile phones are considered to be the very effective technology of mass education. These sorts of most advanced technology should not be applicable for all countries like Bangladesh because the use of technology consequently depends on the social-economic condition, life-style and availability of equipments, talent and intellect, power of reception and interaction of people etc. All most every country of the world has Radio and television broadcasting that's why among all the forms and methods; broadcasting media is the most common & popular. In Bangladesh considering the social economic reality govt. has been using radio and television broadcasting for mass education broadly since the last one decade. A significant result has already been achieved in the field of mass education of Bangladesh.**

Key words: Use of broadcasting media for mass education, Social –Economic aspects, Education technique, Effective ness and significance

I. INTRODUCTION:

The word information and communication are completely depended on a factor called "Technology". Only appropriate technology can assure the fruitful usage of information and communication. We have entered into the age of new social revolution by means of rapid development of electronic information and communication technology --- these are Radio, Television and internets and mobile phones etc. These days use of information and communication technology is an essential component of teaching-learning strategies to achieve various national goals—social economic and cultural. We know "Education" is exchange and transformation of information and communications. Education is called the first mandatory clause of social, economic, cultural and overall development of any country. Education means improving the quality of life of every one to create efficient, active, productive and profitable manpower. Toady implementation of education fully depends on appropriate use of technology. The term 'Technology' means the practice, description and terminology of any or all of the applied sciences of commercial value. The use of technology consequently depends on the social-economic condition, life-style and availability of equipments, talent and intellect, power of reception and interaction of people etc.

This Paper is mainly developed on the perception of Bangladesh. A very small country (14, 3,998.00 square kilometers) of South Asia. Along with her vast population (152.6 million UN 2005), major portion of them are not educated and live below the poverty level. Literacy rate (38%) is lowest among the developing countries. For the past thirty-five years and since achieving the independence Bangladesh has been struggling for education to all by different means. Public education in Bangladesh generally follows the model established by the British prior to 1947. It lacks of sufficient schools and institutions as well as good teachers or instructors. The existing educational system has shown itself to be unable to respond to the massive demand for increased education. That's why a large numbers of disadvantaged groups continue to be denied access to information, knowledge, skills and technology transfer. Education providers, faced with these challenges are seeking new ways of educational technology to impart education. It is impossible to educate those underprivileged groups through the conventional institutions under a regulatory management. So the question is what would be

the alternative? The revolutionary development of electronic information & communication technology --Radio and television might be used on this process. As a whole radio and television broadcasting is the most popular, convenient and effective form of information & communication technology to convey all sorts of message and education to the mass people. Other new forms of communication technologies like Internet or mobile phones are considered to be the very effective technology of mass education. These sorts of most advanced technology should not be applicable for all countries like Bangladesh. All most every country of the world has Radio and television broadcasting. After all one hundred years of broadcasting history, most nations' posses more than a respectable level of engineering skills and Broadcasting talent needed to apply the technology in education.

In Bangladesh considering the social economic reality govt. has been using radio and television broadcasting for mass education broadly since the last one decade. A significant result has already been achieved. This paper discusses initial results how broadcasting technology has created a revolution in the education showground of Bangladesh.

II. RADIO AS AN EDUCATIONAL MEDIA

"Education is the experience of life itself and radio is the communication of life."

Radio as a broadcasting medium plays an extremely vital role in the information & communication process that is prerequisite for development. Radio – is an intimate medium Radio has already known as a News Paper without paper cannot be suppressed or confiscated. This is fact, Radio does not demand the virtually exclusive level of audience attention that press or television requires. But listeners can carry radio within them. It can be provide company in the kitchen, or on the factory floor, in a traffic jam on the motorway or in a hostage cell on the outer side of the world. So, on these regards, off all "Mass media", radio offers the greatest potential for building up a one to one relationship with each member of its audience. Radio can transcended the territory of the state and breaks the barriers of literacy. People have no need to live near to a town or city. They could live very well be in the remotest corner of the country---- to enjoy the benefits of radio broadcasting. And not only their own station, can even they learn form international broadcasting as well if they are able to afford a good receiver. So, radio receivers are widely available, portable and convenient for the listeners. *"Radio also has a developed infrastructure that must be the envy of any developing country operator. In Srilanka, one person in 500 has access to Internet, but virtually every one has to a radio. Bolivia had fewer than five telephone lines per hundred people in 1996, but more than 57 radio receiver per hundred (Girard, 1999)."* Radio has already known as a News Paper without paper cannot be suppressed or confiscated. This is fact, Radio does not demand the virtually exclusive level of audience attention that press or television requires. But listeners can carry radio within them. It can be provide company in the kitchen, or on the factory floor, in a traffic jam on the motorway or in a hostage cell on the outer side of the world. So, on these regards, off all "Mass media", radio offers the greatest potential for building up a one to one relationship with each member of its audience. Radio can transcended the territory of the state and breaks the barriers of literacy. People have no need to live near to a town or city. They could live very well be in the remotest corner of the country---- to enjoy the benefits of radio broadcasting. And not only their own station, can even they learn form international broadcasting as well if they are able to afford a good receiver. So, radio receivers are widely available, portable and convenient for the listeners. *"Radio also has a developed infrastructure that must be the envy of any developing country operator. In Srilanka, one person in 500 has access to Internet, but virtually every one has to a radio. Bolivia had fewer than five telephone lines per hundred people in 1996, but more than 57 radio receiver per hundred (Girard, 1999)."* Radio still continues to be an under–utilized technology in education. From an educational provider's point of view it is easy to set up, produce and broadcast programmes. Radio programmes are cheap to make compared to television and video.

III. TELEVISION AS AN EDUCATIONAL MEDIA

Television --- the most popular and common entertaining media rather than all other visual media. Today we are all inherent with this media. Its language is universal. A single frame or picture can express lot of things rather than million of words. It has versatile appeal to all level of human feelings. Even for a least developing country, like Bangladesh, television has achieved the superb access in the society rather than other scientific utilities such as personal computers and mobile phones. It has become a very common commodity of social life.

As an educator television is the most effective than other media. Television offers real advantage as a medium for public education; television is expensive, in absolute and relative terms. It is not an intimate medium like radio; it is mainly a family media. Lot of people can enjoy television all together. However, television is unique in being able to achieve effects other media cannot. It can tell a story more compellingly than radio because of the use of visual imagery.

IV.HISTORY OF EDUCATIONAL BROADCASTING IN BANGLADESH:

The history of electronic media based education in Bangladesh (Former East Pakistan) dates back 1956

when 200 radio sets were distributed through the country to give education from a distance mood. An audio-visual education center was established in 1962. No further progress was in sight till 1971 when the people of this part fought a bitter struggle to over through the Pakistani occupation forces in the nine months long war and got independence on December 16, 1971 by tell of million lives.

V. BANGLADESH OPEN UNIVERSITY FOR EDUCATIONAL BROADCASTING:

The post war Bangladesh was faced with the challenge of meeting the education needs for vas masses. To meet this challenge various measures were taken in different times. At last in October 1992 with a view to imparting education to all, Bangladesh Open University (BOU) was established by an act of the parliament. The main objective of this university is to expend all level of education and knowledge to the every class of people and create efficient manpower. Besides the print media and tutorial services, mainly educations are provided by radio and television programmes. Seven different schools offering 22 formal programmes for the students of BOU. At present more than seven hundred thousand students are enrolling in the different programmes of BOU. It has mentioned earlier that Bangladesh lacks of institutions and good infrastructures for proper education. As for example every year nearly fifteen hundred thousand students pass in the Secondary School Certificate Examination (The biggest public examination in Bangladesh) but due to absence of adequate institutions only two third students can get admission and rest of them had nothing to do before 1993 when Bangladesh Open University was established. Problems are as same as for other public examinations. BOU is the last destination for those. Though BOU provides Education in distance mood but without educational broadcasting it would be somewhat impossible for BOU to expand its service.

At the same time 18 non-formal programmes are also produced to create awareness and knowledge about health, environment, basic science, agriculture, food, nutrition etc. for the people of all walks of life. All the programmes of BOU reach to its target people through the National Broadcasting Authority. BOU broadcasts every day 25 minutes radio and 66 minutes TV in six days of week. So, Bangladesh Open University has opened a new vista of media education by means of radio and television. So the educational broadcasting of BOU not only educates its student as well as educates the mass people through the non-formal programmes. The following figure-1 demonstrates the creditability of BOU: -----

Year	Students Enrollment at BOU
1992	5075
1993	6121
1994	10597
1995	28854
1996	27756
1997	30376
1998	42471
1999	37550
2000	72032
2001	58844
2002	82660
2003	82424
2004	106634
2005	122875

Figure 1. Source: Students Support Service Division, BOU.

VI. EDUCATIONAL BROADCASTING IN GOVT. MEDIA

Bangladesh Betar (Radio) is the largest electronic media of Bangladesh. It is a state-owned radio broadcasting organization. Bangladesh Betar broadcasts programmes through 10 regional stations and several units or offices. Total broadcasting hour 170 hours 10 minutes / Day. On an average, per day Betar broadcasts 315 minutes of programmes per day through all the stations for the students of primary, secondary, higher secondary level, for the illiterate. Population, Health & Nutrition Cell of Betar produces programmes on issues like resisting child-marriage, building up public opinion for getting married at a reasonable age, motivating people in favor of small family, eradicating all forms of superstitions, ensuring proper maternal and child care to control death rate of children and pregnant women, disseminating basic facts about health and nutrition. Besides this Betar also produces programmes for current issues and awareness according to public demand. Bangladesh Television (BTV) is also state-owned Television network in Bangladesh. It is carried out through one center, one sub center and 18 really stations. The average transmission time of BTV a daily stand at 14 hours. Educational broadcasting: 60 minutes /day.

VII. EDCUATION TECHNIQUE FOR BROADCASTING MEDIA:

To whom (Listeners/ Viewers),
What (Contests) and
What for (Educational goal)

VIII. THE EDUCATIONAL PROGRAMMES ARE MAILLY TWO TYPES:

Programmes for schools (formal programme-curriculum based)
Programmes for life long education (Informal education)

IX. SCRIPTING FOR EDUCATIONAL RADIO:

The absence of colour, light and picture is indeed a serious limitation of radio broadcasting; despite these handicaps a fruitful radio programme can create a massive impact on all of basic human feeling. Education through radio should be very distinct, direct and define. Complex topic, sentences & words, which creates confusion to the listeners should be try to avoid in all concern. As for example the mathematical or scientific terms may not be suitable or appropriate in radio. Topics on literature, history, religion, poetry, basic health, nutrition, laws etc. would be good for radio programmes. Because listeners creates an imaginary scene in his mind when they listen a radio programme. A fruitful educational programme in radio is a true "Word Vision". Generally the listeners' can memorize only 30% to 40% content of total programme. That's why it is very necessary for every educational radio script may be written in three parts first summary of main topics, Secondly brief discussion and finally summarized the whole topic once again.

XI. IMPLICATION OF BROADCASTING MEDIA IN EDUCATION:

It has mentioned earlier that electronic media based educations are an effective means to educate the public for the developing countries of South Asia. In Bangladesh Education is the fundamental to the development. In Bangladesh absence of adequate teaching institutions and qualified teachers are the major factors for all sorts of education. The government has placed a high priority on it, particularly at primary level. The student teacher ratio is 63 to 1 the worst in Asia. Average student/teacher contact time is 2.5 hours per day, one of the lowest rates of the world. There are lots of problems in the education sectors – among all absence of good teachers are the main reasons. Broadcasting media may come forward on this issue. A good teacher and instructor can teach in classroom in front of a few students but through radio and television it can be reached to the millions of students. Due to high illiteracy rates and low level of schooling among disadvantage groups, in many developing countries continuous to limit their ability to lift themselves out of poverty. So, it is a great advantage for expands education to each and every one.

XII.COMPARATIVE COST-EFFECTIVE ASPECT OF RADIO AND TELEVISION:

The approach of any technology consequently depends on the social-economic condition, life-style and availability of equipments, talent and intellect, power of reception and interaction of people etc. The following figures (2-4) are demonstrating the actual reality:

X. SCRIPTING FOR EDUCATIONAL TELEVISION:

Like educational radio programmes, television programmes have the same formats with some extra benefits to add dances, animation, and computer graphics etc. Television programme is relatively flexible or more complex and critical than radio. Television has lot of scope to describe the topic in various ways due to its visual support that's why it seems to be flexible than radio. A single picture or single frame s is somewhat more powerful than millions of words. On the other hand due to audio-video are incorporating at the same time, so, fraction of fault or misinterpretation will be totally despoiled the programme. On this context an educational television programmes demands lot of care, research and intonation rather than radio programme. The producers should be very care full on the costumes, make-up, get-up, physical attitude and personality of the anchors as well as on scenery, props etc. It requires sufficient and adequate visual support to establish the topic. Nothing is hidden in television programme and viewers have no chance to create any imagination. Like educational radio programme, television script has scope to do the same practice to make more fruitful and effective.

Name of Media	**Approximate unit price**
Two band (FM & MW) Radio receiver	USD$ 04.00 – USD$ 05.00.
36cm Black & White Television receiver	USD$ 50.00 – USD$ 60.00. License fee: USD$ 04.28 for one time only.
Moderate Personal Computer set	USD$ 500.00 – USD$1000.00. Internet charge: USD$ 0.57/hour
Mobile phone	USD$ 50.00 – USD100.00. Call charge : USD$ 0.072/ minute

Figure 2. Proportional cost study of others communicative media with Radio & television.

Source: Bangladeshlive@ yahoo.com
Copyright@ 2007 Website Pros.Inc.

Name of Media	Users ratio (Set /Person)
Radio	130: 1
Television	230: 1
Moderate Personal Computer	6000 : 1
Mobile phone	No reliable report.

Figure 3. Proportional user of others communicative media compare

Name of Media	Facilities / Access
Radio	Nation wide coverage / extremely easy to operate & maintenance.
Television	All most every corner (97.77%) under the network/ easy to operate & maintenance.
Moderate Personal Computer	Mainly divisional & some districts town have the internet service / Fully an intimate medium, complicated, some extend it requires proper training to operate. To get the at least moderate facilities, it requires very good infrastructures----like uninterrupted power supply and telecommunication system as well as availability of technical expertise. *Only 58% of total country is under electrification though it does not fully exist all the time.
Mobile phone	Some privet companies claim they have nation wide coverage.

to radio & television

Figure 4. Comparative facilities & accessibilities of all media.

XIII. SUCCESS OF GOVT BROADCASTING MEDIA IN BANGLADESH:

Though the report of Bangladesh Betar is not satisfactory as a mass educator but Bangladesh television (BTV) is more success on that issue. Examples:

”Mati O Manush” is a pioneer programme, starting from mid 1980s, has created a revolution to the agriculture sector of Bangladesh. Lot of unemployed people finds their way to establish themselves in the agriculture sectors.

“Mina” an educational cartoon show has become the most popular one for ever, started in 1985. All sorts of most essential basic information & education have come out from that show.

Besides these two TV serial *“Shabuj Shathi”*and *“Shabuj Chhaya”* is the best example how Television acts as a Mass Educator.

*Case study one: Impact of the *“Shabuj Shathi”* in Bangladesh

Research by: Population Communication Services (PCS) project of Johns Hopkins University Center for Communication Programs (JHU/CCP).COMMUNICATION Impact! December 1999, Number 7.

It’s a 13 part TV serial on integrated family planning and Family health service. It went on BTV in October 1997. The impact of *Shabuj Shathi* is witness to the power of Entertainment-Education drama when it is designed, written and produced with painstaking care.

Evaluation of drama was carried out by a nationally representative in rural and urban areas. Sample survey of 10,400 men and women from 15 to 49 years of age (OMQ, 1998). Analysis of the impact of the drama was conducted on a sub sample of 4,566 married women ages 16 to 49, weighted by region and urban/rural residence. An index of overall health. knowledge was constructed from a series of questions about safe motherhood, childhood diseases, HIV/AIDS, nutrition and goiters.

The following two graphs (Figure 5-6) are showing the potentiality of this TV serial.

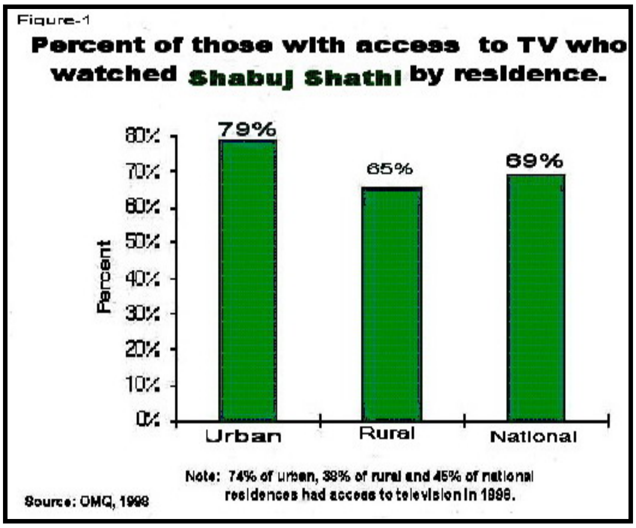

Figure 5. Percentage of those who had access to watch TV in residence.

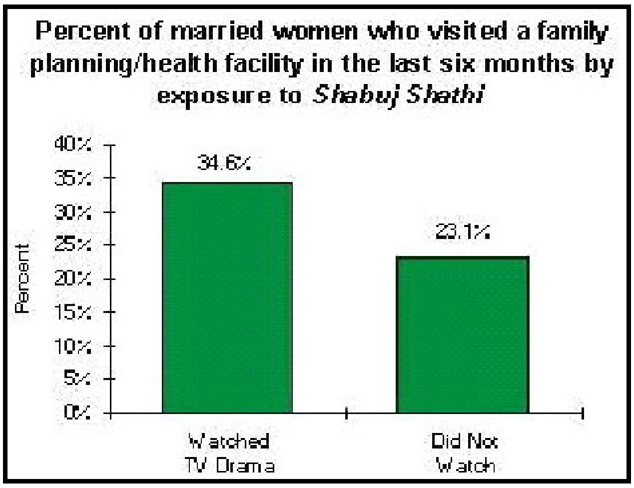

Figure 6. Percentage of married woman who visited health clinics by Exposure of Shabuj Shathi.

***Case study two: Impact of the *“Shabuj Chhaya”* in Bangladesh**

Research by :Mai P. Do, D. Lawrence Kincaid, Center for Communication Programs - Johns Hopkins University

The objectives of this 13 episodes TV serial were to improve knowledge and behaviors related to various health issues among men and women.

The drama was aired nation-wide between January 21 and May 5, 2000. An audience survey was carried out right after the airing of the drama as one of efforts to evaluate impacts of the drama.

Objectives of the evaluation were:

- To measure the acceptability of the drama among audience,
- To measure the extent of changes in health knowledge and behaviors, especially in terms of their relationship with exposure to the drama.

Exposure to the drama was categorized into three levels: No exposure (having watched none of the 13 episodes), Low exposure (having watched 1-5 episodes) and High exposure (having watched 6-13 episodes).

The following figures (7–13) are showing the impact of Shabuj Chaya on mass people.

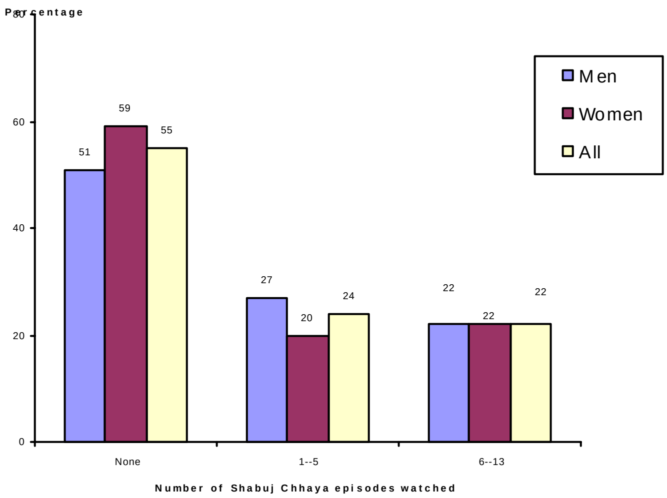

Figure 7. Number of Shabuj Chhaya drama episodes watched by gender, Bangladesh, 2000.

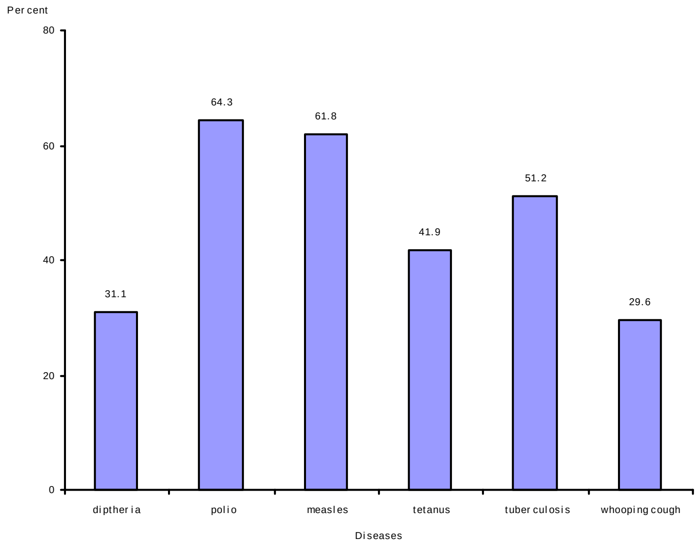

Figure 8. Percent of respondents who could name diseases that are Preventable by child immunization, Bangladesh, 2000

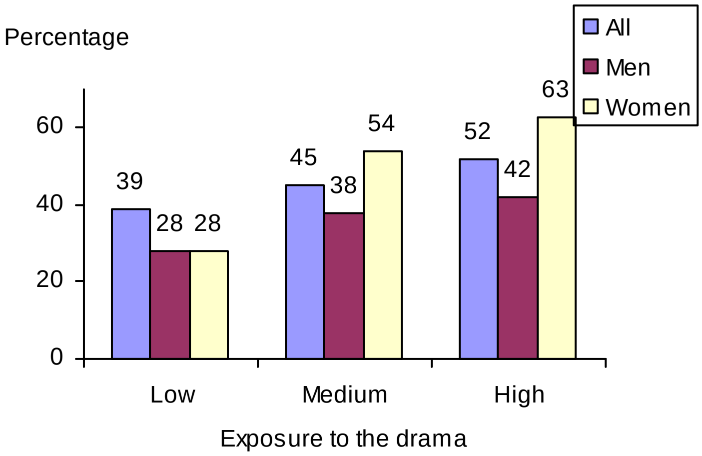

Figure 9. Percentage of people who could name at least a symptom of pneumonia by exposure to the drama and gender, Bangladesh, 2000

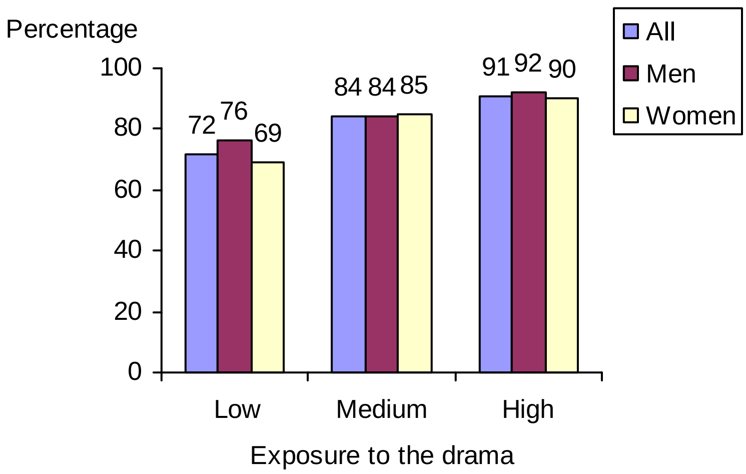

Figure10. Percentage of people who knew that breast milk should be given to a newborn by exposure to the drama and gender, Bangladesh, 2000

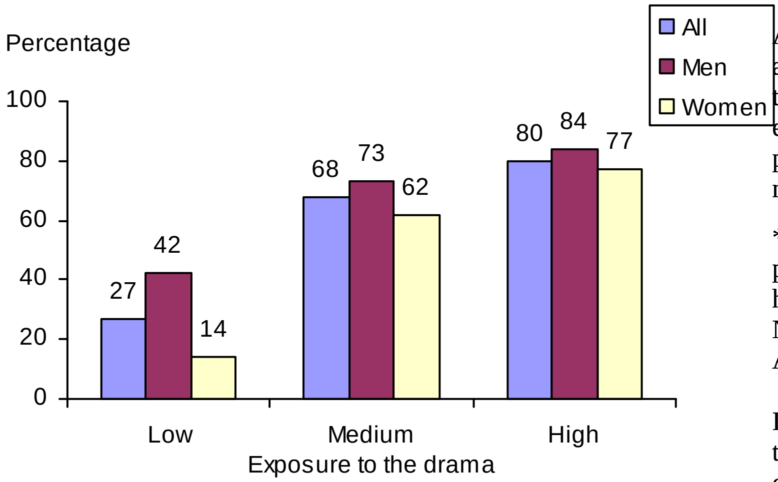

Figure 11. Percentage of people who ever heard of HIV/AIDS by exposure to the drama and gender, Bangladesh, 2000

Figure 12 & 13 are the comparative study of using contraceptives before and after by exposure to Shabuj Chhaya.

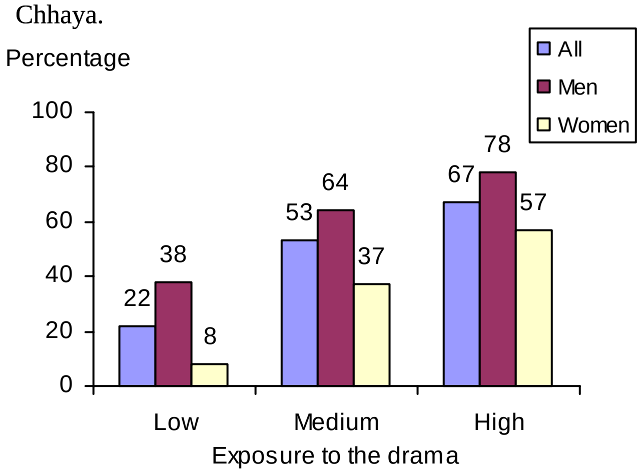

Figure 12. Percentage of currently married people who were using modern Contraceptives by level of health knowledge and gender, Bangladesh, 2000

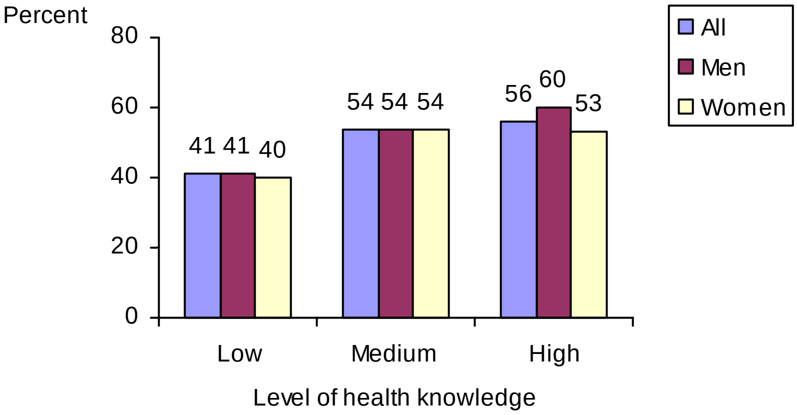

Figure 13: Percentage of people who could name at least 1 disease preventable by condom use by exposure to the drama and gender, Bangladesh, 2000.

These two TV serials on Family planning and Reproductive health education programmes have shown how broadcasting media create a remarkable impact on the people of different category. Due live in a conservative society certainly we fill shy to talk about sex and reproductive health issues. Only Broadcasting media can easily break down these social problems.

In Bangladesh now there are eight satellite privet Bangladeshi TV channels and Four FM privet radio channels. All these channels are fully commercial purpose though they also some time produce some educational programmes but these are not countable at all. If government make a law that every channels should broadcast at least one educational programme every day, it would be more helpful for impart mass education in Bangladesh.

*In Bangladesh the success rate of child immunization programme [EPI–Extensive Programme for Immunization] is higher than any other country of South and South-East Asia. Now Bangladesh is considered to be a "Polio" free country of Asia.

XIV. CONCLUSION

It is not to say that broadcasting media alone can achieve all the educational goals and solve all the problems faced by the conventional systems. Consideration must be given not only to which medium will most effectively convey a message but also how large an audience is likely to be reached. We can only hope government of these regions should be given more emphasis in media education for improving a nation's human resource development towards the goal of education for all.

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An improved block matching criterion for video coding

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Abstract—**Motion compensation plays a vital role in video coding for removal of temporal redundancy. Although block based motion compensation techniques are mostly used but the matching criterion used in such techniques which is based on mean absolute error/mean square error (MAE/MSE) do not give better prediction. In this paper, a new block matching criteria based on fuzzy membership function is being proposed and its comparative analysis with other existing techniques is presented. Through experimental results it has been observed that the proposed method of block matching outperforms the existing criterion of block matching techniques.**

Keywords- Motion Compensation, MSE/MAD, Search Window, Motion Vector, Fuzzy Matching

I. INTRODUCTION

In recent years, video compression has played an important role in multimedia data storage and transmission. Video compression techniques [1-2], removes spatial as well as temporal redundancy using intraframe and interframe coding respectively. Interframe coding can achieve large level of compression, if the motion of various objects present in the video data, can be obtained accurately. Motion of an object may include translation, rotation, zoom etc which can be approximated by piecewise translation of several areas of a frame with respect to a reference frame. This approximation of motion by using pixel translation motion in successive frames for interframe coding is called Motion Compensation (MC).

Most popular motion compensation technique is the Block Matching Algorithm (BMA), where each video frame is divided into fixed or variable size blocks and correlation between the current frame and the reference frame is performed at the block level in a given search window. The direction which gives maximum matching between the two temporally adjacent blocks is called the Motion Vector (MV). Matching of blocks is measured by using either Mean Square Error (MSE) value or Mean Absolute Error (MAE) value between the corresponding blocks and this error is minimum for the best matching blocks. Exhaustive Search method in BMA finds the optimal motion vector. However, the computational complexity is very high as it searches for all $(2p+1)^2$ points for a search window of pxp size. To reduce this computation, a number of algorithms like 2-D Logarithmic Search [3], Three Step Search [4], New Three Step Search [5], Four Step Search [6], Gradient Descent Search [7], Diamond Search [8,9], Hexagon based Search [10], Adaptive Rood Pattern Search [11] have been presented where only selected points in a given search window are processed. In all above block matching techniques, the only matching criterion that has been used between two blocks is the minimum mean square error value or minimum mean absolute error value.

In this paper, a new method based on fuzzy membership function for block matching is being presented which gives tremendous good results than existing method. In section 2, a preliminary background of block matching based motion compensation is being presented along with one block matching algorithm named three step search. Section 3, covers the proposed method and comparative study based on experimental results is being done in Section 4. Finally, Section 5 concludes this paper.

II. FRAME WORL OF BLOCK MATCHING

A video frame may contain various independently moving objects, therefore, it is better to first divide a frame into small sized blocks to study the motion of an individual object more precisely. The basic idea behind the block matching algorithm is to divide a frame into different blocks. As shown in figure 1, for each block in the current frame, a matching block in the reference frame is searched in a given search area. The direction of the block with respect to the current frame's block which has maximum matching in the reference frame, is declared as the motion vector for the corresponding block in the current frame. The matching criterion mostly used in literature is either minimum mean square error (MSE) or minimum mean absolute difference (MAD), which at point (i,j) for an NxN block and search window size of dxd, is defined as follows:

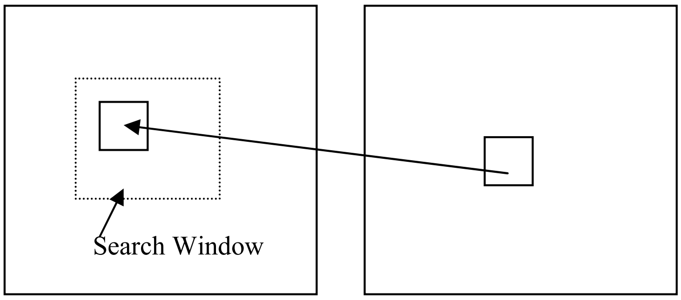
$$MSE\ (i, j) = (1/N^2) \sum_{(x,\, y)} [c(x, y) - r(x+i, y+j)]^2 \qquad (1)$$

$$MAD\ (i, j) = (1/N^2) \sum_{(x,\, y)} |c(x, y) - r(x+i, y+j)| \qquad (2)$$

where $-d \le i, j \le +d$ and c(x, y) and r(x, y) are pixel values at position (x, y) in the current and reference frame respectively.

Motion vector is defined as the value of (i, j) for which MSE(i, j) or MAD(i, j) is minimum i.e. if the reference frame block is shifted in the direction of (-i,-j), a corresponding predicted block will be found in current frame. This location

(i, j) is called the minimum block distortion measurement (BDM) point. Obviously, the prediction error between the predicted and actual block in the current frame should be minimum for good matching.



reference frame current frame

Fig. 1. Block Based Motion Compensation

For simplicity, the block matching algorithm that has been used for comparative study is Three Step Search (TSS). A brief description of this algorithm is being given.

Koga, Iinuma and Hirano in [4], proposed an algorithm, which is simple to implement. Instead of using exhaustive search of all search points which is quite time consuming process, some selected points are searched.

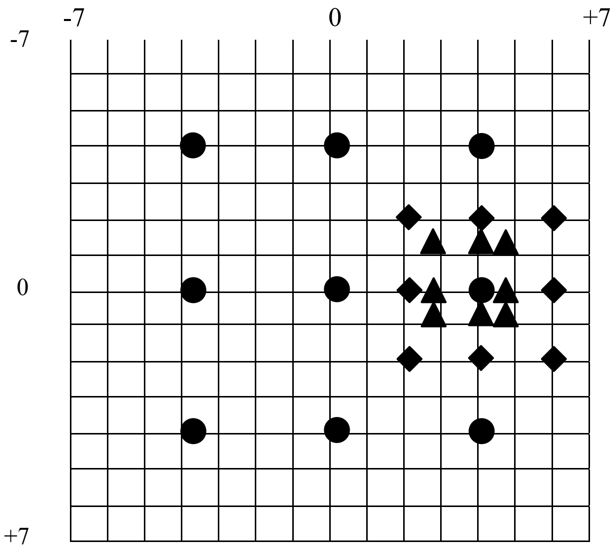


Fig. 2. Three Step Search

General algorithms for ±p search window size is described below –

Step 1: stepsize = $2^{\log 2(p+1)-1}$

Step2: Select the central point and its 8 neighbors at stepsize distant from it along horizontal and vertical directions. Analyze them and select the point which has minimum BDM. If this point is the central point, go to step 4, else go to step 3.

Step 3: stepsize = stepsize/2. Treat minimum BDM point in previous step as the new center point and process it along with its 8 neighbors at stepsize distant from it along horizontal and vertical directions. If the new BDM point is the center point, go to step 4 else repeat step 3.

Step 4: Analyze the 8 immediate neighbors along with the center point. The location of the minimum BDM point gives the direction of motion vector.

Figure 2 shows the three step search procedure. A search window of size ± 7 has been taken. Circle shaped points are processed in step 2 of the algorithm. Diamond shaped points are processed in step 3 and finally triangular shaped points are processed in step 4.

III. BLOCK MATCHING BASED ON FUZZY MATCHING FUNCTION

Let R and C are two blocks of equal size (say nxn) in the reference frame and current frame respectively. Further, let R = $[R_1, R_2, \ldots\ldots R_L]$ and C = $[C_1, C_2, \ldots\ldots C_L]$ be the pixel values in block R and C respectively where $L = n^2$ be the total number of pixels in each block. The matching function M(C), $0 \leq M(C) \leq 1$, is used to define the degree of similarity between block C and any block R of the reference frame. Since the image block may have different range of pixel values along each dimension, the pixel intensity value is re-scaled to [0, 1] to compute the matching value for each dimension consistently. If intensity value R_k in block R is re-scaled to $S(R_k)$, then

$$S(R_k) = \frac{R_k - R_{low}}{R_{up} - R_{low}} \qquad (3)$$

Where R_{low} and R_{up} are the lower and upper bounds of all R_k's. The matching function M(C) is now defined as -

$$M(C) = (1/L) \sum_{k=1}^{L} f\left(|S(R_k) - S(C_k)|, \alpha\right) \qquad (4)$$

where

$$f(d, \alpha) = \begin{cases} 1 - d\alpha, & \text{if } d\alpha \leq 1 \\ 0, & \text{otherwise} \end{cases} \qquad (5)$$

The function $f(|S(R_k) - S(C_k)|, \alpha)$ measures the degree of matching between $S(R_k)$ and $S(C_k)$, and the positive parameter α controls how fast the matching function value decreases as the error $|S(R_k) - S(C_k)|$ increases.

Finally, the location of the center of any such block R in the reference frame in a given search window for which the value of M(C) is maximum, gives motion vector.

IV. EXPERIMENTAL RESULTS

A number of video sequences having various degree of motion have been analyzed. Implementation has been done using MATLAB 7.0 in Window – XP platform. For simplicity, Three Step Search (TSS) procedure has been used as motion compensation technique. The value of parameter α has been chosen as 2.0 though other values also give the same result. The algorithm has been found better in terms of various parameters for smooth as well as noisy data.

Table 1 : Performance comparision between proposed fuzzy matching based criterion with MAD based criterion in terms of average MAD/pixel and PSNR value when frame distance = 1.

Video Sequence	Average MAD/pixel		PSNR	
	MAD based Matching	Fuzzy Based Matching	MAD based Matching	Fuzzy Based Matching
Airbus	10.17	6.20	31.00	32.38
Cactus Comb	14.31	12.25	29.31	30.09
Flower	17.90	16.04	29.07	29.65
Carphone	12.78	11.43	29.61	30.23
Miss America	4.85	4.75	33.89	34.16
Multibar	5.41	5.49	32.38	32.14
Susie	4.88	3.03	32.50	34.48

Table 2: Performance comparison between proposed fuzzy matching based criterion with MAD based criterion in terms of average MAD/pixel and PSNR value when frame distance = 2.

Video Sequence	Average MAD/pixel		PSNR	
	MAD based Matching	Fuzzy Based Matching	MAD based Matching	Fuzzy Based Matching
Airbus	8.13	7.25	31.70	31.87
Cactus Comb	16.86	15.38	28.88	29.58
Flower	25.91	22.86	28.14	28.73
Carphone	15.78	12.55	29.07	30.01
Miss America	6.49	5.19	32.65	33.62
Multibar	5.81	5.66	32.00	31.80
Susie	6.67	3.79	30.87	33.20

Table 1 and Table 2, give a comparison of proposed fuzzy block matching based criterion with the existing mean absolute difference (MAD) based block matching criterion in terms of average mean absolute difference per pixel and PSNR value for various video sequences. The search window size used is ± 7 and the distance between the reference frame and the current frame is 1 and 2 respectively. It can be seen that the performance of the proposed algorithm almost outperforms the existing method for both the criterion. Average mean absolute difference is smaller in our approach and PSNR value is more in comparison to the existing technique.

Table 3, gives a comparative study of two criterion in terms of average number of search points per block for frame distance 1 as well as frame distance 2. Except video sequences like Miss America, the average number of search points are lower in the proposed algorithm for frame distance 1 as well 2.

Table 3: Performance comparison between proposed fuzzy matching based criterion with MAD based criterion in terms of average search points for frame difference 1 and 2.

Video Sequence	average search points/block, when frame distance = 1		average search points/block, when frame distance = 2	
	MAD based Matching	Fuzzy Based Matching	MAD based Matching	Fuzzy Based Matching
Airbus	23.89	23.26	23.51	23.32
Cactus Comb	23.78	23.64	23.82	23.61
Flower	23.86	23.66	23.98	23.68
Carphone	21.99	21.13	22.11	21.20
Miss America	22.19	22.48	22.32	22.51
Multibar	24.33	24.33	24.33	24.33
Susie	23.40	23.47	23.51	23.45

Further, average square error/pixel is plotted with respect to frame number for carphone video sequence in figure 3. The dotted curve represents the existing MAD based criterion while solid curve represents the proposed method. It is clear that our method is better than the existing one for almost all frames.

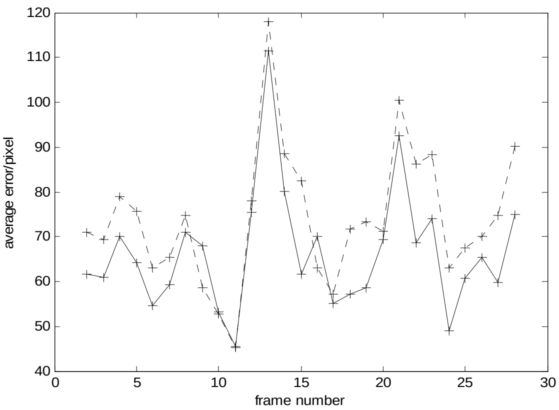


Fig. 3. Performance comparisons in terms of average square error per pixel vs frame number.

(a)

(b)

(c)

Fig 4: Frames of Susie video (a) original frame (b) predicted frame using MAD based matching (c) predicted frame using fuzzy based matching

(a)

(b)

(c)

Fig 5: Frames of Flower video (a) original frame (b) predicted frame using MAD based matching (c) predicted frame using fuzzy based matching

Figure 4 and figure 5, show three frames of susie and flower video sequence – original frame, predicted frame using MAD criterion and predicted frame using fuzzy method. Frame predicted by fuzzy matching is much better than the frame predicted by existing technique.

V. CONCLUSION

A new block matching criterion for motion compensation has been proposed and experimentally examined to prove its effectiveness over other method. Three performance comparison criterions – average MAD/pixel, PSNR value and average number of search points/block have been used for to compare the existing method with the proposed one. The results of the fuzzy matching method are more favorable. The only weakness of the proposed method is computation time which is being optimized. Further, the algorithm not only gives better results for smooth video data but also results have been found favorable for noisy and blurred inputs.

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Multimodal Information System for Learning Experience Recording

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***Abstract*—This paper describes a new method of collecting and processing data about users' learning experience in large networks like the internet. An automated measurement method is used to identify and index learners' Browsing-Discovering-Learning (BDL) behavior while interacting with various e-learning materials (e.g. e-courses, edutainment games, etc.). The proposed method is based on algorithm developed by the Distance Education Study Centre at Riga Technical University that calculates browsing, discovering and learning probability distribution curves obtained by collecting and evaluating the multimodal human-computer interaction data. While being near real-time, this measurement is considered highly unobtrusive and cost-effective because of its highly automated approach.**

Keywords: Evaluation and outcomes assessment, computer aided learning

I. Introduction

As information retrieval systems become more and more effective with regard to precision and recall, users have increasingly better access to high quality electronic learning materials. Learning experience assessment presently occurs mainly relying on experts' evaluation (rules of thumb, educated guesses, intuitive judgments, common sense). There are various techniques that attempt to recognize more relevant knowledge. Typically, knowledge is ranked according to variations of a standard education model (test results, grades, certificates, diplomas, university degrees). These variations could include (a) how recently the knowledge was obtained, and/or (b) how close the skills are to the expected level. Although this strategy provides assessment results that are acceptable in scope of a traditional education, the results have relatively low applicability in non-linear e-learning environments [1]. These knowledge evaluation techniques are most effective in cases where the learning path is homogeneous and already classified into subjects or in cases where the learner is studying in a well known and specific university program. In other cases, however, these techniques are often not effective because each deviation introduced by the user increases the chances that the desired knowledge will be inadvertently eliminated from the assessment results.

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II. E-Learning experience retrieval

The idea of automated retrieving of learning experience by recording user's electronic "gestures" [2] is a simple method for determining the relevance of the particular learning material for the particular user by measuring the learning component of a BDL distribution [3].

In the case of learning environments whose organization is of relatively uniform structure (traditional high schools, universities, etc.) and learning materials are hand picked and verified by experts (Ministries of Education, professors, etc.) it is valid to assume that a proposed learning material should be of greater interest than one that is not being suggested. Many electronic databases (e.g. the World Wide Web), however, have extreme variations in the quality and importance of learning materials. In these cases, ranking with regard to learning experience should be introduced to separate a learning material that is used once in an obscure learning context as to a similar learning material that is used once by a well-known and highly respected expert.

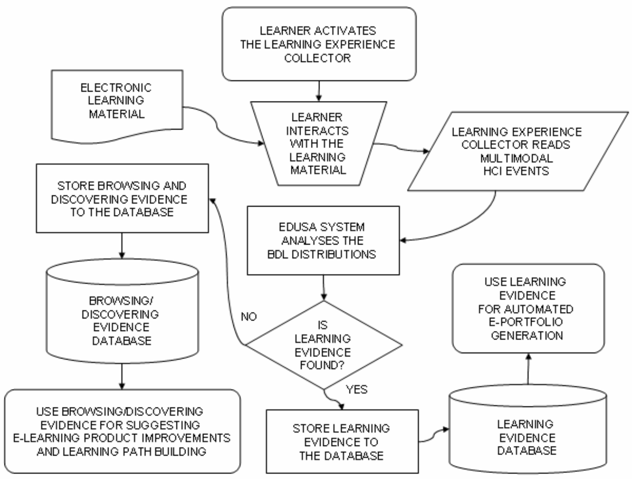

Figure 1. The learning experience retrieval cycle

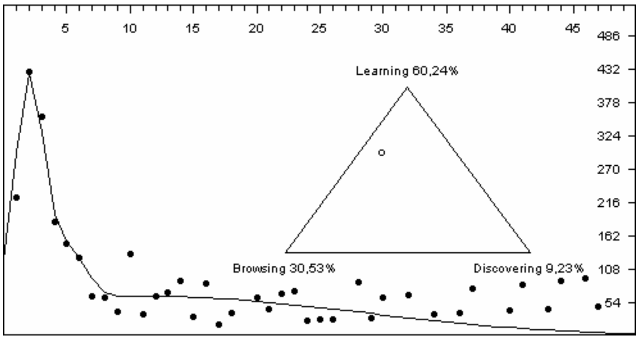

Figure 2. An example of a BDL-diagram (x, time in sec.; y, HCI events)

III. BDL METHOD

2005 Distance Education Study Centre at Riga Technical University started a research project based on earlier defined concepts of E-Gestures and Good Content Indicators [2, 3] and developed a first working prototype (called EDUSA 1.0) with the functionality of automated measurement of learner's satisfaction. 2006 the research area was extended by adding EDUSA tests for m-learning within the scope of 'PUMPURS' project (VPD1/ERAF/CFLA/05/APK/2.5.1./000078/038).

BDL-algorithm was developed by the Distance Education Study Centre at Riga Technical University to measure learner's multimodal participation events (keyboard, mouse behavior, etc.) frequency during the given learning session.

The collected data is analyzed using the smallest-squares-method with the purpose to find the first three normal distribution curves (Browsing, Discovering and Learning curves) that best fit to describe the data. After this, area below each of the curves is calculated and normalized as a relation to the range 0..100.

The resulting output is represented as a location on a ternary diagram with all the three components: Browsing, Discovering and Learning on its axis (Fig. 2).

A. Experiments and Datasets

Some preliminary work involving the technique described above can be found in [3] in which a series of experiments were described which used a game-based and a student-teacher learning paradigms.

During the testing session EDUSA writes every task-related action to a XML log file. This way it can handle both continued and discontinued learning sessions while analyzing the recorded data subsequently. EDUSA has the ability to reconstruct discontinued learning tasks and analyze them by putting in different evaluation situations (task scopes, e-gesture sets, etc.). EDUSA analysis interprets learner-computer interactions provided by the interface. This allows evaluation of both linear and non-linear learning sessions.

The datasets used in this paper are part of the EDUSA data collection "Tests1".

The first dataset is based on "Jaunpils Innovation Management Course / Marketplace Game" with 5 PCs and 20 participants. 255 log files with 253 MB of XML data were generated.

The second dataset is based on "Liepaja IT Course / SQL Fundamentals" with 19 PCs and 20 participants. 242 log files with 101 MB of XML data were generated (Tab. 1).

TABLE I. EDUSA PILOTING SESSIONS, DATA COLLECTION "TESTS1"

#	Session name	Duration (days)	Participants	Objective
1	Jaunpils-Session	5	20	Game winning
2	Liepaja-Session	1	20	Knowledge acquisition
3	Dikli-Session	5	20	Game winning

These results can be extended by applying the model of BDL Trajectories to visualize and investigate the significance of BDL method as a tool for assessment of interactive e-learning materials and using EDUSA as a way of interpreting the applicability and contribution of BDL approach in learning environments.

B. BDL Trajectories

Each testing subject (i.e. the electronic learning material) produces a specific configuration of BDL measurement points within the ternary coordinates' space. According to the model, these points are situated within a trajectory representing a learner's path from Browsing through Discovering and ending at Learning ternary space segment. Figure 3 shows the Browsing, Discovering and Learning segments of the BDL diagram. Figure 4 shows the examples of how the BDL Trajectories can be distributed within the ternary coordinates' space.

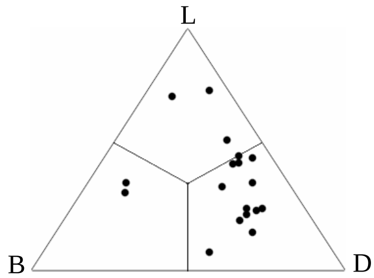

Figure 3. Group data distributed through the BDL segments

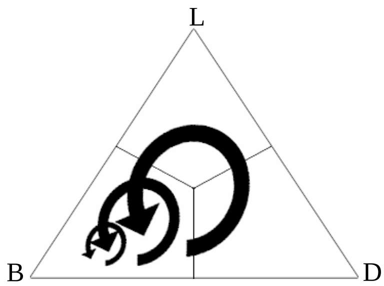

Figure 4. Examples of possible BDL trajectory dynamics

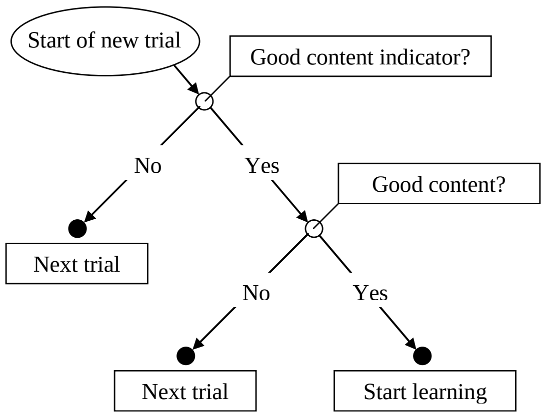

Figure 5. Good Content Indicators decision tree

C. *The Role of Good Content Indicators*

A Good Content Indicator (GCI) is any signal leading to forward movement within a specific learning path [2]. Figure 5 shows the decision tree for a learner. At the starting point of a new BDL cycle, learner is looking for GCIs (Browsing). After encountering a GCI, learner examines if the GCI leads to a content that can be used as a next step on her current learning path (Discovering). If so, then the learning phase can begin at this point.

IV. TARGET GROUP SATISFACTION ASSESSMENT

A. *Non-automated satisfaction measurement*

Johnson et al. indicate that studies of learner satisfaction are typically limited to one-dimensional post-training perceptions of learners. Learner's satisfaction is too often measured with "happy sheets" that ask learners to rate how satisfied they were with their overall learning experience [4].

Harrison, Seeman et al. [5] identified four major components of effectiveness in distance education programs: instruction, management, telecommuting, and support. Within each of these broad categories are two to five sub-components.

Jegede et al. described another example of a validated approach to assessing a deeper degree of satisfaction identifying eight components of effective learning environments: interactivity, institutional support, task orientation, teacher support, negotiation, flexibility, technological support, and ergonomics. By building on these valid and reliable measures of effective learning environments, a more significant assessment of learner satisfaction and outcomes can be obtained [6].

B. *Automated satisfaction measurement*

According to the literature there have been very few attempts or in very strictly defined environments (e.g. MS Word) started until now to develop methods of truly automated system-wide evaluation of learner's satisfaction. In order to perform a satisfaction measurement of today's technology-savvy non-linear [1] learner, a holistic automated measurement approach is required.

C. *Discovering/Learning Behaviour Assessment*

Results available after the automated data analysis included: (1) a reference user activity index, (2) a per-cent deviation between user data and calculated curve, (3) a per-cent relation between Browsing, Discovering and Learning (BDL) integral values, (4) time points of BDL curve maximum occurrences and (5) width values for the BDL curves.

V. SUMMARY OF THE SYSTEM ARCHITECTURE

The Learning Experience recording system consists of the Client and Server software components:

A. *Client component*

Users who whish to benefit from the automated Learning Experience collection outcomes, e.g. a better position within education and/or employment market, can install client software on their personal computers that have to be connected to the internet.

Client component when explicitly activated by the user collects the BDL data, does the initial processing and then sends information to the server.

B. *Server component*

Sever component performs the final processing of the user's BDL information and stores it to the database from where it can be retrieved to build electronic portfolios or for particular e-learning product evaluation purposes.

VI. CONCLUSIONS

In practice, there are millions of units of electronic learning materials in large electronic databases and it is not possible to evaluate them by experts' inspection. The method of collecting and processing data about users' learning experience in large networks like the internet as described in this paper represents a very efficient way of how to obtain near real-time data about the current state of the knowledge of users of such networks.

Furthermore the proposed method can be used to a) contribute to automatic ePortfolio generation by integration of BDL data into the traditional learning experience evaluation scenarios, b) suggest various e-Learning product improvements based on the results produced by the automated assessment method and c) build a set of possible learning paths based on previously recorded learning experience.

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Mobilizing Existing Resources in an e-Learning System to Enhance English Proficiency

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Abstract— ***English language proficiency among Malaysian students has been deteriorating over the years and basic oral skills have been appalling due to lack of usage and reflective practice. Interactive English lessons, multimedia applications, a pool of retired English language teachers and free audio and video conferencing tools are some of the available resources. The aim of this paper is to show that mobilizing existing resources within an e-learning system could boost the overall communication skills of students.***

Keywords-e-learning;interactive,;multimedia elements; audio and video conferencing tools

I. Introduction

There is growing concern about the rapid decline in the standard of English in Malaysian schools which if left unchecked would lead to the country losing its competitiveness especially in the industry and technical fields [1]. Despite e-learning being around for many years, it is not widely used in the public sector in Malaysia, in particular the Ministry of Education. There is an outcry by the private sector that students graduating from schools, colleges and universities cannot fit into the job market because of poor English communication skills. Based on a 2005 report in Malaysia Today entitled "Malaysia has 60,000 Graduates Unemployed", the Economic Planning Unit of the Prime Minister's Department had conducted a survey and found that around 60,000 Malaysian graduates are unemployed due to lack of certain skills such as communication skills, poor command of English and lack of work experience [2].

The Malaysian Government on its part in assisting students to improve communication skills as well as in acquiring subject content competencies has invested and continuing to invest millions of Ringgit (RM) in equipping teachers with laptop computers and extending broadband services to schools and colleges in the hope that the future productivity of Malaysia's workforce would increase and contribute to the nation's prosperity. During the Eight Malaysia Plan period (2001-2005), a total of RM7.9 billion was allocated for ICT related programmes and projects that included 'smart schools' and computer infrastructure for rural schools [3]. During the Ninth Malaysian Plan (2006-2010), the development expenditure and allocation for ICT-related programmes increased to 12.9 billion (US 42.9 billion). It is hoped that adequate and reliable ICT infrastructure with extensive capacity to support access and delivery of information will remain a major factor in the support of a knowledge-based economy [4]. In relation to arresting the declining English communication skills, nothing dramatic happened. In a recent article in the Sunday STAR Forum dated 25 March 2007 what Professor Datin Dr Zubaida, chairperson of the Malaysian University Entrance Test (MUET) Syllabus Revision Committee had said is cause for further concern. "Over the years, the number of students sitting for Malaysian University English Test (MUET) has grown as the language aptitude test gained recognition. However, the results have been consistently poor"[5].

II. THEORETICAL FRAMEWORK

Commercial e-learning tools and learning management systems that give guidance and practice are expensive to purchase. Furthermore their content is foreign and not in line with local curriculum specifications. Thus, there is a dire need to create a virtual e-learning tool that has interactive English lessons which could provide the much needed practice for pupils. The authors have created and proposed the extensive use of the 'Virtual English Language Tool' (VELT).

The interactive lessons embedded in VELT are guided by the theoretical framework as outlined and depicted by the Technological Pedagogical Content Knowledge (TPCK) model in Figure 1 [6]. The TPCK model of technology integration in teaching and learning argues that developing good content requires a thoughtful interweaving of all three key sources of knowledge — technology, pedagogy and content. Hence, the concept of when, when not and how to integrate technology in teaching and learning English had been taken into consideration when designing the lessons so that learning would be more meaningful to students. Much thought had been put when incorporating multimedia elements in the VELT lessons as they not only motivate student learning but promote creativity. Besides the interactive and information and communication technology (ICT) integrated lessons various resources must be mobilized so that VELT could act as a

powerful anytime-anywhere e-learning tool to put a stop to the rut in the deteriorating standard of English.

III. VELT

VELT is an e-learning tool where students and adults in Malaysia could use at their leisure to improve their English language. The primary aim of this tool is to help the students to improve their listening and speaking skills. Basically, the tool is somewhat like a simple learning management system where students do a set of interactive ICT integrated lessons. A notable feature is that learners are able to book a time-slot for a one-to-one tutorial with a tutor of their choice. The student and the tutor would then engage in an audio and video conferencing tutorial using the free instant messaging service at a prearranged time. The flowchart in Figure 2 depicts the various stages in utilizing the resources in VELT.

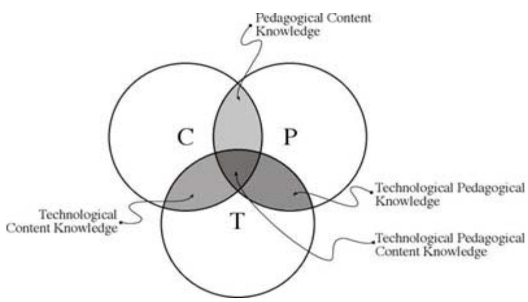

FIGURE 1. TPCK MODEL OF ICT INTEGRATION

IV. MOBILIZING AND UTILIZING RESOURCES WITHIN VELT

A. *Interactive lessons*

Interactive lessons form the main component of this e-learning tool. A high degree of interactivity is incorporated into the English lessons embedded in the proposed tool. The interactive lessons engage users in a kind of quest with a meaningful goal in an authentic true to life settings. Lessons are grouped according to classes i.e. from Year 1 to Year 11. Each class has a collection of more than ten lessons and the lessons have more emphasis on developing listening and speaking skills. ICT tools are meaningfully integrated in these lessons and the exercises embedded in these exercises are interactive. Students need to complete all the lessons in a class before moving up to the next level or class. The English lessons are presented using PowerPoint slides. Sound, images, video clips and other multimedia elements used in the slides help to elicit interest in the lessons and provide powerful motivation for pupils to learn English. Multimedia and hypermedia software can provide interesting learning environment and can simulate authentic tasks for students. Research in the neural sciences supports the view that multimedia exercises can be designed to take advantage of how neural processes work together in the learning process [7].

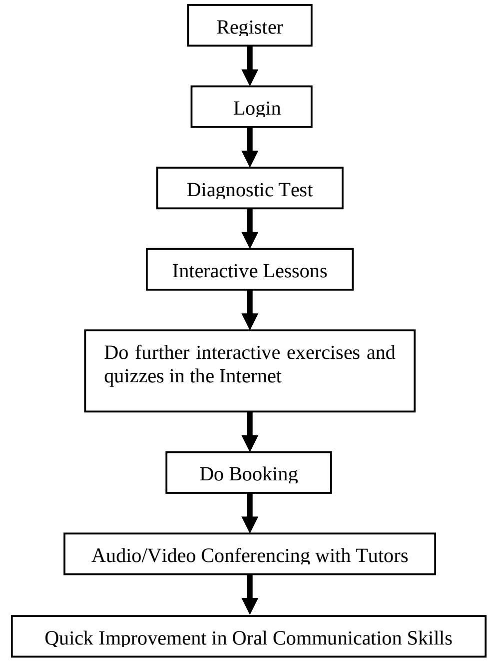

Figure 2. Flow chart of VELT

B. *The World Wide Web*

Web-based learning using the Internet is gaining popularity among primary and secondary school students. Apart from disseminating information or knowledge, the web is an excellent medium for teacher-student and student-student interaction and communication. The World Wide Web comprises hyper-linked documents that include text, sound, animation, video and live video streaming that provides a resource-rich multi-media environment which can exert a powerful motivation for students to learn. Multimedia is firmly set in the twenty-first century and its use is increasing exponentially to the extent that many children are learning much of what interest them from the web rather than from school [8]. There are tens of interesting and interactive lessons in the web which are just waiting to be used by the interested learner. A striking feature of this tool is the hyperlink to the interactive exercises in the World Wide Web. The learner is often ignorant of the existence of the many free lessons and quizzes in the internet. VELT helps to bridge this gap by providing the free website addresses that give practice in listening and speaking activities. The World Wide Web is therefore a virtual library at one's fingertips; it is a readily available world of information for the language learner [9]. There are hundreds of websites that have been created to assist in the teaching and learning of English. There are many self-exercises in the internet. For example, 'English Exercises Online' at http://www.smic.be/smic5022/ has over 100 free exercises. They cover vocabulary, grammar and reading comprehension. For an interactive lesson with a real teacher one can visit http://eslgo.com/. At this site a student can learn

English as a second language (ESL) with an ESL teacher. A user can click on the "free online ESL class" and the user will soon view two separate lists of "classes". A learner can take the classes according to level (beginner, intermediate or advanced) or according to content such as business, technology and travel.

C. E-Mail

The use of electronic mail (e-mail) is a specific feature of the Internet. The use of e-mail now plays an ever increasing role in fostering communication between pupils and between teacher and pupils. The benefits of using e-mail are abundant in English Language teaching and learning. By using e-mail and sharing files, students have the chance to collaborate and work together with other classmates, peers, and teachers. Networking electronically can help learners create, analyze, and produce information and ideas more easily and efficiently. Students should be encouraged to use the e-mail to make social contact with pen friends from other countries, especially with native speakers of English. E-mail conversations are social activities and social activities tend to engage students' interests [10].

D. Audio and Video Conferencing Tools

The Book Tutorial Time module is a significant part of VELT. It enables the student to book a particular time-slot for a tutorial session with the tutor. Besides choosing the teacher, the student would not only be able to pick one of the assigned time-slot for the audio/video conversation but would be able to list down the type of assistance that is needed. Assistance could be in the form of dialogue between the learner and the teacher, reading a text, pointing out pronunciation difficulties, listening comprehension exercise and the appropriate use of tenses in daily conversation. The audio conversation would therefore be able to provide adequate practice in the use of the language and thereby develop the listening and speaking skills of the user. Audio and video conversations greatly motivate and improve students' speaking and listening abilities. In addition to these, the online tutor would provide relevant website addresses that would provide further practice in English Language.

E. Online Tutors

The number of teachers in Malaysia has increased by leaps and bounds to keep up with the burgeoning population. The population of Malaysia now stands at 27.17 million with more than 400,000 teachers [11]. Teachers who were trained to teach English after 1971 were in a position where their usage and proficiency were below par based on the fact that the Rahman Talib Report (1960) made Bahasa Melayu as the main medium of instruction in national school and it became a compulsory subject. Students need to obtain a credit in Bahasa Melayu before they can be awarded the School Certificate. Students therefore took great pains to master Bahasa Melayu and became fluent in Bahasa Melayu but one can see deterioration in their command of English language. Students who had gone through the national curriculum with Bahasa Melayu as the main medium of instruction found themselves disadvantaged when they became English option teachers. The point is English language teachers prior to the implementation of The Rahman Talib Report were well versed with English language compared with teachers now. There is now a pool of retired English language teachers numbering more than 3,000 who are still healthy and can contribute to uplifting the proficiency level of the students in the country. These eligible retired teachers could be mobilized to become online tutors within the VELT system and thereby contribute to the productivity of the country. In a recent article in 'The Star', a popular daily, Datuk Clement said that there are now 1.3 million Government workers and thousands retire each year. He further added that the retirees can become a productive asset to the country [12].

V. IMPLEMENTATION OF VELT

VELT being a web-based e-learning tool had been uploaded in the school server of two primary schools in Malaysia and all the pupils in the school's computer rooms had access to the prototype tool via the local intranet. The first school is located in Kuala Langat District, Selangor and it is referred to as School X. The study in this school was done in 2005. The second school where the research study was conducted is located in Ampang District. This school will be referred to as School Y and the study was undertaken in early 2007.This means all primary school students in School X and School Y can make use of this tool. Interactive English lessons from Year 1 to Year 6 are available in this virtual e-learning tool. The school laboratory has broadband internet access called the SchoolNet and this enables the pupils to other hyperlinked activities via the lessons in VELT. The infrastructure facilities in these two schools are good and the 25 computers in the laboratory are equipped each with a headset that includes a microphone. Pupils can carry out audio conferencing sessions with their friends.

A. Use of VELT in a Year 5 Class in School X

Two classes were chosen in this study. Class A and Class B. In Class B, normal teaching was carried and there were not many ICT integrated activities carried out. Pupils in this class rarely used the computer laboratory to carry out their English lessons and pupils in this class did not use VELT. Class A is a controlled group and the use of VELT had been carefully demonstrated to the 39 pupils in Class A in School X which is located in Kuala Langat District, Selangor. School A is located in town and most of the pupils in Class A come from suburban areas. All Class A pupils were given each a CD-ROM containing the VELT lessons. In this way pupils were able to go through the interactive lessons even though they did not have broadband access. Pupils first fill in the registration form and upon completion they are able to gain entry into the system. The Class A pupils went through the ICT integrated lesson during the class time as well as at home. Besides the integrative English lessons, some of the pupils used e-mail to send their compositions as well as talk to their online tutor using Yahoo Messenger. Pupils used VELT for a period of nine months (i.e. February 2005 to October 2005). A pre and post test on the use of VELT showed some remarkable results.

A comparison of the pre and post test results as depicted in Table 1A revealed that there had been some marked improvement in the performance of the pupils in Class A. In fact in the Final Examination, pupils scoring A for English had increased from 5 to 8. There was a notable difference in the B

category. Pupils scoring B increased from 30.8% to 51.3% and this implied that some pupils who had previously scored C had improved their English proficiency by one grade. Pupils scoring C on the other hand dropped from 17 to 11 pupils and this time there were no failures in English. One can infer therefore that the performance of pupils have in fact improved after having used VELT for a period of 9 months. In Class B however the performance of the pupils did not show any notable difference. Improvement in the attainment level in English language was minimal and this is depicted in Table 1B.

TABLE 1A. YEAR 5 ENGLISH TEST MARKS OF CLASS A

Month	A	B	C	D	Total
February 2005	5	12	17	5	39
October 2005	8	20	11	-	39

TABLE 1B. YEAR 5 ENGLISH LANGUAGE TEST MARKS OF CLASS B

Months	A	B	C	D	Total
February 2005	4	10	20	8	42
October 2005	5	11	19	7	42

B. Use of VELT in a Computer Club Class in School Y

Two groups of students were chosen in this study and each group consists of 20 pupils of the Computer Club in School Y. Group A members belonged to the controlled group and the use of VELT had been carefully demonstrated to the 20 pupils. Group B members on the other hand were not given the interactive lessons and they did normal computer club activities. Group A members used VELT for a period of nine months (i.e. February 2007 to October 2007). A comparison of pre and post test on the use of VELT showed some outstanding results. In fact in the Final Examination as depicted in Table 2A, pupils scoring A for English had increased from 2 to 9. There was another notable feature in the D and E category i.e. no body failed and all passed in the October exam. One can again infer therefore that the performance of pupils have in fact improved after having used VELT for a period of 9 months. In Group B, however the performance of the pupils did not show any notable difference. Improvement in the attainment level in English language was minimal and this is depicted in Table 2B.

TABLE 2A. ENGLISH LANGUAGE TEST MARKS FOR GROUP A

Months	A	B	C	D	E	Total
February 2007	2	6	5	6	1	20
October 2007	9	4	7			20

TABLE 2B. ENGLISH LANGUAGE TEST MARKS FOR GROUP B

Months	A	B	C	D	E	Total
February 2007	3	4	6	5	2	20
October 2007	2	6	5	5	2	20

VI CONCLUSION

The successful implementation of VELT in Malaysia in relation to uplifting the English proficiency and communication skills of students and adults, need the concerted effort of all the stakeholders. These include the full cooperation and support from the Government on the use of VELT in school and beyond the classroom, the appropriate use of interactive websites, daily use of e-mail, the frequent use of audio and video conferencing and most importantly, the utilization of the retired pool of English language teachers. These measures can give a shot in the arm in arresting the deteriorating standard of English language in our country. The projected contribution of the retired English language teachers who are still healthy cannot be overemphasized. The researchers passionately believe that a move in this direction would surely result in improved proficiency in the near future and Malaysia would be in a strong position to make vision 2020 a reality.

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Out of sight, but not out of mind

Harnessing the power of RFID technology through logistic operations

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***Abstract*—Since the early adopters of RFID technology by the Department oi Defence, Walmart and Proctor & Gamble, the usable standards for technology was evolving through EPC Global and Massachusetts Institute of Technology lab. It was pursued as an opportunity cost. The spin-off from early investment encouraged the business community worldwide about its feasibility and superiority over the popular bar code system.. Consequent to the logistical mess during Operation Desert Storm in Iraq, a strong need was felt for coordinating the combined movement of arms, ammunitions, food and other supplies which became very critical due to lack of asset visibility. To overcome this situation, RFID became a preferred choice of managing huge inventory of all kinds. This paper will present the challenges of adopting the RFID technology and how it is added to the velocity of logistics operation under all circumstances. Jonathan Schwartz, President and COO, Sun Microsystems, Inc. states, " *The Information Age is over. We're entering an era where network connectivity is almost ubiquitous - it's participate or perish.*"**

Keywords- technology transfer, real world awareness, mobile workforce, TWIMP© (Transportation, Warehosuing & Inventory Control, IT, Materials Handling, Packaging, Marking & Labellin), Logistics and Supply Chain Management

INTRODUCTION

WHAT IS RFID ?

Radio Frequency Identification (RFID) is rapidly changing the way businesses track inventory and assets. From Wal-Mart and Tesco to the U.S. Department of Defense, early efforts are already showing benefits, but software, integration, and data processing for RFID still present a challenge.

Radio frequency identification (RFID) is one of the most promising and anticipated technologies in recent years. Magazine articles, television shows, analyst papers and the like are frequently trumpeting the potential benefits to users of RFID. This research paper will help you to understand what RFID is, how it works, describe the current standard and compliance environment and some considerations to make sure that you have a successful implementation and get the most from your investment. The stakes for RFID implementations are high – for both expenditures and benefits. Arming yourself with a good understanding of the technology and important considerations can ensure that the decisions that you make minimize any missteps and maximize your experience. (Intermec / Translogistique Canada Seminar 2006)

Manufacturers, retailers, logistics providers and government agencies are making unprecedented use of RFID technology to track, secure and manage items from the time they are raw materials through the entire life of the product. Manufacturers can especially benefit from RFID because the technology can make internal processes more efficient and improve supply chain responsiveness—for example, early RFID adopters in the consumer goods industry reduced supply chain costs between 3 and 5 percent and grew revenue between 2 and 7 percent because of the added visibility RFID provided, according to a study by AMR Research.

In order to design and implement an RFID technology, it is important to pay attention to the basic building blocks of integrating a system as follows:

- Tags and tag protocols, including the Electronic Product Code (EPC)
- Readers and reader protocols
- RFID middleware
- Security and privacy
- Managing RFID devices
- RFID's impact on your architecture

In one of the foremost software companies that invested heavily in the RFID technology was Sun Microsystems Inc. At a test site in – a state of art warehouse was built in Texas for demonstrating the efficacy of the RFID system and how it works in a seamless transaction business environment.

Bill Glover, one of the software developers at Sun Micro Systems Inc first worked with RFID in 1995, tracking individual cattle using ear tags. Another main contribution was made by Himanshu Bhatt Head of the U.S. RFID Practice and Software Technology Lab for Sun Microsystems, Inc. "Unique competitive advantage erupts from enterprises that couple the RFID technologies with modern business integration using service-oriented architectures. (Mark Bauhaus, Senior Vice President, Sun Microsystems, Inc.).

The efficacy and potential value of RFID had to overcome several challenges – the most important ones was lack of knowledge in the new technology, overcautious approach to adoption and use of RFID applications in business and the overwhelming debate on the cost of tags that made this technology really out of reach for many business enterprises who preferred the conventional bar code system. It is true to say," that from Noah's Ark and the Egyptian Pyramids to railroads and steel mills, people have used and developed skills to manage technology risks and uncertainties. However, in today's technology like the RFID, they have pushed people to even greater risks and high gains."

Under this scenario, let us look at the brave pioneers of this technology – esp those who were prepared to invest in the expensive product trials and applications The Department of Defence (DoD) in USA and Walmart relentlessly pursued in the research and development of RFID technology that after a decade of years now, we see the benefit of this technology percolating to all areas of business applications including the ports and SALIK: the road toll traffic management system for alleviating congestion under the newly established Road Transport Authority (RTA) in Dubai, UAE recently.

RFID systems are designed to operate at a number of designated frequencies, depending on the application requirements and local radio-frequency regulations:

- Low Frequency (125kHz)
- High Frequency (13.56MHz)
- Ultra High Frequency (860-960 MHz)
- Microwave (2.45 GHz)

Low-frequency tags are typically used for access control & security, manufacturing processes, harsh environments, and animal identification applications in a variety of industries which require short read ranges. The low frequency spectrum is the most adaptive to high metal content environments, although with some loss of performance. Read ranges are typically several inches to several feet.

High-frequency tags were developed as a low cost, small profile alternative to low-frequency RFID tags with the ability to be printed or embedded in substrates such as paper. Popular applications include: library tracking and identification, healthcare patient identification, access control, laundry identification, item level tracking, etc. Metal presents interference issues and requires special considerations for mounting. Similarly to the low-frequency technology, these tags have a read range of up to several feet. In a recent event, the author had the opportunity to observe the patient identification system (PIS) where still the old bar-coded wrist bands were used at SSM Health Center, St Louis, USA and also at Etobicoke Hospital, Toronto, Canada and Apollo Hospital, Chennai, India. This points to the need for greater number of users in the primary healthcare centers around the world to adopt RFID technology.

UHF tags boast greater read distances and superior anti-collision capabilities, increasing the ability to identify a larger number of tags in the field at a given time. The primary application envisioned for UHF tags is supply chain tracking.

The ability to identify large numbers of objects as they are moving through a facility and later through the supply chain, has an enormous opportunity for ROI in retail such as reduction of wasted dollars in inventory, lost sales revenues due to out of stock inventory, and the elimination of the human factor required today for successful barcode data collection. There are large numbers of additional markets with demand for UHF RFID technology such as transportation, healthcare, aerospace, etc.

Microwave tags are mostly used in active RFID systems. Offering long range and high data transfer speeds at significantly higher cost per tag making them
suitable for railroad car tracking, container tracking, and automated toll collection type applications as a re-usable asset. Salik toll gate system uses the microwave tage in managing traffic congestion.

The Table-1 at the bottom of this paper highlights the different characteristics of the three RFID operating frequency ranges:

BUSINESS APPLICATIONS OF RFID: GUIDELINES FROM SATO AMERICA

Applications - Library Information Systems

Tracking a library's assets and loan processing is very time-consuming and traditional bar-coding systems help to improve the process. However, RFID technology offers additional enhanced features:

Efficient processing – When each library item contains an embedded RFID tag on a printed label, its availability can be tracked much more efficiently (versus manual tracking). Library items can be checked in and out much faster than manual barcode or human readable data processing. In fact, with RFID, processing returned items no longer requires any human intervention at all. RFID enables libraries to provide certain servicesnaround the clock, without incurring additional costs.

Security – If a tagged library item has not been checked out, any attempt to remove it from the library premises will be detected via the RFID antenna at the entrance gate, hence the RFID tag doubles as a EAS antitheft device.

Inventory management – Book inventory that previously took ***weeks or months*** to execute can now be shortened to ***hours*** using RFID tagging Using a portable RFID device, a librarian needs only to walk through a corridor of book shelves to check the status of the books available. The RFID reading device reads item information from the books' IC chips and then automatically interfaces with library inventory software systems to update the appropriate databases. In addition, it can notify the operator immediately if an item is not in its designated location.

Supply Chain Management

Key challenges faced by companies in their supply chain, is the visibility, tracking and traceability of materials and products as well as the quality and quantity of data collected in real time. RFID's ability to increase data collection throughput and accuracy enable companies to identify materials, products and trends in supply chain with greater accuracy in real-time, compared to data collection technologies utilized to date. Once RFID technology is fully integrated, minimal human effort is required in this process thus reducing errors and costs. By providing accurate, real-time data and information, RFID solutions enable companies to capture "live" data, converting it to meaningful information and automating all associated transactions and processes.

Healthcare

Erroneous patient data, including administering incorrect medications or dosages, is a major factor resulting in serious and in some cases, fatal medical mishaps. According to the Institute of Medicine2:

- Between 44,000-98,000 Americans die from medical errors annually (Institute of Medicine, 2000; Thomas et al., 2000; Thomas et al., 1999)

- Only 55% of patients in a recent random sample of adults received recommended care with little difference found between care recommended for prevention to address acute episodes or to treat chronic conditions (McGlynn et al., 2003)

- Medication-related errors for hospitalized patients cost roughly $2 billion annually (Institute of Medicine, 2000; Bates et al., 1997) These statistics have dramatically increased the demand for fail-safe accuracy in managing patient care; RFID is providing an effective solution. In RFID-equipped hospitals, patients wear wristbands with RFID tags containing encoded medical information. All prescription bags contain an embedded RFID tag containing details of the medication. Before any medication is administered to a patient, an RFID reader verifies the information between patient's tag and the prescription bag's tag. Information about the patient's medical allergies or other relevant patient care criteria is also highlighted on the RFID host computer. This secure patient-data system greatly reduces the possibility of human error thereby preventing a majority of unnecessary medical mishaps.

Benefits

The primary benefits of RFID technology over standard barcode identification are:

- Information stored on the tag can be updated on demand
- Large data storage capacity (up to 4k bits);
- High read rates
- Ability to collect data from multiple tags at a time
- Data collection without line-of-sight requirements
- Longer read range
- Greater reliability in harsh environments
- Greater accuracy in data retrieval and reduced error rate

www.iom.edu/subpage.asp?id=14980

What About Barcodes?

As barcodes approach their "middle ages" (it's been 30 years since a pack of gum was scanned at a Marsh grocery store in Ohio), they are as "alive" and useful as ever. And while RFID provides advantages, the demise of the barcode is greatly exaggerated. The Auto-ID Center, the research and development group that formulated and standardized much of the RFID technology evolution, did not set out to make barcodes extinct. According to its spokesperson, "The Auto-ID Center does not advocate replacing barcodes as barcode-based systems such as the UPC are a standard automatic identification technology in many industries and will be an important complimentary technology for many years."3

Caveats

The main caveat of RFID technology is the cost of the physical RFID tag. A typical barcode label costs about $0.02, whereas an RFID tag label can costs upwards of $0.25 or more depending on quantity. The initial implementation costs for RFID are also higher, depending on requirements and equipment specifications.

Although initial RFID implementation may currently cost more, the cost will gradually drop to a competitive level in the coming years as companies adopt the technology. Meanwhile, companies that can exploit the strategic benefits of RFID today stand to gain significant advantages over their competitors slower to adopt RFID. Early adopters can clearly benefit from cost savings and intangible longterm competitive advantages which outweigh the cost of the RFID implementation.

CONCLUSION - RFID SUMMARY

Over the past few years, RFID technology has been attracting considerable attention. Giants such as Wal*Mart, Target, BestBuy, U.S. Department of Defense (DoD), Tesco, REWE and Metro Group have announced RFID mandates
instructing their top suppliers to start utilizing RFID technology as part of a supply chain compliance program. In January 2005, there were in excess of 400 major companies worldwide required to use RFID technology. As a result of the current RFID supply chain mandate schedules, an estimated 50,000+ suppliers who will ultimately be affected by these plans and RFID solutions are a large
driver for future business growth. The long-term focus in the United States will be on the retail and DoD adopters,
who have to be compliant in the near future. Eventually, they will move beyond compliance only, and attempt to use RFID to increase efficiency and start gaining

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- Material Handling Industry of America, www.mhia.org
- The RFID Sourcebook, a guide to RFID technology, vendors and applications
- www.frontlinetoday.com/rfidonline
- www.translogistique.org
- www.gust.edu.kw/glf
- www.psionteklogix.ca
- RFID Journal If you have a serious interest in RFID, I suggest checking out the RFID Journal. The site has a great FAQ page
- RFID glossary, and detailed vendor listing. Some of the content (articles, case studies) requires paid subscription.
- howstuffworks: How RFID Works Nice tutorial on RFID
- RFIDtalk.com Online forum dedicated to RFID.
- RFIDlog.com A frequently updated listing of articles related to RFID.
- RFID Times Another frequently updated listing of articles related to RFID.
- RFID Gazette And yet another frequently updated listing of articles related to RFID.
- RFID Update Page dedicated to RFID from InventoryOps.com
- RFID white papers. Very informative papers available from Zebra Technologies.
- RFID.org Part of the AIM site.
- Auto-ID Center This is a partnership of businesses and universities working towards a set of RFID standards. Some very good RFID info is available here. I highly recommend downloading the Technology Guide.
- Uniform Code Council Establishes and promotes multi-industry standards for product identification and related electronic communication. Info on bar code symbologies, compliance labeling, EPC, XML.
- AutoID.org This page from autoid.org allows you to download some useful documents. I recommend downloading MH108_03051_EPCglobal_Brief.zip , a PowerPoint presentation on EPC.
- AIDC 100 This is a not-for-profit organization of AIDC professionals. Very interesting reading on their Opinions Page.
- RFID Solutions Online
- Spychips.com Interested in privacy concerns related to RFID? This site put out by CASPIAN focuses on these issues. Yes, it's biased, but so are all the other sites listed on this page.
- RSA Security Documentation of the "Blocker tag" designed to confuse RFID readers.
- Dubai Road Toll Management System (Salik) - http://www.arabianbusiness.com/8104-dubai-unveils-gccs-first-road-pricing-scheme
- White Paper on RFID - SATO America, Inc. 10350-A Nations Ford Road • Charlotte, NC 28273 Phone: (704) 644-1650 • Fax: (704) 644-1662 Rev_0106 4 www.satoamerica.com

TABLE - 1
Operating Characteristics of Different Frequency used in RFID

Frequency Range	**125 KHz** Low Frequency (LF)	**13.56 MHz** High Frequency (HF)	**868 - 956 MHz** Ultra-High Frequency (UHF)	**2.45 GHz & 5.8 GHz** Microwave
Typical Max Read Range (Passive Tags)	< 0.5 m	~ 1 m	~ 3 m	~ 1 m
General Characteristics	Relatively expensive, even at high volumes. Low frequency requires a longer more expensive copper antenna. Additionally, inductive tags are more expensive than a capacitive tag. Least susceptible to performance degradations from metal and liquids	Less expensive than inductive low frequency tags. Relatively short read range and slower data rates when compared to higher frequencies. Best suited for application that do not require long range reading of multiple tags	In large volumes, UHF tags have the potential for being cheaper than LF and HF tags due to recent advances in IC design. Offers good balance between range and performance; capable of reading multiple tags quickly	Similar characteristics to the UHF tag but with faster read rates. A drawback to this band is that microwave transmissions are the most susceptible to performance degradations due to metal and liquids, among other materials
Tag Power Source	Generally passive tags only, using inductive coupling	Generally passive tags only, using inductive or capacitive coupling	Active tags with integral battery or passive tags using capacitive, E-field coupling	Active tags with integral battery or passive tags using capacitive, E-field coupling
Typical Applications Today	Access control, animal tracking, vehicle immobilizers, POS application including SpeedPass	Smart Cards, Item level tracking including baggage handling (Non-US), libraries	Pallet tracking, electric toll collection, baggage handling (US)	SCM, electronic toll collection
Notes	Largest install base due to the mature nature of low frequency, inductive transponders	Currently the most widely available frequency worldwide due mainly to the relatively wide adoption of smart cards; common frequency worldwide	Different frequencies and power levels are used worldwide: Europe allows 868 MHz @ .5 to 2watts whereas the US permits operation at 915MHz @ 4w; Japan does not allow transmissions in this band at this time.	
Data Rate	Slowest			Fastest
Ability to read near metal or wet surfaces	Best			Worst
Passive Tag Size	Largest			Smallest

Characteristics and Challenges of Today's Technology-Based Businesses
• High task complexities, risks and uncertainties • Fast-changing markets, technology and regulations (RFID product standards) • Intense competition, open global markets • Resource constraints, tough performance requirements • Tight end-date driven schedules • Total project life-cycle considerations • Complex organizations and cross-functional linkages • Joint ventures, alliances, and partnerships; need for dealing with different organizational cultures and values • Complex business processes and stakeholder communities • Need for continuous improvements upgrades and enhancements • Need for sophisticated people skills, ability to deal with organizational conflict, power and politics • Virtual organizations, markets and support systems • Increasing impact of IT and e-business
Resulting in demand for
• High market responsiveness • Fast development (esp in RFID Tags) • Low cost (mass market adoptio of RFID) • High levels of creativity, innovation and efficiency
Join us at the presentation of this technical session on RFID where you will see the business applications in large manufacturing company such as Toyota and the Ports in India . All within 30 minutes to enhance your real world awareness with kind courtesyof Psion Tecklogxi Canada. Special training needs can be addressed later post conference if you send us a formal enquiry at suresh.p@gust.edu.kw. Thanks you and see you soon!

E-Learning versus Face-to-Face Learning: An Economic and Statistical Analysis of Higher Educational Systems in Iran

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***Abstract*- In recent years e-learning has become a process which is changing the educational system from traditional to collaborative web-based activities in the widespread borderless world. For overcoming remoteness, distance learning and for prevailing the time problem, a time-boundless system of education is recommended. In this way various architectures of e-learning systems are implemented in which time and costs are really significant parts. A statistical analysis of traditional system with virtual educational system in Iran on the economic dimension illustrates that the best option for educational system is to have a combination of both systems.**

Keywords- Economic comparison, E-learning, Statistical analysis, Traditional educational system, Virtual educational systems

1. Introduction

This paper compares e-learning with face-to-face learning on the economic dimension and demonstrates that a hybrid approach is the most efficient one. Internet has significantly impacted the establishment of Internet-based education, or e-learning. Internet technology evolution and e-business has affected all industrial and commercial activity and accelerated e-learning industry growth. It has also fostered the collaboration of education and Internet technology by increasing the volume and speed of information transfer and simplifying knowledge management and exchange tasks. E-learning could become an alternative way to deliver on-the-job training for many companies, saving money, employee transportation time, and other expenditures. In this way economy is the fundamental problem, and for solving this problem economic comparison should be discussed (Bifulco and Bretschneiderb, 2001). In general, many people who in a way are involved with educational systems accept that the existing system of education, which we call traditional system, is not effective anymore. It is now time to critically analyze the traditional system on the time dimension, for example, for migrated students to a campus or the wasted times between classes. Racial diversity is one of the significant problems that cause some students away from college areas because of their skin color (Munenea, 2007).

E-learning engineering educational system is a system that many researchers started to invent to solve the problems mentioned above (Raaij, and Schepersa, 2006). Each year many computer-based devices are invented, produced, and enter the world markets. These devices are the inevitable parts of e-learning, because for any system we need some tools and the tools of e-learning are computer-based devices which are the fundamental items for the architecture of e-learning systems (Kambourakisa, Kontonib, Rouskasa, and Gritzalis, 2005). E-learning system supports external collaborative activity (i.e. domestic students can consult with foreign students) rather than internal collaborative activity (i.e. two domestic students consult each other in physical space), which makes it an effective web-based technology (Ngaia, Poonb, and Chana, 2005). E-learning system is a capable system for educational systems, especially for interactive activities which is increasing among students all over the world for improving their knowledge (Chen, Yu, and Chang, 2005). All researchers emphasize on the economic role of new technologies, and talking about cost and effectiveness is more relevant and important when a system of education is being discussed. Even some researchers argue it as a cost dilemma (Liao, 2004) and some other agree on the cost effectiveness of computer-based education (Duffy, Parry, and Ramakrishnan, 2004). The present study provides an economic analysis of varied systems implementation, and thus discovers the most effective and efficient system.

2. An Analytical Economic Evaluation

Many researchers tried to evaluate traditional system and e-learning system economically (Stark, Gruber, Renkl, and Mandl, 1998). For accomplishing that, they compared the systems in different ways; mostly they attempted to calculate the "Rate of Investment" for each system (Phillips, Trolley, and Cross, 2000). For economic comparison we need costs and benefits of both educational systems. Cost is a substantial element and it is divided into direct cost and indirect cost and plussed by fix cost and marginal cost. When the costs and benefits of each system have been obtained, we then can calculate the overall benefit by different methods, such as net present worth, rate of return, and equivalent uniform annual cost. Our study is derived

from engineering educational systems in Iran. For economic comparison we also need the benefits. There is littlec economic benefit in traditional system, but for e-learning system we can mention several economic benefits, for example, opportunity benefit: E-learning system is time-boundless, students have enough time for other activities like working which can compensate a large amount of costs, it is the value added for e-learning system (Fletcher, D., 1990). Benefit of accommodation: food, traveling or moving and transportation that were costs in face-to-face learning are benefit in e-learning system. Students would live in their own city and house that reduces the costs and alter them to benefits. We won't take it into account as a separate benefit but for e-learning system's equations and tables we put zero instead of their costs. The cost of instructor's repeated teaching is omitted, in e-learning, because everything is recordable and there is no need for instructor to teach the same course for many times as the training simulator can be used. Benefit of quality: Lessons in e-learning system ensure quality because of their repeatability (i.e. the lesson which is taught can be repeated) and the opportunity they provide for collaborative learning (i.e. a student can discuss a problem with other students all over Iran). Further analysis can be developed using the following terms.

Notations:

C_M	Cost of moving	C_A	Cost of accommodation
C_R	Cost of registration	C_N	Cost of nutrition
C_M	Cost of maintenance	C_E	Cost of equipment
C_T	Total cost	C_{EF}	Cost of extra facility
B_W	Benefits of working	B_r	Benefit of omitting repetition
B_q	Benefits of quality	B_T	Total benefits

Now we can develop a linear formula for costs and benefits which help us to compare the two systems under review in this paper:

$$C_T = C_M + C_A + C_N + C_E + C_R + C_M + C_{EF} \quad ; \quad B_T = B_W + B_q + B_r$$

Assuming that an implementation of an e-learning educational system throughout Iranian Universities is done, an economic comparison between the implemented e-learning educational system and the traditional system would provide the annual costs and benefits of the two systems for ten years as shown in Table 1. The numbers are arithmetic means based on interviews conducted on 10 Iranian Universities for traditional system and 5 Iranian Universities for e-learning. Null entries in the table for e-learning costs indicate that there is no cost for the related components.

2.1-Economic Computations

Now, by the following equations the economic comparison is accessible for both educational systems.

Assumptions:

- Benefits are with positive mark and costs are with negative mark.
- Interest rate in Iran is different in varied years.
- The system that has higher net present worth is economically more efficient.
- The formula is according to the factor of [P, F, A].

Notations:

P_{Net}	net present worth	P	present worth
I	interest rate	F	future worth
N	number of periods	A	annual cost or benefit

$$P_{Net} = F \times (P/F, I, N) + A \times (P/A, I, N) \tag{1}$$

For calculus way we use the following equations:

$$P_1 = \frac{F}{(1+I)^N} \tag{2}$$

$$P_2 = A \times \left(\frac{(1+I)^N - 1}{I \times (1+I)^N}\right) \tag{3}$$

$$P_{Net} = P_1 + P_2 \tag{4}$$

2.2- Trend Analysis

One of the most important basis of comparison is the future trend which is obtained by forecasting. In the following figures, the past trend and also the future trend for 5 years is presented by computing linear trend analysis using Minitab version 14. The total costs of traditional engineering educational system, from the year 2006 until 2010, are shown in Figure 1 by means of the following equation:

$$Y_{t_{Traditional}} = 279.242 \times t + 549.667$$

In the above equation, t is the number of years which is 1 to 10 for the study years (1996-2005) and for forecasting it is 11 to 15 years (2006-2010).

Costs

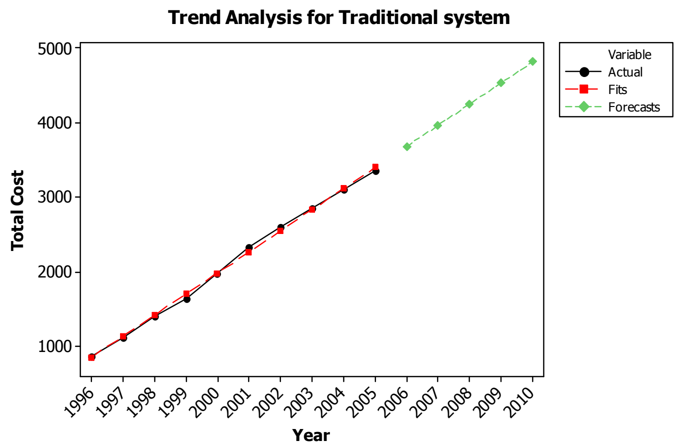
Traditional system	Year	C_M	C_A	C_N	C_E	C_R	$C_{M\&R}$	C_{EF}	C_T
	1996	55	300	250	55	150	10	45	865
	1997	60	450	270	60	200	15	50	1105
	1998	65	600	290	65	300	25	55	1400
	1999	70	700	300	70	400	30	65	1635
	2000	75	900	320	75	500	35	70	1975
	2001	80	1100	340	80	600	40	80	2320
	2002	85	1200	400	85	700	45	85	2600
	2003	90	1300	430	90	800	45	90	2845
	2004	95	1400	470	95	900	50	95	3105
	2005	100	1500	500	100	1000	55	100	3355

E-learning system	Year	C_M	C_A	C_N	C_E	C_R	$C_{M\&R}$	C_{EF}	C_T
	1996	0	0	0	2500	850	20	30	3400
	1997	0	0	0	2450	900	25	45	3420
	1998	0	0	0	2400	950	30	55	3435
	1999	0	0	0	2300	1050	30	70	3450
	2000	0	0	0	2250	1100	35	80	3465
	2001	0	0	0	2200	1150	40	90	3480
	2002	0	0	0	2150	1200	45	100	3495
	2003	0	0	0	2050	1300	45	130	3525
	2004	0	0	0	2000	1500	50	150	3700
	2005	0	0	0	2000	1500	50	150	3700

Benefits

E-learning system	Year	B_W	B_q	B_R	B_T
	1996	450	88	50	588
	1997	530	115	68	713
	1998	580	135	80	795
	1999	610	150	87	847
	2000	650	180	90	920
	2001	700	200	95	995
	2002	800	230	110	1140
	2003	850	250	130	1230
	2004	900	270	180	1350
	2005	1000	300	200	1500

Table 1. Mean Costs and Benefits of E-Learning and Traditional Systems of Education [1996, 2005] (in millions of dollars)

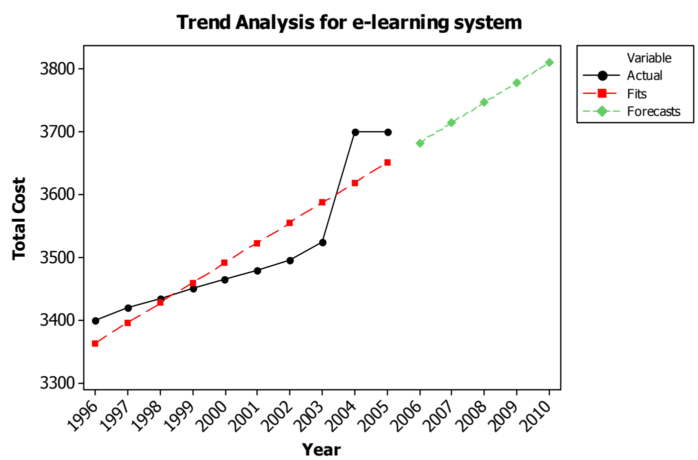


Year	Value (millions)
2006	3683$
2007	3967.09$
2008	4251.18$
2009	4535.27$
2010	4819.36$

Figure 1. Trend analysis for traditional system

Also, for e-learning engineering educational system the trend is shown in Figure 2. Forecast for the e-learning system for the next 5 years is done by means of the following equation:

$$Y_{t_{e-learning}} = 31.8788 \times t + 3331.67$$



Year	Value (millions)
2006	3682.33$
2007	3714.21$
2008	3746.09$
2009	3777.97$
2010	3809.85$

Figure 2. Trend analysis for e-learning system

2.3- Significant Factors Effect in Forecasting

We can choose more important cost factors of e-learning and traditional system and identify their importance for forecasting the total cost as follows:

Notations:

C_A	Cost of accommodation	C_R	Cost of registration
C_{EF}	Cost of excessive facility	C_T	Total costs
α_j	$j=0,1,2,3$ coefficient	t	Number of years

$$\sum_{i=1}^{10} C_{Ti} = \alpha_0 t + \alpha_1 \sum_{i=1}^{10} C_{Ai} + \alpha_2 \sum_{i=1}^{10} C_{Ri} + \alpha_3 \sum_{i=1}^{10} C_{EFi} \quad (6) \; ; \quad \sum_{i=1}^{10} C_{Ai} C_{Ti} = \alpha_0 \sum_{i=1}^{10} C_{Ai} + \alpha_1 \sum_{i=1}^{10} C_{Ai}^2 + \alpha_2 \sum_{i=1}^{10} C_{Ai} C_{Ri} + \alpha_3 \sum_{i=1}^{10} C_{Ai} C_{EFi} \quad (7)$$

$$\sum_{i=1}^{10} C_{Ri} C_{Ti} = \alpha_0 \sum_{i=1}^{10} C_{Ri} + \alpha_1 \sum_{i=1}^{10} C_{Ri} C_{Ai} + \alpha_2 \sum_{i=1}^{10} C_{Ri}^2 + \alpha_3 \sum_{i=1}^{10} C_{Ri} C_{EFi} \quad (8) \; ; \quad \sum_{i=1}^{10} C_{EFi} C_{Ti} = \alpha_0 \sum_{i=1}^{10} C_{EFi} + \alpha_1 \sum_{i=1}^{10} C_{EFi} C_{Ai} + \alpha_2 \sum_{i=1}^{10} C_{EFi} C_{Ri} + \alpha_3 \sum_{i=1}^{10} C_{EFi}^2 \quad (9)$$

The result should be an equation as follows:

$$C_T = \alpha_0 + \alpha_1 C_A + \alpha_2 C_R + \alpha_3 C_{EF} \quad (10)$$

After putting the related information in the above equation, the following equations are in hand:

Regression equation for traditional system:

$Y_{Traditional} = 486 + 0.961\, X_1 + 1.78\, X_2 - 4.03\, X_3$

Regression equation for e-learning system:

$Y_{e\text{-}learning} = 2451 + 1.27\, X_2 - 4.45\, X_3$

The above equations can be used to obtain the forecasting of total cost of each system according to special cost factors.

3. Statistical analysis for hypothesis testing

In this part a hypothesis testing is affordable for discovering more economic systems of education as follows:

$$H_0: \mu_{e-learning} - \mu_{traditional} = \delta \leq 0 \;;$$

$$H_1: \mu_{e-learning} - \mu_{traditional} = \delta > 0$$

Where H_0 states that the mean total cost of e-learning is less than or equal to traditional system against *H1* which means the mean total cost of e-learning is more than the traditional system. For this hypothesis testing one-tailed student-t distribution is used.

Assumption:

$$\sigma^2_{e-learning} = \sigma^2_{Traditional}$$

Notations:

μ	The mean of the population
n	Number of samples
δ	Difference between the mean of the populations
$\overline{X}$	The mean of the sample (data)
σ	The variance
S	The standard deviation

$$t_{\alpha, n_e + n_t - 2} = t_{0.05, 10+10-2} = 1.734 \quad (11)$$

If $t > t_{\alpha, n_{e-learning} + n_{traditional} - 2}$ then H_0 is rejected: $5.051 > 1.734$

This result shows that the mean total cost of e-learning system is more than that for the traditional system. So what makes e-learning system to have its fans that are too many, despite the former calculations? There are several reasons: (1) The future trend of the world toward virtual education based on computer-based elements; (2) The quality of engineering education in e-learning system; and (3) The economical benefits of e-learning engineering educational system, which is the most substantial reason (Fresena, and Boydb, 2005).

3.1- Blended Approach

In this section, two different hypothesis testing approaches are being used, each of which illustrates a result. We choose three cost factors of each system to fulfill the hypothesis testing. For traditional system, we choose the cost of accommodation, the cost of equipment, and the cost of registration as cost factors for the supposed testing. The rules used here are the same as in section 3. The test would be as follows:

$$H_0: \mu_{e-learning} - \mu_{traditional} = \delta \leq 0 \;;$$

$$H_1: \mu_{e-learning} - \mu_{traditional} = \delta > 0$$

Where H_0 means the mean total costs of e-learning cost factors are less than or equal to those for the traditional system against $H1$ which means the mean total cost of e-learning factors are more than those for the traditional system.

$$t_{\alpha, n_e+n_t-2} = t_{0.05,10+10-2} = 1.734$$

For the given data we obtain t = 7.81.

If $t > t_{\alpha, n_{e-learning} + n_{traditional} - 2}$ then H_0 is rejected: 7.81> 1.734. As a result, H_0 is rejected. It means that even if some of the cost factors are being selected, the result is same i.e. the mean total cost of e-learning system is more than traditional system.

Another experiment is done as a blended approach. In this case a combination of two systems i.e. traditional system and e-learning system is used simultaneously. Now we select another set of three cost factor in blended situation i.e. costs of the same parameters in two systems are added to each other, and that sum is multiplied by 1/4 as a share coefficient. Those factors are the cost of moving, the cost of accommodation, and the cost of nutrition. Therefore, we set another hypothesis testing as follows:

$$H_0: \mu_{hybrid} - \mu_{traditional} = \delta \leq 0 \;;$$

$$H_1: \mu_{hybrid} - \mu_{traditional} = \delta > 0$$

Where H_0 means the mean total cost of blended cost factors are less than or equal to traditional system against H_1 that means the mean total cost of blended cost factors are more than traditional system.

$$t_{\alpha, n_e+n_t-2} = t_{0.05,10+10-2} = 1.734$$

If $t > t_{\alpha, n_{hybrid} + n_{traditional} - 2}$ then H_0 is rejected: -1.184< 1.734. As a result H_0 is not rejected.

Corresponding to the above hypothesis tests we come to the result that the blended approach i.e. parallel consuming of both systems, is more cost effective. Nonetheless, in blended approach a student would be at the environment of university time by time which ensues to a better interactive relationship between students.

4. CONCLUSION

Economic comparison is a substantial factor for implementing projects, especially when we want to discuss an engineering educational system. By the means of economic comparison between e-learning engineering educational system and traditional engineering educational system we can realize which system is suitable economically and it helps us in a better decision making and implementation. By finding out varied costs and benefits according to above mentioned formulas economic comparison and also future trend is achievable. As it was illustrated the blended approach provides a more acceptable economic situation in the future, the reasons would be lack of environment for and accommodation in traditional system and infinite capacity of e-learning system. Further, transition from traditional to blended system will avoid the shock of a sudden replacement of educational system to e-learning. In future work we will insert the fixed and variable costs in our economic comparison separately and the depreciation rate will be taken into account.

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E-Learning: An Approach to Building a Knowledge Society in the Arab World

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***Abstract*– This paper highlights the role elearning is playing in building a knowledge society in the Arab World. In this age of globalization, information and telecommunication technologies have increased global access to knowledge, information and skills. The Arab World could benefit from these new developments by adopting e-learning to facilitate global linkages and to build capacity that ensures knowledge creation and information dissemination.**

Keywords *– E-learning, knowledge, development, globalization, Arab World, capacity building*

I. INTRODUCTION

In recent years, globalization has increased human contacts to the extent of making information and knowledge within reach of everybody everywhere. Modern information and communication technologies (ICTs) have facilitated information dissemination, technology transfer, knowledge creation, socio-cultural exchanges, and human understanding. In building a knowledge society, education becomes vital due to its contribution to the stock of human capital, knowledge absorption, invention and innovation and research and development. In other words, educational institutions, including schools, colleges and universities, are necessary for speeding up the process of leapfrogging and sustaining economic growth. From an economic point of view, there has been a general understanding that economic change depends on organizational and individual learning. E-learning advances the process of knowledge at individual, organizational, managerial, national and international levels.

Arab countries are making substantial efforts to increase knowledge absorption through technology transfer, building ICT capacity, attracting foreign direct investment, and financing research and development. Ultimately, however, the potential gain from globalization will depend on the nation's capabilities to create indigenous knowledge, invent new technologies, produce new products and increase labour market flexibility. Despite its financial and human potential, the Arab world is still suffering from market constraints and inadequate infrastructure to enhance global linkages and create indigenous knowledge.

E-learning strengthens the fundamentals for promoting a knowledge society. In most Arab countries, e-readiness is inadequate to increase knowledge acquisition and to enhance technological innovations. However, building knowledge capacity requires the contribution of both public institutions and private enterprises. In this regard, government role becomes indispensable due to its financial, legal, managerial, organizational and institutional influence over the main determinants of a knowledge society. This paper highlights the role e-learning plays in the process of transforming Arab countries into knowledge-based societies. Knowledge becomes not only an important factor in production, but also a major determinant in wealth creation and sustainable development.

II. THE KNOWLEDGE SOCIETY

Socio-economic transformation has been linked to the country's ability to absorb global knowledge and disseminate information. Nations with limited financial, scientific, technological, and educational capabilities could benefit from the new global trends by strengthening connectivity and increasing access to global knowledge and information. Promoting knowledge-based activities underscores the importance of organizational and institutional changes to facilitate the use of the new skills for the promotion of development. Gaining benefits from E-learning requires building technological and educational capacity in order to enable the country to produce, market and deliver knowledge and information content.

In recent years, terms such as knowledge organization, knowledge economy, knowledge management, knowledge industry, knowledge workers and knowledge leadership are widely used to identify the role of knowledge in human advancement. owever, not only is greater advancement in technological and scientific activities required to achieve a status of knowledge society but also creating a culture suitable for rapid

modernization. The concept of a knowledge society as explained by the United Nations to:

"denote a more advanced developmental stage or to refer to a second-generation information society. Whereas an information society aims to make information available and provide the necessary technology, a knowledge society aims to generate knowledge, create a culture of sharing and develop applications that operate mainly via the Internet. The goal of the knowledge society is to fill societal needs, create wealth and enhance quality of life in a sustainable manner."[1]

This implies that in a knowledge society attitude toward learning also has to change, i.e. a new culture needs to develop that exhibits learning as a priority for human advancement. Knowledge is not a commodity that can be manufactured but has to be acquired through life-long learning, training, and schooling. Achieving such objectives implies that institutions including universities must modify their existing programs and design new ones to strengthen learning and to enhance knowledge creation. The potential of e-learning in Arab countries is expected to have a positive impact on all aspects of human life -- including the social, economic, political, environmental, scientific and technological development. Thus closing the digital gap must be given top policy priority in all governments of the region. A distinction is being made between information society and a knowledge society. The former is a requisite for the latter in the sense that information represents the building block for the knowledge society. The concept of knowledge society has much broader meaning than just processing information and technological innovation. It includes all aspects of a nation's development spanning economic, social, scientific, technological, industrial, cultural and political aspects. To carry out a task of such magnitude will require institutional structures comprising research centers, universities, workshops, and training facilities. For example, universities play an important role in building capacity capable of promoting a knowledge society through production of skills, invention of new technology and development of new production methods.[2] The existing knowledge gap between Arab countries and the industrialized nations represents a barrier for achieving rapid modernization. Recent literature on development studies closely links economic growth to absorption and creation of knowledge, and, therefore, knowledge acquisition will remain one of the greatest challenges facing Arab countries in the coming decades.[3]. In the knowledge society, the Internet serves as a powerful instrument for knowledge acquisition and data dissemination. Sustainable development requires scientific knowledge and technological support which can be acquired through the Internet to meet knowledge deficiencies in economies where there are limitations on the production of knowledge as in the case of GCC countries. As a consequence, speeding up development involves rapid knowledge acquisition and application to ensure that the processes of development are sustainable.[4] So far, the experience of Arab countries with development has not been satisfactory due largely to the inadequacy of theoretical models and policies that are based on the Western approach to development. However, future development in Arab countries need not be in isolation from the experiences of other countries including these of Western nations.

III. E-LEARNING

As a tool for building capacity to absorb and create knowledge, e-learning should be adopted in Arab countries. E-learning facilitates leapfrogging by allowing countries to bypass several developmental stages.[5] Access to knowledge has become within the reach of all nations if certain measures and effective policies are implemented to enhance technological development and increase global knowledge absorption. Building capacity for knowledge creation, characterized by the importance of investment in science and technology, increases human capital requirements, maintains high degree of labour flexibility, builds efficient institutions, and spurs research and development. Countries with limited resources could employ modern technologies including elearning to deepen global integration and increase access to global knowledge. In addition to the diversified learning resources and programs offered by e-learning, students are given greater access to knowledge and information via linkages to global sources. E-learning provides more flexible and mobile learning features which are suitable for different locations with little or no extra efforts.

1 United Nations, Towards an Integrated Knowledge Society in Arab Countries: Strategies and Implementation Modalities (New York: United Nations, 2005), P. 3.

2 See Menou, Michel, Educating Citizens of the Global Society, Cooperation South No. 1, 2001.

3 See for details World Bank, World Development Report 1998/1999: Knowledge for Development (Washington: World bank, 1999).

4 Al-Roubaie, Amer and Al-Zayer, Jamal, Knowledge Creation and Global Readiness in GCC Countries in Allan Ahmad (ed.) Science, Technology and Sustaniability in the Middle East (London: Inderscience Entreprises Limited, 2007).

5 See Choucri, Nazli, Knowledge Networking: Leapfrogging for Technology, Cooperation South, No. 2, 1998.

This makes E-learning suitable for isolated places as well as for those who cannot afford to take time off for training and acquiring new skills needed for improving their knowledge understanding. E-learning requires the use of network technology to facilitate access to information and knowledge which can be operated from home. For example, women with children along with family commitment can access to new skills without the need for going outside their homes. In the Middle East, where the participation of women in the workplace and the economy is constrained by socio-cultural and religious values, e-learning increases labour market flexibility through greater participation of women. The region suffers from high unemployment among nationals, particularly women whose employment opportunities are limited. Modern offices rely on computer networks and Internet connections which can be set up in homes. E-learning is technology based learning driven by an electronic fusion of computer and communication technologies. The new technologies empower people with skills, knowledge, information and ideas, which increase choices and enhance productivity. As a process for enhancing educational standards, e-learning is defined as a "means of becoming literate, involving new mechanisms for communication: computer networks, multimedia, content portals, search engines, electronic libraries, distance learning, and web-enabled classrooms."[6] "e-learning is the use of network technology to design, deliver, select, administer, and extend learning."[7] In e-learning, the e stands for :

1) exploration aiming at finding information and knowledge-related issues;
2) experience where the web can be used to enhance learning experience;
3) engagement which enable individuals to develop new method in learning that give them greater participation in societal affairs;
4) ease of use which gives access to all knowledge seekers and learners;
5) empowerment by giving people the means to strengthen their capabilities and improve their participation. "E-learning is placing a wealth of educational material and resources on line, making knowledge accessible to virtually every citizen on the planet."[8]

The following are some of the benefits of e-learning:

1. Technology has revolutionized business, now it must revolutionize learning
2. Anywhere, anytime, anyone
3. Substantial costs savings due to elimination of travel expenses
4. Just-in-time access to timely information
5. Higher retention of content through personalized learning
6. Improved collaboration and interactivity among students
7. Online training is less intimidating than instructor led courses [9]

Perhaps the greatest challenge for the governments in the Middle East is to increase investment in Elearning by broadening the capability of getting connected to global networking and distance learning resource webs. At the global economic level, the competitiveness of a nation depends on the productivity of the economy which is characterized by highly skilled workforces, access to information, production of knowledge, use of ICTs and free mobility of capital and labour. Economic development is no longer a product of local decisions alone, but also depends on global linkages which increase knowledge absorption and skills acquisition.[10]

IV. THE ARAB WORLD

In most Arab countries, adequate capacity for knowledge absorption and creation is still limited despite their financial and human potential. Recent reports by the United Nations on the status of human development in the Arab World have attributed the current state of stagnation in these countries to low investment levels in education, particularly science and technology.[11] Educational institutions are poorly equipped to support knowledge creation strategy that meets the scientific and technological requirements of development. Similarly, low investment in human capital and inadequate expenditure on research and development is hindering rapid socio-economic change. In other words, benefits from globalization will be constrained by the lack of knowledge absorption and global linkages. As it can be seen from Table 1, the Middle East and Africa stand the lowest among other regions in the world in terms of the percentage of the population on line. For

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6 Stocks, Peter "E-Learning: Education Businesses Transform Schooling", Eduventures.com, June 2000, P. 2.

7 Learnframe, Facts, Figures & Forces Behind e-Learning, www.learnframe.com P.6.

8 See Agni Vlavianos-Arvanitis, Bio_education for Global Environmental Leadership, P. 2.

9 Learnframe, Ibid, PP 10 – 12.

10 See Mowlana, Hamid, From Medieval to Modern Times: Information in the Arab World, Cooperation South No. 1, 2001.

11 See United Nations, Arab Human Development Reports, Several years

example in 2005, 2.4% of the population in the Middle East and Africa is connected compared to 71.5% in North America and 11.1% world average. At the national level, E-learning could enhance development by increasing the participation of the community members in decision-making. It helps people to understand the complex and diverse national objectives of development by supporting or designing programs and policies which contribute to sustaining growth. Transforming the economy into a knowledge-based economy will require a diversified learning process that includes most of the population. E-learning speeds up the nation's capability to absorb knowledge and accelerate the process of technology transfer. In this age of global competitiveness, low levels of technology adoption and inadequacy of knowledge absorption hinder global integration. E-learning facilitates economic transformation by increasing the nation's capabilities to disseminate information and create knowledge. Similarly, e-learning enhances the nation R&D activities via access to research institutions and information from the rest of the world. For example, challenges such as the environment, economic, demographic, social, climatic and poverty which are facing Arab countries could be eased through R&D. To this end, E-learning increases the productivity of the economy by facilitating transfer of technology, knowledge creation and information dissemination. An important outcome emerged out of the process of globalization is the internationalization of education, particularly at the university level. The Arab world should take advantage of new global opportunities by increasing connection to knowledge centers and make use of information available through the global networks and other electronic means. In other words, investment in learning technologies accelerates the educational processes by providing more choices and greater time flexibility suitable for different groups or ages in society, i.e. e-learning creates a "literate environment" in which opportunities to continuing education is provided through electronic means. Access to such environment will include all ages making education available to all those who are willing to acquire it.

TABLE 1 PERCENTAGE OF THE POPULATION ONLINE (%)

Region	1995	1998	2000	2005
North America	8.9	27.6	47.9	71.5
West Europe	2.2	8.8	21.7	50.1
East Europe	0.1	1.0	3.3	15.2
Asia-Pacific	0.1	0.7	1.7	4.6
South/Central America	0.1	0.5	2.1	7.9
Middle East/Africa	0.0	0.3	0.7	2.4
Users Worldwide	0.7	2.5	5.2	11.1

Source: Learnframe. Facts, Figures & Forces Behind e-Learning

E-learning uses modern technologies to enhance communication and education. For example, computers provide an alternative means to becoming literate through multimedia, distance learning, electronic libraries and web-classrooms. E-learning could provide alternative for traditional learning, especially in countries where financial resources are limited. Governments can pursue such policy by providing incentives and by building infrastructure to increase connectivity Globalization has broadened access to knowledge and information by linking nations through a wide range of electronic networking capable of transmitting information and knowledge globally. E-learning requires the development of new educational strategies about the purpose and value of education. In the Arab world, adapting Elearning methods could have a positive impact on national identity and narrow the existing generation gap driven by cultural globalization. E-learning could be more effective in presenting a true picture of the cultural, social, linguistic and religious characteristics of the national identity than either TV or radio. In other words, the use of E-learning could reverse the current state of cultural fragmentation and create a suitable environment for rapid modernization deeply rooted in the heritage of the people. Today, the global village requires people to communicate and to exchange ideas about business, information, knowledge, trade, social and cultural relations. Nations cannot cultivate the fruits of the knowledge society unless they gain access to modern technology. E-learning allows nations to leapfrog by increasing the knowledge capability which is needed to sustain development and enhance human understanding. Becoming an integral part of the global society, the Arab world must try to strike a balance between traditional values encapsulated by the Islamic fundamentals on one hand and the new culture driven by globalization on the other. In this regard, E-learning should not only teach modern knowledge but should serve to protect the indigenous culture from being eroded by the influx of Western cultural products spread through modern information technologies. Similarly, in conservative societies where women's participation remains limited due to traditional and religious values, E-learning serves to erode the gender gap by allowing women to acquire knowledge, work, exchange views, and participate in the political process without contact with the other gender. The Arab World faces severe challenges not only in the sphere of education and knowledge deficiencies but also in areas related to the environment, agriculture, industry, water, health, pollution, population and poverty. If used effectively, E-learning provides opportunities for meeting such challenges by increasing public awareness, enhancing knowledge acquisition, developing new

skills and empowering women. In most developing countries, education receives large proportion of government expenditures. E-learning provides low cost education through the use of electronic technologies. Universities can play the role of intermediaries between industry and sources of knowledge and information by conducting research using both local and global knowledge.

E-learning should be used as a national tool to enhance human development and increase wealth creation. Education is not determined by schooling alone but by a number of technological, social, cultural, economic and political factors. In other words, E-learning should be designed to include organization and top management of both public and private sectors to ensure that skills, knowledge and information are acquired and used in the national interest. An effective national policy must integrate all theses forces to ensure that E-learning serves the national objectives. Under such circumstances, government incentives for building E-learning capacity may not be sufficient without the cooperation of private agencies, international organizations and universities. The advantage of Elearning goes beyond literacy by contributing to industrial, environmental, economic and political development. There has been much said about democracy in the Middle East which can be enhanced through E-learning teaching. In general, however, decision makings at all levels are subject to improvement through E-learning. In addition, environmental challenges such as population growth, urbanization, water conservation, pollution, and waste management can be met through the introduction of effective E-learning programs. Similarly, the delivery of state services becomes much easier with the use of E-learning through an electronically enabled citizenry to whom government is able to deliver faster and at lower cost. A just society should be open and accessible to all individuals despite divergences in social, religious, racial and economic backgrounds. Education serves as a balancing tool to establish equity and justice capable of narrowing ethnic and sectarian differences and promoting national unity. To meet these challenges, education needs to be reengineered to become a creative means for sustaining development. Globalization is introducing a new society which requires greater interconnections, effective communication, creative ideas, more knowledge and better information. In countries where illiteracy rate is high, E-learning offers an alternative and effective means for enhancing public knowledge and helping people to participate in development. As globalization penetrates deeper, local knowledge becomes inadequate to make decision and formulate policies. Development is a complex process of structural changes which require scientific and technological knowledge may not be produced locally. E-learning accelerates structural changes through economic diversification, information dissemination, skills production and knowledge acquisition. Not only e-learning helps workers becoming familiar with modern production methods, but also empower top managers and company executives with skills and knowledge needed for making decisions. In the new economy, literacy is not sufficient for taking advantage of globalization; instead connectivity and e-readiness is paramount. Building ICTs capacity provides new opportunities in terms not only of production and exports of new products but also in stimulation of economic growth. Table 2 highlights the stages of development in Arab countries. As illustrated in the table, most Arab countries lag in their developmental stages reflecting the failure to enhance efficiency and to mobilize innovation to strengthen the process of development.

TABLE 2. CLASSIFICATION OF ARAB WORLD COUNTRIES INTO STAGES OF DEVELOPMENT

Stage of Development	**Arab World Countries**	**Other Countries in this Stage**	**Important areas for Competitiveness**
Stage 1 (factor-driven)	Egypt, auritania, Syria, Morocco	India, China	Basic requirements (critical) and efficiency enhancers (very important)
Transition from 1 to 2	Algeria, Libya, Oman, Tunisia, Jordan	Colombia, Thailand, Venezuela	Basic requirements (critical) and efficiency enhancers (increasingly important)
Stage 2 (efficiency-driven)		Turkey, Russain Federation	Basic requirements (very important) and efficiency enhancers (critical)
Transition from 2 to 3	Bahrain	Barbados, Czech Republic, Korea	Same as above, but innovation factors become increasingly important
Stage 3 (innovation- driven)	Qatar, United Arab Emirates, Kuwait	United States, United Kingdom, Japan	All three areas important: basic requirements, efficiency enhancers and innovation factors

Source: World Economic Form 2007, Arab World Competitiveness Report 2007

V. CONCLUSION

In this paper a brief assessment has been made about the impact of e-learning on building a knowledge society in the Arab world. As a means for acquiring knowledge and disseminating information, e-learning is a useful tool for promoting societal changes and for increasing human understanding. The Arab World lacks an adequate technological capacity which is necessary for acquiring knowledge and increasing human welfare. In recent years, globalization has offered new opportunities, particularly for developing countries, to build capacity that serves to increase knowledge and to promote development. Elearning underscores the importance of giving access to education and information needed for inducing societal changes and promoting awareness about some of the important challenges facing many countries in this age of globalization. Adopting e-learning could broaden public understanding and improve communications to enable decision makers and policy strategists to construct effective plans and sustain development. In the Arab, e-learning could endorse globalization by increasing labour market flexibility via acquiring skills and absorbing knowledge. Elearning provides new opportunities for these countries to overcome some of the challenges including the gender, environmental, water and democratization.

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The perceived value of e-learning along with traditional learning among undergraduate students at the Hashemite University

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Abstract— **The main purpose of this study is to define the perceived value of e-learning along with traditional learning among undergraduate students at the Hashemite University. The results of study indicated that the e-learning was in the middle range of scores, while traditional learning was in the lower range. The e-learning had significantly higher scores for perceived value among students than the traditional learning. The perceived value of e-learning among male students is more positive than female.**

Keywords- E-learning, traditional learning, the Hashemite University, Jordan

I. Introduction

Jordan has realized the importance of information and communication technology in moving toward the knowledge-based world economies. The Ministry of Higher Education and Scientific Research always emphasize in its strategies and vision for the future, the utilization of Information Technology in its strategies and methodologies of work.

In Jordan, the growing demands on the higher education system for both quantitative and qualitative improvements necessitate a more efficient use of the resources available to the sector, and the establishment of more systematic decision-making. The Universities of Jordan are challenged to work smarter, to do more work with fewer resources. At the same time the Universities must continue to improve the quality of service and support to their stakeholders in order to remain competitive with other institutions on the local, regional and global level. Computing and Information Technology are expected to play an important and strategic role as the Universities respond to this challenge by developing and implementing new and creative approaches to sustain academic programs and support operations. In order to achieve that, Jordanian higher education system put efforts to find out where does the system stands, how does it measure-up, and to reach consensus by the stakeholders on what needs to be done to restructure our higher education system to support the development of a knowledge-based economy according to world class standards (Ministry of Higher Education and Scientific Research, 2007).

The Universities have made steady progress in the use of computing and Information Technology in the past decade. Students, faculty members, and staff have become more conversant with using technology to fulfill their scholarship, research, support, and administrative needs. However, Universities have been challenged in their effort to maintain a sufficient level of resources to adequately address computing and information technology increasing demands. Therefore, over the years, studies have been undertaken periodically to focus on specific computing and information technology concerns.

Jordanian Universities have developed various computerized information systems to support and facilitate the activities and services that are performed at most of the functional levels of their respective Universities. The level of sophistication and quality of these subsystems varies from one University to another, but in general they are characterized by not being fully integrated and they have limited maintainability, scalability, and flexibility. In addition, they lack the international best practices and in some cases, they are built using old technologies.

E-learning has been around for ten years or so at the Hashemite University. During that time, it has emerged from being radical idea - where the effectiveness of which was yet to be proven- to something that is widely regarded as mainstream. It becomes a service offered by most colleges and universities and the core to business plans. Now, e-learning is evolving with WWW as a whole and it is changing to a degree significant enough to warrant the name: E-Learning. E-learning mainly takes the form of online courses, where the dominant learning technology employed today is a type of system that organizes and delivers online courses (e.g. Blackboard learning management system (LMS)). LMS takes the learning content and organizes it in a way where courses divided into modules and lessons, supported with quizzes and tests and discussions. Blackboard integrated into Hashemite university information system since 2003 with active hybrid courses of 130, and 3000

student make effective use of the system. Nowadays, wireless network, course management systems, multimedia, and other technologies add new dimensions of richness to e-learning (The Hashemite University, 2008).Consequently, ICT systems and technologies are not fully utilized in areas related to management, planning, and academia to improve efficiency, quality of teaching and learning, decision support, and reducing operational costs.

So far, most discussions on the use of e-learning in Higher Education have focused on ways for the teacher to incorporate the new technology into their teaching. Discussions, or even knowledge, about e-learning from the student perspective seem to be very sparse. However, there are reports of students overwhelmingly preferring to take class using e-learning than a traditional course. They felt that e-learning was a helpful tool in their learning (Brotherton & Abowd, 2002). The present study explores e-learning along with traditional learning in Higher Education seen from the students' point of view. It discusses their perceived value of e-learning along with traditional learning among students at the Hashemite University.

Students' perceptions of e-learning in university education may be influenced by specific individual variables as gender, major, ownership of personal computer, and their GPA. Men and women focus on different aspects of using computers (Venkatesh & Morris, 2000). Hence, it could be hypothesized that young male students are more prone to adapt to e-learning than not so young female students.

Over the past few years there have been many reports published of individual subject specific case studies indicating that the integration of e-learning into a face-to-face courses can have positive effects on learning outcomes (Housego and Freeman 2000, Phillips 2000, Heines 2000, Aberson et al., 2000, Diochon and Cameron 2001, Saunders and Klemmif 2003). The main purpose of this study is to define and analyze students' perceived value of e-learning with traditional learning among the Hashemite students in Jordan.

II. The Aim of the Study

There were two specific aims of the study.

- *First*, to explore the students' general perceived value of e-learning with traditional learning.
- *Second*, to analyze the significant differences in perceived value of e-learning with traditional learning based in specific student factors such as gender, major, ownership of personal computer, and GPA.

III. Questions of the Study

This study addressed the following specific questions:

1- How do undergraduate students perceived the value of e-learning and traditional learning at the Hashemite University?

2- Are there significant differences in students perceived the value of e-learning and traditional learning regarding to their gender, major, ownership of personal computer, and GPA?

IV. Procedures

A. Population and sample

The study base was students enrolled in educational culture classes during the first academic semester 2007/2008 as a university elective course. 700 students met this criterion. From these students, 200 respondents were canceled from study analysis because of missed items without answered. 500 students (72%) returned the questionnaire.

Of the respondents to the survey, 38.8% were male and 61.2 were female. The distribution of respondents across major subject areas were 45% scientific and 55% were humanities. 60.4% of the students surveyed stated that they have personal computer (PC). Nearly 72% of respondents stated that their GPA over 2 points of 4.

Table 1: Distribution of students regarding to the variables of study

Variables	Value Label	N	%
Gender	***male***	194	38.8
	female	306	61.2
Major	***scientific***	225	45.0
	humanities	275	55.5
Ownership of personal computer	***owner***	302	60.4
	not owner	198	39.6
GPA	***less 2***	142	28.2
	2 over	358	71.6

B. Data collection

After acquiring the instructors' permission, the questionnaire was administered during regular class periods to students in the first semester of the 2007/ 2008 academic year. The students received written instructions that specified the purpose of the study and explained the procedures to be followed while responding to the questions. In particular, the students were told that there were no right or wrong responses. Students were asked to return the survey to the class instructor who passed it on to the researchers. The questionnaire included a brief demographic sheet that required students to provide basic demographic information about themselves. The students were given 20 minutes to complete the questionnaire.

C. Instrumentation

The perceived value of e-learning and traditional learning consisted of (11) items relate to e-learning and (23) items related to traditional learning. There were five alternatives for the answers to items of questionnaire: (1) strongly disagree, (2) disagree, (3) undecided, (4) agree, and (5) strongly agree.

Perceived value of e-learning survey scores can range from 11 to 55. The range of scores 11 to 25.67 was low, 25.68 to 40.35 was middle, and 40.36 to 55 was high. Perceived value of traditional learning survey scores can range from 23 to 115. The range of scores 23 to 53.67 was low, 53.68 to 84.35 was middle, and 84.36 to 115 was high.

V. Results:

Results of Question One: How do undergraduate students perceived the value of e-learning and traditional learning at the Hashemite University?

Table 2 shows the means and standard deviations for the students perceived the value of e-learning and traditional learning. The e-learning had a mean score of 29.00, while the traditional learning had a mean score of 25.57. Based on guidelines for interpreting the scores of students perceived the value of e-learning and traditional learning, the e-learning was in the middle range of scores, while traditional learning was in the lower range of scores.

Table 2: Means and Standard Deviations for the students perceived the value of e-learning and traditional learning

e-learning		Traditional learning	
Mean	*SD*	*Mean*	*SD*
29.00	2.10	51.23	2.76

Table 3 shows the results of a two-tailed t-test for equality of means to determine whether there was a significant difference between the e-learning and traditional learning scores on the perceived value of students. The results show significant differences between the e-learning (M = 29.00 ± 2.10) and traditional learning (M = 51.23 ± 2.76), t(82) = 5.200, p = .000 on the perceived value instrument. Thus, the e-learning had significantly higher scores for perceived value than the traditional learning.

Table 3: t-Test for Equality of Means for the students perceived the value of e-learning and traditional learning

	t	df	Sig. (2-tailed)
Perceived value of e-learning and traditional learning	5.200	498	.000*

* p<.01

Results of Question Two: Are there significant differences in students perceived the value of e-learning and traditional learning regarding to their, gender, major, Ownership of personal computer and GPA?

A Five-Way MANOVA was used to compare if there were differences in students perceived the value of e-learning and traditional learning at the Hashemite University based in their gender, major, Ownership of personal computer and GPA.

Table 4: Five-Way Multivariate tests for students' perceived the value of e-learning and traditional learning based on their gender, major, owner PC, and GPA.

Effect	Wilks' Lambda Value	F	Hypothesis df	Error df	Sig.
Intercept	.046	4712.120	2.000	451.000	.000
Gender	.977	5.220	2.000	451.000	.006*
Major	.989	2.623	2.000	451.000	.074
Owner PC	.998	.452	2.000	451.000	.636
GPA	.995	1.194	2.000	451.000	.304

* p<.01

Univariate analysis test was conducted as follow-up test to assess the effects of gender, on students' perceived the value of e-learning and traditional learning.

Table 5: ANOVA Summary for the students' perceived the value of e-learning and traditional learning based on their gender

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	*e-learning*	117100.819	1	117100.819	4890.021	.000
	Traditional learning	483063.253	1	483063.253	7359.214	.000
Gender	*e-learning*	136.078	1	136.078	5.682	.018*
	Traditional learning	118.479	1	118.479	1.805	.180
Error	*e-learning*	10823.997	452	23.947		
	Traditional learning	29669.552	452	65.641		
Total	*e-learning*	342866.000	500			
	Traditional learning	1353347.000	500			

Table 5 presents ANOVA results. ANOVA results indicate that e-learning (F (1, 452) = 5.682, p=.018) significantly differs for gender.

Table 6: Means and Standard Deviation for the students' perceived the value of e-learning regarding their gender

Dependent Variable	Gender	Mean	SD
e-learning	*male*	26.719	.587
	female	24.958	.449

Table 6 shows the significant difference for gender among students' perceived the value of e-learning, that male students (M=26.719) are more positive than female (M=24.958) in their perceived the value of e-learning.

VI. Discussion and Conclusions

Students' current perceived value of e-learning is clearly in middle score range. Their use of the Internet to underpin the assignment process is middle as is the fact that many still see the significance of 'books' to the teaching and research process. Previous published work has also shown how students use the Internet in conjunction with books (Ray and Day 1998) which argues against the concerns of Lindsay and Mclaren (2000) that students may become too reliant on the Internet as a single source of information.

The students surveyed firmly believe themselves that e-learning has a significant role to play in supporting and enhancing their university learning experience. But it still necessary to combining face-to-face classes with online activities (discussion boards, short answer tests). It clearly felt that e-learning could sometimes be used as an alternative to face-to-face activities.

Despite these apparent drivers for flexibility, and in contrast to their views on use of e-learning, students overwhelmingly came out against the notion of holding face-

to-face classes less regularly. The main reason for this was a clearly held view that face-to-face communication and events, with both academic staff and fellow students, was critical to their overall learning. The fact that they also felt that irregular classes would lead to loss of routine, continuity and motivation served to highlight the present perceived importance of face-to-face classes to campus based students.

Many courses rely heavily on the lecture as a means of presenting the information or existing knowledge that forms the basis for the overall delivery of the course. Previous substantial studies have shown why it is that students appreciate lectures (e.g. Brown and Daines 1981). Whilst many of students clearly did not want to see face-to-face contact reduced, also some of students did not wish to see any further increase in the number of lectures they received. Although a number of respondents did indicate in some way that they preferred more interactive forms of classroom based teaching, the need to have more time for independent study was also commonly raised. This may be linked to the major reasons that students gave for feeling that online activities should be combined with face-to-face classes, most of which related in some way to having greater opportunity to think about and reflect on what had taken place in class.

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APPENDIX

THE PERCEIVED VALUE OF E-LEARNING WITH TRADITIONAL LEARNING SURVEY

To study aimed to investigate for the students perceived the value of e-learning and traditional learning.

A. Part one: student information:

GPA: less than 2 ( ) More than 2 ( )
Major: Scientific ( ) Humanities ( )
Gender: Male ( ) Female ( )
Ownership of personal computer: Yes ( ) No ( )

B. Part two had 11 items to measure the perceived value of e-learning along various dimensions:

(1) Strongly Disagree
(2) Disagree
(3) Neutral
(4) Agree
(5) Strongly Agree

	Items	(1)	(2)	(3)	(4)	(5)
1	Be actively involved in the learning process					
2	Address my questions and concerns					
3	Voice my opinion and viewpoints					
4	Understand the course materials					
5	Stimulate my interest in the subject					
6	Relate the subject matter to other areas					
7	Put effort into nonassessed work					
8	Control when and where to learn					
9	Learn the materials in less time					
10	Complete the assignments in less time					
11	Use written communication in learning.					

C. Part three used 23 items to gauge the perceived value of various aspects in students' learning experiences:

	Items	(1)	(2)	(3)	(4)	(5)
1	Seeing the professor					
2	Hearing the professor					
3	Understanding the professor					
4	Obtaining feedback from the professor					
5	Obtaining feedback from assessed work					
6	Guiding by clear learning objectives					
7	Guiding by detailed course outline					
8	Asking questions while learning					
9	Participating in student–student communications					
10	Presenting thoughts to class					
11	Presenting thoughts to professor					
12	Understanding textbook					
13	Understanding course material					
14	Applying course material					
15	Integrating course material					
16	Learning definitions					
17	Practicing problem solving					
18	Using written communications					
19	Completing assignments					
20	Taking practice examinations					
21	Reviewing course content					
22	Studying in groups					
23	Knowing current standing in class					

An Interactive and Ubiquitous Mosaic of Services based on RFID at University

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***Abstract*—The present paper introduces the creation of an interactive system for university environments based on personalization of services thanks to Radio Frequency Identification (RFID). The described system is a mosaic application that integrates different services that will allow identifying and locating students and teachers in some areas of a Faculty, as well as offering personalized information such as mails, messages, news, etc. The mosaic of services is designed to allow different level of interaction with the users and different kinds of methods to interact with them, such as voice, touch screens or handwriting recognition systems. In addition, it also describes the technologies involved to ensure a high level of security. For example, digital signature applied to RFID ensures some security features such as integrity and non-repudiation.**

RFID, interaction, location, digital signature, mosaic of services.

I. INTRODUCTION

A new age of interactive and ubiquitous technologies is arriving to university environment, and it is here to stay. Nowadays, interaction between humans and computers is changing towards a more natural way of saying what the user needs and how he retrieves the information. In this line, traditional peripherals such as mouse or keyboard are being relegated to a second place due to the arrival of new and more attractive input/output methods. Examples of these new peripherals are touch screens, voice and handwriting recognition systems or voice synthesizers, which require an active behavior of the user. On the other hand, ubiquitous systems are becoming real in many environments. In these environments the user does not have to carry out any action, the system retrieves information automatically and transparently and reacts in consequence.

In a deeper view, it is possible to find out that biometric sensors, Radio-frequency identification (RFID) or location systems such as Global Positioning Systems (GPS), Infrared, Bluetooth or Wi-Fi are ahead on the challenge of retrieving information from the user in a transparent way. In fact, this information is very useful, because it opens a wide range of new systems that can act and react depending on environmental circumstances and user's movements, profile and location.

This ubiquitous philosophy is also being applied inside university and learning environment. For example, it is possible to offer customized services depending on where the teacher is in every moment. Other application would be a system that could know who enters in a room and offers him personalized information without any interaction by the user. In another case, it could be very useful for a student to know if the teacher he is looking for is in his office or not, or his contact information. Therefore, it would be even better for the student to have the opportunity of asking his questions to a virtual assistant, whose goal is to answer the questions of the students. In this particular case, if a student asks a question, it is very useful to know who is he, his degree and his subjects in order to limit the possible answers to his question.

For all those reasons, the present paper describes the design and development of a system that improves and makes easier the interaction among the main roles involved in the university scenario: teachers, students and administrative staff.

II. OBJECTIVES

The main objective of this system is, in first place, to identify the identity of the users (students, teachers, stuff) that enter in a department of a Faculty. When the user approaches the door of the department, the system will automatically and transparently identify who is the user and if he is allowed to access. In this case, the door will open automatically before he touches the handle. Then personalized information about the user will be shown in a touch screen. For example, if the user is a teacher the system will show how many unread mails he has in his mail inbox, how many unread messages he has in the e-learning platform or the notes that other people have left him. In addition, the teacher will also be able to send notes and messages to other teachers from the system and to see the news and a collaborative agenda for the department.

On the other hand, if the user is a student, he will have the opportunity to know if a teacher is in his office or not, his contact information (mail, phone) and to leave him a note or an email using the platform.

In addition, if the student has a question he will be able to ask it to a question-answering system (Virtual Assistant) that will use the knowledge that it has of the student (identity,

profile, degree, etc.) to give personalized information. This question-answering system is able to retrieve answers to questions posed in natural language using the knowledge stored in some knowledge source, generally a web site, a document repository, etc. [1]. In the particular case of this project, the question-answering system retrieves the information to answer the questions from the content available in e-learning platforms, such as dotLRN or Moodle, or some search engines of the organization.

III. Hardware Architecture

Once, the objectives have been described, it is necessary to comment the hardware set needed to the design and development of the system. In first place, it is possible to differentiate between two kinds of hardware inside the project. The first one includes all the material needed to create the Radio-frequency identification system. The other one includes the set of screens and peripherals that will allow the interaction with the user. Both sets will be described deeply in the following points.

A. Choosing the most suitable RFID set

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders [2]. RFID tags come in three general varieties: passive, active, or semi-passive (also known as battery-assisted). Passive tags require no internal power source, thus being pure passive devices (they are only active when a reader is nearby to power them), whereas semi-passive and active tags require a power source, usually a small battery.

An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader.

Inside the project, several RFID readers have been tested in order to find the technology that best adapt to our requirements. In first place, several questions must be considered before creating the prototype [3]:

- How many users must the system be able to admit at the same time? 1, 2, 5, 10 or 50?
- How far must the system be able to identify users? 2 cm, 10 cm, 75 cm or 1 meter?[4] [5]
- What is the cost of the set?
- What is the best reading frequency? 13.56 MHz?
- What is the best type of RFID tag? Passive or active?

The first RFID set studied is a short range reader for passive tags (Figure 1). This reader uses the 13.56 MHz band and can read and write passive tags. The main inconvenient of this reader is its short reach, due to the fact it is only able to read tags with a maximum reach of 10 cm, what does not satisfy the requirements of the project.

Figure 1. Short rangeRFID reader.

The following set to study is also a 13.56 MHz reader. It also offers read and write features, but in this case it is able to read passive tags up to 75 centimetres. This reader is able to read several tags at the same time identifying the users entering or leaving the room. The figure 2 shows this RFID set with the reader, the tuning unit and the antenna.

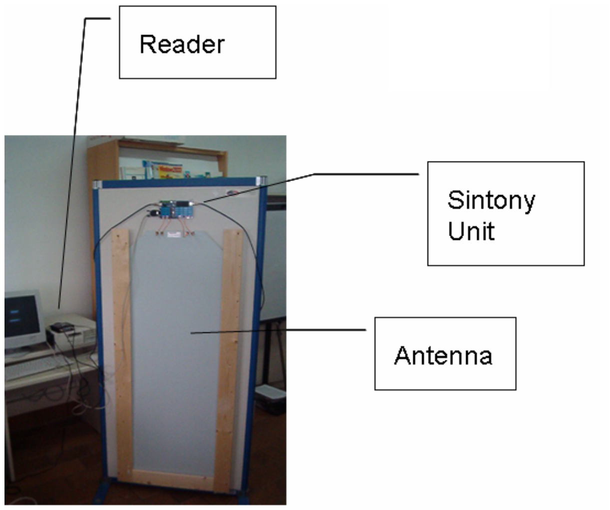

Figure 2. Long range RFID (at 13.56 MHz).

The third set manages UHF frequency with passive tags. In this case the distance between the reader and tags are 2 meters (Figure 3). Ultra high frequency (UHF) designates a range of electromagnetic waves whose frequency is between 300 MHz and 3 GHz and allows a wavelength of 100 meters. The inconvenient of this set is its cost, due to the fact is much higher than the two previous ones, and the fact that the point-to-point transmission of radio waves is affected by many variables. Atmospheric moisture, the stream of particles from the sun called solar wind, and time of day will all have an effect on the signal transmission. Atmospheric absorption reduces, or attenuates, the strength of radio signals over long distances [6].

Figure 3. An UHF RFID set.

Finally, the last one is a novel RFID set. It is a Near Field Communication set that absolutely changes the method of reading because the reader is included in the user mobile phone. It also works with 13.56 MHz (Figure 4).

In this case, a single interaction is needed. It consists of passing the mobile phone near the tag, about 2 centimetres from the top. Therefore, while in the previous cases the reader is fixed and tags are mobile, now the reader is mobile and tags can be mobile or fixed. In this case, the mobile tags would be for students and teachers.

Figure 4. NFC Device.

The NFC technology allows reading and writing tags, using communication through the mobile phone [7], but due to the very short reach of reading and other characteristics related to complexity and security it was also discarded for the particular context of the project.

Finally, the chosen option was the long range set, which allows reading up to 75 centimetres, because it is the set that best adapt to the project's necessities and requirements.

B. New input/output methods

Nowadays, input/output methods are changing. Peripherals are not just a keyboard and a mouse any more. Instead of keyboards, it is possible to use voice commands, handwriting or touch recognition (Figure 5), as well as movements through a web cam in order to make the computer know what are the needs of the users.

On the other hand, instead of using text to show information the system will use a voice synthesizer to read the texts, thanks to a graphical environment that looks like a real person inside the application.

Figure 5. New input/output methods: A touch screen.

The system offers different kind of interaction. Before the user enters the room he will find a small screen with information about the location of the teachers. In this screen the user will have the opportunity to send them an e-mail or to leave them a note with a message.

Once the user has entered the room he will find a big touch-screen. Thanks to it, the user will be able to interact with the system, asking for personzalized information thanks to the question-answering system. This system will say the answer to his question with human voice. The human voice synthesizer will be also used to say him 'Hello Mr. / Mrs. <name>' when he/she enters the room and to say how many e-mails, messages or notes he/she have unread.

IV. INTEGRATION OF SERVICES IN THE MOSAIC

A. General view

The Mosaic application is a distributed system that offers personalized information and services. This is possible thanks to the transparent identification of users through the RFID reader. The ID obtained is used to know information about the user, such as name, degree, subjects, mail passwords, notes, agenda, etc.

B. Designing the Mosaic

Thanks to all this knowledge about the user, the system will offer several independent services in a same platform. Some of the services that the Mosaic application will integrate are:

- Notes Manager: Possibility of leaving notes to other users.
- Mail Manager: It allows the user to send an e-mail to other users or to know how many unread e-mails he has.
- Shared Agenda.
- News Service.
- Identity Manager: It grants access to the room if the user is identified thanks to an RFID system.

- Virtual Assistant: Question-answering system that allows natural language questions. It will use the user's contextual information to answer the question looking in the knowledge stored in e-learning platforms such as dotLRN or Moodle, or search engines [8]. In addition, this service will have a visual 3D interface able to answer with human voice.

The disposition of the different modules and services integrated into the Mosaic can be seen graphically in the figure 6.

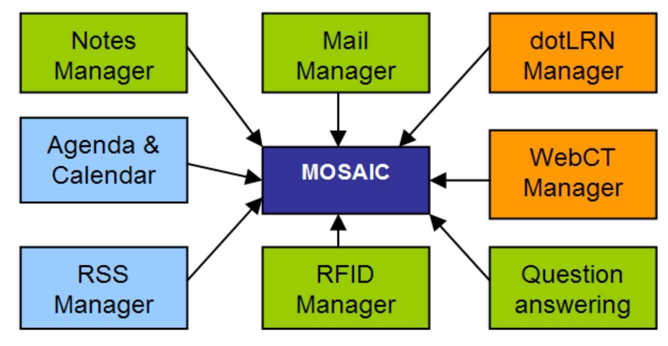

Figure 6. Servicies and modules integrated in the Mosaic application.

The system will show on a map if a teacher is in this moment or not using green colour if he is, and grey if he is not. On the right side of the screen it will appear the information about the user that has recently entered in the laboratory. In the image showed in the figure 7 the teacher 'Gabriel Diaz' has been identified, and it is showed how many unread e-mails, notes, and messages in the Moodle and dotLRN e-learning platforms he has in this moment.

The system also enables simultaneous users entering at the same time. In this case, information about several users will be showed in the screen.

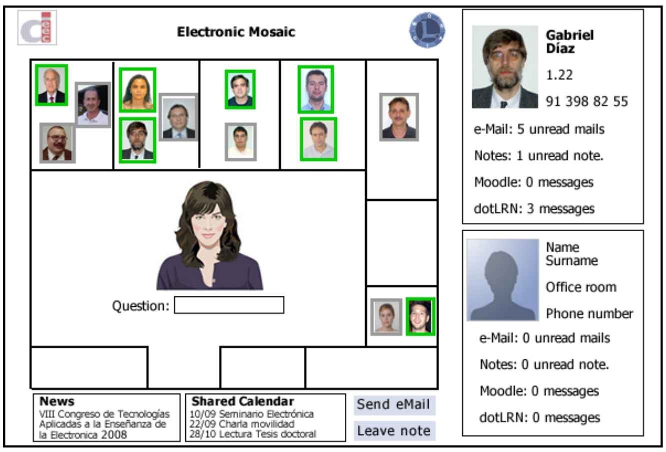

Figure 7. Visual interface of the Mosaic application.

On the bottom of the image, it is possible to se the news and calendar modules, as well as the button to send an e-Mail or to leave a note to someone.

C. *The Virtual Assistant: A Question-answering system*

The main goal of this module is to improve and optimize the relationships between students and teachers by means of a more efficient use of the knowledge stored in the new e-learning platforms.

In that sense, universities usually use several e-learning platforms with information about courses and technical documentation, such as dotLRN and Moodle. Some organizations have also information available on their official Web Sites, in the faculties Web sites and even in every department Web Site. With this scheme, when a student needs to know something about a course, or when a staff member is looking for some concrete information, usually a lot of time is wasted, because it is like looking for a needle in a haystack [9].

For that reason, this module is designed to have the capacity to answer automatically the students' questions. For that complex task, it will be used the information already available in all these knowledge sources: Web Sites, Learning Management Systems (LMS), databases, etc. In the figure 8 it is showed the logical architecture of this module.

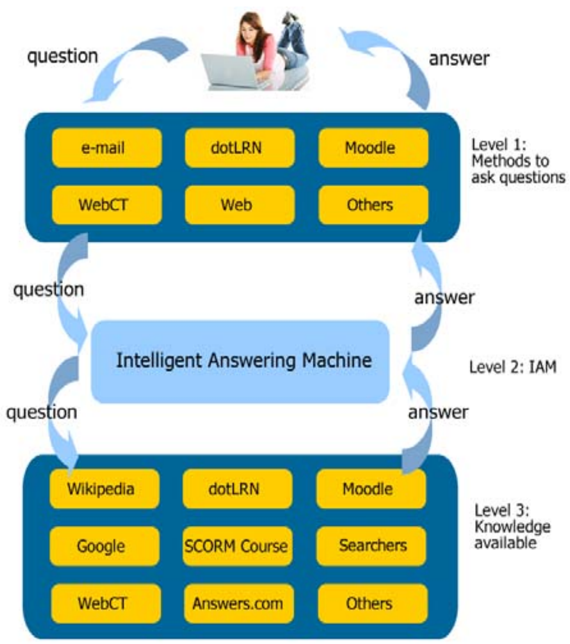

Figure 8. Virtual assistant architecture.

For that task, the solution is a middleware that uses the information of several custom-built search engines. These engines will know where to look for an answer, how to filter it and how to compare it with answers from other sources. In a first approach, only administrative information will be used to answer the question, because the creation of a system able to answer technical subjects requires a more sophisticated system.

Finally, the external view of this module is a 3D human interface able to speak with human voice. This 3D virtual assistant only synthesizes the information obtained from the e-learning platforms.

V. ENSURING INTEGRITY AND NO REPUDIATION WITH DIGITAL SIGNATURE

A primary security concern surrounding RFID technology is the illicit tracking of RFID tags. Tags are world-readable, what poses a risk to personal location privacy, for that reason, it uses cryptography to prevent tag cloning [10]. More sophisticated devices engage in challenge-response protocols where the tag interacts with the reader. In these protocols, secret tag information is never sent over the insecure communication channel between tag and reader. Rather, the reader issues a challenge to the tag, which responds with a result obtained using a cryptographic circuit keyed with some secret value. Such protocols may be based on symmetric or public key cryptography.

Cryptographically-enabled tags typically have dramatically higher cost and power requirements than simpler equivalents. For that reason, in the prototype of this project simple passive RFID tags have been chosen. These tags will contain an ID valid only in the university environment [11]. Moreover, in order to secure the identification system and avoid cloning or manipulation, a Digital Signature scheme will be applied on the RFID tags.

Digital Signature is a security scheme that ensures integrity and no repudiation. It means that the system will know if someone or something has changed the content of the tag, and that if some organization has created the tag it is not possible to other user to create another tag supplanting the authority of the organization.

In this scheme, there are two keys, one public and one private. The private key is used to sign some information, in our case an ID. This will happen when the tag is created, because it is in this moment when both the ID and the signed information must be written into the tag. The result of the signing process is a string of bits that will only be deciphered by the public key. The private key will be stored only in the server and the public key can be stored wherever the application is, because if someone steals it there is no risk for privacy. The scheme showed in the figure 9 exemplifies the digital signature process.

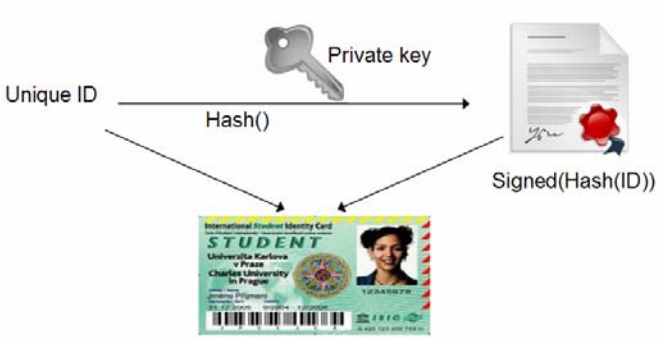

Figure 9. Digital signature scheme.

In first place, the hash of the tag ID is obtained. This hash is signed using the private key stored in the server of the organization. At the end of the process, there will be stored an ID and a digital signature in the tag.

Once the user is identified and the information of the RFID tag is read, the digital signature of the tag is deciphered using the public key. The result of this process must match with the hash of the ID read from the tag. This process can be seen graphically in the figure 10.

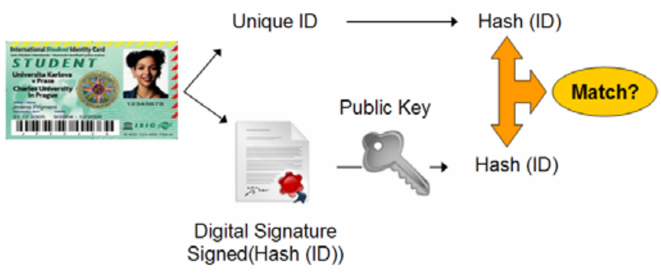

Figure 10. Deciphering information in a Digital Signature scheme.

Thanks to the use of this scheme, the system achieves the following benefits:

- The integrity of the tag is ensured. It means that the content of the tag has not been manipulated by a third person.
- No repudiation. It means a third person cannot create a tag with the identity of the original authority.
- If someone intercepts the public key there is not risk to security. This is because this key is only used to decipher the signed information, and it is impossible to obtain the private key from the public key.
- SQL Injection problem is avoided. This technique explodes a vulnerability in the validation level of the entries to a database [12]. An SQL injection happens when a SQL code is injected inside other SQL code to change the normal working of the system. The result of the process is a malicious SQL query (delete, update, select) executed in the database.

VI. CONCLUSSIONS

This paper is the result of the research done in UNED to create an interactive system able to make use of the new input/output methods, such as voice, handwriting, etc. It merges these new techniques with the ubiquitous philosophy, identifying and locating users transparently with RFID, and reacting in consequence.

The system integrates different and heterogeneous services in a uniform layer offering personalized information to every user. One of the advantages of this architecture is the possibility of adding or removing services easily because all these modules are not very related with each other. In addition, the autonomous services used in the project allow a certain

level of personalization depending on several factors, such as user's profile or location or environmental circumstances (time, day, meetings, practices, etc).

A fundamental issue inside the development of the project has been the security of the information. For that reason, a research has been done over the most suitable security protocols that can be used together with RFID technology. The conclusion of these studies is also presented in this paper. It describes how the digital signature, already used in many environments, can solve many of the problems that are appearing in the RFID world: tag cloning, tag manipulation, SQL Injection, viruses, etc.

Finally, although this development is initially intended for university environment, the creation of a Mosaic of services using identification with RFID can be also applied in many other environments, such as shopping centres, hospitals, museums and, in general, in every scenario where the personalization of the services provided to the users is relevant.

ACKNOWLEDGMENT

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E-Learning Challenges

in the Arab Countries

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***Abstract*—The national focus in higher education is shifting from the traditional instructor-centered technique to the e-learning technique. Many challenges that face the spread of the e-learning are of paramount importance. E-learning has expended the boundaries of teaching and learning. The advanced learning technology has a strong focus on adult education especially in higher education, industrial and vocational training. The purpose of this paper is to highlight the fact that e-learning in Arab countries has its own challenges. Deeply rooted in the literature, this manuscript provides suggestions for facing and overcoming some of these challenges. A brief overview of the blackboard e-learning tool is presented as an example of the wide spread of e-learning tools all over the world. Particular emphasis is placed upon suggested solutions that may lead to successful implementation and integration of the e-learning tools in Arab countries.**

I. INTRODUCTION

Online learning in the US is prospering and becoming more entrenched each year. However, the situation is very different worldwide—particularly in the Arab world. Online education depends strongly on digital infrastructure, PC and Internet penetration, and connection costs, all of which vary hugely from one Arab country to another. The situation is most advantageous in the Arab Gulf and least favorable in countries like Sudan and Yemen. Some Arab countries have made good starts in online learning while others remain at the concept stage.

In 2003, the League of Arab States issued a Draft Declaration of Principles endorsing e-learning as a tool that can help eliminate illiteracy, achieve universal primary education, and help improve both the training of teachers and the delivery of lifelong education for honing professional skills. Albeit that declaration remained largely abstract and did not spell out any concrete programs to help achieve those goals [1].

II. SURVEYING THE EDUCATIONAL SCENE

Despite the various levels of progress in the implementation of the e-learning paradigm in the Arab region due to the varying degrees of digital readiness in different parts of the Arab world, a quick survey of the educational scene in the region shows great interest in online learning and several attempts at starting programs in this new paradigm. In the United Arab Emirates (UAE) the e-learning market alone is currently estimated at $14 million and is expected to increase to $56 million by 2008. In the Arab Gulf (Saudi Arabia, UAE, Kuwait, Bahrain, Qatar, and Oman, in decreasing order of edu-economic importance) total spending on e-learning was estimated at $72 million in 2004. This figure is well below the average in the much of the world, but it's growing at a 27 percent compound average rate. Online education spending in the Arab Gulf region will thus reach $240 million by the end of 2009. Saudi Arabia with its large student population, dominates in academic e-learning, while the UAE leads in business e-learning services [2].

Some clear governmental efforts in Syria resulted in the creation of the Syrian Virtual University (SVU), in 2002. SVU aims to serve the entire Arab region and market through partnering with foreign universities that have strong experience in online education [3].

The UAE's national University (UAEU), by far the largest university in the country, has also been making significant strides in the adoption and implementation of online learning. The number of active Blackboard users jumped from about 1200 in fall 2002 to about 4000 in spring 2003, and has steadily increased to about 8000 today. Another governmental project, although of much more limited scale, is the e-TQM college (electronic Total Quality Management), which was launched in September 2002 in Dubai in the aim of providing world-class e-learning programs to the community, as well as to public and private sector employees.

Sana'a University in Yemen (one of the largest in the Arab world with 70,000 students and staff) has signed a deal with Microsoft to deploy the latter's Learning Gateway Solution e-learning platform, which includes course content as well as interaction and examination tools.[4].

Another concrete sign of ebullient interest in online education in the Arab world is the fact that Blackboard had great number of customers in the region. In the following

paragraph a historical overview on the Blackboard and its significant features will be demonstrated as an example of e-learning tool.

III. Blackboard Historical Overview

Blackboard Company founded in 1997 with a vision to enable educational innovations everywhere by connecting people and technology, Blackboard is a leading provider of e-Education enterprise software applications and services. It consists of five software applications bundled in two suites, the Blackboard Academic Suite and the Blackboard Commerce Suite. [5]

During few years it has spread so fast in higher educational institute all over the world. One of the components of the Academic Suite is the Blackboard Learning System BbLS, a state-of the-Art learning management system, provides instructors and students with a comprehensive set of easy-to-use tools for designing and managing both web-based and face-to-face courses. With access via the web 24/7, this technology facilitates creating interactive, anytime, anywhere learning environments. It is also integrated with Banner Student Information System that is used in wide range of universities.

IV. Sample of Facilities available

Classes in which instruction is face to face, fully online, partially online, or ***hybrid*** all rely on BbLS, delivered via network, for the following premier electronic resources and tools [1]:

A. *Instructional Preparation and Content*

- Organize course material online for easy access.
- Create content and learning activities.
- Post class syllabi, study guides, and notes.
- Set up threaded discussion groups and topics.

B. *Course Management*

- Manage class assignments, papers submitted, deadlines, tests, and grades.
- Provide students with feedback.
- Manage group activities.

C. *Communication*

- Customize home page views by institution, faculty, and student.
- Post announcements.
- Participate in and monitor discussion boards and chat rooms.
- Check students or teaching assistants online at any time.

D. *Assesment*

- Develop study guides, self tests, and quizzes.
- Conduct student surveys for quick feedback.
- Track evaluations.
- Set up threaded discussion groups and topics.

E. *Student tools*

- Take notes.
- Use self tests to study.
- Monitor personal progress.
- Communicate with faculty and other students.
- Collaborate with project teams.

A ***hybrid course*** uses technology to deliver approximately 50 percent or fewer class sessions, but at least one class session per term is replaced by technology.

V. New Generation of e-learning tools

There is a significant interest in the new generation of learning management systems like Moodle. Moodle is an open software package designed using sound pedagogical principles, to help educators create effective online learning courses. The software is used all over the world by universities, schools, companies and independent teachers. Although Moodle is completely free, it still didn't receive any considerable attention in the Arab countries, except on some individual basis and in few private universities.

Sloodle is an Open Source project which aims to develop and share useful, usable, desirable tools for supporting education in virtual worlds, making teaching easier. Through engagement with an active community of developers and users, the Sloodle project integrates the Second life multi-user virtual environment and the Moodle learning-management system.

VI. CHALLENGES FACING THE E-LEARNING

Effective e-learning helps to migrate people to rapid learning models, offers significant cost saving possibilities and additional revenue generation. So why is Arab world higher education institutes not rushing to this medium of learning management and delivery?

A. *Education Paradigm*

The first problem is that most Arabic universities are still largely trapped in the instructional paradigm. Instructional paradigms focus on *"providing instruction"* with distinct emphasis on the role of the teacher. Under this structure, students are typically passive listeners and the instructor is the center of teaching and instruction [7]. Our view of education requires us to have experts, classrooms and relatively passive

learners. We don't believe adults are mature enough to learn on their own.

B. *Memory Modelling*

Most of our education programs continue with a memory model – expecting students to learn complex information that will change in a few months. As the world moves faster, Higher education institute simply speed up efforts to pour information into already overloaded brains – despite average retention rates of less than 20%. Retaining has become the norm, not the exception.

C. *Technical and cost Constraints*

Technology is another major stumbling block to developing an Arabic e-learning culture. E-learning to date has been dominated by powerful, but technically demanding international tools that most local universities and institutes cannot support. The cost is often prohibitive – both in terms of the software itself and the highly specified machines required to support it.

Global e-learning software does not generally operate within the technical limitations presented in the developing world – a world of limited bandwidths, irregular connectivity, disparate technical platforms and low-specification hardware.

Although it is true that the digital infrastructure is well developed in some regions (the Arab Gulf, in particular), its actual penetration into homes and actual usage in workplaces and schools remain very limited.

D. *Fears of E-learning*

The resistance and objection to e-learning is mostly due to the following fears [6]:

- Fear of the expenses.
- Fear of the change.
- Fears that the e-learning is a fad.
- Fear that e-learning systems will compromise other IT systems.
- Fears of a new way of learning.
- Fears about tracking learning usage.
- Fear due to lack of prior experience in e-learning.

E. *Customer Service Support*

Still every semester, the number of courses using e-learning tools increases, and the amount of activity doubles annually. The challenge is to meet the demand for technical and functional support created by this phenomenal growth.

This is complicated by the fact that the training teams are often inexperienced in IT systems and are daunted by technical demands.

F. *Using e-learning as Traditional learning.*

Sadly, most teachers/trainers still define e-learning in terms of PDF files, e-books and online assessments, and don't have a vision of the intelligent learning experience it can provide. Courses are becoming very boring, nonproductive.

G. *Languages.*

The region's population relies largely on Arabic as a learning language (especially at the primary and secondary levels, and Arabic has made limited inroads in the digital information landscape.

H. *Pre university education.*

The educational system has not prepared students for an active, independent, lifelong-learning approach to education, a prime prerequisite for participating and succeeding in the online-learning world.

I. *Integration and Compatability.*

There is a lack of successful integration most of the time between the learning management system and other essential enterprise applications.

VII. SOLUTIONS TO FACE THE CHALLENGES

Adapting the learning paradigm, that focuses on the outcomes of the educational process thereby "*facilitating learning*". Applying the learner centered approach where the role of the student is one of an active participant who is encouraged to become engaged in the learning process through various interactive activities facilitated by the instructor through the e-learning tool. This paradigm helps to produce an empowered, informed, and responsible student. This process theoretically embraces continued improvement in the quality of learning. [7]

It is clear that our current learning approach needs a complete overhaul. We need to stop treating our brains like information storage warehouses, it is important to replace the memory model by technology. Technology has long out-competed the brain in its ability to store information, and is increasingly making jobs redundant in operational, clerical, and even managerial roles where people need to follow defined processes. Yet, we still spend over 75% of our corporate teaching efforts pursuing this memory model.

Provide sufficient bandwidth in Arab countries to remove the technical constraint stumbling block. Local educational organizations often need to deliver e-learning at a rate under 30KB per click, which international products cannot provide. Many locations are often connected via dial-up modem.

The development of local learning software can be used specifically to resolve these challenges. In some Arab developing countries, the solution will be developing e-learning that is adapted to outdated hardware and software, restricted bandwidths and unstable network connections – at a cost that makes it viable for their local needs.

Satellite technology can be utilized to take e-learning software to many different locations simultaneously.

Before and during implementing the e-learning technique, the educational organization must be prepared to handle resistance and objections. Make sure it has solid enough information to combat the teachers and the learner's fears [6].

Some strategies can be suggested to face the fears like:

- Be clear about the objectives of the e-learning project.
- Provide enough training and workshops to the educators.
- Discuss all the risks involved.
- Develop and distribute tools that help faculty to prepare for, create, and use the online instruction. Faculty use these tools to build content, map face to face courses to the online environment, and develop interactive multimedia instructional materials.
- Practice
- Periodical feedback from faculty and students.
- Avoid giving up.

To cover the growing requirements of customer's faculty and students, expert campus support must be made available with a network of more certified administrators and trainers.

To avoid changing e-learning to instructional traditional learning, for instance, instead of holding endless management courses, e-learning technology can capture the logic of the processes, patterns and principles that we want students to use. Creating a strategy without having to sit through a long theoretical specialist course is then feasible. Faculty can simply prepare a review of the key concepts, and then access the online tools that help them build an effective strategy. In this way, talented young students could fast-track their careers without having to go through an entire curriculum of management courses.

. The new technological developments have decentralized the loci of information and reduced the authority of traditional linear communication.

Education systems in the Arab world need to challenge the traditional assumptions about treating the students' brains like information storage warehouses. For example, students will remember more content if brief e-learning activities are introduced to the lecture. Contrast this to the prevalent content tyranny that encourages faculty to push through as much material as possible in a given session. We can build or simply use intelligent technologies that take on this role. Higher educational organizations and training centers should then empower their learners with the skills and support systems needed to access knowledge on demand. E-learning plays an important role in this regard, by introducing just-in-time learning and by teaching valuable lessons through simulation. It is an integral part of the total learning solution.

The purpose of this is to integrate theory into practice as faculty shift towards more learner-centered practices.

Special care should be taken during the choosing of the e-learning tool to avoid compatibility problem. Testing stage must be rigorous and extensive.

The current isolation of the theories of intelligent education techniques from the educators in different fields must stop. Faculty must be encouraged to attend conferences, share in collaborative e-learning projects, within the same country and across other countries. While this has value, there are pitfalls. Aggregating the results of several studies and projects on the effectiveness of e-learning can be misleading as the forms of e-learning vary significantly in each of the Arab countries.

VIII. CONCLUSION

Bridging from traditional learning to e-learning is a daunting task in Arab countries higher educational organizations. Governmental efforts should be paid to create structures for complete programs; online programs of professional development and training for employees; and higher education efforts, both individual projects and collective exchange efforts. Organizations must be prepared for the change. Careful consideration of the mission and purpose, criteria for success, learning and teaching strategies, learning theory, productivity and funding; and nature of roles within the institution are fundamental in crafting e-learning stream [8].

High education in Arab countries must start a new age of cooperation in applying high quality, consistent educational tools that offer maximum institutional control and customization. It should be integrated with other organization supported applications. It should provide easy sharing of instructional materials across courses, departments, and institutions. One of its essential features is to increase collaboration among faculty and students, provides convenient single resource for grades, calendar, course materials, quizzes, and communications, and accountability for core courses using standardized evaluations.

Organizations should enhance faculty creativity to stretch the learning boundaries. Universities must encourage conducting more studies of the faculty attitudes and experiences with online teaching in the Arab world.

Faculty members must then change their teaching methodology from instructional to intelligence method. They must be committed to the transitioning from a teaching paradigm to a learning paradigm. Faculty members have to accept changing the way in which they teach. This begins with the course syllabus.

The mission and purpose of the e-learning should communicate a message that encourages faculty and student participation, discovery, and construction of knowledge. The criteria for success should be broad in scope to encourage success in all students [9].

Using multiple feedback measures encourages and enhances learning over time. The e-teaching and learning strategies should be multifaceted, experiential, and collaborative [10].

Using other successful experiences in the implementation of e-learning management system in other parts of the world that have same or close characteristics can help in guiding and enhancing the process of e-learning in Arab countries.

Although the plans of the Arab ministries of education to apply e-learning systems are certainly generating a great deal of controversy, albeit giving up is a big mistake. E-learning may impose steep developing curves on both governments and people. It may take some precautionary steps to smooth out the bumps, and wait out the inevitable setbacks until the payoffs start emerging.

Acknowledgment

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The Framework of Knowledge Discovery in Data Scattering Using Graph Mining

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***Abstract*— Over the years, frequent itemset discovery algorithms have been used to solve various interesting problems. As data mining techniques are being increasingly applied to non-traditional domains, existing approaches for finding frequent itemsets cannot be used as they cannot model the requirement of these domains. An alternate way of modeling the objects in these data sets, is to use a graph to mode the database objects. Within that model, the problem of finding frequent patterns becomes that of discovering subgraphs that occur frequently over the entire set of graphs. In this paper we present a computationally efficient algorithm for finding all frequent subgraphs in large graph databases. We evaluated the performance of the algorithm by experiments with synthetic datasets as well as a chemical compound dataset. The empirical results show that our algorithm scales linearly with the number of input transactions and it is able to discover frequent subgraphs from a set of graph transactions reasonably fast, even though we have to deal with computationally hard problems such as canonical labeling of graphs and subgraph isomorphism which are not necessary for traditional frequent itemset discovery.**

Keywords: Frequent pattern, graph, subgraph isomphism, frequent subgraph, canonical labeling

I. INTRODUCTION

Graph is a ubiquitous data representation that has been used in many application domains for different real-world objects. Examples of graph representations include the topology of communication networks, social networks, citation networks, chemical 2D structures, protein 3D structures, RNA structures, gene phylogeny data, protein-protein interaction data, and signaling, regulatory, and metabolic pathways. An example that have been extensively studied in the pharmaceutical industry, the 2D structure of a chemical can be modeled as an undirected labeled graph where each node represents an atom in the chemical, labeled by the atom type, and each edge corresponds to a chemical bond, labeled by the bond type. With graph representations, automated classifiers have been built to identify target chemicals in a database of known chemicals [BB02].

Graphs have also been widely utilized for representing protein structure in protein structure comparison [APG+94]. In the following discussion, we first give a formal definition of labeled graphs (graphs with node and edge labels) and then discuss two methods that use graphs to represent protein structures.

II. LABELED GRAPHS

A Labeled Simple Graphs

Here we first define labeled simple graphs and then labeled multigraphs and peudographs.

Definition 2.1 ***A labeled simple graph*** *(graph) is a quadruple G = (V, E, Σ, λ) where V is a set of vertices or nodes and* $E \subseteq V \times V$ *is a set of edges joining two distinct nodes. Σ is the set of nodes and edge labels and* $\lambda : V \cup E \rightarrow \Sigma$ *is a function that assigns labels to nodes and edges.*

The size of a graph G, denoted by $|G|$ is the cardinality of its node set. The degree of a node *v* is the number of edges incident with *v*. We use V [G] and E[G] to denote the set of nodes and edges for a graph G, respectively. We usually assume node labels and edge labels are disjoint and a total ordering is defined for the label set Σ. A graph database is a list of labeled graphs where each graph is assigned an integer identifier called graph id. A simple graph G is undirected, if the binary relation $E[G] \subset V \times V$ is symmetric (i.e. $(u,v) \in E[g]$ implies $(v,u) \in E[g]$ and $\lambda(u,v) = \lambda(v,u)$), otherwise, G is directed. Unless stated otherwise, all graphs are undirected in this paper.

B. Multigraphs and Pseudographs

A multigraph is a graph where a pair of nodes may be joined by more than one edge (multiple edges). A loop is a degenerate edge that joins a node to itself. A simple graph can have neither loops nor multiple edges, a multigraph may have multiple edges but no loops, and a pseudograph may have both. To make the description precise, we have the following definition.

Definition 2.2. ***A labeled multigraph*** *is a quadruple G = (V, E, Σ, λ) where* $\lambda : V \cup U \rightarrow 2^{\Sigma} - \{\phi\}$ *is a function that assigns (multiple) labels to nodes and edges.* 2^{Σ} *is the powerset of a set Σ. The interpretations of V, E, and Σ are the same as those of simple graphs. If a labeled multigraph contains a loop, it is a labeled pseudograph.*

Example 2.1 In **Figure 1**, we show a graph database with three graphs P, Q, and S with graph id 10, 20, and 30, respectively. The edge (p_2; p_5) in graph P has multiple labels $\{x, y\}$ and hence P is not a simple graph. Graphs Q and S are simple graphs.

We notice that simple graphs are special cases of multigraphs. Below, we use the term “multigraph" in such way that it may refer to both simple graphs or graphs that indeed contain multiple labels for a node or an edge. Throughout our discussion, we use capital letters to represent graphs and lower case letters with subscripts to denote nodes in graphs.

The order of nodes in a graph is arbitrary.

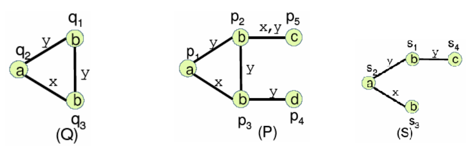

Figure 1. A database G of three labeled graphs. The labels of nodes and edges are specified within the nodes and along the edges.

C. Paths, Cycles, and Trees.

We also use the following graph-related terms:

- A *simple path* (path) is an n-node undirected graph L where $V[L] = \{l_i\}, i \in [1, n]$ and $E[L] = \{(l_i, l_{i+1})\} i \in [1, n-1]$. $n > 0$ is the length of the path L.
- A graph G is *connected* if for each pair of distinct nodes (u, v), there exists a path $L \subseteq G$ such that $l_1 = u$ and $l_n = v$ where n is the length of L.
- A *cycle* O is an n-node path L with one additional edge connecting l_1 and l_n. n is the *length* of O.
- An *acyclic* graph is a graph with no cycle.
- A *tree* is a connected acyclic graph.

III. REPRESENTING PROTEIN STRUCTURES WITH GRAPHS

Graphs have been widely used to represent protein structures. In such representations, we generally use a node to represent an amino acid residue and an edge to represent the binary relation between a pair of residues. Depending on the applications, the binary relation may be (Euclidian) distances between pairs of amino acid residues (distance matrix) or the physicochemical contacts between residues (contact maps). Below we discuss the detail of distance matrix and contact map of protein structures.

A. Distance Matrix

A matrix $X_{n;n} = (x_{i;j})$ ($1 \leq i,j \leq n$) is the distance matrix for a protein P with n elements, if the entry $x_{i;j}$ is the (Euclidian) distance of the i-th and j-th element in protein P. For each protein structure, there is exactly one distance matrix. However, the reserve is not true.

Given a distance matrix X, there are at most two structures corresponding to the matrix (when $n > 4$). This is because inter-element distances are the same for a mirror image of a structure.

Using a distance matrix at the amino acid residue level, a protein structure is represented by a graph where each node represents a residue and each edge connects a pair of residues. Edges in such graphs are labeled by the discretized distances between the two residues that they connect.

B. Contact Map

A protein contact map is the same as the protein distance matrix representation, except that edges in contact maps are not labeled by distances but by a boolean indicating whether the pair of amino acid residues are in “contact" or not. There are many ways to define the “contact" relation. The most common way is a distance based method where a pair of residues are in contact if their distance is below a distance threshold and otherwise not [HSS+02]. More sophisticated methods such as Delaunay Tessellation and almost-Delaunay are also used to define the residue contact relation [HWW+04].

IV. SUBGRAPH AND SUBGRAPH ISOMORPHISM

A fundamental part of pattern discovery in graph represented real-world objects is to define what is a pattern and to specify how to decide whether a pattern occurs in a graph represented object. To make this more precise, we use the follow definitions.

Definition 3 *A multigraph G is a* ***subgraph*** *to another multigraph G’ if*:

- $\forall u \in V[G], (u, \in V[G'])$,
- $\forall u, v \in V[G], ((u, v) \in E[G'] \rightarrow (u, v) \in E(G'))$,
- $\forall u \in V[G], (\lambda(u) \subseteq \lambda'(u))$ and
- $\forall (u, v) \in E[G], (\lambda(u, v) \subseteq \lambda'(u, v)$.

It is easy to see that the above definition applies to simple graphs also.

In this paper, a *pattern* is a graph. We say a *pattern* occurs in a graph G, if it is topologically identical to a subgraph of G. To make this more precise, we introduce the following definition:

Definition 4 *A multigraph G is* ***subgraph isomorphic*** *to another multigraph G' if there exists a 1-1 mapping f : V [G] → V [G’] such that*:

- $\forall u \in V[G], (\lambda(u) \subseteq \lambda'(f(u)))$
- $\forall u, v \in V[G], ((u, v) \in E[G] \rightarrow (f(u), f(v)) \in E(G'))$ and,
- $\forall (u, v) \in E[G], (\lambda(u, v) \subseteq \lambda'(f(u), f(v))$.

G’ in the above definition is a *supergraph* of G. The bijection f is a *subgraph isomorphism* from G to G’ and the node image

$f(V[G])$ of V is an occurrence of G in G_0. With a slight abuse of notation, we may use the term “subgraph" to refer to a “subgraph isomorphic" relation. Two graphs G and G' are *isomorphic*, denoted by $G = G'$ if they are mutually subgraphs of each other. Non-isomorphic subgraph G of G'is a *proper subgraph* of G', denoted by $G \subset G'$.
A proper supergraph is defined similarly.
An induced subgraph is one that preserves all edges in the larger graph. In other words, a graph G is induced subgraph isomorphic to another graph G' if $G \subset G'$ with a bijection $f : V[G] \rightarrow V[G']$ such that

- $\forall (u,v) \in E[G], ((u,v) \in E[G] \rightarrow (f(u), f(v)) \in E(G'))$ and,
- $\lambda(u,v) \subseteq \lambda'(f(u), f(v))$.

. We call a graph G an induced subgraph of G' if G is induced subgraph isomorphic to G'.

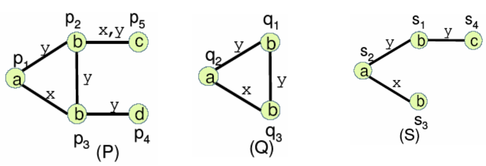

Figure 2. A database G of three labeled graphs duplicated from Figure 1. The label(s) of nodes/edges are specified within the nodes/along the edges.

Example 2. In Figure 2, we show three graphs that are duplicated from Figure 1 for the readers' convenience. The function $f : q_1 \rightarrow p_2$, $q_2 \rightarrow p_1$, and $q_3 \rightarrow p_3$ is a subgraph isomorphism from graph Q to P and hence Q occurs in P. The set fp1; p2; p3g is an occurrence (and the only one) of graph Q in P. We notice that Q is also an induced subgraph of P since Q preserves all edges of P in the node image $\{p_1; p_2; p_3\}$. Similarly, S occurs in P but S is not an induced subgraph of P.

A. Ullman's Algorithm

Ullman's algorithm is one of the most widely used algorithms to solve the subgraph isomorphism problem [Ull76]. Though Ullman originally developed the algorithm for unlabeled and undirected graphs, this algorithm can be easily extended to many other types of graphs with little extra effort regardless of whether these graphs are labeled or unlabeled, have multiple edges or not, have graph loops or not, and are directed or undirected. In the following discussion, we present the basic form of Ullman's subgraph isomorphism algorithm for unlabeled and undirected graphs. See [HBW+05] if interested in subgraph isomorphism in other types of graphs.

In Ullman's algorithm, the pattern graph and graph to be matched with (the parent graph) are represented by standard adjacency matrices $A_{n;n}$ and $B_{m;m}$ where n and m are the total numbers of nodes in graphs A and B respectively. $a_{i;j}$ equals to 1 if the i-th node of the graph A is connected to the j-th node of A and otherwise 0. Matrix $B_{m;m}$ is defined the same way as that of $A_{n;n}$.

Ullman used an $n \times m$ binary matrix M, known as the permutation matrix, to record intermediate search results. Each row in the permutation matrix has exactly one 1 and each column has at most a single 1. The permutation matrix encodes a 1-1 mapping from nodes of A to those of B. To see this clearly, we interpret an entry $m_{ij} = 1$ in M as a match between the ith node in A and the jth node in B. Since each row of M has exactly one 1, each node in A maps to exactly one node in B; since each column of M has at most a single 1, no two nodes in A can match the same node in B. In other words, M encodes a 1-1 mapping from nodes of A to those of B.

Using linear algebra, we obtain $C = M(MB)^T$ where X^T is the transpose of matrix T.
One important theorem about graph matching is that M stands for a subgraph isomorphism from A to B, if and only if:

$$\forall (i, j : 1 \le i, j \le n), (a_{ij} = 1 \rightarrow c_{ij} = 1) \qquad (1)$$

To search for all successful matches, Ullman's algorithm enumerates the space of all possible permutation matrices M using a backtrack method. The proof the theorem and the algorithmic details of the backtrack search can be found in [Ull76].

V. A ROAD MAP OF FREQUENT SUBGRAPH MINING

Because graphs are ubiquitous data types in many applications including protein structure analysis [HWP03, HWB+04], identifying recurring patterns of graphs has attracted much recent research interest. Recurring subgraph patterns provide insights of the underlying relationships of the objects and are the starting point for subsequent analysis such as clustering and classification. Successful applications of recurring subgraph pattern identification include improving storage efficiency of databases [DFS99], efficient indexing [GW97, SBV01], and web information management [Zak02a, RGM03]. With no surprise, algorithms for graph based modeling and analysis are going through a rapid development [HWB+04].

In this section we define the frequent subgraph mining problem, followed by an introduction to current algorithms of mining graph databases.

A. The Problem

Given a set of Σ, the graph space G^* is all possible simple connected graphs with labels from Σ.
Given a group of graphs $G \subseteq G^*$, the support of a simple graph G, denoted by $s(G)$, is the fraction of G where G occurs.
The frequent subgraph mining problem is defined as:

Definition 5 *Given a graph database G and a parameter* $0 < \sigma \le 1$, *the frequent subgraph mining problem is to identify all simple graphs G* $\in G^*$ *such that the support of G is at least* σ .

An algorithm that solves the frequent subgraph mining problem is a frequent subgraph mining algorithm. We focus on simple graphs in frequent subgraph mining for historical reasons: most of the current algorithms only identifies simple graphs. In addition, most of the algorithms assume that the input graph database contains only simple graphs. One notable exception for handling multigraphs in presented in [HPW+06]. We consider only connected graphs in a graph space since unconnected graphs can be viewed as a group of connected graphs. Once connected frequent subgraphs are identified, unconnected ones can be obtained using frequent item set mining techniques, as observed in [KK01].

B. Overview of Existing Algorithms

Since frequent subgraph mining is computationally challenging, early research focused on either approximation techniques such as SUBDUE [HCD94] or methods that are only applicable for small databases like Inductive Logic Programming [DTK98].

Because computing frequent subgraphs in large graph databases is time consuming, research in frequent subgraph mining focuses on improving the efficiency of the algorithms. All scalable algorithms take advantage of the anti-monotonicity of frequency, which asserts that any supergraph of an infrequent subgraph pattern remains infrequent. We can break existing frequent subgraph mining algorithms into three components that are discussed in the sequel.

- Searching for initial seeds: preprocessing the input graph database and identifying a set of initial frequent subgraph patterns as "seeds". Graph topology of seeds is usually simple, e.g. single edge or simple paths.
- Proposing candidate subgraphs: for each seed, a new set of patterns are proposed that are supergraphs of the seed and are likely to be frequent.
- Validating candidate subgraphs: for each proposed candidate, the support value is computed. Only frequent ones are selected as seeds for the next iteration.

Components (2) and (3) may be utilized repeatedly in order to obtain all frequent subgraphs.
Base on the previous analysis, we can generate new subgraphs by adding one edge to existing frequent subgraphs. To illustrate the process, Reader may see Figure 3.

FSG (*Frequent Subgraph Mining*) [KK01] identifies all frequent patterns by a level-wise search procedure. At the first step, FSG preprocesses the input graph database and identifies all frequent single edge patterns. At step k, FSG identifies the set of frequent subgraphs that contains exactly k edges. This set is denoted as F_k. For a graph G, the edge size of G is the number of edges that G contains. The task at step k is subdivided into two phases: candidate subgraph proposing and candidate subgraph validation, with the detail covered below.

C. Candidate Subgraph Proposing.

Given a set of frequent k-1-edge graphs F_{k_1}, FSG constructs candidate frequent k-edge subgraphs by "joining" two frequent k-1-edge subgraphs.

In FSG, two graphs are "joinable" if they have the same edge size $l > 0$ and they share a common subgraph of edge size l - 1. The "join" between two joinable graphs G_1;G_2 with edge size k - 1 produces a set of graphs that are supergraphs of both graphs with edge size k. In other words, in FSG, the join operation is defined as:

$$FSG\_Join(G_1, G_2) = \begin{cases} \{G \mid G_1 \subseteq G, G_2 \subseteq G, |E[G]| = k & \text{If } G_1 \text{ \& } G_2 \text{ are joinable} \\ \phi & \text{Otherwise} \end{cases}$$

We use $|E[G]|$ to denote the edge size of a graph G.

FSG applies the join operation for every pair of joinable graphs in F_{k_1} to produce a list of candidate k-edge patterns C_k. The join operation is illustrated in Figure 3 and the pseudo code is presented in Algorithm 2.

In Figure 3, we show the FSG join operation for a pair of graphs.

D. Candidate Subgraph Validation.

FSG selects the frequent subgraphs with edge size k from the set C_k by computing the support value of each graph in C_k. To compute the support value of a graph G, FSG scans the database of graphs and for each graph G' in the graph database, FSG uses subgraph isomorphism test to determine whether G is a subgraph of G' and updates the support value of G if it is. The pseudo code of the FSG-validation is presented below.

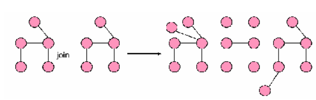

Figure 3. An example of applying the FSG join operation to a pair of graphs. Nodes and edges have the same label.

E. Putting It All Together.

Here we present the pseudo code for the FSG algorithm, which identifies all subgraphs F in a graph database G with support threshold $0 < \sigma \leq 1$.

We simplified the FSG algorithm to explain its basic structure; see [KK01] for details of performance improvements.

Algorithm 1 FSG(G, σ): Frequent Subgraph Mining

1: $F_1 \leftarrow \{e | s(e) \geq \sigma\}$ # all frequent edges

2: $k \leftarrow 2$

3: while $F_{k\_1} \neq \emptyset$; do

$C_k \leftarrow$ FSG-join(F_{k-1}; k)
$F_k \leftarrow$ FSG-validation(C_k; G; σ)
$k \leftarrow k + 1$
end while
$F \leftarrow \bigcup_{i \in [1,k]} F_i$

Algorithm 2 FSG-join(F_{k-1},k): join pairs of subgraphs in F_{k-1}

Ck ← Ø ;
for each G_1;G_2 $\in F_{k-1}$ do
if there exists $e_1 \in E[G_1]$ and $e_2 \in E[G_2]$ such that
  $G_1 - e_1 = G_2 - e_2$ then
$C_k = C_k \cup \{G \mid G_1 \subset G, G_2 \subset G, |E(G)| = k\}$ # joinable
end if
end for
return Ck

VI. CONCLUSION

In this paper we presented an algorithm, FSG, for finding frequently occurring subgraphs in large graph datasets, that can be used to discover recurrent patterns in scientific, spatial, and relational datasets. Such patterns can play an important role for understanding the nature of these datasets and can be used as input to other data-mining tasks. Key elements to FSG's computational scalability are the highly efficient canonical labeling algorithm and candidate generation scheme, and its use of a TID list based approach for frequency counting. These three features combined, allow FSG to uniquely identify the various generated subgraphs, generate candidate patterns with limited degree of redundancy, and to quickly prune most of the infrequent subgraphs without having to resort to computationally expensive graph and subgraph isomorphism computations. Furthermore, we presented and evaluated a database-partitioning-based approach that substantially reduces FSG's memory requirement for storing TID lists with only a moderate increase in run-time.

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Graphical MATLAB Based Tool to Visualize Gate Tunneling Current in Ultra-Thin MOSFET Devices

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***Abstract*—A MATLAB Graphical User Interface is developed to simulate the gate tunneling current of nanoscale MOSFET devices as the gate oxide thickness is scaled down in today's sub 0.1-µm CMOS technologies. The proposed package is user friendly and provides circuits' designers with an idea about tunneling current effect on the behavior of circuits.**

I. Introduction

As MOSFET is scaling down into sub-nanometer regime gate tunneling currents begin to have more and more significant influences on the characteristics of MOS structures and MOSFETs. With such thin oxides, the impact of gate tunneling current on static power consumption and substrate current can no longer be ignored. Many documents on the analytical models of gate tunneling current have been published [1]–[5]. However, there is not a simple yet graphical model to quantify tunneling current through ultrathin gate oxide for future MOS technologies.

This paper introduces a simple MATLAB tool which can be used to show the I-V characteristics of MOS transistors calculate the dimensions of the transistor and simulate the effect of gate tunneling currents. The tool is based on BSIM3 parameters [6] and can be easily developed to perform advanced calculations. In fact the proposed MATLAB tool can in be used as an educational package in colleges and universities to show the tunneling current effect without going into the details of Schrödinger equation and complex analytical models.

BSIM3 model is widely used in industry to simulate analog circuits. It provides an accurate MOSFET SPICE model since it is a physics-based model. Incorporating current tunneling effects will provide more accurate I-V characteristics instead of conventional C-V characteristics.

This paper is organized as follows: BSIM3 equations are introduced in section II, in section III we select a model for the tunneling current, section IV describes the proposed MATLAB tool, in section V we introduce the effect of gate leakage current on current mirrors and we conclude our paper in section VI.

II. BSIM3 Equations

The following BSIM3 equations [7] are used in the proposed tool to simulate the MOS device behavior.

Effective gate-to-source voltage:

$$V_{GSeff}=\frac{2n\frac{kT}{q}\ln\left[1+\exp\left(\frac{q}{kT}\frac{v_{GS}-V_T}{2n}\right)\right]}{1+2nC_{ox}\sqrt{\frac{4\Phi_{FB}}{q\varepsilon_o\times NCH}}\exp\left(\frac{q}{kT}\frac{V_{OFF}}{n}\right)\exp\left(-\frac{q}{kT}\frac{v_{GS}-V_T}{2n}\right)} \tag{1}$$

where

k	boltzmann's constant;
T	absolute temperature;
q	electron charge;
V_T	threshold voltage;
C_{ox}	gate capacitance per unit area;
V_{OFF}	offset voltage in the subthreshold region
NCH	channel doping concentration.

Drain-to-Source saturation voltage:

$$V_{DSsat}=\frac{v_{GSeff}+2\frac{kT}{q}}{A_{bulk}} \tag{2}$$

where A_{bulk} is the charge bulk effect.

Drain current:

$$I_D=\frac{1}{2}\frac{W_{eff}}{L_{eff}}\mu_{eff}C_{ox}V_{GSeff}V_{DSsat} \tag{3}$$

where μ_{eff} is the effective mobility, L_{eff} is the effective channel length and W_{eff} is the effective channel width.

III. TUNNELING CURRENT MODEL

The following equation is entered in the tool's program to simulate the tunneling current effects:

$$J = \frac{q^3}{8\pi h \phi_b \varepsilon_{ox}} . C(V_g, V_{ox}, T_{ox}, \phi_b) . \exp\left(\frac{-8\pi\sqrt{2m_{ox}}\,\phi_b^{3/2}\left[1-\left(1-\frac{|V_{ox}|}{\phi_b}\right)^{3/2}\right]}{3hq|E_{ox}|} \right) \quad (4)$$

The above equation was proposed by Lee and Hu [3]. C(Vg, Vox, Tox, ϕ_b) is a correction function developed by empirical fitting.

where

E_{ox}	electric field in the gate oxide;
m_{ox}	effective electron mass in the oxide;
V_{ox}	voltage across the oxide.
ε_{ox}	oxide dielectric constant

$$C(V_g, V_{ox}, T_{ox}, \phi_b) = \exp\left[\frac{20}{\phi_b}\left(\frac{|V_{ox}| - \phi_b}{\phi_{bo}} + 1\right)^{\alpha} . \left(1 - \frac{|V_{ox}|}{\phi_b}\right)\right]\left(\frac{V_g}{T_{ox}}\right) . N \quad (5)$$

where α is a fitting parameter, ϕ_{bo} is the Si/SiO_2 barrier height and ϕ_b is the actual tunneling barrier height. N represents the density of carriers in the accumulation and inversion layer of the injecting electrode.

IV. GRAPHICAL MATLAB-BASED TOOL

A graphical user interface of the tool was designed using the Matlab GUIDE environment [8] which greatly simplifies the process of building and developing GUIs. The GUI of the tool is shown in Fig.1. The objective of this tool is study the behavior of the MOS device and more specifically to visualize the gate tunneling current in ultrathin gate oxide MOS devices.

The tool allows the user to enter the input voltages (V_{GS} and V_{DS}) and the Drain current. The user has the ability to select the process technology as well as the transistor type. The I-V characteristic of the transistor can be drawn using the same user interface. The tool can also indicate in which region the transistor is operating (off, triode or saturation).

Fig.2 shows an example illustrating the operation of the proposed tool. The right hand axis shows the effect of increasing the gate oxide thickness (t_{ox}) on the NMOS transistor.

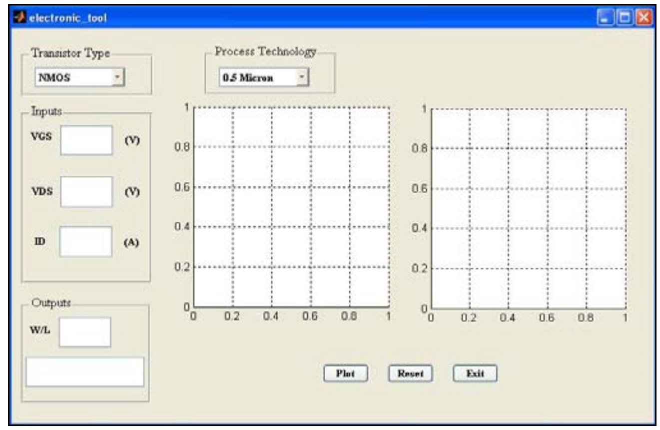

Figure 1. User interface of the proposed tool

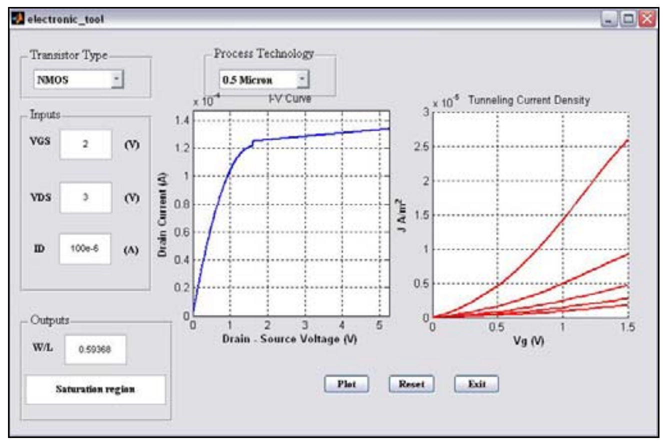

Figure 2. Example illustrating the operation of the tool

As the gate oxide is scaled down the gate tunneling current increases dramatically. The five curves shown on the right axis are taken for t_{ox} = 1.5 nm to t_{ox} = 5.5 nm.

The tool provides the ability to select a specific technology (i.e. 0.5 µm, 0.35 µm, 0.25 µm, etc …), and the type of MOS device (i.e. NMOS or PMOS).

A difference in circuits' behaviors has been observed when simulating basic analog blocks (current mirror cells) using same device dimensions but different Tox.

V. EFFECT OF GATE TUNNELING ON CURRENT MIRRORS

A graphical tool is designed to show the effect of gate tunneling on current mirrors. A current mirror is a current source that generates an output current that is controlled by an input reference current. Current mirrors are used in a wide variety of applications where it is very important to have an accurate and reliable current source. The basic current mirror consists of two NMOS transistors (Fig.3).

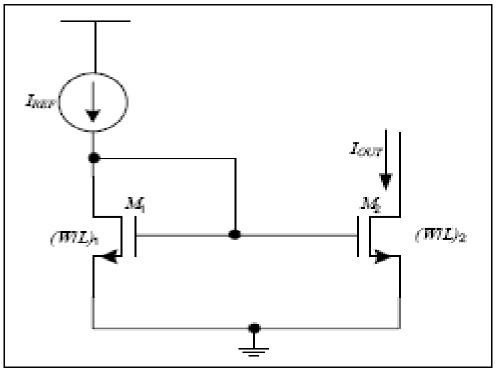

Figure 3. Basic current mirror circuit

If the transistors are matched then the output current should be the same as the reference current. In the deep sub-micron realm, a channel length of 100 nm needs a gate oxide thickness of 1-2 nm. In this regime, gate tunneling currents have an impact on the operation of the current mirror; in this case the output current and the reference current are no longer equal due to the gate leakage current. The second interface is shown in Fig.3.

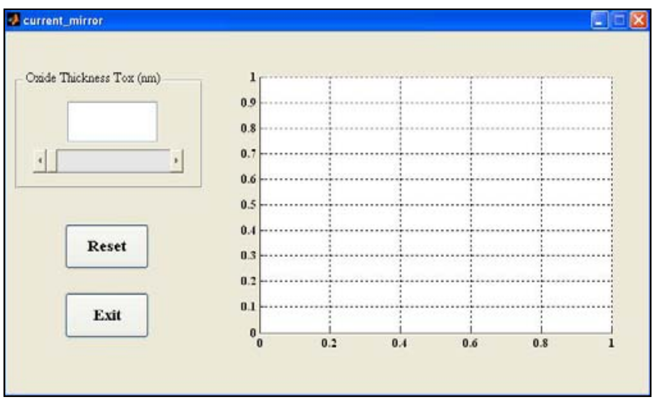

Figure 4. User interface of the current mirror simulator

The output current of the current mirror is simulated with respect to the reference current. The user has the ability to select the gate oxide thickness using the slider in the interface. The selected t_{ox} is then displayed on the text box as shown in Fig.4.

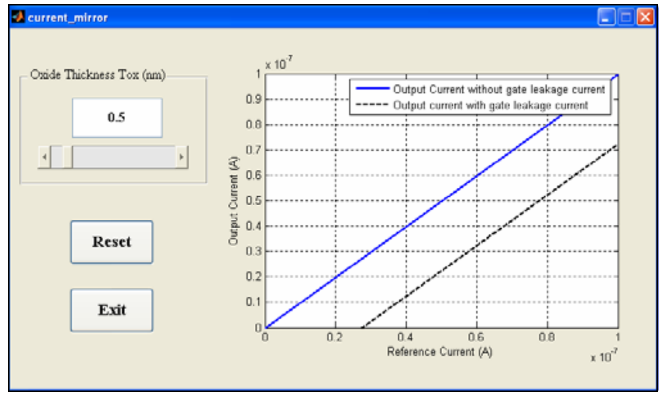

Figure 5. Output current of the current mirror with and without gate leakage current. t_{ox} = 0.5 nm

The blue solid line represents the output current of a current mirror without considering the gate leakage current, while the black dashed line represents the output current with gate leakage current. It is obvious that due to the extreme reduction of the gate oxide thickness, the mismatch between the two curves is large. The slider in the interface helps the user to visualize the effect of decreasing or increasing the gate oxide thickness (t_{ox}). In Fig.6 t_{ox} is increased to 0.75 nm.

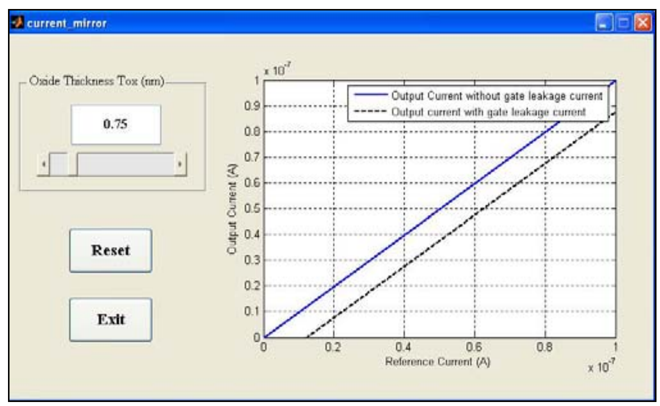

Figure 6. Output current of the current mirror with and without gate leakage current. t_{ox} = 0.75 nm

The mismatch between the two curves decreases as the gate oxide thickness is increased as shown in Fig.7, Fig.8, and Fig.9.

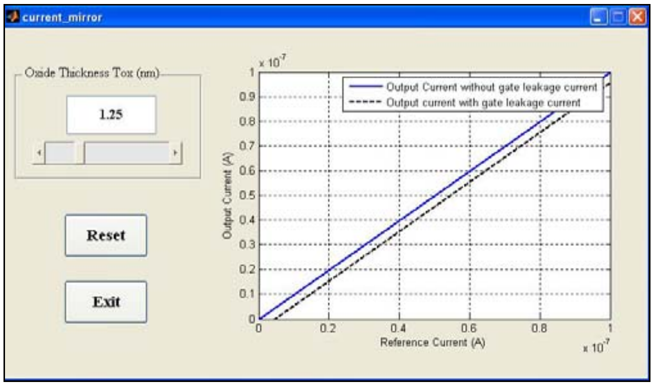

Figure 7. Output current of the current mirror with and without gate leakage current. t_{ox} = 1.25nm

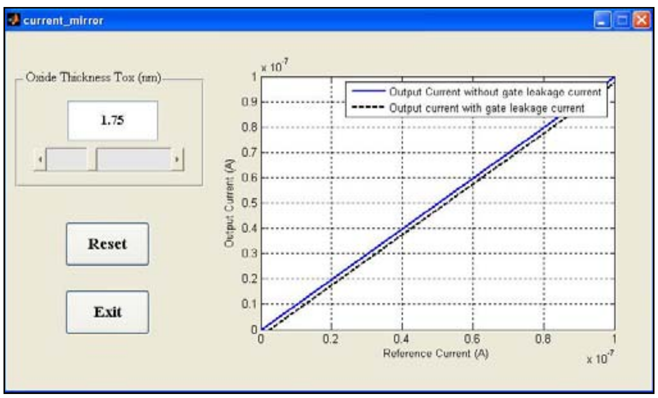

Figure 8. Output current of the current mirror with and without gate leakage current. t_{ox} = 1.75 nm

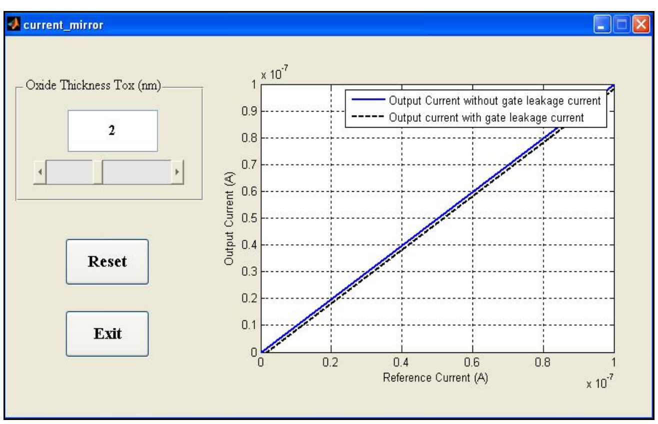

Figure 9. Output current of the current mirror with and without gate leakage current. t_{ox} = 2 nm

The gate leakage current has no observable effect when the gate oxide thickness exceeds 3 nm and the two curves are superimposed on each other as shown in Fig.10.

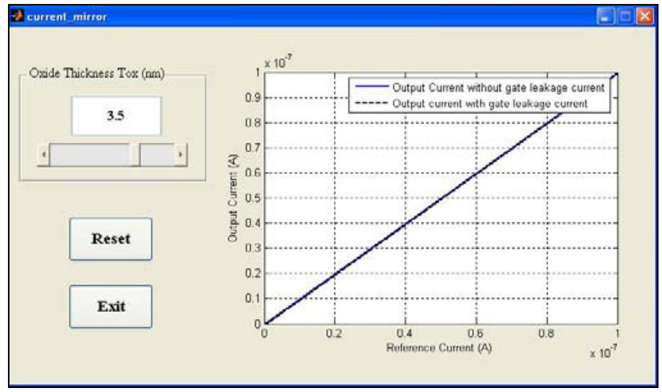

Figure 10. Output current of the current mirror with and without gate leakage current. t_{ox} = 3.5 nm

Several works have been done to solve the problem of gate leakage currents, some of these works focus on circuit techniques to compensate for the tunneling current. High dielectric constant materials are also used to reduce the gate leakage current. Intel Corporation has developed the 45 nm Penryn processors using high-K metal gate transistors which reduce the gate oxide leakage ten times over the silicon dioxide. These transistors have important advantages over the traditional transistors. The new technology increases the derive current more than 20%, reduces the switching power consumption, and reduces the leakage currents.

VI. Conclusion

In teaching MOS devices and circuit designs using ultrathin gate oxide MOS devices, instructors at universities and colleges need to use different methods to explain complex concepts. The gate tunneling current is one of the hot issues in today's CMOS technologies and mathematical models involving Schrödinger equation and its solutions is not easy to follow by undergraduate students. The introduced Matlab tool aims to help instructors explain as well as students understand gate tunneling current. It is simple and offers tracking step by step of all the calculations. The tool can be also used to design and analyze basic CMOS analog circuits without going through long calculations and solving equations which could be time consuming step.

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Implementing Virtual Work Tools in Global Enterprises

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***Abstract* — Today's global work environment is becoming increasingly virtual, driven by the need for increased productivity and supported by advances in information and communications technologies (ICT). Implementing virtual work tools in a global environment requires careful attention to the nature of virtual work tools, how these tools are used to support business processes, and the management issues associated with managing virtual work groups.**

Keywords - Communication; Conferencing; Knowledge Management; Online Learning; Telework; Virtual Work

I. Introduction

Many technologies are available to support virtual communication technologies. Sophisticated technologies may fail if deployed by enterprises not prepared to use them. This is especially true when virtual tools are used in a global setting. Less complex technologies may yield significant benefits when used by enterprises that understand how to manage them.

We begin by discussing the nature of virtual work tools within a higher education enterprise context. We then review three categories of virtual work tools: communication, conferencing, and collaboration tools. Next comes a discussion of virtual work tools implementation issues. We conclude with future trends in virtual work tools.

II. Background

A virtual worker in this context is a student, faculty or staff member who routinely works in a different geographic location from others. Some virtual workers are teleworkers – working from home – while others may work on a campus without significant interaction with co-located colleagues and students. Still other virtual workers are nomadic themselves, regularly working at multiple locations, in some cases without a permanent location, such as university extension programs reaching out to military personnel around the world. Virtual workers may experience an absence of traditional workplace intermediation factors such as physical workspaces, face-to-face classes, and chance physical encounters. Enterprise technologies are defined here as those technologies that are deployed for use by all workers

In higher education, online learning is an increasingly important component of institutional strategic plans and academic programs. The Sloan Consortium reports that almost 3.5 million U.S. students enrolled in online classes in Fall 2006, and that the annual growth rate for online classes is approximately 10% [1]. The global growth of online education has resulted in more heterogeneous online classrooms. In addition to students with different cultural and educational backgrounds, students interact with online environments in a far more diverse ways than they do with a traditional environment. Today's course management systems provide faculty members with new tools to organize course content, package assignments, conduct assessments, facilitate discussions, and maintain digital copies of student work. In addition, globalization de-emphasizes face-to-face communication and can leverage intellectual capital generated by faculty and students. Increased and sometimes discontinuous use of communication, conferencing, and collaboration tools can result.

Our technology environment is evolving from an industrial model to a pervasive model. The advent of the commercial Internet in 1995, explosion of cellular telephony, and proliferation of personal computing devices has given rise to "nomadicity," defined by Kleinrock as "transparent virtual networking" [9]. Nomadic users access data, programs, and services as they move from place to place in a transparent, integrated, and convenient fashion. Gupta & Moitra describe virtualization and pervasive computing as "an umbrella of IT capabilities …characterized by mobility, wireless connectivity, context awareness, implicit inputs, proactiveness, smart spaces, and the use of natural interfaces for human-device interaction" [6].

Not long ago, it took years for virtual technologies to find their way into homes. Today, virtual workers often use technologies prior to enterprise adoption. Examples include video capture and editing, peer-to-peer networking, instant messaging, blogging, and portals. Teleworkers can install very capable home technology infrastructures at modest costs. Pervasive technology, nomadicity, and consumerization contribute to a culture of "networked individualism" where individuals interact with the network on their own terms [2]. The enterprise implications are clear: implement a technology

infrastructure capable of supporting virtual work, but support nomadic workers using their personal technologies.

How do these trends relate to higher education's use of virtual work tools? Globalization, pervasive technologies, wireless technologies, and the consumerization of technology provide opportunities for workers to do more of their work from anywhere, and for higher education enterprises to design learning delivery systems with less regard for location.

Virtual work is a multi-dimensional phenomenon. Holtshouse proposes a "four space" model of the future work environment comprised of physical, organizational, informational, and cognitive spaces [7]. Physical and organizational approaches differ for virtual and on-site work. Tacit workers will personalize today's "one size fits all" information space to address multiple and sometimes conflicting cognitive needs. Higher education enterprises deploying virtual work tools need to address both technological and managerial issues, and we know that technologies are sometimes implemented without adequate management capabilities.

III. VIRTUAL WORK TOOLS

Until the late 1990s, most enterprise applications – even e-mail – used client-server technology that required specialized client software on end-user computers. Internet and cellular telephony services became globally available in the late 1990s, followed closely by broadband wireless services and personal digital assistants (PDAs). The adoption of the Web browser as a "universal client" has simplified desktop management and promoted software standards but has complicated the delivery of content. Some workers may use a desktop computer with a hard-wired network connection while others use PDAs and cellular network services. Other workers maintain multiple devices and require seamless access to information regardless of which device they choose to use.

Several trends drive the evolution of virtual work tools. Significant improvements in international Internet bandwidth have been accompanied by dramatically reduced costs, promoting business-to-business network connectivity. Internet-based videoconferencing is widely available and no longer requires expensive on-site equipment and support [12]. Global industry standards now support development of virtual work tools [11].

In addition to using productivity software, e-mail, and calendaring, most virtual workers are also familiar with collaboration technologies such as instant messaging, file sharing, and blogging. These skills support adoption of groupware and conferencing [13].

We have grouped today's virtual work tools into three broad categories – communication, conferencing, and collaboration – as shown in Figure 1.

Communication tools comprise the most ubiquitous set of virtual work technologies and are available to virtually all global enterprises and workers at relatively low cost. Telephony services are available virtually anywhere as public switched, private switched, voice over IP (VoIP), or cellular services. E-mail is widely deployed, and most workers routinely send documents as e-mail attachments, although many enterprises do not effectively manage attachments. Productivity tools – word processing, spreadsheet, presentation, and database applications – are used to document tacit knowledge. Most enterprises have deployed local area networks or enterprise file systems for shared document storage, although document knowledge is most often managed at individual or departmental levels. Informational web sites provide product and service information, and secure intranets are used to store documents and process transactions.

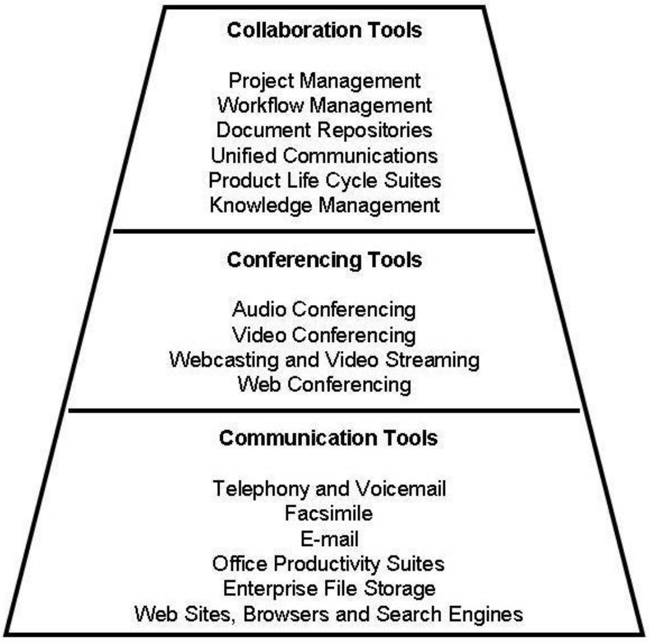

Figure 1. Classification of Virtual Work Tools

Conferencing tools comprise more complex virtual work tools supporting real-time meetings between virtual workers. Conferencing tools require a more robust infrastructure, greater investment, and better employee training to be used effectively. Audio conferencing connects participants using telephones, cellular phones, or VOIP, and is widely available from many service providers. Video conferencing adds full-motion video to real-time meetings and can be carried over ISDN or Internet connections. Conference bridges can add audio participants to a videoconference session. Videoconferences can be webcast in real-time or streamed on-demand following the meeting.

Many enterprises extend their use of conferencing tools by using Web conferencing, providing participants with an online meeting environment for sharing text or presentations. The leader can stream audio or video to participants. Participants use a chat window to send text messages to the group, and may be authorized to transmit audio or video content. A whiteboard is allows participants to mark up a shared workspace. Web conferences can often be recorded to provide on-demand streams of prior sessions. Some conferencing tools support file and application sharing where participants manipulate a file or application. Many conferencing tools also provide survey and polling tools.

Collaboration tools comprise the most complex virtual work tools, integrating project and document management functions into communication and conferencing tools. Collaboration tools are expensive to acquire and maintain, require ongoing management and user training, and require integration with enterprise applications and productivity tools. Collaboration tools support document or product development using productivity or design tools. They include project management systems for task and participant assignments, team work areas, and shared calendaring. Many collaboration tools include unified communications and workflow systems to integrate telephone, facsimile and e-mail messages into the virtual work environment and to route tasks between participants. Collaboration tools provide federated contact lists, presence indication and social networking features.

Many enterprises extend their use of collaboration tools by using document repositories to provide shared access to versioned project documents. Participants receive automatic change notification through e-mail messages, voicemail messages, or Real Simple Syndication (RSS) feeds. Project dashboards aggregate critical project information, support personalization of screen layout and notification, and may provide intelligent agents to take actions on behalf of participants. Some collaboration tools support real-time engineering design. Enterprises may use collaboration tools to provide input to knowledge management systems.

Pickering & Wynn summarize the shortcoming of today's virtual work tools, including lack of cross-cultural or cross-language support, inability to interpret context and nuance, and lack of social networking features [11]. Today's solutions also lack interoperability, suffer from usability issues, are sometimes unreliable, and are often deployed without attention to employee needs. Implementing virtual work technology on a regional or global scale presents additional challenges, including the wide variation in broadband services in different regions, difficulties managing groups across time zones, communication issues resulting from network latency, the lack of end-to-end quality of service capabilities on today's networks, and providing technical support to end-users on a 7x24 basis.

IV. IMPLEMENTATION ISSUES

Enterprises deploying virtual work tools need to address both technological and managerial issues, and we know that some technologies are implemented without adequate management capabilities. To decide when and how to deploy virtual work tools, we need to understand the global and enterprise technological context, the nature of virtual work tools, and best practices for managing virtual work.

Deciding how business will be conducted. Business practice decisions broadly define how business will be conducted. The business should consider its need or centralized versus decentralized operations, and how much tactical and strategic work will be conducted internally or with partners. The business should also consider how much work will be cooperative or collaborative. Cooperative tasks are divided into independent subtasks and managed hierarchically, but collaborative tasks are organized as intertwined layers. Cooperative work requires synchronicity only when assembling partial results, but collaborative work requires continuous synchronicity to focus on emerging products [4]. Communication and conferencing tools can support cooperative work, but collaborative work requires collaboration tools.

Selecting and implementing the most appropriate tools. A virtual work environment will likely consist of a number of tacit tasks, projects, and programs. Some tacit work profiles are more appropriate to be supported by the use of communication tools, while others may be more appropriately supported by conferencing or collaboration tools. As the cost of implementing and maintaining virtual work tools varies widely, managers must pay close attention to the allocation of virtual work tool resources to ensure that valuable resources are not squandered.

A strategic technology assessment can estimate the potential for using technology to support business strategy. The assessment provides a "reality check" link between business strategy, business practices, and virtual work tools. The strategic technology assessment should evaluate evolving technologies from the perspectives of stages, adoption cycles, commoditization, and "buy versus build." An inaccurate assessment of a potential new technology may lead to acquiring a technology that is not used by partners or customers. Predicting the availability and pricing of hosted services has long-term consequences for deploying virtual work tools.

Intellectual property and security policy decisions in reaction to unforeseen events. We recommend defining broad intellectual property and security policies before deploying virtual work tools. Intellectual property and security policy decisions define policies for phases of the collaboration life cycle, frameworks for security practices, and a better understanding of the enterprise strategy and implementation practices. Security policies reflect intellectual property policies, statutory requirements, and contractual obligations. Security policies have shorter life cycles than intellectual property policies, and virtual work requires sophisticated use of access control lists as employees work on multiple projects and within multiple project phases. This need for flexibility conflicts with traditional enterprise security control practices.

Managing virtual work groups. Virtual teams require proactive leadership, project management, and personal attention to team members. Open and frequent communication can build team trust. Team leaders should build clarity and predictability by setting clear objectives and responsibilities, using clear language, and promoting constructive discourse. Team leaders also need to interpret facts and tasks within the larger context of the enterprise.

Managing virtual team members from different companies requires attention to group formation and norming activities. Where possible, team members should possess strong personal networks. Teams should have time to form personal relationships and identify mutual interests, and leaders should provide opportunities for task-related and social interaction.

Managing virtual team members from different countries requires greater communication about work tasks. An initial face-to-face meeting can allow team members to establish relationships. Regularly scheduled status meetings, adjusted for participation across time zones, should be facilitated and documented. Team leaders should track team member participation to identify isolated team members.

Managing virtual team members from different cultures requires additional focus on cultural diversity. Team leaders should provide opportunities for team members to discuss cultures and values, and to address cultural communication differences. Some cultures place great importance on face-to-face interaction, so scheduling periodic face-to-face or video meetings is important.

Managing virtual team members who speak different languages requires educating team members about virtual communication and practicing communicating before beginning virtual work. Team leaders should identify language interventions including translation. Comprehensive written communication is critical to multi-language virtual teams, but team members will need additional time to review documents and interpret context.

Enterprise knowledge practices yield competitive advantage derived from alignment of technology architecture, delivery processes, workgroup practices, and virtual work management practices. This competitive advantage should align to the institutional strategy defined at the first level of the framework.

Enterprises at this level can also support self-governing "learning communities" such as those in Hewlett-Package, Xerox, the World Bank, British Petroleum, IBM, and Siemens [3]. Learning communities tend to be national or international in scope, are responsible for a knowledge domain, but are not formal organizational units. Incorporating social networking features into virtual work environments can encourage the development of learning communities.

V. CONCLUSIONS

Friedman describes a flattening of global business driven by existing and future technologies that enable enterprises to become increasingly collaborative [5]. More than 90 percent of Americans believe it is important to prepare future generations for a global society [8].

We expect to see the continuing maturation of unified communications that integrate telephony, voice mail, e-mail, conferencing, instant messaging, and corporate data. The rapid deployment of ubiquitous wireless networks and consumerization of wireless technologies will accelerate development of pervasive computing. We expect that discontinuous change will disrupt the life cycles of some expensive enterprise infrastructure components [6].

The widespread adoption of video capture and editing will facilitate integration of video content into virtual work environments and knowledge repositories. Mature knowledge ontologies will facilitate integrating a wide range of objects into the virtual work environment. Individual objects or object collections need to be described in terms of multiple ontologies. Agent technologies will help manage knowledge repositories, objects, and communications [10]. Virtual work portals will help manage multiple virtual work environments accessed concurrently by workers [14]. A virtual portal will host several logical portlets and enable workers to customize their view of each portlet.

Additional investments in IT infrastructure and a shorter lifecycle for IT investments will continue to focus on collaboration technologies, especially those that support social networking by student workers. Within higher education there will be a need to "give up some control" of how student workers use technology which will result in them using a mixture of their own personal technologies as well as the institution's enterprise technologies.

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Efficient Search for Plagiarism on the Web

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***Abstract*— Understanding the characteristics of written English allows Internet search for the source of a document to be carried out efficiently. There is a Zipfian distribution of word frequencies in natural language, with some words common and many words rare. If we take a group of three words, the rarity of most of these triples is extreme. This can be exploited to detect web pages similar to a given target document: while a Google search for some triples from the target may return many hits, other triples will only be found in a few documents on the Internet. These documents may well be similar to the target, and are certainly worth examining more closely. Initial experiments show that this approach is very promising, and it is being implemented in a software tool called WebFerret.**

***Index Terms*— Plagiarism, Search Engines, Ferret.**

Overview

In this paper we review the problem of plagiarism, explain how the Ferret software tool detects similar pairs of documents in a collection, and show how Ferret can be extended to efficiently detect sources of Internet plagiarism.

The Problem of Plagiarism

The problem of plagiarism, whether real or perceived, is an important and emotive issue for both students and staff in higher education; both are concerned to maintain the quality of degrees. Honest students can feel aggrieved that while they are working hard to earn their degrees, others may be gaining their qualifications by cheating. Someone who hands in plagiarised work that is not discovered may even gain a better award than an honest student!

Staff do not want to waste their time marking and giving feedback on work that was not done by the student who submitted it. It is very time consuming to search for the source of plagiarism if it is suspected, and even more time consuming to document the evidence if it is confirmed [1]. It is also very annoying to invest that effort, but then to fail at the investigation stage. Even among staff who have not recognised plagiarism, it is a problem; it raises our expectations of what an average student might reasonably produce. One effect of this is that degrees are devalued over time. The detection and prevention of plagiarism is therefore an important topic.

But according to THES (June 23, 2006, p.4), "53% of students said that they did not believe their tutors would spot cheating" [2]. The same survey of 3200 students (commissioned by JISC PAS) found that 87% supported the use of electronic detection tools.

University procedures when plagiarism is suspected frequently require staff to fully document relevant passages, both in the student's work, and in the original sources. This is time-consuming when carried out manually, even with the help of Google searches. Not only must the correct source documents be found, but the offending passages must be identified. Automated tools, such as Ferret [3] can help to locate and document copying with the minimum of invested time.

We have identified 4 catagories of plagiarism, based on the source of the copied work [4].

1) If the source is a fellow student, then the offence is generally referred to as collusion. The significant point here is that we have got the source. Somewhere in the pile of work to be marked is the document that was copied. Existing tools such as Ferret rapidly find such copies and are effective also at documenting collusion.
2) If the source is the Internet, then it is likely that the culprit may have used material from more than one source, and may have made changes. But we can find the source. The student presumably typed some fairly obvious keywords into a search engine, which then gave him the raw material for his essay. But if the dish is under-cooked, he has committed plagiarism and we can find his sources in exactly the same way that he did. In fact we shall see later in this paper that we can often identify directly which source he used, with very little effort.
3) The third possible source is an essay bank. Here we can't easily find the source. Some commercial plagiarism detection services claim to have obtained essays from essay banks, though there is a more honourable and economical way to do this than paying money: simply wait for another student to pay for and submit an essay from the same source.
4) In the final case, where the work was written to order, then it is completely impossible to find the source. Unless the bespoke author used Internet sources to construct the essay, the only avenue open is to find indications that the student who submitted the work is in fact unfamiliar with its content (see e.g. [5]). This is the problem more recently identified as "contract cheating" which has been extensively investigated by Lancaster [6] and others [7].

These four categories of plagiarism are useful in considering approaches to dealing with the problem.

The focus of this paper is on detecting plagiarism from the Internet, and we analyse an extension to our existing plagiarism detection tool Ferret to address this requirement.

What is Ferret?

Ferret is a copy-detection tool, which has been produced at the University of Hertfordshire [8]. It has been developed over more than 6 years, is *freely* available on the Internet [9], and has been used by HE institutions around the world. It analyses documents on the user's own computer, extracting text from pdf, Word or RTF formats. It has a fast and intuitive interface and produces reports highlighting any evidence of copying, ranking all pairs of documents based on similarity. It can detect copying in multiple languages (both natural and computer) simply by changing the definition of a "word" within the program code. This can vary: for Chinese we would use a single character in place of a word for western languages [10]. For computer languages it may be helpful to add additional tokens alongside normal words.

Ferret makes it easy to compare large collections of documents for signs of copying. It is also very fast: the algorithm it uses is linear, both in space required and in time taken, as the total number of words in the input documents grows. Comparisons of the Ferret algorithm with other approaches [11], [12] show that its performance is excellent.

However, Ferret has one limitation, which is that it only works on collections of documents provided by the user. A typical question raised by potential users is whether it can search the Internet for related documents. We are developing such a version of Ferret, and this paper describes the main technical issues which we have explored in the process of so doing.

Running the current Ferret has three stages:

1) Select documents to compare, by identifying them using a file selector as shown in figure 1.

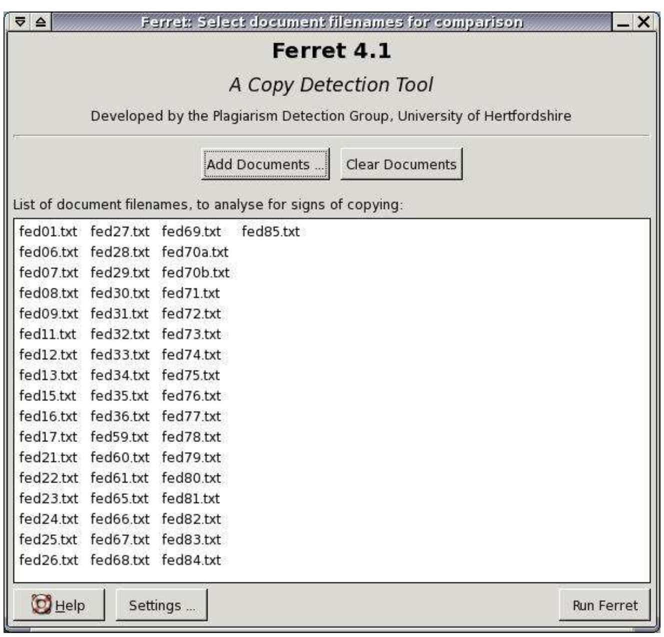

Fig. 1. Selecting files to check

2) Analyse documents, producing a ranked list of document pairs (as shown in figure 2) and a measure of *similarity* (as explained later).

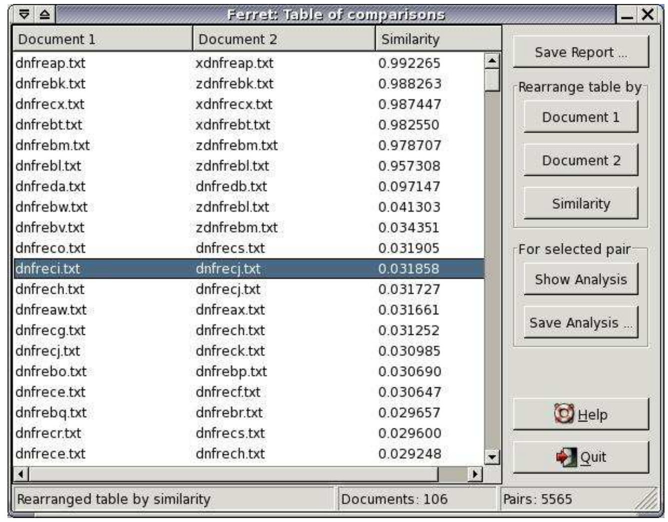

Fig. 2. Pairs in order of similarity

3) Compare pairs of documents, as shown in figure 3, to see which parts may have been copied.

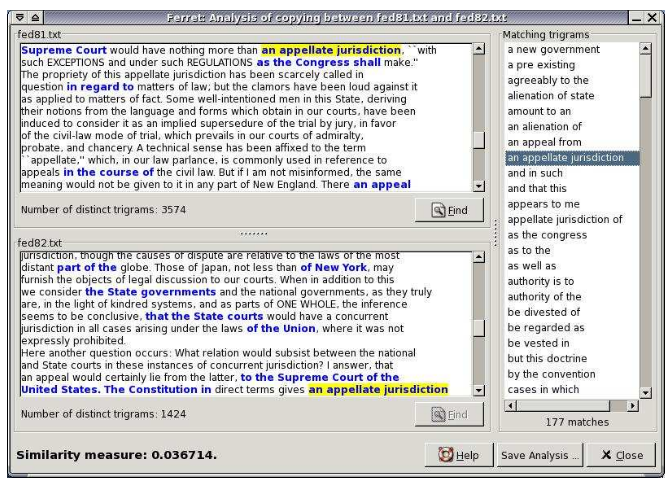

Fig. 3. One similar pair examined

In addition to the displays of the working program, Ferret allows the user to save copies of the analysis and detailed comparisons into pdf reports, for printing or later use, possibly as evidence.

How Ferret Works

Ferret works by extracting *trigrams* (sequences of three words). If we take as an example the phrase "multicasting is a standard feature in Internet . . . ", then the trigrams in this phrase are: "multicasting is a", "is a standard", "a standard feature", "standard feature in", "feature in Internet" . . .

Note that the number of trigrams is two less than the document length in words. Some trigrams, e.g. "a standard feature", are fairly generic, others, e.g. "multicasting is a", are topic specific.

The reason that Ferret is so fast is that we build an index of trigrams as the documents are read, so if there are n input

files, checking all $\frac{n.n-1}{2}$ pairs of documents is done in more or less linear time.

In order to *rank* documents by similarity, we need some metric. If A is the set of trigrams from document 1, and B is the set of trigrams from document 2, then

$$\text{Similarity} = \frac{\text{Number of common trigrams}}{\text{Total number of trigrams}} = \frac{|A \cap B|}{|A \cup B|}$$

For example, suppose document 1 is “multicasting is a standard feature in Internet”. If document 2 is “multicasting is a feature of the Internet” then there is just one common trigram: “multicasting is a”.

The total number of trigrams is 9, as there are 5 in each document but 1 trigram is common. They are “multicasting is a”, “is a standard”, “a standard feature”, “standard feature in”, “feature in Internet”, “feature in Internet”, “is a feature”, “a feature of”, “feature of the”, “of the Internet”. This means that (for this tiny example) our similarity metric would be $1/9$ (which is 0.11 or 11%).

In practice a lecturer looks not for a particular value of similarity, but rather looks at the most similar pair of documents first, then the next most similar, and so on .... The point at which she would stop is when her academic judgement says that the pairs she is examining no longer show any signs of plagiarism. If matching trigrams are scattered over the whole document, copying is not indicated, but if they are in closely packed blocks it is likely that both files in the pair share some common source. In fact we plan to implement a metric that automates that aspect of the lecturer’s judgement.

WHY NOT USE TURNITIN?

Our aim is to *search* automatically for potential sources of plagiarism, but automated tools for plagiarism detection have existed for many years. The commercial, US-based company Turnitin is perhaps the best known. It offers plagiarism detection against Internet available sources, so it would seem silly for us to compete with an established service.

However documents must be *given* to Turnitin, leading to a transfer of intellectual property; Turnitin *charges* for its use; and Turnitin cannot be *customised*, as it is a closed, commercial system.

The new version of Ferret, WebFerret, will avoid all three of Turnitin’s problems. First, staff will retain ownership of their documents: WebFerret may be used on your own computer, and the web application will not retain copies of documents. Second, WebFerret will be free for staff to use. Third, Ferret has been designed to be extended. Currently, Ferret works on English, other European languages, Chinese and (certain) computer programming languages. As a product of the University, Ferret can be tailored to suit the needs of staff within the University needing to detect plagiarism in different kinds of documents.

OUR APPROACH

How should we select Internet sources to go in our document collection? One approach would be to search on the same keywords that the students are likely to have used. But if you have a document that you suspect may be plagiarised, you can use the same technique that our plagiarism detector uses. Do a Web search of some unusual phrases in the text; do not search for phrases that would indicate the subject matter of the document as that makes it harder to spot whether you have hit the right document.

For example, consider the following piece of text:

> “It is at best a temporary utility that will eventually become obsolete when multicasting is a standard feature in Internet routers. By then there will be an established base of MBone users (which should make the router manufacturers happy).”

The triples in the first sentence of this sample piece of text are shown in table I together with the number of hits produced by a Google search on that exact string.

Triple	Frequency	Common?
it is at	about 1,770,000	* * *
is a standard	about 1,750,000	* *
is at best	about 1,470,000	* *
at best a	about 1,360,000	*
that will eventually	about 1,290,000	* *
a standard feature	about 743,000	*
will eventually become	about 699,000	*
utility that will	about 461,000	* *
standard feature in	about 116,000	*
eventually become obsolete	about 32,600	
become obsolete when	about 22,400	*
feature in Internet	about 18,100	*
best a temporary	about 16,800	
multicasting is a	about 12,900	* *
in Internet routers	about 10,400	*
a temporary utility	about 2,070	
when multicasting is	about 787	* *
temporary utility that	3	*
obsolete when multicasting	2	*

TABLE I

GOOGLE DOCUMENT FREQUENCIES FOR TRIGRAMS OF SAMPLE TEXT

Although the most startling observation is that a few triples only appear 2 or 3 times, it is important to note the frequencies of even the relatively common strings: although some triples are fairly frequent, most are much less so, as the following graph (figure 4) shows. The common words (listed later, and marked with an asterisk here) tend to lead to more common triples (though not entirely so).

Contrast the frequencies of the individual words shown in table II, which have the same rapid fall-off in frequency, but for a starting point more than three orders of magnitude higher. Again the graph in figure 5 makes this plain.

The list of 116 common words (and artefacts of the Internet) is: the, be, to, of, and, a, in, that, have, i, it, for, not, on, with, he, as, you, do, at, this, but, his, by, from, they, we, say, her, she, or, an, will, my, one, all, would, there, their, what, so, up, out, if, about, who, get, which, go, me, when, make, can, like, time, no, just, him, know, take, person, into, year, your, good, some, could, them, see, other, than, then, now, look, only, come, its, over, think, also, back, after, use, two, how, our, work, first, well, way, even, new, want, because, any, these, give, day, most, us, b, c, p, html, s, t, e, br, www, http, h, is,

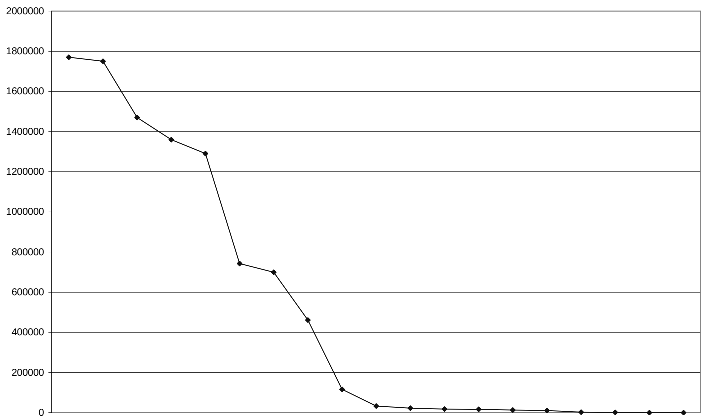

Fig. 4. Declining frequencies of word triples

Word	Frequency	Common?
a	6,800,000,000	*
in	5,540,000,000	*
is	4,000,000,000	*
it	3,050,000,000	*
that	2,890,000,000	*
at	2,800,000,000	*
will	2,620,000,000	*
when	1,920,000,000	*
internet	1,560,000,000	
best	1,510,000,000	
become	705,000,000	
standard	605,000,000	
feature	395,000,000	
eventually	151,000,000	
utility	140,000,000	
temporary	114,000,000	
routers	40,400,000	
obsolete	23,500,000	
multicasting	1,470,000	

TABLE II

GOOGLE DOCUMENT FREQUENCIES FOR WORDS FROM THE SAMPLE TEXT

was, went, were, are. The commonest 8 words in the sample sentence are on this list.

Further evidence of the rarity of certain phrases (even in a database as large as the Internet) can be found by a search for “temporary utility” and “manufacturers happy” – an Alta-Vista search gave three hits on the query: +“temporary utility” +“manufacturers happy”. One is a book on the subject, the second is an acknowledged quote from that book, and the third is a plagiarised student report (accessible via the instructor’s web-site).

We repeated this experiment more recently using Google. As can be seen in table III, the number of copies of that paragraph had increased from three to six: the original, two copies with citation, and three without. We also found further evidence of the rarity of specific word triples.

The addition of a perfectly common word like “that” to the end of a search string reduced the number of hits from around 21,000 to just the six matching documents: more evidence for the effectiveness of trigrams as a basis for automated Internet search.

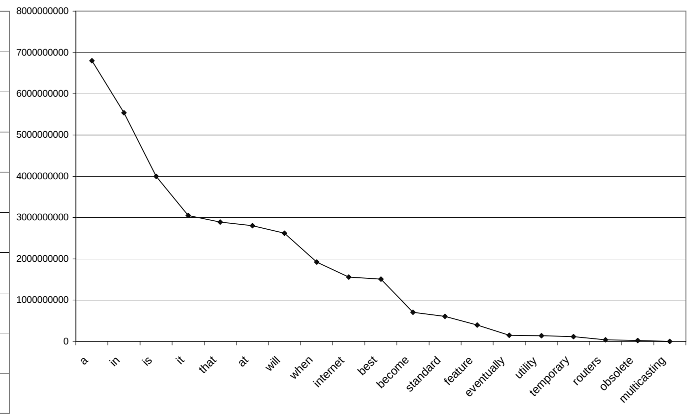

Fig. 5. Sharply declining word frequencies

Search on	Hits
“temporary utility”	about 21,000
“temporary utility that”	6
“router manufacturers”	about 27,000
“manufacturers happy”	about 2,300
“router manufacturers happy”	6

TABLE III

EXTENDING SEARCH STRING BY ONE WORD ELIMINATES ALL IRRELEVANT HITS FROM GOOGLE

STEPS IN WEBFERRET

Our aim is to search automatically for potential sources of plagiarism: we do this by passing search terms to an Internet server, and retrieving the lists of documents resulting from the search. Ferret provides us with *trigrams*, which we can use as search terms. However not all trigrams are equally likely to produce good results, so we adopt the rule that trigrams containing common words are more likely to occur by chance, and so exclude them. Actually, the evidence of the example above suggests that this may not be so, but as a general rule the assumption seems reasonable, especially when each document will contain several hundred trigrams.

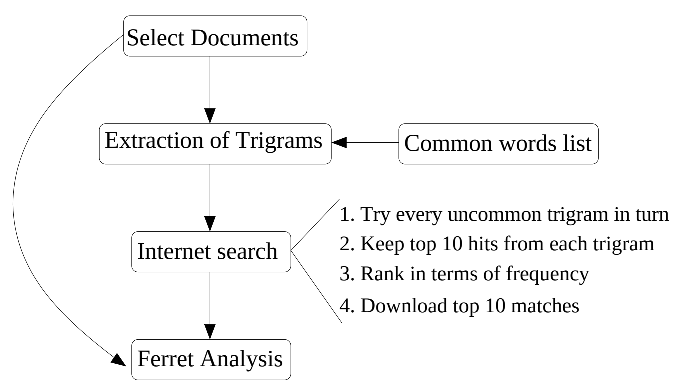

Fig. 6. The process used by WebFerret

WebFerret works in the same manner as Ferret, except during the analysis step, see figure 6. First a list of suitable trigrams is extracted from the documents to be analysed. These

trigrams are used to search the Internet for relevant sources, and the sources are downloaded into a folder. The potential sources are added to the set of documents to be compared (but note that potential sources are not compared with other potential sources). These additional steps are hidden from the user (except that they add to the processing time).

The following graph (figure 7) shows that most triples are rare in Google, so most occur in very few documents, so the strategy we adopt is likely to be successful in most cases.

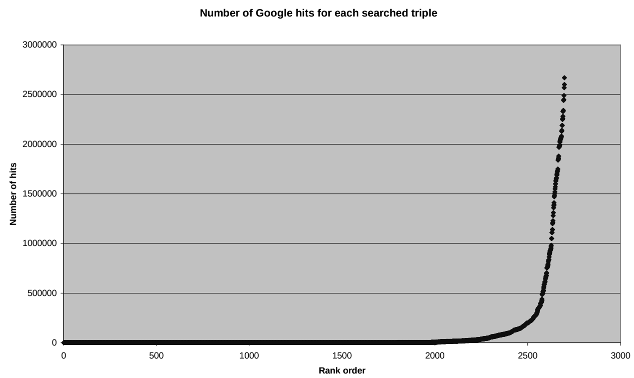

Fig. 7. Number of Google hits per triple

Effectiveness of WebFerret

In order to confirm the effectiveness of our strategy we took some documents (listed in table IV) and used WebFerret's algorithm to see if we could find them on the Internet.

File Name	Size (words)	Description of the document
ad-hoc-thesis.txt	488 words	student thesis, spellings corrected, titles removed [Studi]
education-essay.txt	907 words	copy of student work, not published on Internet [Malcolm]
heberling.txt	872 words	article on plagiarism [Heberling]
ryan-hamlin.txt	932 words	article on plagiarism (accused of copying heberling) [Ryan & Hamlin]
i33.txt	861 words	icmlc02 paper [Zhuang, Meng, Yin & Wang]
i367.txt	946 words	icmlc02 paper (very similar to i33) [Zhuang, Meng, Wang & Yin]
yip-stereo.txt	888 words	wmpmc paper [Yip et al.]

TABLE IV

Summary of test cases used

WebFerret's search process using the Google SOAP search API finds the target document in all cases.

Eliminating trigrams containing any one of the 116 very common words reduces the number of trigrams searched for by about 90%. This will give an order of magnitude speed-up, both on searching *and* on analysis.

Future Work

Once we have produced a trial version of WebFerret, we will get feedback on a number of questions:

- Does user need to alter search criteria?
- How much control should user have on search?
- Should old searches be kept?

The main outcome will be the WebFerret software system which may be installed on a user's own machine; Windows, Linux and Macintosh OS X versions will be created. We plan to develop a web interface also, so that organisations who want to can allow their users to upload student work and retrieve results over the Internet. A further benefit of the web interface is that the results of Internet searches by different staff members may be shared, within and across departments.

WebFerret will provide reports on the comparisons made, estimates of the amount of duplication present between pairs of documents, and detailed analyses of where copying has been found within each document. An evaluation of WebFerret's performance will be undertaken. Once WebFerret has been completed, we will speak to the colleagues managing our VLE: the ideal situation would be for WebFerret to integrate alongside the VLE, automatically producing feedback about potential plagiarism and collusion on submitted assignments.

Summary

Ferret helps staff by alerting them to similarity between pairs of documents; staff must make their own judgement as to whether the copying is “fair use” or “plagiarism”.

WebFerret, like Ferret, will accept textual documents of many forms. Currently, documents generated by popular word processors, adobe PDF documents, and plain text files are supported. Because WebFerret will look at the content of the documents, it is not specialised towards any discipline.

Although initially we anticipate a number of cases of plagiarism being detected using the tool, we suggest a major enhancement for teaching and learning will be in deterrence. Knowing that work may be submitted to a fast and powerful plagiarism-detection tool will dissuade students from plagiarising.

But perhaps most useful is the use of such tools to educate students on good practice: highlighting that *this* block of text is copied and insufficiently referenced in a particular student's work can educate them much better than a general exhortation not to plagiarise. We hope that staff will be encouraged to use WebFerret because of its fast and simple interface and that students will be reassured that this emotive problem is being dealt with.

The current version of Ferret is freely available, and the authors welcome comments [9]. We are actively developing WebFerret based on the principles outlined in this paper, and aim to release it later this year.

Acknowledgements

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Monte Carlo Simulations In Molecular Dynamics of a Gas. A Didactic Approach

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Abstract— **In this paper we are working with Simulink, which is a part of Matlab software, in order to create a 3D simulation of molecular dynamics of a gas, by exploiting the Monte Carlo methods. The use of Monte Carlo simulation in molecular dynamics is widespread and the 3D simulation is a valuable tool for didactic of certain phenomena. The 3D simulations enable the presentation of spatial and dynamic images, which exhibit relationships among complex concepts. We have created three stochastic models, the "Billiard", the "Drunk Ball" and the "Many Molecules" model of the Xenon gas. The models are based on the kinetic theory of an ideal gas. The results extracted from the third model concern the internal energy, the pressure and the rms velocity of the molecules.**

Keywords-Monte Carlo; simulation; random; molecular dynamics; gas; SimMechanics; energy; pressure.

I. Introduction

A. Monte Carlo Method

Statistical simulation can be generally described as any method that simulates through the utilization of sequences of random numbers. As statistical simulation methods can be seen the numerical methods known as Monte Carlo (MC) were problems in physics, chemistry, biology, medicine, forecasting in meteorology and economics find solution. MC techniques are also efficient, when you need to evaluate integrals, especially with a large number of integrations [1], [2].

The simulated system, with the MC methods, gets random conditions after the selected points are taken as results and the estimated value is being feed from the weighted data [3].

B. Molecular Dynamics

A wide number of theories have been developed, so that the behavior of the molecules of the materials can be understood. All of them describe stochastically the phenomena of the material structure and are called Molecular Dynamics and are used widely as tools in computational physics and chemistry [4].

R. K. Pathria [5] is being precise when he says that "there is no interesting physical system that its calculation can be done analytically". It is also impossible to find in an interacting system with more than two objects, an analytical solution [4]. Most of the times in Molecular Dynamics, we resort using statistical sample collecting of the parts in the general equation. A wide spread method due to its efficiency and general use is the MC method.

C. Use In Didactics

The models of the physical systems are an important tool in the teaching of sciences and can be used from the primary education to the tertiary education. A lot simulation techniques have been developed in order to be used either for didactic or for research. The Molecular Dynamics models can be represented more reliably by using the computational abilities of the computers today. The use of Information and Communication Technologies (ICT), gives the opportunity of solving traditional problems in the realm of Physics and Chemistry [6]. Simulation tools as the MC methods are quite proper to support discovery learning [7]. Using the principals of the above theory, the simulation model must be designed to interact with the user. Also the ability of the molecular dynamics models to interact is becoming better with the use of 3D animation [6].

D. 3D Simulation

The 3D simulations enable the presentation of spatial and dynamic images, which exhibit relationships among complex concepts [8].

The fact that the bigger part in the human brain is allocated by the optical observation system [9] can not be ignored and it is substantially an impulse for the educators to use optical techniques in the teaching of complex objects [10] in order to succeed the best results. The 3D simulations give the opportunity to represent the real world almost as it is, promoting this way experiences that help students understand the teaching materials [11]. Therefore education becomes a lively experience, wherever reasons of distance, money, time, scale or safety of the students render training in real world conditions some times impossible. These technology-based learning materials are especially useful in molecular dynamics in order to provide students the chance to conceptualize phenomena and processes.

Identify applicable sponsor/s here. *(sponsors)*

II. THE SOFTWARE

A. Matlab

Matlab (Matrix Laboratory) is used in most Technical Universities, due to its potential in forming models of physical phenomena and problems in mechanics. Additional, the technical adequacy of the software in the teaching of science is invaluable, so that the results given will be reliable [12] and able to approach real world situations.

The educational software must have increased possibilities of interaction with the student and with the right use from the educator to promote discovery learning [13]. Matlab is the main tool for engineers and so the results from the solution of the models are direct and reliable, as far as the physical systems are concerned. On the other hand, the designers of the software allow the possibility for changes on any point of the designed model.

B. Simulink

Built on top of the mathematical software Matlab, Simulink, is a graphical programming language [14] with the basic characteristics to be the ones following:

- It is graphical, mouse-driven software that allows you to model a system by drawing a block diagram on the screen and manipulating it dynamically.
- A flexible, quite easy-to-use and modular environment gives the ability to the software to be used for modelling, simulating and analyzing dynamic systems [15].
- Blocksets are add-ons to Simulink that provide additional libraries of blocks for specialized applications, like communications, signal processing, and power systems.

Simulink gives the option to the user to change many parameters of the simulation, the basic of them are [14]:

- The Solver parameters give the option to start and stop the simulation at will, to choose the solver and specify its parameters and select some output options.
- The Diagnostic parameters enable the user to select the actual level of warning messages being displayed, as the simulation runs.
- The input from and the output to the Matlab, can be arranged from the Workspace I/O parameters.

Although it is mainly a programming language, it does not require high level programming abilities, since it can be executed by composing the ready made blocks from the libraries – Lego Programming.

C. SimMechanics

It is a part of the Simulink block library. The blocks are used for the simulation of mechanical systems and are ready made applications of the basic structure of mechanical systems. The blocks refer directly to a mechanical subsystem and are not mathematical functions. For example there are blocks that simulate shafts, bodies, joints, sensors and actuators, constraints, drivers and force elements. All the parameters of the simulation, which are real world values, can be changed on the blocks properties. The values can be changed easily and at a wide range, proving this way the absolute control of the simulation and the interaction abilities with the user. Depending on the calculation way, the following model types can be distinguished [16]:

- The applied forces, torques and constraints result the motion of the mechanism that can be calculated from the *Forward Dynamics*.
- In order to find the necessary forces and torques that produce a specified motion for an open loop system we use the *Inverse Dynamics*.
- With the use of *Kinematics* we are able to produce the same, as above, but for close loop systems. The extra internal invisible constraints that arise from the above structures are included.
- Simulink's trim command *searches Trimming* in a system motion that steady or equilibrium states.

The result representation can be graphical in 2D and 3D. The 2D graphical representation is provided by the "scope" in the form of electrical signals. The 3D graphical simulation of the mechanical model can be represented by the tool "machine for model". Additionally, the output data of the model can be saved in a file.

The simulation is event-based, time is not real and depends on the event progress. Simulink makes sure that time steps within machine precision occur exactly at the time state the event occurs, by using the zero crossings. This plays an important role in the handling of state events and the accurate integration of discontinuous signals [17].

III. THERMODYNAMICS

It is known from the thermodynamic theory [18] that the properties of an ideal gas can be described macroscopically by three elements, the pressure (p), the temperature (T) and the volume of the gas. So we have the equation of the state of the ideal gases:

$$pV = nRT = NkT \qquad (1)$$

where R: ideal gases constant, n*:* the mole number, N: the number of the molecules and k: the Boltzmann constant.

$$n = \frac{m}{M} \qquad (2)$$

The pressure that forces the molecules of the gas at the surface of the container is:

Identify applicable sponsor/s here. *(sponsors)*

$$p = \frac{Nm\overline{u^2}}{3V} \qquad (3)$$

where m: the mass of each molecule and

$$\overline{u^2} = \frac{\sum u_i^2}{N} \qquad (4)$$

The translational kinetic energy of each gas molecule, without a vibrational or rotational energy, will be:

$$E = E_m = \frac{1}{2} m u^2 \qquad (5)$$

The internal energy of the system will be:

$$U = \sum E_m = \frac{1}{2} Nm\overline{u^2} \qquad (6)$$

$$U = \frac{3}{2} nRT \qquad (7)$$

The values of the velocity of the molecules are different for every gas and are determined by the Maxwell-Boltzmann distribution function. An important value is the rms velocity u_{rms}:

$$u_{rms} = \sqrt{\frac{3kT}{m}} = \sqrt{\overline{u^2}} \qquad (8)$$

Finally, as we can see from the above, the equations concerning the behavior of a gas depend on the mass and the velocity of the molecules.

IV. The Models

In the present work we have created 3 models that simulate the molecular movement and dynamics of a gas.

A. The"Billiard" Model

According to the MC Principals, we have created a model similar to the billiard game. Four balls are moving in 2D, on a table with specific limits. As each simulation starts, the balls are forced to move by a random force in direction and value, resulting each simulation to give different results. This model saws the random movement of a physical system, where the balls in every simulation have different behavior. The final model is a combination of the model of each ball (Fig.1).

Model properties:

- The mass of each ball is 150 gr.
- There is no gravity on the environment.
- The table dimensions are 10x5 m.
- The balls react elastically only with the limits of the table and not with each other.

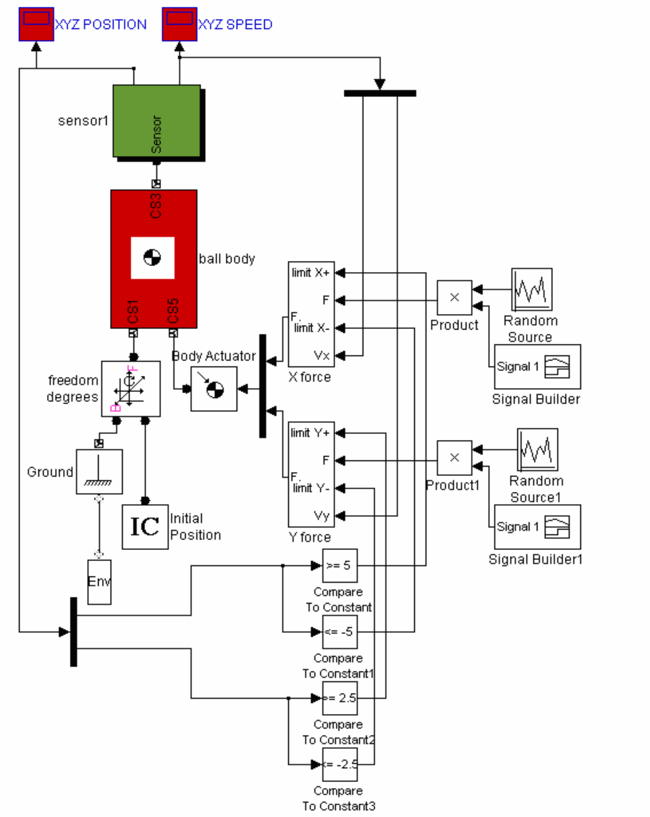

Figure 1. The model of a ball.

- The force applies randomly on the balls for 0.1 sec at the start of the simulation.
- The random force generator is Gaussian, the sample time is 0.1 sec, with the mean value at 0 and the variance at 1 in N (Newton).
- The degrees of freedom are 4 in the X, Y axes.
- There is no force applying on the balls, after the starting force.
- We are able to see the 3D graphical representation of the ball's movement and the graphs of position and velocity of each ball.

B. The " Drunk Ball" Model

On the next step we have created a model of a ball that moves in 3D by a random force. We call this model "Drunk Ball", according to the problem of the "Drunk Sailor" which can be solved by the MC method. The force on the ball now is random and continuous, in order to simulate the motion of a molecule that moves by reacting with the other molecules. The model is designed like the previous one but there is a major difference in the applying force. Especially when the "Random

source 3” in Fig. 2, gives a number between -1.37 and 1.37, the applied force is on the X column. When the above number is below -1.37, the applied force is on the Y column and in any other case we have the force applying on the Z column. This way we have equal probability of the applying force on the three axes, considering that the random source is Gaussian. We also have a random value of the force from the “random source” 0, 1, 2.

Model properties:

- The mass of the ball is 50 gr and there is no gravity on the environment.
- The container’s dimensions are 30x30x30 m.
- The ball reacts elastically with the limits of the container.
- The sample time of the “Random source 3” is 0.005 sec, the mean is 0 and the variance 10 (Gaussian).
- The random force generator is Gaussian, the sample time is 0.05 sec, with the mean value at 0 and the variance at 0.2 in N.
- The degrees of freedom are 6 in the X, Y, Z axes.
- The force on the ball is applied for the whole time of the simulation.
- We are able to see the 3D graphical representation of the ball’s movement and the graphs of position, velocity and acceleration of the ball, as in the previous model.

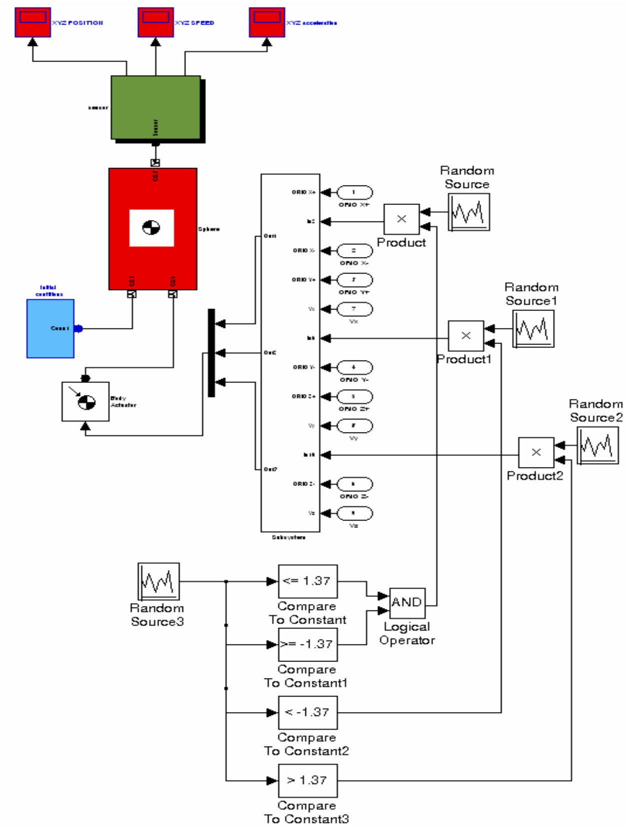

Figure 2. The “Drunk Ball” Model

The computational faculty of the computer forces us to draw some limits on the design of this model. It is known that a molecule is reacting and changing its velocity 10^9 times per second approximately. The force in this model is changing 200 times per second. If we increase the sampling, the model runs slowly.

Also the dimensions of the container are designed to be large enough to help the observer see the random movement of the ball better.

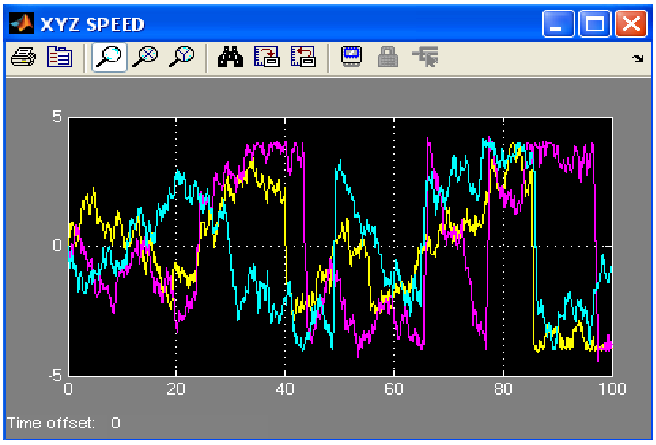

Figure 3. Velocity of the “Drunk Ball” (u_x:yelow, u_y:blue, u_z:pink)

C. *The “Many Molecules” Model*

In order to create a model of the molecular dynamics of a gas, we have selected the Xenon (Xe) gas, which has heavier molecules and relatively slower. The mass of each molecule is $21{,}81 \times 10^{-23}$ gr and from (8) we found that the u_{rms}=7.5m/sec at T=300 ^{o}K. We choose to create a model of 8 molecules, for a better and quicker work on the computer. Furthermore, an eight molecule Xenon gas (M=131,3gr/mol) has n= 1.33×10^{-23}mol and from (7) U=4.976×10^{-20} J at T=300 ^{o}K. The gas pressure at this situation from (1) is p=1.228×10^{-24} N/m^2. The above values are theoretical and we expect them to be proven by the model.

Model properties:

- The mass of each ball is $21{,}81 \times 10^{-23}$ gr.
- There is no gravity on the environment.
- The table dimensions are 30x30x30 m.
- The balls react elastically only with the limits of the table and not with each other.
- The force on the balls is random, at value and direction and continuously applied.
- The random force value generator is Gaussian, the sample time is 0.05sec, with the mean value 0 and the variance 0.2×10^{-23} in N.
- The random generator of the force direction is Gaussian, the sample time is 0.005sec, with mean value 0 and variance 10.
- The degrees of freedom are 6 in the X, Y, Z axes, with no rotation available.

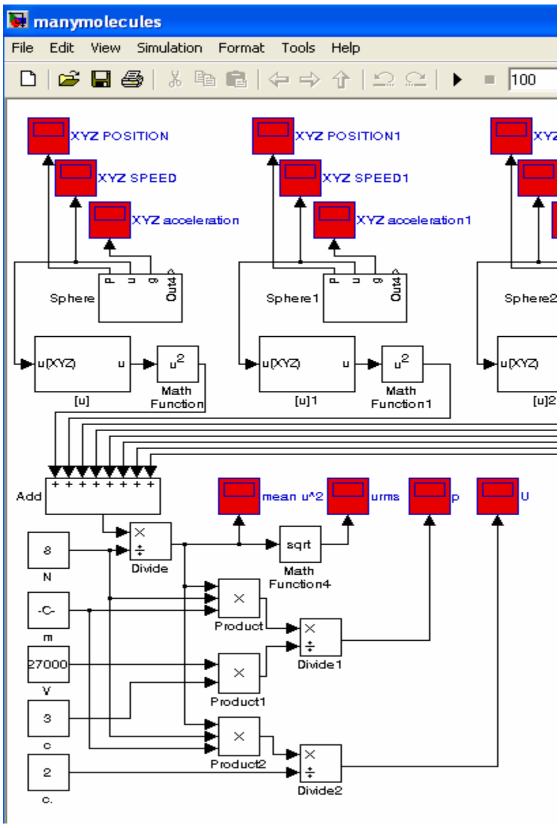

Figure 4. The model and the calculations

- The force is continuously applied on the balls.
- The simulation time is 100sec.

The properties of this model are nearly common to the "Drunk Ball" model. In Fig. 4 we are able to see the code for the calculation of u_{rms} from (11), U from (8) and p from (5).

The tool "machine for the model" represents the movement of the molecules at the simulation time. The graphical abilities

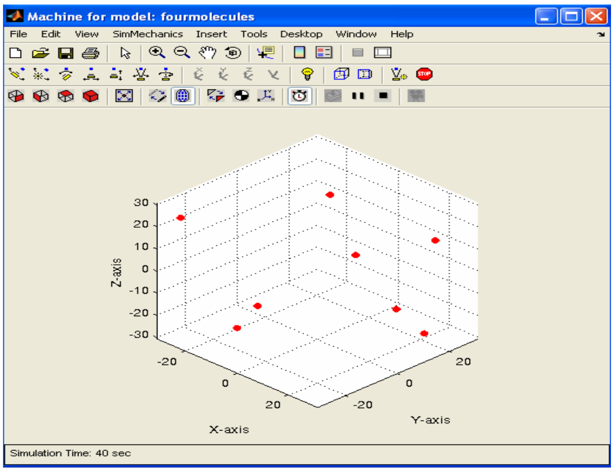

Figure 5. 3D representation on "the machine for the model"

of the machine are satisfactory and additionally we are able to change the viewing angle during the simulation.

V. Results

We are able to extract important results from the last model, concerning the molecular dynamics and especially the u_{rms}, U and p. Our model is becoming more stable after the first 40 sec, due to the MC techniques, that need a number of random samples to give stable results. Additionally, this unstable situation at the start of the simulation is being helped by the inactivity of the balls, which act like real balls.

A. Velocity rms u_{rms}

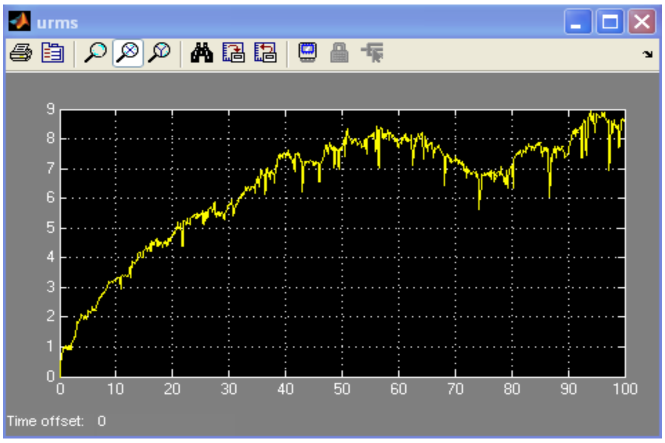

Figure 6. Velocity rms u_{rms}

In Fig. 6 we observe an increasing value of velocity and after 40sec a stable one at 7-8 m/sec. This value is approximately the one we expect. During the MC simulation, every time we run the model, we get different results and all of the times close to the above diagram.

B. Internal Energy U

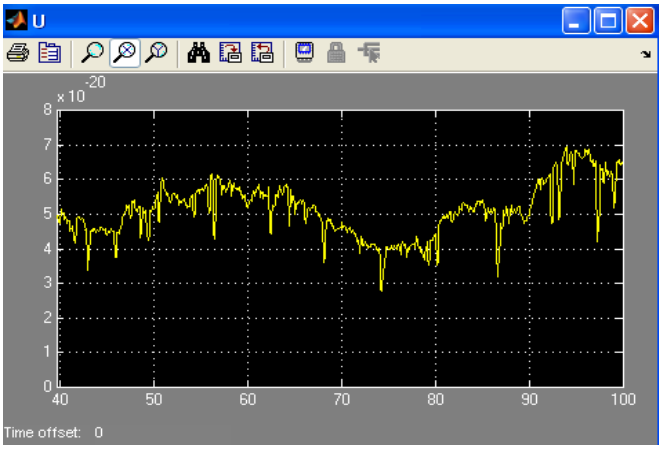

Figure 7. The internal energy

In Fig. 7, after 40 sec we are able to see a stable value at $U \approx 5x10^{-20}$ J with T=300 ^oK. This value is according the one we were expecting.

C. Pressure p

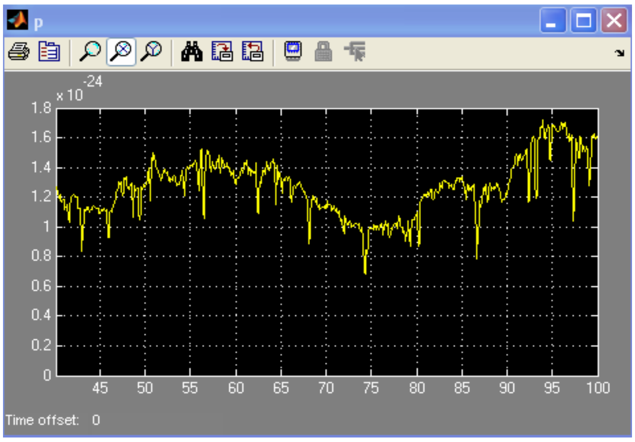

Figure 8. The pressure graph

Fig. 8, after 40 sec, shows a value of p=1-1.7x10^{-24} N/m^2. This value is close to the one we were expecting.

VI. CONCLUSIONS

The MC method can be used for the representation of molecular dynamics, which can be graphical in 3D. We are henceforth forced to use a small number of molecules and this effects the conformity of the results. According to the MC principals, every time the model runs we are able to have different results. We also have dissemination of the results proving that the MC techniques can simulate the Maxwell-Boltzmann distribution function of the molecule's velocity.

In all of the results we observe some intense fluctuations. Every time that a molecule is at the limit of the container its velocity instantly reaches zero, and due to the small number of molecules this becomes important for the total result. According to the MC methods, if we were able to simulate more molecules and get more samples per second, the diagrams would be closer to the physical systems. The above can be achieved if we sacrifice the 3D graphical representation of the molecules movement and allow the computer to run faster.

Working with SimMechanics, all the properties of the model can be changed easily, because of the graphical interface during simulation. This promotes discovery learning since the user interacts with the model. It can be used for the teaching of physics or chemistry, in all the stages of education, from the primary schools to the university. The ability of the model to present the 3D graphical representation of the movement of the molecules, offers an experience of how the molecule's structure works.

The project presented can be extended to a great number of thermodynamic processes. An improved approach to the model can be made by arranging the simulation to work according to the quantum mechanics theory.

The assessment of the project included examining students' conceptual understanding before and after studying molecular dynamics is under investigation. In this framework we have conceptual questions from standardized tests, as well as questions designed to assess the effect of 3-D simulations and experiments.

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Accessibility and Model-Based Web Application Development for eLearning-Environments

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Abstract— **Especially eLearning and eScience technologies offer a wide range of possibilities for pedagogical concepts supporting individual demands and interests. The two deciding factors are given by its interaction capability and the ability to adapt to the user, both practically unachievable using traditional media. These two features are the key to extend the methodology of teaching scenarios as well as the support of individual learning strategies – the integration of new media into the academic education thus possesses the potential to assist in transcending the disadvantages in the education of disabled people. Based on semantic content encoding and model-based development, a broad range of accessibility features can be supported.**

Keywords-model based development, web applications, accessibility

I. INTRODUCTION

Learning and eScience platforms are characterized by non linear information structures and intensive use of graphical and interactive components. Together with the dynamic generation of content these are the properties, which lead to new presentation approaches and new forms of learning environments. Unfortunately, the resulting Web applications are often not accessible for disabled persons. On the other hand, computer-based technology allows a complete separation between content and presentation. Therefore, new media possess the potential to adapt the presentation to individual users in principle. To build accessible Web applications, one has to respect the needs from the beginning of the design process. Based on recent proposals for a model-based Web application development, we discuss the essential modeling requirements to ensure enhanced accessibility in eLearning environments for education.

A number of guidelines (designed and published by the World Wide Web Consortium (W3C), the European Commission, national governments and others) have been passed during the last years to address the issue of accessibility. The majority of the suggested rules focus on easy access to (more or less static, less interactive) information portals. Often, the paradigm of a universal design for all people is assumed. However, the existing concepts do not address the implementation of highly multimedia-based interactive learning and teaching contents for disabled persons, nor are they well-suited to this task. Advanced eLearning platforms are capable to adapt the presentation to the user and they can provide him with additional information about multimedia content, navigation and presentation suited to his own needs. Therefore, the universal design approach can be replaced by a user-centered or target-group-specific design which is based on two main paradigms:

Semantic encoding: The flexibility of the separation of content and representation requires extensive semantic encoding of the complete content: supporting the underlying semantic technologies is vital to the realization of a broad accessibility of highly interactive virtual knowledge spaces and incorporating intelligent tools for the development and administration of content. Here, it is important to mention that semantic encoding may not be restricted to the content elements themselves, but has to be extended to all aspects which are highly content-related as, for example, navigation mechanisms. Semantic encoding means explicitly storing all relevant knowledge concerning the Web application to provide the technology of the user with the needed knowledge to present the content in a proper way. Thus the encoding is presentation-oriented.

Model-based development: Model-driven development is related to a design process where all information is available to provide the designed application with the semantic information about the used objects, their relations and meanings. Storing this knowledge in a way enabling the compiler to automatically generate all required information, model driven design processes for Web applications are a promising approach to bring together the requirements of learning environments and accessibility. The conceptual design makes it possible to enable accessibility without extra effort.

More precisely, nowadays some approaches examine the possibilities of Web application development with Model-Driven Architecture (MDA). Web applications are at first designed in a precise Conceptual Schema (CS) described with the Unified Modeling Language (UML) which afterwards can be translated by a model compiler into the corresponding application. The design of a CS is, applied to Web applications, an even bigger challenge additionally complicated by some missing features of UML to model Web-based applications. Not only is it necessary to map the structure and behavior of the whole application but also that of the intended navigation

and presentation. Prototypes of model compilers are already in existence.

Within the BeLearning-Project at the Berlin University of Technology, model-based development is investigated. Thereby, Moodle [1] (as a non field specific eLearning platform) and Mumie [2] (as a field specific platform for mathematics) serve as demonstration environments to evaluate the potentials of model-driven development to enhance the accessibility criteria of eLearning platforms.

Finally, in comparison to traditional teaching materials and media forms, the modern information and communication technologies offer new approaches concerning far-ranging user adaptivity concepts through flexible content adaptation to individual needs on all levels.

II. Accessibility

Different kinds of Web applications demand different paradigms to assure accessibility. The universal design is convenient for static content whereas eLearning platforms with dynamic content generation require other paradigms for an accessible design.

A. Universal Design

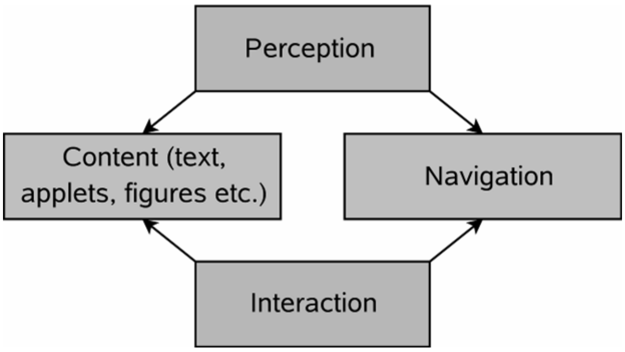

Figure 1. Content and Navigation

The recommendations of the W3C are based on the universal design paradigm. In general the Web presentation has to present all information readable for all users. That means for all multimedia content like pictures, graphics, animations etc. a textual pendant must be available. Even the input must be independent from the input device. The WAI formulates four principles of accessibility in the working draft of the to-be recommendation [3]:

- Content must be perceivable to each user.
- User interface components in the content must be operable by each user.
- Content and controls must be understandable to each user.
- Content must be robust enough to work with current and future technologies.

The fields where accessibility is relevant can be split-up along the lines of two main issues: perception and interaction (see Fig. 1).

So far the existing standards do not state sufficient recommendations for knowledge, learning or expert portals. They are not particularly applicable to these areas as they barely integrate the characteristics of the new media like multimediality and interactivity. These, however, are the properties, which lead to new presentation approaches, to new forms of teaching and learning and which are essential in the development of new learning environments.

B. Target-Group-Specific Design

Dynamic Web applications allow adapting the presentation to the needs of the users and additional information about multimedia content, navigation and presentation can provide him. The first paradigm based on this is a target-group-specific design which classifies the users in different groups with specific characteristics. For disabled people a useful classification should starting from functionality and not from medical diagnosis such as visually, hearing, physical and mental impaired people.

The flexibility of the separation of content and representation requires, however, extensive semantic encoding of the complete content: supporting the underlying semantic technologies is vital to the realization of a broad accessibility of highly interactive virtual knowledge spaces and incorporating intelligent tools for the development and administration of content. Here, it is important to mention that semantic encoding may not be restricted to the content elements themselves, but has to be extended to all aspects which are highly content-related as, for example, navigation mechanisms [4]. Semantic encoding means explicitly storing all relevant knowledge concerning the Web application to provide the technology of the user with the needed knowledge to present the content in a proper way. Thus the encoding is presentation-oriented. Even the storing of data in an XML-dialect has to respect some issues to support accessibility:

- authors are able to associate explicitly multiple media objects with alternatives
- semantic-rich XML-language
- documentation and export of the semantics

But in general it is not possible to classify disabled persons in some groups and therefore this paradigm is only an intermediate step.

Even a classification of mental models addresses the issue of adaptation in the fields of learning and teaching in a better way. For example the mental models of blind people depend on if they are blind by birth or later. The association of colors and geometrical notions is different as between blind and not visually impaired people. The impact of mental models for accessibility is part of further examination.

C. User-Centered Design

Between disabled people almost everyone has his specific limitations. User centered means that the user can specify his needs particular. There is no separation of groups. He can choose if he want to see pictures or not and so on. This is the most flexible but difficult paradigm too because estimations about the requirements of the user are hardly to made. Here the

transition to usability is seamless. The changeover from a universal design to a universal presentation process cannot be made in one step. The following course of action is useful.

- At first forms of presentation that are accessible for all users are integrated. That means text, navigation, links etc.
- Second, forms which can be transformed equivalent to other presentation modes. In principle these transformations are technical problems.
- At last forms without a possible equivalent transformation to other modes of presentation include questions of pedagogy and higher level approaches as well as further research. In the beginning these presentation forms cannot be used for essential information but for additional support.

In general the user centered design is more capable than the universal design to fulfill the requirements of the intensive use of multimedia and interactivity in eLearning environments. As an intermediate step the target-group-specific design can reduce complexity.

D. Summary: Demands of Accessible Dynamic Web Applications

Dynamic Web applications storing semantic information demand new forms of this development too. In order to store the descriptions of multimedia objects and interactions in a semantic way, a development process is needed which supports a "semantic thinking" to generate these information. Thus, generating the information additionally during the development process without extra effort will be possible. The process of developing the Web application has tot be schematic and requires specification tools which are powerful to describe complex Web applications and abstract enough to be processed by a compiler or similar. UML and model-based Web application development extending MDA for the Web use offer these features. The additional information which makes the Web application accessible can be derived from an extended CS. This approach is presented in the next chapter.

III. CONCEPTUAL MODELING

Different recent projects examine the possibilities of conceptual modeling to develop Web applications. The MDA-methodology has been extended to accomplish these needs. Existing approaches commonly use UML and some extensions to develop a CS describing not only structure and behavior of the Web application but navigation and presentation as well. Some examples are:

- Object-Oriented Web Solutions (OOWS) [5]
- Object-Oriented Hypermedia Design Method(OOHDM) [6]
- WebSite Design Method (WSDM) [7]
- Web Markup Language (WebML) [8]

Among the approaches for model-driven Web application development examination of accessibility is still unusual. Currently some other problematic points are: The Modeling of dynamic Web applications since current approaches are often intended for more or less static informatory Web applications ("Kiosk applications"). Then integration of later modifications of the model has to be possible and the compiler process should enable the opposite direction. And models are necessary to describe flexible interactions with the user. Here two projects are presented. They are focused on the enhancement of navigation models to support accessibility and on adaptive linking. First, based on WSDM the Dante-project [9] aims to support technologies like screen readers with additional information about the navigation. Second, the OOWS-approach includes the description of adaptive navigation techniques in the early process of Web modeling [10].

A. WSDM and Dante – Additional Information about Navigation

The WSDM is a user centered Web page design method. Web pages can be developed in a systematic way and different phases of the generation are specified. WSDM is focused on the presentation of information thus interaction beyond linking is not supported. It includes the following parts (see Fig. 2 left). Starting from a clarified mission statement describing purpose and subject of the Web application intended, possible users are identified and separated into different audience classes in a hierarchical way. The characteristics of each class are specified. During the conceptual design phase the task and information modeling and the navigational design is elaborated. Finally the implementation design and the Web application will be developed. WSDM uses an OWL-ontology (Web Ontology Language) to describe the modeling concepts. As a user-centered approach it is suitable to involve the needs of disabled people. In contrast, the approach is focused on the presentation of information and less on interactivity. Further examination is required to see if it can be extended to include user interfaces and similar models. The Dante-project is based on WSDM and aims to improve the access for visually impaired people to Hypermedia environments – especially the Web – for visually impaired people. It is focused on devising a tool to analyze and transform Web pages using a model-driven approach and generating annotations from the design specifications.

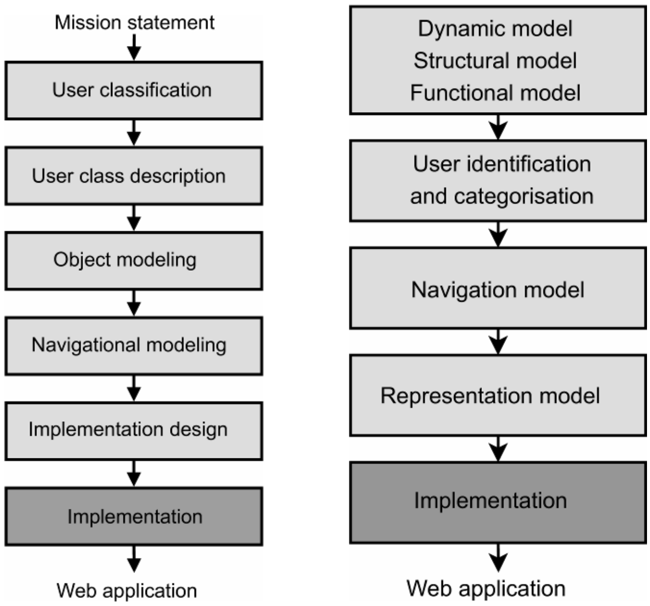

Figure 2. The WSDM-Process (left), the OOWS-Process (right)

Usually, visually impaired users have to rely on screen readers. In some countries Braille-devices are often used, having the same impact on this discussion. These assisting technologies read the content sequentially and cannot detect and present the meaning of different page objects. Without further information this implicit knowledge of the structure is not accessible to visually impaired people. Extra semantical annotation can avoid the problem if the screen reader is provided with additional semantical knowledge of the Web page. The Dante-approach allows semantical annotation of Web pages to explicitly provide knowledge about structure and to provide screen readers with semantical knowledge to better facilitate the audio presentation of the content. The identified objects are annotated with terms from the Web Authoring for Accessibility ontology (WAfA). Currently, such annotations were done manually and do not address the problem of dynamic content.

In combination with the Web design method WSDM it is possible to fully automate the generation of semantical annotations used for Dante. It is estimated that 85 % of the annotations can be provided in this way. This makes Dante interesting for dynamically generated content.

B. *OOWS – Adaptive Linking*

Object-Oriented Web Solutions extends the object-oriented software development approach OO-Method [11] with additional capabilities to capture the navigational and presentational requirements of Web applications. Since it extends an object-oriented design approach it seems more suitable for the conceptual design of complex server-based Web applications.

The OO-Method was extended with three additional models: user, navigation and presentation model. OOWS defines a set of activities to properly specify the functional, presentational and navigational aspects (see Fig. 2 right). A fully operative Web model compiler which includes the presentational layer is part of future work.

Combined with the navigational model is an approach to include the description of adaptive navigation techniques in the early process of Web modeling [10]. Three techniques of linking are included: link-annotation, link-hiding and link-ordering. Even if this technique is not intended to improve accessibility it can be extended to support orientation for visually impaired users.

C. *The Approach of the BeLearning Project*

The field of navigation is one of the major issues to support accessibility. Another one is multimedia content. Starting from the both presented approaches to improve navigation techniques the BeLearning project examines the possibilities to extend the accessibility features for multimedia content too.

Images, graphics etc. have different functions in Web content. They can be links, illustrations, examples etc. Following functions are possible:

- Decoration: The image carries no additional information.
- Representation: The image accompanies the text and amplifies information.
- Organization: The image clarifies the structure of the text.
- Interpretation: The image explicates complicated parts of the text.
- Transformation: The image converts the information of the text to support memorizing of information, to combine single parts etc.

Current discussions concerning presentation are usually focused on the meaning to be conveyed by the objects as the description of a visual object is meaningless to visual impaired people if it is not related to concepts available to their imagination. Otherwise it is important to communicate the significance of the picture so that the user can understand why the image is there and if it is necessary to recognize all details. In fact that does affect only a portion of all pictures. Images, graphics etc. can have following functions:

Even if lot of these aspects can be carried by text too or are not necessary to understand the content a complete substitution is not possible. If the Web application model declares the function of an image it can be decided which substitution can be applied. To make this kind of content accessible at first function and intention must be clear for the user. This sort of "semantic information" is available from the Web model too and can be processed by the model compiler.

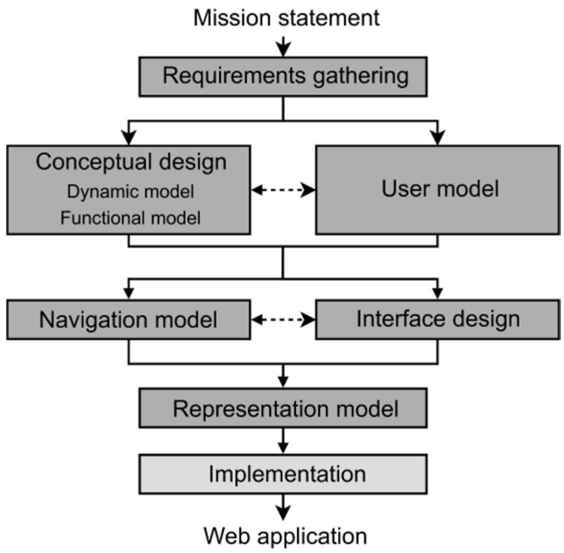

Figure 3. The BeLearning-Process

According to the presented processes an approach (see Fig. 3) is presented to explicitly address the above-mentioned main fields of accessibility - perception and interaction - and to meet the demands of complex server based Web applications like eLearning-environments. Therefore it is necessary to design representation and interfaces too. In the representation model images are combined with objects from earlier models like the functional model and the navigational model which declares the function represented by the image. In most of the cases alternatives are possible.

The development of the user model and the conceptual design of the application as well as interface design and navigation design are parallel operations affecting each other. Additionally, the distinction between navigational links and

other actions will become less and less pronounced in the near future as currently demonstrated by the AJAX-technology (Asynchronous JavaScript and XML).

IV. CONCLUSIONS

With all presented approaches together model-driven Web development can support accessibility in the fields of navigation and illustration. This is not a general approach to support accessibility in all aspects since the support of interaction is not discussed and also multimedia includes not only images. However the basic idea is applicable to other fields too: Accessibility at first is not a question of a simple replacement with other media but to extract the function and purpose of information and find ways to describe these information with models understandable for compilers. Even if interactions with the user are not discussed here in detail they are affected by the issues of perception too. Often the problems of interaction are at first not problems of input but orientation, explanation etc.

Within the BeLearning project is subject of further examination:

- the concept of mental models for use with user classification to support accessibility
- the model-based development of dynamic Web applications
- the integration of interactions in the model-based Web application development process

More issues for future work are other kinds of multimedia content like applets, the use of SVG (Scalar Vector Graphics) to enhance accessibility etc.

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From Pedagogy to Webagogy in Higher Education: Perspectives and Prospectives

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***Abstract*—This paper discusses the possibility of having online education in the Middle East. The first part provides information about the history and development of distance learning, mainly in the West and the Middle East. The second part analyzes the main advantages and disadvantages of webagogy, i.e., web-based pedagogy, and its components. Finally, the conclusion provides practical guidance and advice on how to break the norms in education within a glocal framework.**

***Keywords*—pedagogy; webagogy; distance learning; e-learning**

I. Introduction

Since the foundation of ancient Chinese colleges and Greek academies and lyceums, to the various degree-granting universities in Medieval Europe and lately to the 'colonial colleges' in North America, down to our residential as well as to online universities in modern times, people have interacted and co-worked for educational purposes. They do so on individual or conventional basis in order to observe and research; to examine thought and explore its power; to develop and acquire knowledge (which enables the learner to understand), skills and 'know-how' (which enables us to do), and wisdom and values (which enable us to set priorities); and to build up characters (which enables us to co-operate, to persevere and to become respected and trusted members of society) [1, p. 88]. These pedagogical processes and their respective contents which have followed in many educational institutions since ancient times till our information age, have four critical factors besides time and access to learning and methods of learning. These factors are a) a learner, b) an (expert) teacher (known so far as instructor or lecturer), c) a problem, and d) knowledge; *"these four factors should be present for education to take place"* [2, p. 24].

Actually, several attempts have appeared since Sir Isaac Pitman, a British phonographer and educator in the 19th c., chose to take education outside the traditional, physically located classrooms. Thus, progressive universities in the USA and the UK, e.g., the University of Wisconsin and the University of London established for a long tradition in distance education and they have become models for large scale systems of distance, open, and flexible learning [3, pp. 10-14][1]. During that time, learners were encouraged to use the postal system and take part in lifelong learning and training, a fact that liberated many from the constraints of the conventional educational settings; mainly, time, place and pace inflexibility. Later, learners benefited from the radical improvement that was provoked by the advances in the fields of information and communication technologies [ICT] in the 20th c. These technologies gave birth to the educational television for lecturing and explanation, and to the computers for interaction[2]. Add to this, they inaugurated a new educational period of transition between the industrial society and the information society. Hence, the Internet and the World Wide Web [WWW] have become the new communications network of modern globalization. Consequently, ICT has constructed roads towards the virtual class, and tracks to superhighways and tele-learning in cyberspace [2, pp. 87, 102). Concurrently, a number of terms were introduced into modern educational lexicons, such as, e-learning, online learning, network and web-based learning, hybrid learning, virtual learning, distributed learning, online education, and *webagogy*--the pedagogy of the information age, i.e., the web-based pedagogy. Basically, these terms refer to the educational processes that depend on the use of ICT which assists learners, teachers, and experts, interact not only closely but remotely, synchronously or asynchronously, from their separate locations--wherever that may be home, work, or learning center [4, p. 1]. Naturally, the respective implementation of those processes might vary from one institution to another. As a direct result, both Internet and ICT have become *"an important part of the learning strategies of many universities"* [5, p. 7]. In fact, several conventional, accredited universities in the USA, e.g., Duke University [www.duke.edu], MIT [www.mit.edu], New York University (NYU) [www.nyu.edu], and Georgia Tech [www.gatech.edu], have repositioned themselves in the information societies and have successfully joined the web movement in order to serve millions of people, both traditional students and working adults [6, 3], [7, 487].

On the other hand, educational institutions in the Middle East, like many others in the West, are still campus-based and use classroom learning approach. Students meet their instructors in residential classes where they feel, reflect, think, and do in the learning processes that are followed worldwide [8, pp. 185-190]. Moreover, they implement several learning styles, separately or coherently, e.g., visual (spatial), aural (auditory-musical), verbal (linguistic), physical (kinesthetic), social (interpersonal) and solitary (intrapersonal) [9, 3]. Moreover, instructors may use several teaching methods, e.g., lecturing and discussion, evaluation of performance, role-playing, group work and cooperative

[1] e.g., the University of South Africa (1946) [www.unisa.ac.za], the University of the South Pacific-Fiji (1968) [www.usp.ac.fj], the British Open University-UK (1969) [www.open.ac.uk], Athabasca University-Canada (1970) [www.athabascau.ca], the Empire State College in New York-USA (1971) [www.esc.edu], Télé-Université in Quebec (TELUQ)-Canada (1972) [www.teluq.uquebec.ca]; and the FernUniversität in Hagen-Germany (1974) [www.fernuni-hagen.de].

[2] e.g., UNIVAC computer; CBI: Computer based instruction; PLATO: It is one of the earliest forms of computer-based training. It is also an education network providing access to a central library of lessons; and TICCIT: A system supporting lessons displayed on a color-television screen connected to the student's keyboard and a local computer

learning, and so on. Sometimes they provide feedback or assistance in class and during office hours. On a more administrative level, instructors are required to observe the rules and regulations of their institutions concerning attendance policies; students have to be present; otherwise, they are withdrawn. Besides, faculty members have limited hours to teach and meet their contract obligations. On the other hand, some learners cannot afford being full-timers at their universities because they need to work during daytime, and sometimes in the evening, in order to pay their tuition and fees; universities cannot but mainly function during day time. In addition, many educational institutions have introduced technology to their services; unfortunately, they do not have effective, broad based e-learning strategies regardless of the various artifacts of online learning, e.g., websites and learning content management systems (LCMS).

Furthermore, although the world is walking the path of globalization, Western online degrees are not accredited, to our knowledge, by any Arab Ministry of Education. It is important to note that many instructors as well as students are still consumers of information and not producers of knowledge. Finally, people are invited and challenged to be glocal (global and local) and live their diversities in a world that focuses on e-business and e-commerce, so, why not e-learning! So, would it be possible to have webagogical institutions in the Middle East, why and how? Moreover, what are the major factors that prevent learners from having good webagogy?

II. 'DISTANCE EDUCATION' IN THE WEST AND THE MIDDLE EAST

A. 'Distance Education' in Post Industrial Western Societies

Moore talked about transactional distance education. He considered *"that distance education is not simply a geographic separation of learners and teachers, but, most importantly, is a pedagogical concept."* He added that it is a pedagogical concept because the typological separation of learners and teachers *"profoundly affects both teaching and learning, and, thus, there is a psychological and communications space to be crossed"* [10, p. 22]. Distance education, according to Holmberg, needs *"educational facilities (that may) vary with cultural and social contexts, with national and other traditions as well as with the target groups and educational levels of study"* [11, p. 141]. Several prototypes of distance education are identified as follows: single-mode institutions offering off-campus independent study, dual-mode and mixed-mode institutions (blended learning), extension systems, consortia-type ventures, and new technology-based institutions [7, p. 489]. Besides, there are several reasons for why open and distance learning is strongly supported in many Anglophonic countries: the importance of lifelong learning and distance learning both for increased economic productivity and competitiveness, the second chance given to many adults to enter or complete higher education by removing all barriers, among others, we mention location, time, and family obligations, the reasonable costs than conventional education systems, and the possibility to take courses not available on campus [12, pp. 23-28], [11, 141-143].

In order to cope with the post-industrial information society and its challenges and with the global changes on all levels, academic, technological, political and socio-economic, several online and distance learning universities were established to provoke in-depth reforms by providing full-fledged curricula that are research and student-oriented. Among others we mention, e.g., Kaplan University (1932) [www.kaplan.edu], the University of Phoenix Online (1976) [www.phoenix.edu] *"with little or no physical presence in any given geographical area"*[6], the Jones International University (1987) [www.jonesinternational.edu], Capella University (1993) [www.capella.edu], the African Virtual University (1997) [www.avu.org] and the Global Virtual University (2002) [www.gvu.unu.edu]. It is important to mention that there are hundreds of accredited online colleges and universities in the USA and elsewhere[3]. These e-learning institutions, for-profit and non-for-profit, were designed to prepare people for life in an information society; the present conventional or distance learning educational institutions are designed to prepare people for life in an industrial society [2, p. 2], [13, 38]. Besides, there are several projects to establish virtual universities worldwide which are still under study, e.g., the European Virtual University (1998) [http://www.edscuola.it/archivio/lre/evu.html] and the Mediterranean Virtual University (2006) [www.medvu.org], and so on. In addition, several residential institutions of higher education started to use the web and various ICT tools, combining instructional modalities and online and face-to-face methods of teaching on all levels; academic, administrative, and social, giving rise to what is known as 'blended learning' [14, 4], [7, 493). Others, however, *"might be using distance education as a way to serve on-campus students by providing them the flexibility they need to complete degree requirements in a timely fashion"* [15, 4]. Moreover, many universities are using course management platforms[4] in addition to several e-learning delivery products[5] in an attempt to facilitate learning. Rasmussen, Nichols, and Ferguson considered that these delivery products *"provide faculty with a way to deliver instruction in a fashion that permits them to express their ideas and experiences verbally, using audio capture. These presentations model the ways that faculty typically distribute content in traditional classes"* [16, 271-273]. It is important to mention that, at present, the impact of ICT on education is still debatable, and, thus, it is early to compare their impact with that of Gutenberg's printing press in the 15th c, although their impact on communication and interaction is tremendous. The Gutenberg's press replaced 2000 years of handwritten, paper-based communication, and the WWW expanded the global village *"with instantaneous, two-way communication and a unique ability for anyone to participate*

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[3] www.elearners.com/colleges lists 159 accredited online colleges and universities that offer online degrees in many subjects (Arts & Humanities, Business, Computers & I.T., education & Teaching, Health & Medicine, Science & Engineering, and Social Sciences) and on different levels (Associate, Bachelor, Master, and Doctoral) (February 17, 2008). Moreover, there are many other websites that contain important information about universities and colleges which offer a wide range of distance learning and online degree and certificate programs in Canada, Australia, and some areas of Europe.

[4] e.g., WebCT (now owned by Blackboard), WebEx, Blackboard, Moodle, ATutor, KEWL.nextgen, and ANGEL Learning

[5] e.g., Macromedia Breeze™ (now Adobe Acrobat Connect), RoboDemo™ and Captivate™ (now Adobe Captive)

and contribute" [17, pp. 19-20]. They have *"generated such potential to change dramatically how people communicate and interact with one another"* [18, p. 5].

On the other hand, webagogy in a virtual university or in a dual-mode university requires a virtual class, library, and laboratory. Pedagogy in a virtual facility is no more distant. Faculty, learners, and experts may be web-present. Learners, mainly, web-communicate and web-interact with faculty, administrators, experts, peers and classmates; they web-socialize, web-engage in small groups, web-cooperate, and conduct web-discussions through various conferencing multimedia, maybe in the future through computer-generated virtual reality' (CGVR) which constitutes *"a serious alternative to the conventional classroom as a communication system for learning"* [2, pp. 126-127]. Moreover, the learning process may show combination and interaction of face-to-face learning, e-learning, and project-learning; face-to-face learning may take place in both residential and virtual classrooms [19]. Mason listed three broad categories within which current technologies can be divided: the text-based systems, the audio-based systems, and the video-based systems. Moreover, these three technologies can be integrated, partially or fully merged. A good example is the CD-ROM and the DVD [20, p. 19]. These technologies were traditionally grouped according to their delivery systems types, asynchronous and synchronous. Among the asynchronous communication tools, there are the facsimile used in the context of fax telecommunications technology, the electronic mail[6], the Bulletin Board Systems (BBS), and some delivery platforms, e.g., WebCT and Blackboard[7]. Among the synchronous and real time tools, there are the various text-based conferencing tools[8], the audio-conferencing[9] and the video-conferencing tools. It should be noted that every ITC tool has its costs, usage advantages and disadvantages [21, pp. 2-24], [2, pp. 86-125], [22, p. 60], [20, pp. 19-37]. Besides, it is important to highlight that several traditional libraries, public and academic, went online, during the last decade. New electronic ones were launched to provide learners with appropriate e-materials[10] which can be found at scholarly online journals, electronic publishing, magazines and newspapers. Finally, virtual laboratories are platforms where scientists and researchers publish and discuss the findings and outcome of their researches. *"Unfortunately there are barriers to such useful collaboration, mainly based on finance"* pertaining to the installation and maintenance of very high speed networking technologies [5, pp. 93-94].

B. Traditional Education in Modern Middle Eastern Societies

Distance education and webagogy are still unfamiliar in the Middle East. They are considered unorthodox despite the limited attempts to introduce distance learning to the societies of the Arab world. This unfamiliarity is due to the following reasons: the vast number of traditional institutions of higher education that might resist any change on the educational scene, the lack of awareness about e-learning and sometimes the distrust in what distance education is, how it operates, and what it can do for adult learning, the lack of state legislatures that encourage distance learning and webagogical projects, the lack of experts in the field of distance learning and webagogy on all levels, administrative, academic, and technological, and the profound concerns about quality in online higher education, and so on. It is important to note that the only two serious attempts in developing online education and open education in the Middle East are still assessing their first experiences on various levels. The first institution is the Syrian Virtual University (SVU) [www.svuonline.org] which was inaugurated by the Syrian President Dr. Bashar Al Assad in 2002. SVU is the first academic institution of its kind in the region. The second institution is the Arab Open University (AOU) [www.arabou.org] which was founded by Prince Talal Bin Abdelaziz in 2002. AOU remains the only pan-Arab educational institution that *"adopts an innovative open system of higher education and fosters modern IT resources to support the learning process."* The Arab Open University is a partner of the UK Open University whose supervision covers the following areas: licensing of Materials and the various methods for distance learning, including multimedia materials and programs and IT software. On the other hand, several US and European conventional universities have opened branch campuses and established conventional programs in the Gulf, mainly in Doha-Qatar[11]. Moreover, it was reported lately that *"leading business schools are eager to forge strong connections"* in the Middle East, mainly in the United Arab Emirates [23].[12]

Lebanon, which has more than 40 institutions of higher education, is still behind in distance and open learning, although most of those institutions are pumping big money into their IT infrastructures. Actually, higher education witnessed two unsuccessful experiences in distance and open education during the last decade. The first is related to online education, the latter to independent study. Beirut University Online "BUonline" [www.buonline.edu.lb], founded in 1994, has limited in the beginning its academic activities to research and consultations. In 1998, "distance learning" programs were added to BUonline's academic activities; a minimum of 50% of total course requirements must be completed at BUonline. The Newport University (California) [www.newport.edu] opened in 1998 a 'Directed Independent Study Center' in Beirut. During its few years of function, students had to attend workshops at the center and submit projects and assignments in fulfillment of the courses' requirements. However, the Ministry of Higher education in Lebanon did not legalize the function of the Center, and, thus, the Newport Study Center was closed. In spite of that, the Faculty of Theology at the University of

[6] e.g., Mailing lists and listservs, newsgroups, multimedia for e-mail, Multipurpose Internet Mail Extensions [MIME], and video-mail

[7] e.g., Convene, Cyberclass, Embanet, Real Education, UOL, and Hyper-G

[8] e.g., Multi User Dungeons [MUD]; MUD Object Oriented [MOO]; Multi-user Simulations Environments [MUSEs]; Multi-user Adventures [MUAs]

[9] e.g., Internet Relay Chat [IRC]; MSN; Yahoo

[10] e.g., the Online Computer Library Center (OCLC) [www.oclc.org]; the Education Resources Information Center—(ERIC) [www.eric.ed.gov]; *Questia* [www.questia.com]; the *WWW Virtual Library* [http://vlib.org] which is the direct descendant of the original World Wide Web Consortium [www.w3.org]; and *EBSCO Information services* [www.ebsco.com] are all among the best sites on the Web which provide bibliographic and databases.

[11] http://www.english.education.gov.qa/content/resources/detail/1597

[12] It is important to mention that the Virtual University of Tunis (VUT) which was created in 2002 in order to spread distance-education and foster a continuing learning environment *"will transcend the start-up phase to become an integrated system"* by 2009 [www.uvt.rnu.tn].

Balamand [www.balamand.edu.lb] is the only university in Lebanon, at present, that offers an online Spanish program in Biblical studies, designed mainly to serve the Eastern Christians in Latin America [www.pase-cursos.org] and, a recently added, online Theology program in Arabic [www.alkalimah.org]. However, the credits and courses that a student completes in any of the two programs are not transferable to any degree at the university.

Finally, it is important to mention that the educational environments in which Lebanese institutions of higher education evolve are not responding to new markets and new demands; evolution and revolution are needed in this regard. Unfortunately, these institutions did not enter the distance education or the online education business although, long time ago, they started to use Web-based software. Instead, a few Lebanese institutions of higher education have signed affiliation and cooperation agreements with some American and European universities. These agreements encouraged them to establish residency programs, external programs, and joint programs, aiming at exchanging expertise and knowledge, and, sometimes, at booming their reputation.

III. Some Advantages and Disadvantages of Webagogy

Campus-based pedagogy and webagogy may differ in context but not necessarily in content: they both have the four aforementioned critical factors of education and they both deal with knowledge management[13], training, and performance support, whose combination is a powerful force for learning. Rosenberg stated that, *"not everything can or should be delivered electronically"* [17, p. 118]. The quality, effectiveness, and efficiency of webagogy do depend on the quality of ICT; the learning portals; the learning management systems (LMS); and the learning processes and their outcomes (see [20], [24], [25]). Moreover, Rosenberg listed 11 core LMS capabilities: a common online course catalog, a common online registration system, an up-front competency assessment tool, the ability to launch and track e-learning, learning assessment, management of learning materials, integrating knowledge management resources, organizational readiness information, customized reporting, supporting collaboration and knowledge communities, and systems integration [17, pp. 162-164]. Furthermore, the value of e-learning is the *sum* of its cost-efficiency and effectiveness, its quality, its service, its speed, and its ethical framework. The elimination of any one of these criteria will lead to the fall of e-learning precipitously [17, p. 227].

Moreover, campus-based pedagogy and webagogy have several interrelated stakeholders, internal and external. These stakeholders are administrators, faculty members, learners and their parents, societies and communities, investors, business and industry, firms and organizations, the media, governments, parliaments, regulators, rival institutions (traditional, blended, or virtual), accreditation associations, and so on. The position of each stakeholder may be affected by a number of advantages and disadvantages on all levels: operational and pedagogical. Moreover, Continuous Quality Improvement (CQI) and benchmarks are needed in this regard in order to help institutions of higher education evaluate and assess important aspects of their services and programs. Experts came up with a multi-dimensional view of quality in higher education institutions with the following key areas: the curriculum; the role of teachers; the role of learners; school's leadership, organization, and culture; assessment, appraisal, and monitoring; institutional and learning resources; public disclosure; and student life[14]. However, introducing quality principles in virtual education environments is very difficult. Barbera considered that there are certain errors in the application of quality criteria: The first error consists of the almost exact reproduction of business quality models for education without the necessary reflection—these models focus more on management than on teaching and learning processes. The second error is the evaluation approach which is user/student satisfaction. The third error is the continuing and mistaken belief about the cost of distance education [26, p. 15]. Besides, Tribus emphasized that there are major differences between education and business: *"the school is not a factory; the student is not a 'product', the education of the student is the product and successful completion of the product requires the student to participate as a worker, co-managing the learning process."* Furthermore, he added that *"teaching and learning are two different processes"*, the former is more akin to an assembly process, the latter to research and development [1, pp. 87-88]. Actually, it is true that half-right elements might leave their negative impact, direct and indirect, on the mission, productivity, and prosperity of any institution of higher education, whether it is virtual, blended, or conventional. Thus, it is essential to benefit from the expertise of those universities which have tradition, standards, deep knowledge and experience in webagogy. In addition, it is essential to benefit from those educational associations and organizations[15] which have developed principles, policies and guidelines, standards or benchmarks, and instruments to enhance and ensure quality education in webagogy and make the appropriate adaptation that meet the local needs.

A. The Operational Level

Like any institution of higher education, online institution of higher education needs to gain the trust and recognition of its stakeholders in order to guarantee its legitimacy and continuity. Rosenberg considered that

[13] Rosenberg thought of Knowledge management as a 'virtual corporate brain' that can have six functions/benefits: Learning [to learn and apply information in new situations], vision and action [to see and react to the world around it], memory [to store the collective intelligence], toolbox [to have access to performance support tools and systems], creativity [to serve as a brainstorming forum], and integration [to bring various elements together] [17, pp. 68-70].

[14] See Baldrige's Education Criteria for Performance Excellence (2007) [www.quality.nist.org]; The European Standards and Guidelines for Quality Assurance in the European Higher Education Area (2005) [www.bologna-bergen2005.no]; and The National Standards of Quality for Online Courses (2006) [www.nacol.org]

[15] e.g., the American Council on Education [www.acenet.edu]; The National Education Association [www.nea.org]; the Distance Education and Training Council [www.detc.org]; the Global Alliance for Transnational Education [www.edugate.org]; the Southern Regional Electronic Campus [www.electroniccampus.org]; the European Foundation for Quality in e-Learning [www.qualityfoundation.org]; The Commonwealth of Learning [www.col.org]; ACCSCT: Accrediting Commission of Career Schools and Colleges of Technology [www.accsct.org]; ACCET: Accrediting Council for Continuing Education and Training [www.accet.org]; ATS: Association of Theological Schools in the United States and Canada [www.ats.edu]; MSA: The Middle States Association of Colleges and Schools, Commission on Higher Education [www.msa.org]; and so on.

"building a learning culture is hard work. You have to overcome the perceptions that learning and work are different (and that work is productive while learning isn't), that learning takes place only in the classroom, and that learning and training are one and the same" [17, pp. 180-181]. Moreover, it has to plan what kind of students it wants, what the attributes that enhance the institution are, why it needs the students, what it can offer them (e.g., the image of the online program or the virtual university needs to be clear to students so that they may have some idea of what they are buying with their time and money), and how it is going to keep them [27, p. 103]. Thus, the institution's visibility is increased through marketing strategies that consider the following elements: market & consumer research, marketing audit, public relations, information & communications technology, advertising & promotion, pricing educational programs, academic & social events, programme design (profitable vs. non-profitable), student recruitment, fund raising and budgeting, campus life & environment (in blended institutions), alumni; faculty images & qualifications, linkages with society & market, and so on. It should be noted that marketing activities should be designed and well tested to serve cyber-marketing [27, pp. 129-132].

Now, once the idea is well received by the society, creation of new jobs will occur. Historically speaking, universities' contributions to cultural, social and economic developments have been many and varied. Goldstein *et al.* considered that *"universities, in many respects, behave like any other economic organization…. They can be effective stimulants of regional economic development"* [28, pp. 106-107]. On the cultural level, an online institution of higher education should create both e-learning and lifelong learning cultures because without cultural acceptance by stakeholders, it will never be successful. It is said that *"the wealth of nations will depend increasingly on knowledge-based, high-tech industries"* [12, p. 231]. On the socioeconomic level, new jobs will be created in the various fields of IT, Multimedia, education, assessment, test and measurement, continuous quality improvement (CQI), and so on, provided that new jobs will lead to the growth of the educational sector and, as a result, to competition. This competition might make the 'sister' institutions doubt the efficiency, effectiveness, and quality of online education. Finally, a cultural problem that any institution may face in the future is the Middle Eastern approach to time and punctuality. Thus, all projects, programs, multimedia, and publications might not be delivered on time because of that loose understanding of 'flexibility' and 'procrastination.'

After establishing new jobs, it's time for human capital recruitment. Difficulty may be in recruiting qualified people; reskilling and training people who are willing and interested in acquiring new skills might be a good solution. Online education staffs must be 'up' on traditional instructional and information design skills. Thus, they must be able to master the wide variety of operating systems, networks, modern application software, etc. Unlike western governments and their regulations about distance education, many Middle Eastern governments haven't responded to online education developments, and, thus, they neither sought to establish virtual universities nor to issue state regulations that may support the establishment of credit degree online-programs.

On the other hand, it is impossible at present to estimate the relevant costs of online education compared to that of conventional courses. The cost of an online course comprises two parts: "the cost of developing the capacity to offer online courses and the cost of using that capacity". These costs cover the following: lecture halls, faculty time, teaching assistant time, hardware, software, server usage and maintenance, staff and programmer time, etc. [29, 196-204]. Rosenberg considered that *"e-learning is often the most cost-effective way to deliver instruction (training) or information"* [17, p. 30]. On the other hand, cutting costs would jeopardize not only the operation and services of the institution but also the quality of education that the online school renders the students.

Finally, it is evident that there can be no online education without a strong partnership with ICT. Thus, it is necessary to have competent, responsive, rich and sufficient ICT technical and capital infrastructures (e.g., available telephone networks; internet service providers [ISP]; cabling; servers; hardware and software; educational web platform; encryption, security and back-up systems, support and maintenance unit, and so on) [4, p. 6], [18, p. 2]. Moreover, e-resources, mainly e-journals and databases, are expensive to subscribe to. Thus, if universities are not ready to spend good money on buying appropriate packages, learners won't be able to read, research, and write. Moreover, the lack of textbooks in the light of copyright laws and publications governmental laws may be a major obstacle for importing books. Moreover, the problems of electricity and the telephone connections in Lebanon may be a major obstacle for the full capacity functioning of the different equipment.

B. The Educational Level

In order to cope with the vast degree of multimedia used to serve the goals of learning processes, online education places new demands on faculty, especially on those who have a little experience, and, sometimes, no experience in e-learning and its computer literacy. Thus, faculty members and students must be educated and trained about online education and its various types, methods, and tools prior to any implementation. For this reason, training and orientation sessions are suggested to take place at the beginning of the degree program. It should be noted, however, that the lack of faculty members who support online education and the heavy faculty workloads may both negatively attribute to online learning. Moreover, senior administrators, and sometimes members of faculty curriculum committees may refuse the introduction of distance learning into their traditional programs because they are not able to articulate its strategic importance as well as its role in the broader mission of educational institutions. One of the basic teaching methods is the use of its major tools, i.e., the combination of the different interactive multimedia technologies and their elements (graphics, animation, audio, video, films, and so on). However, technology is not enough; Rosenberg considered that *"Ignoring the tenets of instructional and information design amidst fervor over technology usually results in lots of Web wizardry that often doesn't teach anything of value"* [17, p. 44]. Moreover, the instructional efficacy of multimedia is debatable since multimedia can add value if the learning program is good and has solid content [17, pp. 55-56]. Thus, there should be clear

guidelines regarding course content, development, design, and delivery that are there to require learners to engage in learning and cognition. The cost and time of course development depend on the experience of the developers, the availability of resources, the severity of project timelines, the level of criticality for the company, the complexity of the proposed learning, the amount of multimedia used, the nature of the content, the sophistication of the programming, and the quality of management [17, pp. 225-226]. On the other hand, the experience of using chat-rooms, for instance, is not always positive because it is difficult to have all students available at the same time, which is a major restraint.

Webagogy is more than converting course contents to digital media and uploading them on the WEB or distribute them on CD-ROM or DVD. It is developing rich media contents that add value, boosts productivity and efficiency, and increase interactivity and communication. Moreover, learning needs virtual libraries and laboratories. They are expensive but essential. The testing process of both credibility and accuracy of online resources should be conducted by learners, faculty members, and, V-library and laboratory responsible [5, pp. 95-97]. Outcomes should be reviewed regularly to ensure clarity, effectiveness, appropriateness. Two main outcomes should be assessed; cognitive outcomes which emphasize 'knowing why' and performance outcomes which emphasize 'knowing how' [5, p. 35].

Moreover, learners' performance depends on the learner's competency, resources, and lifestyle along with its traits. Thus, and in order to succeed, learners need to be patient, self-directed, self-advocate, self-confident, self-motivated, self-disciplined, self-sufficient, comfortable with ICT—proper orientation sessions are a must), independent, and researchers. They should also have the ability to work independently and not have the tendency to procrastinate. Naturally, they should be highly skillful in critical reading and writing. Besides, they must master both active (speaking and doing) and passive (reading, listening, and seeing) learning modes although in online education there is a lot of passive learning. Finally, they should not miss the social interaction with instructors and classmates. On the other hand, they should realize that they are studying at their own risk and their chances of success depend on their several factors.

The development of coherent curricula may require the introduction of new courses into the present program and take into consideration the target population. Thus, online education may give the students the opportunity to studying courses or even majoring in fields that are not offered in their local, conventional institutions of higher education. Learners' interaction with faculty and other students are accessible, asynchronously, on a flexible schedule; *"learning is 24/7; it is just in time—any time"* [17, p. 30]. There are seven principles for good practice in education: encouraging contacts between students and faculty, developing reciprocity and cooperation among students, using active learning techniques, giving prompt feedback, emphasizing time on task, communicating high expectations, and respecting diverse talents and ways of learning [5, p. 27]. It is important to mention that e-learning goes beyond the scope of e-reading; it is a process that advances knowledge through research. Learners may find it difficult and prefer to turn away from Web-based education, preferring to go back to campus-based education.

Finally, students may face problems related to whether their courses are accepted by other institutions of higher education, online are they or traditional. Theoretically, virtual universities can sign agreements for equivalencies with other institutions. Practically, this is difficult because universities have the right not to accept any student coming from a university that is not recognized by the state.

IV. CONCLUSION

In 1948, the United Nations issued the Universal Declaration of Human Rights [UDHR] in which it insisted on 'the right to education' where *"higher education shall be equally accessible to all on the basis of merit"* (Article 26.1) [30]. Three decades later, the Director General of UNESCO asked the university world in 1987 the following question, *"can the present-day university still become an efficient institution? Or is it necessary to create another university or another institution to replace the university, which is overwhelmed and unable to recover?"* [31]

Several attempts have taken place to change the educational situation worldwide. Online programs have been designed to replace and/or to complement the campus-based programs. Unfortunately, resistance to change was dominant and e-learning activities are still peripheral. Pursula, Warsta, and Laaksonen wrote, *"The traditional learning and teaching paradigm is still dominant and much time is needed to change traditional face-to-face teaching to blended programs with ICT as one part. The e-learning platforms need to be developed further and the enthusiasm towards e-learning varies greatly, both among teachers and students. Teachers need effective support in order to be able to change their present teaching paradigm and materials to the new pedagogical approach and form needed in the ICT-based teaching and learning. Therefore, a clear strategy and clear commitment of the top management of the university is needed in the promotion of e-learning and virtual university activities"* [32, 440].

Webagogy bridges work and learning. Rosenberg stated that *"this is a fundamental shift from the time-honored practice of going to school. Now schools come to you--at work, at home, and on the road"* [17, p. 179]. He added, however, that *"preparing…. for a shift to e-learning requires an effective change strategy"* [17, p. 199].

Finally, the author of this article recommends the following:

- All governments in the Arab world are urged to pass appropriate legislations that facilitate the establishment of online institutions and that protect e-learners from all kinds of discrimination in the workplace.
- All governments in the Arab world are urged to pass appropriate legislations that recognize online degrees taken from respectful and accredited international institutions.
- Campus-based institutions should cooperate and support the establishment of such e-learning institutions, by opening their libraries and their labs for researches, and by allowing some of their faculty

members to be part timers at those new institutions after providing them with adequate training.

- There should be the need to establish a functioning infrastructure for ICT introduction and use.
- It is urgent to establish favorable conditions for e-learners while purchasing hardware, software, and educational material.
- It is essential to encourage campus-based institutions to add to their traditional curricula an e-learning component.
- It is preferable to encourage campus-based institutions to become glocal by hiring skillful faculty members with a worldwide reputation.
- It would be progressive to establish a Pan-Arab Online University similar to the International Telematic University UNINETTUNO, *"the University without Frontiers"* [www.uninettunouniversity.net].

As a final point, it is important to affirm that *"everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers"* (UDHR, article 29) [30]. Furthermore, it comes as no surprise as the World Summit on Information Society, in its first phase in Geneva 2003, adopted the *Declaration of Principles* whereby in article C.67, peoples of the world *"are firmly convinced that we are collectively entering a new era of enormous potential, that of the Information Society and expanded human communication. In this emerging society, information and knowledge can be produced, exchanged, shared and communicated through all the networks of the world. All individuals can soon, if we take the necessary actions, together build a new Information Society based on shared knowledge and founded on global solidarity and a better mutual understanding between peoples and nations. We trust that these measures will open the way to the future development of a true knowledge society"* [33].

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Wikis in Classroom Participation:

Results From Preliminary Exeperiment

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Abstract— **Wiki systems encourage students' collaboration and participation in course content. This paper reports on an experiment carried out on a group of students studying a course in Operating Systems, at the Information Technology department – King Saud University, to leverage their research and writing skills in classroom participation using wikis. The methodology used to conduct the experiment and the results of the students' feedback are discussed.**

Keywords- Web 2.0; Wiki; Classroom Particpation; Collaberation; E-Learning

I. INTRODUCTION

In the era of so-called 'Web 2.0^{TM}', a new family of social applications is currently emerging. Wikis, blogs and social bookmarking services, to name a few, are all signatures of the Web 2.0 phenomenon. As these technologies are gaining more popularity overtime, many educators are trying to develop new techniques to utilize them in the classroom. Among the well-know Web 2.0 technologies, is the use of wikis in teaching and learning.

Wikis are social software that enable many people to write, edit and share content collaboratively. The term 'wiki' was first used by Ward Cunningham; the originator of the wiki technology, and its meaning reflects the rapid nature of the technology; "wiki wiki" means quickly in Hawaiian language [1].

Recently, many educators embraced wikis technologies for their classroom interactions (see section 2). Collaboration, networking, active learning and peer reviewing, to name but a few, represent potential pedagogical objectives that wiki environments provide for each student [2, 3]. Thus, we believe that wiki publication environments provide students with learning opportunities that cannot be found using other technologies for classroom interactions e.g. blogs [8].

In this paper, we aim to answer four questions about potential benefits of using wikis in classroom participation, namely:

1. To what extent does wiki participation affect the students writing and research skills?
2. To what extent do students benefit from their peers contributions in the wiki?
3. How does commenting on students' writings (either by the course instructor or peer students) affect their participation in the wiki?
4. Are students satisfied with the experience of using wikis in classroom participation?

This paper is based on our experience in using wikis in classroom participation, and the primary goal of this experiment is to help students improve their reading and writing skills.

The organization of the paper is as follows: in section 2, we review some recent research on using wikis in classroom interactions. Then in section 3, we describe the methodology used to conduct our experiment. Finally, sections 4 and 5 respectively, report on the evaluation of the usefulness of our approach and conclude the paper with some observations and lessons learned from this experience.

II. RELATED WORK

Many studies that address the use of wikis in the classroom have focused on both the technological and the pedagogical aspect of the technology e.g. [9],[10].

For instance, O'Neill [4] developed a wiki tool called slides2wiki, to share lecture notes collaboratively among students. The tool enables students to elaborate on the content of the slides by adding their own notes. O'Neill tool was used by several classes at his institute and early students reactions showed positive acceptance of the technology. Likewise, Wang and Turner [1] extended the wiki platform to include new features that help in collaborative writing (such as improving page editing and locking mechanism).

On the other hand, Puente [5] used wikis and forums to evaluate individual students contributions within a group. He asked his students to participate with a topic to one of the courses he teaches, and the grades were calculated based on the type and size (in bytes) of the contribution. At the end of the semester Puente found that his methodology of evaluating students' participation allowed him to have qualitative data to characterize individual contributions. One drawback of Puente's method is that it does not take into consideration the intrinsic quality of the student contribution.

Raitman and Augar [6] investigated the use of wikis platforms as means of online collaboration in tertiary education environments. Their investigation showed that students liked the idea of the wiki and they are willing to embrace the technology in future activities.

Similarly, Forte and Bruckman [7] investigated the links between wiki publishing experiences and writing-to-learn in an undergraduate government course. Their results showed that perceived audience plays an important role in helping students monitor the quality of writing.

From the previous studies we can observe that the aim of using wikis platforms is to enhance teaching and learning and also to create a space for students to practice their writing and evaluation skills. To build on the previous studies, our experiment is conducted to further investigate the benefit of using this collaborative platform in improving students writing and research skills and to measure students' satisfaction on using such a technology.

III. METHODS AND PARTICIPANTS

The experiment was applied on a group of 105 female students studying a course in Operating Systems at Information Technology department in The College of Computer and Information Sciences, King Saud University, Riyadh. The experiment was carried out over the course of a complete semester.

The students were asked by the course instructor to participate to the course wiki with an article written in Arabic about the topics covered in the course. The students were divided into three sections; each section manages its own wiki site[1]. Students were also notified at the beginning of the semester that the wiki participation will constitute 5% of the course final grade, and they have a semester-long to complete their contributions.

Rules and regulations were posted to the students to tailor the type of contributions allowed in the wiki. Among these rules: contributions must address the covered topics in the course, students were allowed to translate topics from English to Arabic and students must cite the references used to write the article. Unrelated, plagiarized and articles without citation were forced to be removed from the wiki by the course instructor.

The students were asked to review their peers work and comment on them (a screenshot is shown in Figure 1). The course instructor also visited the three wikis periodically and comment on the students work.

[1] The address of the three wiki sites: http://os1h.pbwiki.com, http://os2h.pbwiki.com, http://os3h.pbwiki.com [Last accessed Dec 15, 2007]

Figure 1. A screenshot showing a student participation and her peers comments on the topic (as marked in red in the bottom left corner)

The service used to host the course wikis was a free wiki service[2] with basic functionality sufficient to monitor students' participations.

The instructor evaluated the students based on the following criteria:

- Number of contributions.
- Quality of contribution (i.e. proper citation, well-formatted, correct language, etc.).
- Commenting and revising other contributions.
- Type of contribution and its relation to the course content.

Approaching the end of the semester a survey consisted of 10 questions was distributed among the students to provide the course instructor with a conclusive feedback on the usefulness of the methodology used to leverage their participation. The initial sample consisted of 105 students of whom 12 did not complete all of the survey.

IV. RESULTS

Following are the results extracted from the statistics of the three wikis and from the students' surveys.

A. *Wiki statistics*

Quantitative measurements of students' participations on the course wiki are shown in Table I. The table shows the average statistics of the students' activities in the three wikis.

TABLE I. AVERAGE STUSENTS ACTIVTIES

Average number of pages for all wikis	220
Average number of page edits (revisions) for all wikis	1014
Average number of comments per page	0.2

[2] www.pbwiki.com

We can observe from the numbers presented in Table I that on average each student contributed with about 2 articles to her section's wiki. However, the average number of comments per page was very low compared to the average number of page edits. This may be attributed to the student need to quickly modify the article without waiting for the original contributor permission. We have also seen that most comments were actually complements to the contributors by their peers (see Figure 1).

B. Survey analysis

Investigating students' prior experience with wikis, the survey showed that around 79% of the students have never used wiki environments before. Knowing this fact about the students derived us to ask them about the problems they encountered during their wiki participation. Table II summarizes the difficulties encountered by students while participating in the wiki. The most common problem was the difficulty of editing wiki pages. Since the technology was very new for some students, their peers have offered an online tutorial on how to create, edit and link wiki pages.

TABLE II. DIFFICULTIES ENCOUNTERED DURING WIKI PARTICIPATION

No problem encountered	27%
Page Editing	44%
Page linking	13%
Adding comments	5%
Other problems	11%

To address the first research question "*To what extent does wiki participation affect the students writing and research skills*", Figure 2 shows that around 92% of the students' answers (i.e. yes and somewhat likely) have agreed on the benefit of using the wiki in improving their writing and research skills.

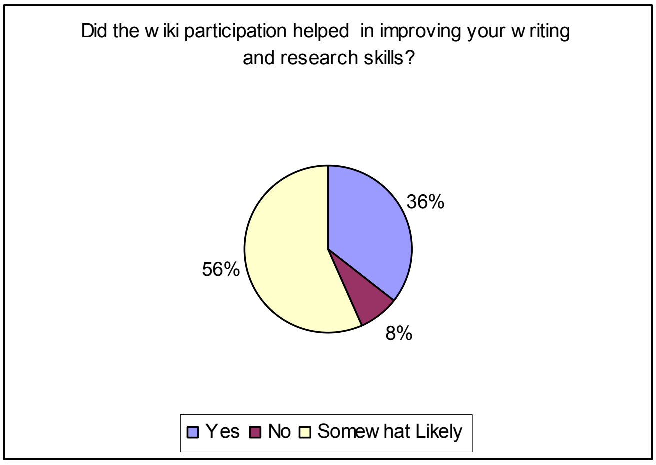

Figure 2. Percentage of Students that benefited from wiki partcipation in improving their writing and research skills

Moreover, the result of our second research question "*To what extent do students benefit from their peers contributions in the wiki*" is shown in Figure 3. Figure 3 shows that 38% of students have benefited from the articles contributed by their peers, i.e. in comprehending the lectures. Yet, 42% have somehow benefited from their peers contributions, while 20% did not see any benefit.

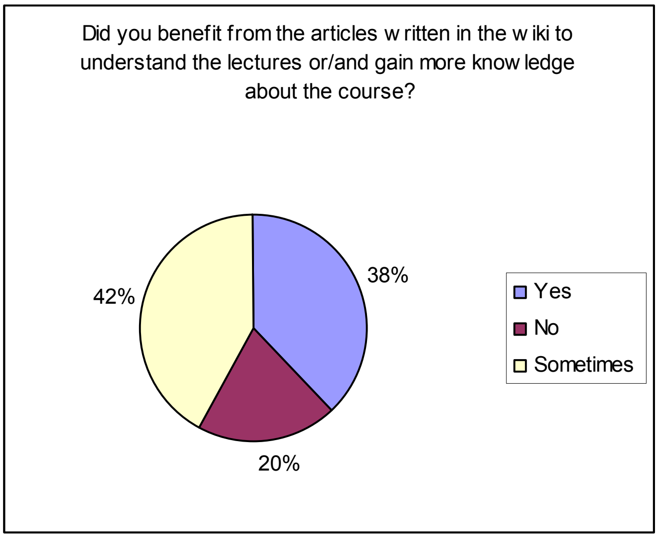

Figure 3. Percentage of Students that benefited from the course wiki

Figure 4 answers the third research question "*How does commenting on students' writings (either by the course instructor or peer students) affect their participation in the wiki*". Unsurprisingly, 33% of the students said that comments affected their wiki participation; 42% found that comments provided by their peers or by the instructor helped in one way or another in improving their writings.

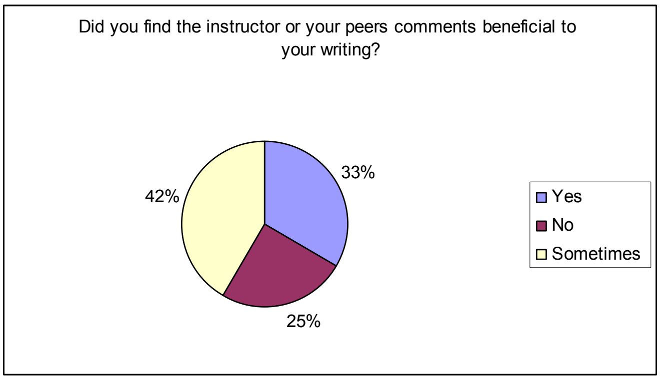

Figure 4. Percentage of Students that benefited from the instrcutor and peers comments

The overall wiki participation experience was fairly acceptable. Figure 5 actually mirrors the answers of two questions that we asked about the benefit the student gained from the wiki participation and the student enjoyment in writing. Both answers were positive. For the first question 41% answered with yes and 42% with somewhat likely. However,

for the second question 19% answered with yes while 43% answered with somewhat likely.

Generally, more than 50% of the students that answered with ‘Excellent’ and ‘Good’ to the overall wiki experience question (shown in Figure 5) found that their wiki participation experience was worthwhile. However, 36% found the experience satisfactory while 10% did find it unsatisfactory.

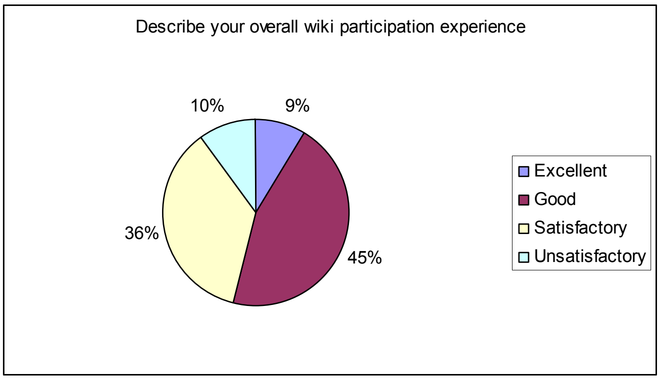

Figure 5. Overall rating for wiki participation experience

Contrary to expectations, in a final question in the survey, we asked the students whether they recommend the use of wiki in classroom participation for other courses. The results showed that 48% agree while 52% disagree to use the wiki participation in other courses. This unexpected disagreement may be attributed to the overload of assignments given to students by other courses at the same semester, which made them resistant to any extra work.

V. DISCUSSION AND LESSONS LEARNED

Using the methodology we have proposed for classroom participation allowed students to participate in their own pace and using their own learning process, this gave them greater opportunities for innovation (as we have witnessed from some students’ participations) and self-regulation (by commitment to class participation).

Also, a sense of peer-reviewing was a vital part of the wiki participation. Thus, students actively participated in their peers’ articles by adding illustrative diagrams or/and by formatting the text or editing the language or making content corrections. This active participation would not be possible if the instructor did not regularly talk about the importance of the wiki participation and weekly announce the best articles contributions on the course blog. These two factors made the students take the wiki participation very seriously and also revealed students talents in writing and diagramming.

Another benefit for asking students to write their participations in Arabic is to fill the void in finding reliable resources on the web that discusses Operating Systems in greater depth.

One major drawback of our proposed methodology was in the time required to monitor students’ participation. The course instructor was committed to check her students’ participation in a daily basis to ensure that the quality and the quantity of participations were up to the instructor expectations. Moreover, the free wiki environment used to host the course wikis offered limited functionality. The service did not provide an easy and intuitive interface to record each student’s participation and log their activities; also it did not provide advanced statistical analysis. The absence of such features has played a great impact on the accuracy of students’ evaluation. Finally, some students reported that the wiki service does not correctly support bilingual writing. This forced some students to overcome this problem by implementing their own hacks.

VI. CONCLUSION

In this paper we have demonstrated and discussed the results of a pragmatic experiment using wiki platforms to leverage students’ classroom participation. It is evident from the results that most students accepted the idea of using wikis in classroom participation. However, some of them suggested considering the wiki participation to be a bonus instead of making it part of the course final grade.

The wiki system used in this experiment was not capable of effectively and accurately monitoring students’ participation. This drawback has increased the burden on the course instructor. Therefore, to exploit the potential of wikis, further technological and pedagogical research need to be carried out to improve the features provided with the technology and to find innovative ideas to push the technology to its potential.

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e-learning in Kuwait University Smart Classrooms

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Abstract*—E-learning is blended-learning that is evolving, and it is altering pedagogy according to newly developed social structures that differ from those in traditional methods. Human social aspects affect pedagogy and play a major role in structuring the process of learning. Examples of social aspects are, knowing each other in the group, solidarity and empathy, awareness of each other's interests, establishing trust, realising credibility through interactions etc. These help to increase the morale among individuals in the group and make the learning process effective and more productive. An exemplar of the latter is depicted at Kuwait University in one of the smart classrooms. A case study was explored and investigated to define the role of and importance of these social aspects that are necessary to have in the e-learning environment. Social issues that arise from this e-learning process are bench-marked against those developed in a triadic awareness framework. This framework emphasises on two main spaces namely, workspace and social. It considers the three components of social awareness factors, which are people, knowledge and process. Each of these components has its related social awareness factors that should be provided in order to satisfy demands of a successful e-learning process. This paper looks at what has been offered and provided in the smart classroom, investigates what instructors and students had to say with respect to the e-learning environment. The paper further compares what has been offered against what should be provided. Analysis highlights and recommends additional important issues that are critical in the e-learning environment. These issues need to be considered and provided for stakeholders in the e-learning process.

***Keywords*- Blended-learning, Pedagogy, Smart classroom, Social requirements, Workspace, Awareness, Triadic framework**

I. BACKGROUND

Education in general, i.e., learning and teaching processes compose pedagogy. Pedagogy is not recognised until the beginning of the course, which defines what happens *prior to*, *during* and *after* the teaching/learning process. Before the invention of ICT technologies and the innovation of e-learning, students usually have the chance to know the learning materials, course instructor, place and time of course prior to the learning process, but with limited access. The instructor also has the chance to know students' names, their fields of study, and some information about them upon request from the registrar. During the course students and the instructor get to know each other through face-to-face (F2F) interaction. The instructor has the chances to develop relations with students, memorize their names, discuss their interests and share common thoughts. New learning materials may develop during the course as the instructor teaches and presents course materials and also with the help of students' discussion and feedback i.e., interaction between instructor and students. Pedagogy starts to structure, and the instructor could also develop new methods of teaching, which would help students learn better and flourish new ideas. The learning process involves and is affected by the social behavioural issues and working scenarios that occur in a physical F2F context. Among these social issues are the awareness factors that also play a major role in defining and structuring the learning process and pedagogy. These awareness factors identify *what*, *who*, *when*, *where* and *how* (the *Quintilian questions (aka the five "W" words): Who, What, When, Where, and How as proposed by [12] and [17].*) to proceed with the learning process. After the learning process, learning continues through established relations that were built during interactions, which encourage further discussions, holding workshops and similar activities. Pedagogy evolves when new people are introduced and technology is utilised and practiced during and after the learning process. New people e.g., facilitators and tutors assist instructors prior to, during and after the learning process. When new technology is practised e.g., ICT tools and systems, it is no longer F2F and e-learning defines a completely new pedagogy. The *what*, *who*, *where*, *when* and *how* have a new context in the e-learning process, and more efforts need to be committed to the learning process in order to make it effortless on users.

Awareness (i.e., knowledge of) has always been associated with Computer Supported Co-operative Work (CSCW) and Groupware. *"Knowledge of group and individual activity, and co-ordination are central to successful co-operation. These factors are clearly critical concerns in the design of computer systems […]."* [6]. It is also closely related to Computer Supported Collaborative Learning (CSCL). CSCL involves the investigation of how learning is accomplished in electronic environments. It involves the study and exploration of pedagogical issues and the social ordering of users in such environments that enable stakeholders (instructor and students) in electronic learning environments to interact together in the learning process. In a traditional learning context awareness is instant, while in an e-learning environment awareness is required to be transferred and communicated through interfaces e.g., artefacts and images. In an e-learning environment, people use technology to

communicate; various types of information are communicated through many channels, both implicitly and explicitly. Types of awareness information vary from awareness of documents, projects, and tasks, to awareness of the location and activities of co-workers. Tele-pointers, office snapshots, video glances, document/project tracking, background noise, transferring files and images, online favourites, and sharing saved bookmarks using the web are some of the various forms of providing awareness, which have been used to date. In creating support for awareness, considerations include: what information to provide, how to provide it, how to give users control of the information, reciprocity, privacy, and interruptions.

Social issues in the learning process are also evident when transferring and sharing knowledge through websites, blogs, wikis, discussion forums, instant messaging and chatting tools. These products increase collaboration among the stakeholders in a classroom context. *'The process of work involves the making public of information, people, and interactions and activities to allow groups to co-ordinate their endeavours'* [20]. This co-ordination may be formal or informal and may involve some form of technical mediation. In an e-learning environment e.g., a smart classroom, the instructor and students utilise tools through user interfaces that enable them to interact and accomplish work. These user interfaces must provide information about what others are doing to efficiently support *prior to*, *during* and *after* the learning process i.e., awareness. Knowledge and understanding of the overall state of a work (learning process) environment, i.e., information, system, and people, is a key factor for successful collaboration [2] [6] [21]. Awareness surrounds the instructor and students at *any-place any-time* they communicate and allows them to co-ordinate and structure their work, because they can perceive what all are doing. Determining what type of awareness information is appropriate to particular situations i.e., real working contexts, can be approached by extracting and evaluating what users require in real working contexts. An e-learning context is concerned with social aspects of individuals working as groups, therefore, *social awareness* is of a major emphasis. E-learning is also concerned with work objects (or artefacts) that are shared between individuals in groups, and therefore, *workspace awareness* is the other important type of awareness.

Awareness information makes people's interactions and activities visible to each other. In an e-learning setting, activities are co-ordinated between individuals through their awareness of each other's actions. When people use technology to communicate, various types of information are communicated through several channels, both implicitly and explicitly. Types of awareness information vary from awareness of documents, projects, and tasks, to awareness of the location and activities of co-workers. Collaboration i.e., communication and coordination over the web is limited when compared to direct user communication (F2F). Supporting awareness e.g., what information to provide, how to provide it, how to give users control of the information, explicit and implicit sources of information, reciprocity, privacy, and interruptions would become vital. Also, questions concerning when information is useful, and when its provision interferes with the collaborative process, are important, since too much information hinder the learning process and successful collaboration. The questions of what information people have access to, what information they use, how they maintain awareness, and when they need awareness, have all yet to be answered. Many research attempts have been made to try to provide such information with varying results.

Awareness and interaction can be both direct and indirect. The instructor and students collaborate through the web utilising tools, hence forming a social network. There is an impact of the web (potential web 2 and web 3) and the unleashing of new technology on pedagogy. E-learning technology and it power is harnessed for stakeholders in order to increase levels of interactivity (v-v Net generation). The moves by the social networking platforms to data interoperability have amazing implications for those who work within e-learning. Direct awareness and interaction are represented by for example, eye-contact, facial expressions, and gestures, while indirect awareness and interaction are represented by for instance, gaze, peripheral awareness, and synchronisation. The following are the types of awareness support found in the literature with brief explanations and examples of systems. This is elaborated Table 1.0 below.

TABLE 1. TYPES OF AWARENESS SUPPORT

Awareness	What is it?	Reference
Social	-Social situation of the members, i.e., what they are doing … etc.	@Work, CSCW'96, [22]
Workspace	-Work artefacts, i.e., files, documents, images and related resources.	BSCW, [3] and [4]
Structural	-People's roles & responsibilities, their positions on an issue, their status, and the state of various group processes.	[15]
Peripheral	-Shared electronic artefacts through sensors as opposed to physical artefacts in the real world.	The PoliTeam Awareness Client, The Theatre of Work Enabling Relationships (TOWER), [11] and [19]
Situational	-Understanding of the state of a dynamic system.	[7]
Informal	-Who is around in the work community?	Peepholes, [8] and [23]
Organisa-tional	-How the group activity fits in with the larger purposes of an organization.	CSCW'98, [10]
Contextual	-Work situations in which users may receive document-related awareness information. It relates to domain specific work patterns.	The PoliTeam Awareness Client, [16]

The support of social awareness is of interest in this article. Research in e-learning applications e.g., conducting e-seminar, e-lecture, and e-workshop has resulted in highlighting what needs to be in awareness from the stakeholders' points of view. A case study at Kuwait University smart classroom is an exemplar of the necessity of social networking and knowledge for the learning process to be successful and effective. This case study emphasise the importance and efficiency of stakeholders i.e., roles in an e-learning session. These roles are the *instructor*, *student*, *facilitator* and *system administrator* (or technician). What needs to be *"in awareness"* is clarified in the framework [1] in figure 1.0 below.

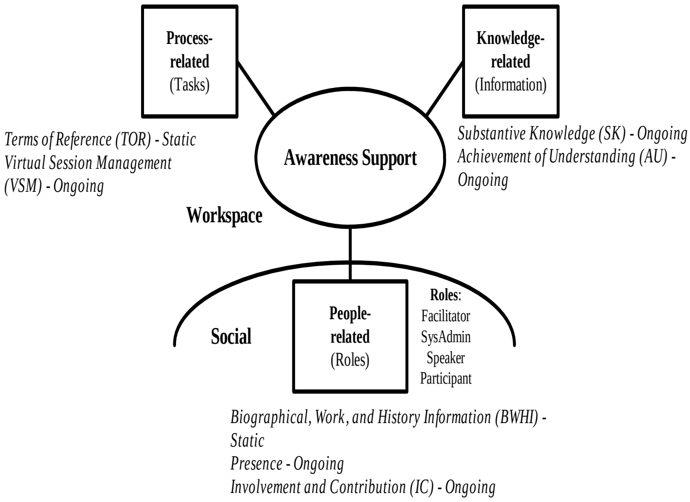

Figure 1. The Awareness Triadic framework developed by [1].

Components of the framework are the awareness issues:

1. Terms of Reference, TOR.
2. Virtual Session Management, VSM.
3. Substantive Knowledge, SK.
4. Achievement of Understanding, AU.
5. Biographical, Work, and History Information, BWHI.
6. Presence.
7. Involvement and Contribution, IC.

Where TOR is the agenda for the event, which includes information concerning the topic, brief information of what it is about, its scope, a list of its objectives and goals, the presenter and brief background, people who are going to manage it, and the structure of how it is going to operate. VSM is mainly related to providing information about how the process is managed. SK is concerned with the *content* of the virtual event (i.e., the e-learning session), specifically with information relating to the topic of the event, e.g., from the presentation itself, related questions and answers (QA), and discussion. AU in the learning process is a cognitive human issue that is concerned with how well knowledge is delivered, perceived, and comprehended between the stakeholders (e.g., instructors and students) during the process. BWHI is the provision of main stakeholders' biographical, work and history information, which is extremely useful in creating a social and friendly working environment. Presence is an awareness issue, which indicates who is present, engaged in the learning process, and available for contact. And finally, IC generally refers to instructor and students' interactions along with activities that are undertaken by facilitators.

II. The Smart Classroom Setup

The study of a Kuwait University smart classroom was part of a general research activity for providing technical support, consultancy, and conducting joint research with Kuwait University Distance Learning Centre (KUNIV-DLC). The purpose of establishing a centre for distance learning at Kuwait University is to provide electronic delivery and perception of information for academic, cultural, and business purposes. The KUNIV-DLC utilises electronic media to accomplish the learning objectives e.g., audio/video conferencing. A scenario for the DL setup is to have an instructor located physically at one site with her/his own audience, and s/he delivers a lecture to a remote site (or various remote sites). This setup requires that the Internet to be functioning at a higher bandwidth and also to have compatible audio/video devices, and communication protocols. The KUNIV-DLC is aimed at providing distance learning services for various learning activities:

- Holding e-meetings.
- Holding and participating in conferences, seminars and workshops, both locally, regionally, and globally.
- Conducting lectures for the university and colleges courses.
- Participating in live lectures with other educational institutes in the world.

Kuwait University aims at providing DL courses and programs for all corresponding colleges at all campuses through smart classrooms. The DL committee at Kuwait University has decided to work with the open-source DL system called MOODLE (http://www.moodle.com), which is an integrated learning management system (LMS), a content management system (CMS), and a virtual environment (online access to learning materials).

The case study that was conducted in the smart classroom at the College of Liberal Arts, aimed at the following objectives:

1. Qualitatively extracting instructors' opinions and points of views about the DL environment.
2. Qualitatively extracting students' comments on what is offered and what they obtain from the environments.
3. Highlighting the problematic issues and positive aspects that motivate teaching and learning in the DL mode.
4. Analysing instructors' and students' feedback which serve as recommendations for better systems' setup and preparation for the DL environment.
5. Creating a framework for what should be provided in an integrated DL environment based on the above results 1-4.

Kuwait University established the main DLC in Khaldiya campus. This centre is equipped fully with Polycom and multimedia systems[1] (http://www.polycom.com):

- Main control panel for communications with other campuses.
- Main instructor desk equipped with a computer system, audio/video, presentation media, annotation, and pointing devices.
- Students' desks each equipped a computer system and audio capabilities.
- Instructor's camera for displaying the image of the presenter.
- A main camera that displays students, which is sensitive to sound and capable of zooming into the speaker at each time.
- A main smart board for displaying learning materials, the web, annotations, and pointing capabilities.
- A large screen for connecting and displaying power point slides and web-based materials, which are displayed at other sites.
- A screen (TV monitor) for displaying other sites (students).
- Projector system for displaying learning materials.
- Microphones that are setup at certain distances capable of picking up voices in the lecture room.

Other campuses or colleges are also equipped with similar devices (main presenter camera, smart display board for PP slides, web and making annotations, audio, and microphones for students). There are other three specified locations (smart classrooms) at Shuwaikh, Kifan, and Edailiya campuses besides the main site in Khalidiya campus as well.

This case study is mainly qualitative research consisting of interviewing the stakeholders (students, instructors), observing behavioural issues, participating while observing, and questioning the stakeholders. Research was conducted inside and outside the smart classroom, where the researcher met instructors and students. During lectures observations were written down, and after lecture times interviews were undertaken utilising questions.

III. Analysis and Discussion

Analysis of the feedback obtained from students and instructors are presented. Taking feedback during a course (or a lecture) or right after a lecture provided a reasonably accurate impression of what has been provided. Users' evaluations are presented to reflect the negative and positive sides of the learning schemes followed at Kuwait University. Quotations from students and instructors were elicited. The researcher's comments are stated to reflect what has been highlighted as concerns of users while *technology-in-practice*. Besides users' feedback, observations that were noted by the researcher during the course were included as well. Here are some highlighted quotes:

Instructor: *'I would like to see my students face-to-face because the environment does not let me to be intimate with my students, besides I see no interaction between me and the students. I would like to feel if they are really understanding me or not. There are no tools for that, and not enough feedback from them.'*

Instructor: *'Are there ways to communicate better with DL students, I can see them in on screen, but I can't see their faces clearly. I don't know if they are paying attention or not. The only thing I am sure of is that my input and explanation on the smart board is visible to them.'*

It is always an advantage for both sides the instructor and the student, to put a face with the other before working in a virtual environment. They need to know who they are, their names, faces, and some details (information) on each other. This will make them feel comfortable when they interact, communicate and work together.

Instructor: *'There should be better tools for interaction and communication. I need to know clearly whether my students have questions or not. The system should display these for me.'*

In contrast to the traditional method of learning, interaction and communication tools are a must in the virtual or the online environment.

Student: *'I had a difficulty in coping up with this new environment, sometimes it's interrupted, not clear, I had to come to class in person and attend the lectures face-to-face at another campus.'*

This emphasises for the necessity of maintenance. A system administrator, facilitator, or moderator should be made available during the delivery of course materials and the entire online session.

Student: *'It felt strange at beginning when I attended the smart classroom, I was actually with another student, there was no one there, I think there should have been a training session for that. We couldn't interact; we thought that the instructor was not paying attention to us. We didn't know what to do.'*

The most essential component of online environments is that the stakeholders should undergo training in how to operate and work within the DL system.

The researcher's observations are summarised as follows:

- The instructor did not mainly look at the screen that displays the students who are at a distance. He did not spread time equally between who attended the class physically and those who attended virtually.
- It seemed that the instructor was really concerned about the attention and feedback of distant students. He simply had neither enough tools nor indications to signal when, what and how to interact with them.

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[1] Main camera for instructor, auto-zooming camera sensitive to sound for students, all-ways audio, main wall-mounted screen, all-ways desk-mounted microphones, and desktop personal computers.

- It was not possible for the students present physically to interact with those present virtually. Were they interested in such interaction? Did they want such interaction? Were there tools available to enable such interaction? The possibility of interaction between students was through a microphone. The camera was capable of zooming on students who spoke up, but it was not enabled.
- In one course, more distant students were more than those physically present, which made it difficult for the instructor to pay attention students located at remote sites and also to keep the classrooms under control.
- The instructor felt removed or separated from distant students, and he wanted to access their feedback and find out whether they had understood him and the learning materials or not.

IV. Conclusion

It is recommended that instructors (or facilitators) of the course prepare and organise learning materials and whatever is required prior to commencing classes. With DL, this is usually done by email, utilising chat tools, forums, message boards, etc. Kuwait University is adopting Moodle (http://www.moodle.com), an open- source LMS and e-learning system, as a solution for managing learning course materials, instructors' information, and students' databases. This system is open-source and staff at Kuwait University are still undergoing training on it. Vast progress was noticed after various training sessions. Course delivery and mechanisms are one-way, i.e., the instructor is the presenter and the facilitator at the same time. There are also technical staff, who are available prior to, during and after virtual classes. Regarding visibility, cameras' capability to zoom in on the instructor and students should be disabled in order to prevent lots of movements, given a lot of talk and hand-waving among students. No interaction or tools for communicating should be available to avoid distractions. Students need to raise their hands in order for the instructor to see them on screen, or speak up to alert the instructor to their comments, answers and questions. Both audio and video should be working at all time in the smart classrooms. In case audio or video is not functioning properly administrators are supposed to troubleshoot and correct problems.

The online environment should be as *effortless* as possible, and should have more support than the traditional method of learning and teaching. Components of the online environment constitute the following resulting framework:

- ***Visibility*** of users and learning materials.
- ***Limited access*** to communication and interaction tools.
- ***Presence of moderators*** and/or facilitators who are required for successful and smooth e-learning process.
- ***Attendance system technical support*** and administration.
- ***Undergoing of training*** is required for the instructor and students. By putting hands-on-practice the DL process becomes more effective.

The online environment should envisage a simple user interface that is effortless and has a well-defined structure for proceedings. The above framework works for the blended mode of learning. Technically, the broadcast and perception bandwidth should be high enough for the course not to be interrupted. Learning materials (e.g. Power-Point slides) should also be visible and accessible. Tools for communication and interaction, e.g. asking questions and signalling a connection, should also be available. Video and audio-conferencing tools would be advantageous but are not a must. The user interface should have a moderation capability, so certain user interface (UI) functionalities can be selected to meet the requirements of work environment (e.g., lecture, seminar, workshop etc.). System support and training are a must, because users are not equipped to hassle with technical information or system malfunctions. Users should be trained properly for their work to proceed smoothly and effectively. Teaching and learning rooms (smart classrooms) should not be cluttered with a lot of devices and wiring; this actually obstructs learners and makes learning difficult.

Finally, awareness becomes an important issue to be considered. *"Awareness is still about the observability of relevant information and the media used to render observable entities and activities"* [5]. The work setting e.g., e-learning defines what needs to be *'in awareness'*. The framework developed in this article highlights the high-level awareness requirements which are specific to the e-learning process. System designers of online learning tools and systems should consider what needs to be *"in awareness"*, and should not overload them with unnecessary information, which might hinder successful teaching and learning. Further research into social behavioural issues of learning when *'technology is in practice'* continues as technology evolves, in order to investigate the effects of technology on how people interact and how technology should be harnessed to suit users at the workplace.

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Curriculum Development in Virtual University

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Abstract: The goal of the current research is to study parameters influencing curriculum of the virtual university and identify its 9 elements. To develop the curriculum firstly the influential parameters should be identified and afterwards the quality of their influence on the elements of curriculum should be studied.

The capabilities of ICT and learner-based learning theories are two of the parameters that impact curriculum development. ICT's multimedia, hypermedia and interactive capabilities and its temporal and spatial flexibility provide the learner with a chance to access various content and learning sources and interact with peer learners, instructors and supervisors and participate in learning activities according to his situation. The sum-up of these facilities helps the learner to form his knowledge actively and in accord with the situation.

Identification of curriculum goals, learning activities, content and sources of learning, teaching strategies and evaluation methods and the interrelation between these elements form the curriculum design. The features of these five elements with regard to ICT's capabilities and significations of learner-based theories have been studied in his research. The findings of the research show that formulation of the elements of curriculum in virtual university with regard to ICT's capabilities and significations of learner-based theories will foster the required skills of information age such as problem solving, critical thinking, communicating, participation and self-navigation.

Keywords- *curriculum design; virtual university; curriculum development, ICT; learner-based theories; curriculum elements*

I. INTRODUCTION

Missions of university education have transformed in the new era. In this era the university should train students that instead of memorization and saving data, have the ability to categorize, analyze and combine data and enjoy skills such as problem solving, communicative skills, discussion, negotiation, management and technological skills in order to keep pace with rapid technological, industrial and social changes. Some experts and leaders of higher education believe that applying ICT in university curriculum can develop such skills among students [1]. On the other hand a study of the history of technologies' introduction into education indicates that technologies have no impact on the improvement of learning quality per se and an effective use of them needs a structured and purposeful educational design [2].

To develop curriculum in virtual university first we should indicate influential elements of curriculum then distinguish the features and relations between elements such as curriculum goals, learning activities, materials and sources of learning, teaching strategies and evaluation methods [3]. Recognizing capabilities and opportunities of ICT and its relevant learning theories are two influential parameters on virtual universities' curriculum that impacts features and relations between elements of curriculum. Therefore the main question of this research is: "What are the characteristics of virtual universities' curriculum design?"

II. Parameters that influence virtual university's curriculum

A. Capabilities of learning technology. Learning technology has numerous capabilities to impact curriculum. Some of these capabilities are:

1. Presentation of multimedia content through text, audio, image and animation;

2. Ability to establish interaction between learner and learning content through computer games and manipulable animations;

3. Individualization abilities such as presentation of content and learning activities through various methods which every learner receives with regard to his learning style and pace;

4. Facilitation of contact and negotiation between students and instructors;

5. Facilitation of learners' access to further material and sources;

6. Creation temporal and spatial flexibility in learning [4].

B. Leaner-based theories in learning.

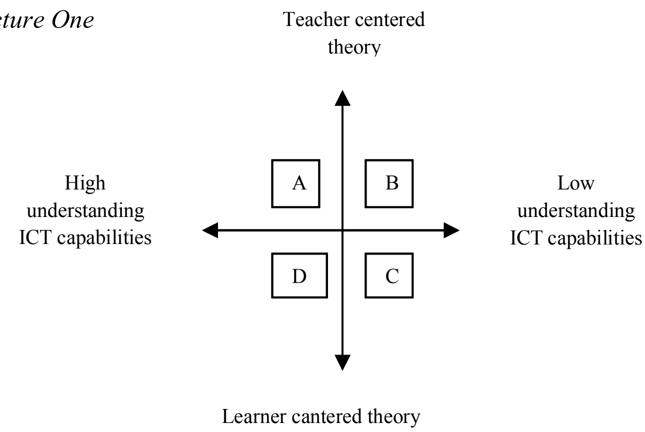
Behavioristic, cognitive and constructivist theories are three general learning theories that have different interpretations on the way a person learns. Behaviorists deem learning as the result of a contact between external impulses and response and stress on external factors in learning. Cognitivists consider learning as a change in internal and mental processes and stress the role of thinking, memory, motivation and individual differences[5].

Constructivists focus on the role of the individual and social environment in learning. This theory stems from the ideas of cognitive psychologists such as Piaget, Brunner, Vigotski and pedagogic ideas of John Dewey and states that every person receives environmental impulses based on prior experiences and extracts a new knowledge out of it. According to constructivists no knowledge exists free from the world outside. Every situation is perceived from different point of views and it's not easy to specify how true each one is. Heylighen introduces coherence or harmony between to cognitive models inside the individual's mind and consensus between different cognitive models of different people as the criterion to find out how correct each construction is[6] However emphasis on experience and personal perception doesn't imply that individuals can't reach a shared understanding, but they share their ideas and point of views through interaction and social negotiation and reach a shared point or idea in some occasions.

In brief, this theory emphasizes learner's activeness, experience and true learning activities, presentation of multiple points of views, interaction and negotiation in learning[7].

Different curricula result from the mutual impact of these two influential parameters on curriculum design. To fully understand the impact of these two parameters, namely ICT capabilities and learning theories on virtual curriculum design we can put the parameter of ICT capabilities on X axis and learning theories on Y axis and recognize four types of curriculum design.

Picture One



Picture One. The impact of ICT and learning theories on virtual curriculum design[4].

a) Virtual curriculum designs that have appropriately remarked ICT's capabilities for

learning and have utilized significations of instructor-based theories in their development.

b) Virtual curriculum designs that have not appropriately remarked ICT's capabilities for learning and have utilized significations of instructor-based theories in their development.

c) Virtual curriculum designs that have not appropriately remarked ICT's capabilities for learning and have utilized significations of learner-based theories in their development.

d) Virtual curriculum designs that have appropriately remarked ICT's capabilities for learning and have utilized significations of learner-based theories in their development.

ICT has multiple capabilities to help the learner construct knowledge. Hypermedia abilities of internet help the learner in non-linear learning and reinforce his control over the learning process. As a tool for empirical learning, simulations encourage the learner to actively create knowledge and real learning and searching the web helps the learner to present different views on the real world. In general, the learning environment helps the learner to actively create knowledge when it provides the opportunity for multimedia presentation, discourse facilitation, direction, mental scaffolding, role playing, simulations and case studies for the learner[8]. Therefore, some believe that there's a close relation between constructivist theory of learning and virtual learning environments and virtual curriculums are mainly based on the significations of these types of theories[9]. Hence, in addition to understanding the capabilities of ICT, learner-based theories especially constructivist theories should be regarded in development of virtual university curriculum.

Goals

Rapid circulation in virtual environment has facilitated access to data. But effective use of data requires categorization, analysis and proper management. In this age, access to data has been replaced with higher goals such as problem solving skills, data creation and management, critical thinking and self-directed learning as one of the major goals of learning[10].Although these were considered as the goals of university curriculum priorly too, with the development of ICT and dominance of learner-based theories, fostering higher goals has received more emphasis especially among virtual universities. Results of conducted researches (for example[11, 12,13]. on virtual learning environments shows that these environments excel traditional learning environments of universities in achieving goals such as problem solving skills, critical thinking ability, management and decision-making in complicated situations, negotiation and establishing social contacts. So the team which designs curriculum for the virtual university should have a correct understanding about ICTs capabilities and learner-based theories in order to decide about sources of goals of virtual university curriculum and relevant approaches.

The goals of university's curriculum are established based on the study of four sources; culture and experience of past generations, applications of higher education for national development, social services and content material [14].

Next issue about decision-making on the goals of virtual university curriculum is determining relevant approaches in these environments. We can divide the approaches on goals of university curriculum into two groups: rational and reflective. In rational approach, the goals of curriculum are established rigidly, explicitly and objectively and other curriculum elements such as content, activities and evaluation strategies are affected by these goals linearly. On the other hand, goals possess a purposeful flexibility in reflective approach and there's a non-linear relationship between goals and other elements of curriculum [15].

Studying the approaches related to virtual university curriculum goals is important from two aspects: first, like the other programs of distance education the curriculum of virtual university is presented in a self-study format and students must have a correct understanding of the goals and expectations of curriculum. Secondly, establishing detailed goals for curriculum limits designers in choosing content, activities, teaching approaches and evaluation methods and takes away the chance to

select from multiple options. Therefore establishing goals for the curriculum of virtual university must be directive not delimitative [16].

Learning Activities

Learning activities is the term used for opportunities that are provided for the learner in order that he consolidates and reinforces his learning in the curriculum. On one hand ICT's capabilities provide many learning choices for the virtual student and he can construct his knowledge by participation in these activities[17]; on the other hand the student himself should try to perform these activities –whether individually or in a group- in the virtual environment of learning, because in this environment not doing the activities means not participating in the educational environment; contrary to class learning environments in which the student may participate without doing any especial activity to learn [18]. Therefore in activity-based curriculum of virtual university, learning activities should be devised based on principles that help the student in better learning and knowledge construction. These principles include:

1. Virtual learning activities should foster higher skills of learning in the learner.
2. Virtual learning activities should increase the capability of self-evaluation and reflection in the learner.
3. Virtual learning activities should strengthen students' motivation.
4. Virtual learning activities should increase students' sense of curiosity.
5. Virtual learning activities should be goal-related.
6. Virtual learning activities should match with students' different methods of learning of.
7. Virtual learning activities should be related to real world.
8. Virtual learning activities should encourage collective and group learning [19].

Simulation, case study and blogging are some examples for learning activities in virtual university's curriculum[20].

Contents and Sources of Learning

One of the main capabilities of the Net is the chance it provides to access various contents and sources of learning. By acquiring search skills every learner will have the chance to access numerous learning sources through the net. Access helps the student to study different ideas about the learning content and gain a thorough understanding of the subject. Becoming aware of different attitudes over the learning subject is one of the issues stressed by constructivist learning theory [21].Learning content is the set of educational contents that help the learner through the learning process[22]. Learning sources are also the collection of knowledge and information material and sources that possess reliability and validity just as authentic resources. The content of a learning source is mainly research-based; it can be referred to as in quotations, and has an acceptable validity[23]. Kimmers considers learning sources as information resources that the learner refers to them in case of need during learning, reflection or development of new ideas [24].

In general every research source or resource that is used by the student for further learning is regarded as a learning source. These may include: objects, samples, books, newspapers, telephone, periodicals and journals, communities and conferences, fairs, VCDs, VHSs, toys, cassette tapes and discs, lecture CDs, charts, posters, films, multimedia and internet sources[25].

Som Naidu has divided e-learning sources and resources into 5 groups:

1. Hyperlink text content that also includes photo, image and animation;
2. Videos related to educational subjects such as interviews and group discussions;
3. Multimedia hyperlink elements such as simulations and graphics;
4. Electronic databases, search engines and digital libraries;

5. Manuals, peer groups and electronic communities [26].

Various sources and resources exist on the web, but their validity needs more attention. Therefore in selecting learning sources and resources the design team of virtual university curriculum must regard issues such as the relation between sources and learning subject and curriculum goals, its relevance with the level of knowledge and needs of learners, up-to-datedness of sources and their scientific validity. In brief the material and sources that support virtual university's curriculum can be put in two general groups:

a) Physical material and sources. Objects, samples of experts' speeches, charts, posters, photos, films, telephones, journals and periodicals, scientific and non-scientific books, reference books, encyclopedias etc.

b) Electronic sources and resources. Digital libraries, electronic magazines, hyperlink texts, multimedia hyperlink elements, manuals, peer groups and electronic communities.

Teaching Strategies

Teaching is a mutual activity between the instructor and the learner that is based on an organized and purposeful plan and is intended to result in learners' learning. In some educational situations the instructor controls the process and in some other the learner. According to learner-based theories the student must actively participate in the learning process and the instructor should assist to construct knowledge by giving direction, monitoring, giving feedback, facilitating discussion and motivating [27].

Traditionally the control of teaching process was conferred to the instructor in university education, but in virtual learning environment the instructor has a marginal role known as "guide by side". The learner is the main controller of learning process in this environment. Various roles have been named for the instructor of the virtual learning environment that nearly none of them have recognized him as data provider. For example Paulsen (1995) discerns the role of online instructor as moderator of electronic discussions; Collins and Berg (1996) as initiator, education manager, participator, facilitator and motivator; Harasim (1997) as programmer and organizer of education; Gibbs and Gustafson (2000) as feedback provider and organizer of educational material [28, 29, 30].

Evaluation

Evaluation is defined as the structured process of collection, analysis and interpretation of data in order to discover to what extent the goals of curriculum have been realized [31]. In university education evaluation has traditionally been one-dimensional and focused on certain goals of curriculum. Criticizing the common evaluation methods, George Light divides the goals of university curricula into four groups of cognitive, social, personal and operational. He believes that in order to become sure about the level of goal realization various evaluation methods should be used [32]

In virtual university curriculum, learning activities are designed to achieve goals such as reinforcement of problem solving skills, reinforcement of negotiation skills, establishing communication, participation and self-navigation. To become sure of the level of realization of these goals various evaluation methods should be used which are relevant with these goals or encourage further realization of these goals [33]. In general, evaluation of students' learning in virtual university should be based on the following principles:

1. Evaluation instruments and goals should be relevant to learning goals.
2. Evaluation strategies should be considered as part of the learning experience.
3. Various strategies and tools should be utilized for evaluation.
4. The quality of evaluation strategies should be monitored continuously.
5. Evaluation should be conducted in order to provide feedback and enhance learning [34].

Important Evaluation Strategies in Virtual University Curriculum

One of the important principles of evaluation in virtual curriculum is applying various strategies and instruments in evaluation. Based on the virtual curriculum's goals and activities of learning different strategies can be used to evaluate students' learning in order to obtain a clear picture of their achievements. Some of these strategies include: evaluation of the level of participation, creating an electronic portfolio, self-assessment, peer assessment, writing a scientific paper[35].

Conclusion

Decisions on curriculum development are made on two general and specific levels. On the general level decisions are made about the principles and elements that influence curriculum and on the specific level decisions are made about the elements of the curriculum and the quality of their interrelation. The more the decisions made in these two levels agree with each other, the higher the quality and influence of curriculum will be.

To develop virtual university's curriculum on the general level elements such as ICTs capabilities and learner-based theories should be taken into consideration and on the specific level the quality of their influence should be made clear. The way these two elements integrate with curriculum elements will impact the learning experiences of virtual student.

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Strategy for Innovative Response to Changes in 21st-Century Schools

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Abstract - **This paper examines how schools can respond innovatively to change by using e-books to make textbooks more relevant, fostering student flexibility and innovation that equip students to adapt to changes and create new knowledge, and develops students' emotional intelligence and collaborative skills, which are prized commodities in the work environment. It will explain how schools can create strategic alliances that allow them to offer a more creative learning experience. Finally, it will discuss new technology that incorporate into education to make it more immediate and provides students access to vast stores of knowledge to facilitate e-learning. The paper provides a model of the path that schools can follow to become innovative and adapt to change, as well as equipping their students to do likewise, rather than relying upon old practices or old technology that no longer serve their purpose. The resultant strategy for promoting an innovative response to change in 21st-century schools fosters the development of students that are innovative, creative, collaborative, and equipped for change.**

Keywords-component; e-book, e-learning, innovation, education, 21st century, school, emotional intelligence, strategic alliances.

I. Introduction

Schools in the 21st century face challenges that were virtually unknown in previous centuries except during times of war or other social upheaval. Although schools in past centuries enjoyed relative stability and consistency of subject matter and approach, today's schools must be prepared for rapid and unforeseen changes in subject matter requirements, educational and business technology, and myriad other facets of the culture that can undergo rapid change. To achieve this preparation, schools need to build in flexibility, assess and instill readiness for change, monitor the changes that are occurring within the society at large, look ahead to upcoming educational and technological developments, and develop innovative responses to change that reflect outside-the-box thinking. This paper will address several facets of this large task of building in flexibility and preparing students for the rapidly changing world:

- Making textbooks more relevant,
- Fostering flexibility and innovation to adapt to changes and create new knowledge,
- Developing emotional intelligence and collaborative skills,
- Creating strategic alliances,
- Incorporating new technologies into education.

A. *Making Textbooks More Relevant*

One aspect of this readiness for change is in school textbooks. While printed textbooks often remained usable for a decade or more, globalization now brings about so many changes within such a short timeframe that the information found in textbooks becomes out of date and inaccurate much more quickly than in the past. New subjects arise, the information concerning old subjects is revised, and the old textbooks do not lend themselves easily to change. Canadian futurist Ian Jukes, speaking at a Leading Lifelong Learning Conference, asserted that "We must reject a system that teaches and tests and rewards the accumulation of vast amounts of useless theoretical obsolete information" [1].

One solution to this dilemma is that of electronic books, or e-books which are far less expensive than printed textbooks and which can be read via no-cost downloadable e-book reader programs that can be used on any type of personal computer from the desktop to the handheld [2]. E-books deliver information in digital format, which enables students to conduct searches and experience "the entire spectrum of digital enhancements, such as hypertext and multimedia" [2]. In fact, "The advances in e-book technology in recent years may provide a ready platform for realizing greater potential for interactive support from the technology" [2]. Students reading an e-book and needing further clarification or wanting to explore a topic further can click on hyperlinks that take them directly to related information; then they can click to come right back to their original page. Instead of toiling to compile information from a stack of printed textbooks, students can much more quickly accumulate information electronically, compile it into a file,

and save it on their computer, where they can later utilize or manipulate it as needed. Furthermore, e-books do not have to be thrown out when their information changes, as printed textbooks were; they can be updated electronically and kept in service much longer. The current capabilities of e-book technology are just the tip of the iceberg; however, as media experts envision much more innovative uses for it. According to media professor Jay David Bolter of Georgia Tech, "future e-books might 'change for each reader and each reading'" [10]. Students may be able to "skim the highlights from a vast reservoir, as one now browses in a library," or "for more in-depth learning, the same material might be reformatted into a digital textbook organized around a learner's current priorities" [10]. The malleability of electronic technology and the digital format make possible innovative ways of learning that were never possible with printed textbooks, and students can have access to a much larger body of information than was possible with traditional bricks-and-boards libraries.

B. Fostering Flexibility and Innovation

This century's schools must be flexible and prepared for change. They have to be adaptable to the changes that are occurring within society at large so that education will be relevant to the students. Moreover, they have to be able to instill that same readiness for change into their students to prepare them for further education and for successful future careers in the global marketplace. As technology changes, schools must teach within the context of the new technology. Old technology quickly becomes an anachronism that students do not need to learn, while understanding the new technology is paramount. There is more to remaining relevant than merely changing with the times, however. Schools that install new equipment and add new courses are only solving part of the globalization problem. It is also necessary to provide innovative responses to change and to develop students' capacity for innovation. Providing students with information and acquainting them with important facts is still important but not as vital as training them to find information for themselves and think creatively to develop their own solutions and create new paradigms. Futurist Peter Drucker predicted that our society would "increasingly [value] those activities that actually create new knowledge," and the 21st-century schools can be those that "shift their intellectual focus and priority from the preservation or transmission of knowledge to the process of creation itself" [3]. Such schools "may need to organize themselves quite differently, stressing forms of pedagogy and extracurricular experiences that teach and nurture the art and skills of creativity," such as replacing the art or music with the studio where teachers can demonstrate artistic techniques and then allow their students to experience them as well as creating new ones of their own or transforming the teacher into the leader of a creative team in which the students are tasked to develop the solution to a problem collaboratively [3]. Toady's classroom is moving away from the old model in which teachers presented information for students to commit to memory and is now moving toward a new model in which teachers equip and empower students to unearth information through their own research and examine it for new possibilities that have not yet been tried. By empowering students in this way, teachers ensure that students can engage in lifelong learning and that they can "learn their way through" problems that they might otherwise have turned over to someone else to solve.

Innovation is the heart of the 21st-century school's successful response to change. According to Galbraith et al., innovation "refers to the creative process of seeing new applications for existing knowledge and the ability to combine different bits of knowledge to create new capabilities or solutions [12]. Further, as described by Pinchot (1985), Kanter (1985), and Quinn (1980), "it requires a blending of perspectives across constituencies and disciplines that links organizational members more tightly and binds the organization as a whole more closely to the external community it serves [12]. Innovation changes the face of education in multiple ways, but primarily by "its collaborative nature" [12]. The old model of student competition is rapidly giving way to student collaboration as schools are beginning to recognize that on the job, the emphasis is not on doing one's own work but on functioning effectively as part of a collaborative team. Not only are there few situations where one individual can gain and retain the only knowledge about a concept within an organization, new concepts arise all the time that need the combined expertise and creative thinking of many individuals across multiple departments. Students that have been taught only to do their own work are ill equipped to function as part of a collaborative team where ideas are shared, concepts are built, and novel solutions are forged.

C. Developing Emotional Intelligence and Collaborative Skills

In addition, although schools may be able to provide students with a solid traditional education and students may have some idea of what their education should address, "few possess the ability to envision programs that address their emerging needs" [12]. What this requires, according to Goldenberg, Horowitz, Levav, and Mazursky (2003), along with Wolpert (2002), is "highly systematic, innovative thinking, which hinges on the ability to harvest ideas from a wide variety of sources and the willingness to act on the information gathered" [12]. "Reference [3] envisions a "divisionless" school that will be "far less specialized and far more integrated," with both real and virtual structures that "provide both horizontal and vertical integration among the disciplines." The business world, for example, is already embracing aspects of the social sciences, as evidenced by the new emphasis on human capital, social capital, and emotional intelligence. An essential component of the innovative response to change, particularly in terms of the collaborative approach to education, is the development of students' emotional intelligence. Reference [8] report that "There is a growing emphasis in tertiary education that students should develop professional skills as part of their education." The authors point out that "skills such as problem solving, communication, collaboration, interpersonal skills, social skills, and time management are actively being targeted by prospective employers as essential requirements for employability, especially in team environments" [8]. In an Edith Cowan University study in

Australia, student teams were tasked to develop Internet sites for real clients, "with teamwork processes supported with online tools to monitor progress and contributions" [8]. The study found "a strong correspondence between students' emotional intelligence and team harmony" [8]. Reference [7] asserts that emotional intelligence is also essential for innovation, as "it is the interplay of both cognitive as well as emotional brain that propels experimentation and innovation on the part of the employees at the workplace."

D. *Creating Strategic Alliances*

In addition to creating a collaborative environment, schools may also seek to establish "strategic alliances" with creative groups or organizations, such as "the art world, the entertainment industry, or even Madison Avenue," much as the Massachusetts Institute of Technology's Media Laboratory has done [3]. Further, a school that values innovation needs to be able to recognize and promote both teacher and student creativity. An emphasis on "rational reasoning and on standardized tests" may enable educators to find students gifted with "academic intelligence" while "ignoring the creative minority, who are equally essential to our progress in the world" [11]. Moreover, creative students' "special ability to solve problems in new and unique ways is not measured by intelligence tests as now constructed. There is a difference between being educated and applying creative knowledge" [11].

E. *Incorporating New Technologies into Education*

Not to be forgotten is the technological component of 21st-century schools. Students today are researching their papers on their laptops as well as in school libraries, and many are even attending school via the Internet at cyberspace universities such as the University of Phoenix [3]. These online universities "are already well on their way to becoming 'knowledge servers,' linked into a vast information network" [3]. However, the educational world tends to lag behind other domains in taking up new technologies, no matter how beneficial they may promise to be. Lewis J. Perelman (1987) wrote in his book Technology and Transformation of Schools, "There is a strong tendency (in public schools) to view technology or any innovation as an "add-on" to an established and unalterable infrastructure" [9]. It is incumbent upon schools to go beyond the technology that is ubiquitous at the moment, because it is already on its way to becoming inadequate for tomorrow's students. Not only e-books and cyber conferencing with other students, but other new technologies are continually emerging that can add immediacy to the education process, such as podcasting lectures and virtual education. An example on podcasting can be the digital files over the Internet so that students can download the files into their MP3 players, one brand of which is called the "iPod," and listen to them at their convenience, replaying them as needed. Because today's students are accustomed to receiving their favorite music via podcasts, receiving lectures through the same medium is familiar and expedient. Virtual education, or teaching classes over the Internet, is increasingly being done, as it allows students to participate in classes asynchronously instead of being forced to meet at a particular time when they might be working or sleeping. Both podcasting lectures and offering virtual education make the education process more immediate to students as well as enabling them to incorporate learning into an otherwise busy schedule.

II. METHODOLOGY

This study is attempting to answer questions related to the followings: how all of these elements of e-books, creativity, innovation, emotional intelligence, strategic alliances, and technology can be incorporated into a workable model that provides an innovative response to change for 21st-century schools, equips students to create new knowledge and new paradigms as needed to meet changes, and enhances the ability of students to collaborate. The other research question this study attempts to answer is: What is the path that schools can follow to become innovative and able to adapt to change, as well as equipping their students to do likewise? The answer to this question will be provided in the form of a strategy and path diagrams developed through grid analysis and research. The strategy will equip schools to face change and change along with it, rather than relying upon old practices or old technology that no longer serve their purpose. At the same time, it will foster the development of students that are innovative, creative, collaborative, and equipped for change.

The five components necessary to form an innovative response to change in 21st-century schools are straightforward, yet many schools already employ some or all of them and still lack a systematic and integrated approach that implements them as part of a functional framework. This paper sought to develop such a framework as a baseline that different schools could adapt to their own unique situations. While some thoughts were given to surveying students and teachers to elicit their opinions on how the five components could be integrated. There is a risk that this approach would generate much creative brainstorming germane to developing further innovative ideas but little of the systematic analysis necessary to produce the fully integrated framework necessary to improve on existing individual implementation of the components. Even thoughtful responses to surveys tend to be the result of first impressions rather than analysis, so survey results would not provide the type of information being sought. On the other hand, scientific methods such as statistical analysis would have served best either to suggest or confirm an approach rather than to formulate one. Therefore, the analytical approach modeling was adopted for this paper instead is based on a logical methodology that examines the components in conjunction with one another in order to build an extensible framework that could be modified as necessary in response to change; beside adopting a pilot study by interviewing three people in managerial positions in Kuwait at an educational institute and a professor who is specialized in this field and works in University of Southern Queensland - Australia "where I'm doing my master degree in training and development" this made room for creative ideas by gathering the information from them while relying on a systematic and logical approach and it produced an approach that could be picked up and used by other schools, even though their needs and situation might be substantially

different. By adhering to the methodology in analyzing their own framework, schools can arrive at a framework that is roughly similar to ours yet specifically tailored to their own situation. The methodology incorporated five steps, following a logical progression on a continuum from separate, non-integrated components to full integration, in which the five components interact with and work in conjunction with one another and it will be explained by using the grids (Table 1):

- Analysis of component compatibility,
- Analysis of component inter-promotability,
- Identification of mechanisms that create interactivity and synergy,
- Development of an initial broad-brush framework geared for flexibility and adaptation,
- Culmination of the analysis in the establishment of an extensible framework that incorporates all five components providing an innovative response to change and that can be adapted to new scenarios without damage to its structural integrity and functional effectiveness.

TABLE I. PROMOTION ANALYSIS

	Incorporating New Technologies	Creating Strategic Alliances	Developing Emotional Intelligence & Collaborative Skills	Fostering Flexibility & Innovation	Making Textbooks More Relevant
Making Textbooks More Relevant	**90%**	**0%**	**20%**	**80%**	**100%**
Fostering Flexibility & Innovation	**90%**	**0%**	**90%**	**100%**	
Developing Emotional Intelligence & Collaborative Skills	**90%**	**0%**	**100%**		
Creating Strategic Alliances	**70%**	**100%**			
Incorporating New Technologies	**100%**				

III. ANALYSIS

This five-step logical process starts at the macro level by first determining whether the five components are compatible enough to be included together in an integrated methodology. Although such compatibility is often taken for granted, the effectiveness of a strategy is impaired when its various components work at cross-purposes from one another. To assess compatibility of the components, they were built into a grid as a visual construct to facilitate the evaluation of each intersection of components for compatibility. If any two components had been mutually exclusive, this would have posed a problem for the logical analysis intended to lead to integration. For example, if making textbooks more relevant posed a logical obstacle to developing emotional intelligence, cobbling those two components together into the same framework would have been self-defeating. However, as each component was analyzed in conjunction with every other component, it was found that there were no such conflicts.

The second step is to analyze whether any of the five components promoted one another. To the extent that one component promotes another, they are not only manifest greater synergy but also provide common areas that allow them to be loosely coupled in a manner that permits flexibility while allowing them to work in tandem with one another. Inter-promotability was assessed in terms of how each component furthered the other. For example, making textbooks more relevant promoted the incorporation of new technologies into education, as relevance implied keeping current with technology as well as with information. Other similar connections among the five components demonstrated that the five components would work well together in a common framework if the framework encouraged it. Although a grid analysis was used for this part of the analysis as well, it was merely a visual construct to enable visualization of the relative degrees of promotability between components for the purpose of identifying each locus where a connection was feasible. Where there is a low correlation between two components, there is a low possibility for an effective join between them; a high correlation evidences a potential for an effective join the correlation between each set of two components was estimated by identifying the degree to which they promoted one another. This was strictly subjective, but the grid visually made clear where the components were in consonance with one another.

The third logical step in the analysis is examinations of these high-correlations join spots to determine what mechanisms might create interactivity and synergy there, as well as leading to a greater capacity for innovative response to change. For example, incorporating new technologies had a high correlation with making textbooks more relevant. Technology could be incorporated in the form of replacing printed books with e-books or by enhancing printed books with information available via the Internet, for example. Therefore, in the path to innovative change, these two components could be logically joined. Joining them would result in a synergy by virtue of the fact that as new technologies make textbooks more relevant, relevant textbooks result in education that produces further innovation and yet more new technologies.

The fourth step is the development of an initial broad-brush framework geared for flexibility and adaptation. A flexible, broad-brush framework is one that can be implemented in a variety of situations, not just the particular one under study here, but it can also be tailored to the detail level within a particular situation. In this case, there needs to be a framework for innovative response that enables the school to change as the environment changes, to make room for new information, new technologies, and new approaches. Two keys to this flexibility are modularity and an open

organizational structure. Modularity organizes objects into self-contained units that can easily be added or withdrawn from the academic mix without disrupting the rest of the curriculum. Individual modules can be modified without requiring modification of the other modules, and they can be repositioned in the curriculum as needed. For example, several decades ago, computer science was considered a high-level subject akin to rocket science in which professors wore white lab coats and engaged in advanced mathematical inquiry. Today, five-year-olds can use computers, so if computer science were a module at a university, it would have undergone dramatic change through the decades. If computer science ever becomes obsolete, it can be withdrawn from the curriculum as a self-contained unit. Although modularity maintains objects in separate units, it still permits their free interaction, so interdisciplinary work can be framed and reframed easily, as per Duderstadt's divisionless school. An open organizational structure is one that focuses on tasks and human capital rather than organizational hierarchies. Response to change is predicated upon organizing the right people and tasks to address a particular change, and these can be organized differently when the need changes or a new issue arises. This approach is similar in theory to the "boundaryless" organizational structure implemented at General Electric in the late 1980s and early 1990s, in which the vertical and horizontal boundaries in the organization were removed to enable a boundaryless corporate structure that unstopped the "stifled flow of information and ideas among employees" [5]. Just as the boundaryless organization at General Electric brought down the barriers of hierarchy and bureaucracy to become "one of the cultural elements General Electric credits for its phenomenal success over the last 15 years" [5], divisionless schools can likewise eliminate unnecessary boundaries and organizational structures that merely retard the flow the information and expertise so that teams can be formed and dissolved as needed and resources can be re-appropriated to meet unforeseen new needs. This creates an environment where change is not only more easily accomplished but where adapting to change becomes a cultural element and part of everyday work. As school culture facilitates change, change becomes less of a threat and more of a natural function.

The fifth and final component is the establishment of a complete, extensible framework comprising the other components in one structure that permits an endless series of adaptations to changes that take place. This framework although composed of individual modules is joined at the places of greatest synergy and behaves as a single unit that stretches, moves, and adapts in response to change, molding itself to become what is needed rather than tearing, breaking, or becoming obsolete. The framework has many parts that can operate together in the same timeframe, flowing with change and reframing itself to eliminate parts that become less useful, and adapting to new protocols as they arise.

One key to the framework is the order in which the components are arranged. This order forms a "path" that schools can take to incorporate these components and achieve the innovative approach desired. To formulate a path, the first step is to determine whether any of the components must be implemented prior to the others, and if so in what order. The five components, again, include:

- Making textbooks more relevant,
- Fostering flexibility and innovation to adapt to changes and create new knowledge,
- Developing emotional intelligence and collaborative skills,
- Creating strategic alliances,
- Incorporating new technologies into education.

Of these, creating strategic alliances should be the first step taken, although as new technologies and innovations are incorporated they may generate the need for additional alliances later on. Strategic alliances should be in place before the other components are implemented, because other components may be predicated on them and because they may expand the possibilities of the other components. Reference [4] points out that the formation of strategic alliances is "a recent popular response by colleges to external pressures" that allows two or more educational institutions to "address outside environmental influences systematically" and to "form collaborative efforts that enhance both the quality and breadth of their services." Moreover, strategic alliances are posited to "outnumber mergers by at least 20 to 1" over the next ten years" [4]. Starting the path with strategic alliances expands the creative possibilities and the resources available for implementing the rest of the components. Alliances with other schools that are already implementing innovative approaches or that have resources such as creativity labs should be explored so that resources already available in the vicinity of the school can be leveraged and used as part of the basis for the next step in the path.

The second step in the path is incorporating new technologies. This step should come after forming strategic alliances, because those alliances may offer access to new technologies; it should come before the other steps because the level of technology must be known before the exact approach for implementing the other components is developed. Technology will determine, for example, the extent to which collaboration can occur, as on-site collaboration often depends on people ware, while off-site collaboration depends on more sophisticated information technology. "Reference [3]: We established campuses in Europe, Asia, and Latin America, connecting them through robust information technology, to study the implications of becoming a world university."

After the first two steps have taken place, the remaining three components can be implemented in any order, or even simultaneously, because they do not depend on the prior implementation of each other. These three components making textbooks relevant, developing emotional intelligence and collaborative skills, and fostering flexibility and innovation are elements of the learning environment that create a culture of flexibility and innovative response to

change. In the path toward innovative response to change, there are key factors that are more easily developed after the first two components are in place and that are more related to style than process. Application of these three elements to the process, however, results in a process that anticipates and adapts to change rather than becoming a solidified process that is constrained to operate in the same manner every time.

IV. RESULTS

The results of the methodology and analysis are represented by a path diagram (Figure 1) that illustrates the order in which the components should be implemented for achieving the innovative 21st-century school. The following path diagram shows the creation of strategic alliances as the first step, followed by the incorporation of new technologies as the two steps precedent to improving innovative potential. The remaining three components are implemented simultaneously, and the overall result is a school and its students that respond innovatively to change.

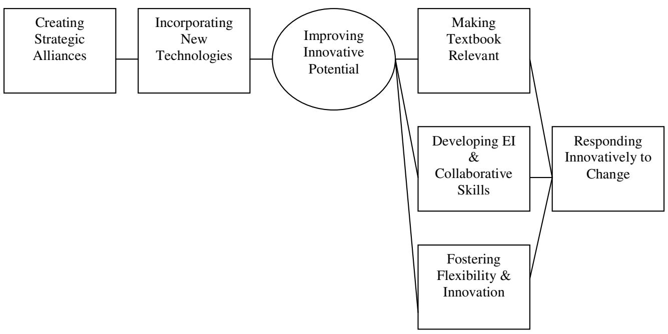

Figure 1. Innovative 21st-Century School Path Diagram

The path diagram forms the basis for the accompanying strategy with the same purpose. The strategy was developed with a view toward the impact of related theory. The most relevant is institutional theory, which posits that institutions offer resistance to change that manifests as behavior constraints promoting stability and suppressing change through “rule-setting, monitoring, and sanctioning activities” and by “providing the very understandings, interests, and actions of actors that constitute behavior” [6]. Based on this theory, the strategy seeks to reduce such activities as antithetical to innovation and adaptability. Using the example of the resistance that Edison encountered in implementing his incandescent lighting system; Reference [6] explain that the logic used to interpret situations “become the basis for defining the legitimate and illegitimate actions that inspire normative and regulative sanctions” and that “These logics operate in part by identifying what is not possible.” After announcing his plan for incandescent lighting, Edison was told by leading scientists and physicists that his idea “was utterly impossible” and that he exhibited “the most airy ignorance of the fundamental principles both of electricity and dynamics” [6].

The strategy was developed to minimize the types of resistance identified by institutional theory that mitigated against innovation and outside-the-box thinking. It comprises the establishment of strategic alliances with innovative educational institutions that offer resources, procedures, programs, activities, and events that facilitate innovation, creativity, knowledge creation, and creative/adaptive responses to change. The strategy incorporates new technologies, not as a one-time action but as an ongoing quest for and implementation of new technologies that support an innovative response to change. It includes the use of e-books, monitoring the selection of books carefully to ensure that they enhance rather than retard innovation. The strategy also incorporates instruction and activities to promote emotional intelligence and collaborative skills and foster flexibility and innovation. The strategy aims to equip students with knowledge, tools, and strategies for solving problems creatively as individuals and as collaborative teams. It also aims at preparing students for rapid change by creating a flexible culture and mindset that regards change as natural and inevitable.

V. CONCLUSION

This study compounds several components necessary for schools and students to manifest an innovative and creative response to change in 21st-century schools. Identification of key components was supported by a literature review, and the methodology included a step-by-step logical analysis using grids as a visual construct. Through an analysis of the compatibility and inter-promotability of the five components, as well as identification of mechanisms that created interactivity and synergy between them, the loci where joins could occur in the framework were identified. From this, an initial broad-brush framework was developed which was further refined by the incorporation of modularity and an open organizational structure. The results included a path diagram and strategy emphasizing textbook relevance, the incorporation of emotional intelligence, and the fostering of flexibility and innovation to create a responsive culture of change that can be adopted to achieve the goal of an innovative response to change for schools and their students.

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Towards Improving the Engineering Education Continuum

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***Abstract*— This article describes three complementary educational techniques aimed at improving the learning continuity for engineering students, especially under social, economical and cultural pressures more pronouncedly experienced in developing countries. These techniques are: Paced Active Learning (PAL), Regularly Assessed Performance (RAP), and Computer Assisted Presentation (CAP). The techniques largely rely on the familiar premise that the pace of learning activities significantly affects student performance, motivation, as well as long-term knowledge retention. The article outlines the main reasons behind the popularity of a common learning activity pattern - designated as Traditional Reviewing Activity Pattern (TRAP) – and presents the key rationale behind the three proposed educational techniques which, although not new in themselves, are proving to be effective in changing the students' learning pattern from a TRAP to a more efficient Continuous Learning Activity Pattern (CLAP), especially when integrated in a more comprehensive engineering educational approach.**

Keywords: Computer assisted presentation, e-learning, engineering education, knowledge retention, learning activity pattern, paced active learning, regularly assessed performance.

I. INTRODUCTION

It is widely acknowledged that students, in general, and engineering students, in particular, are facing significant educational challenges in modern times. These challenges are imposed not only by the fast pace of technology, but also by the ever increasing complexity of modern life, which appears at times to be impeding their path to efficient learning.

The issues of student learning, motivation and performance, as well as teaching approaches and strategies have been the subjects of a large number of educational publications (see for example the bibliographies of [1] and [2]). In this context, many educational approaches have been proposed, some of which are Student-centered [3], and promote many aspects of Active [4], Cooperative [5], and/or Collaborative Learning [6], [7], while others are Problem-based and emphasize the importance of problems tackled by students in improving their learning [8], [9].

In this article, the author presents three educational techniques largely based on Active Learning and tailored to suit engineering students. These techniques draw upon the author's experience as an engineering instructor in a Middle-Eastern university, and combine his observations in a comprehensive knowledge delivery framework.

After only a few years of experience as an engineering instructor, one cannot help but note that the challenges faced by modern engineering students, especially in developing countries (see [10] for example), seem to affect their academic performance and disrupt their learning patterns to a remarkable degree. Poor level of knowledge retention, short academic memory and questionable potential for progress are only but a few of the symptoms associated with students' disrupted/discontinuous learning patterns.

In the next section, a widely adopted learning pattern is described based on close observations of students' behavior. The reasons behind the adoption of this learning pattern by a large number of students are then analyzed and grouped into three major categories: economical, cultural and social. Each of these categories is discussed in some detail.

In the third section, the three proposed educational techniques are outlined. Their main purpose is to infuse more continuity into the students' learning pattern. As mentioned earlier, the techniques are mainly based on a modified version of Active Learning dubbed Paced Active Learning (PAL), and on the importance of providing the student with permanent access to a regularly updated personal assessment record.

In the fourth section, the rationale behind PAL is presented based on two complementary concepts: slowing down the learning transients and increasing the rate of learning events. These two concepts effectively lead to speeding up the long-term learning process, thus allowing for a higher level of knowledge retention.

The fifth section briefly describes a short survey and some preliminary experiments aiming at verifying and validating the benefits of these techniques, as well as their level of acceptance among students.

In the sixth section, the three proposed educational techniques are presented as part of a more comprehensive integrated engineering education approach including a learning strategy and a personal effort policy.

Finally, the last section concludes by summarizing the main features and contributions of the three educational techniques, when implemented in a higher learning environment, especially in relation to improving the students' education continuum.

II. Traditional Learning Patterns and Modern Challenges

A. Traditional Reviewing Activity Pattern (TRAP)

In a higher learning environment, it is natural to observe a heightened learning activity just about the time regular tests are scheduled. In an American styled institution, for instance, with two midterms and a final test scheduled to take place during a semester, the level of learning activity increases noticeably three times per semester (see Fig. 1).

The waveform of Fig. 1 could be interpreted as the superposition of a continuous, but very slow steady-state component, and a "near-discontinuous" transient component, made up of steep, bell-shaped waveforms, centered about exam times. The transient component could well be approximated by a discontinuous signal called "pulse train" in signal's theoretic terms (assuming the education extends beyond one single semester), and at the limit, if the selectivity of its peaks is high, the signal could even be approximated by a discrete signal designated as "impulse train" [11].

The near-discontinuous transient of the learning curve may raise serious concerns in relation to its long-term effectiveness. In fact, the remarkable slowness of the steady-state component of the learning curve could be interpreted as largely due to the excessively fast transient. Since humans generally need sufficient time to grasp information and transition it from exposure to expertise, it seems inadequate to try to process the information in a relatively short period of time in an attempt to pass exams! Knowledge is typically built cumulatively piece by piece and the success of its application depends on the level of depth to which each piece has been investigated. As a result, if the activity that takes place around exam time is near-discontinuous, it will be considered more a reviewing rather than an actual learning activity, which explains the selected title for this type of activity: Traditional Reviewing Activity Pattern (TRAP).

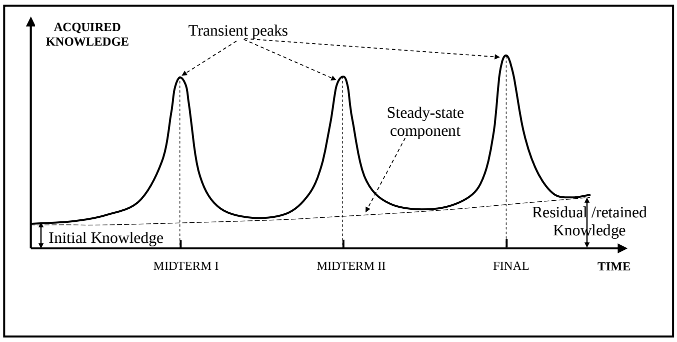

Figure 1. The Traditional Reviewing Activity Pattern (TRAP)

Based on experience, the problem with TRAP is that new knowledge seems to dissipate almost as fast as it is acquired, as witnessed by close observations and common students' comments. Although some knowledge gain appears to be retained at the end of the semester, as shown in Fig. 1, it is clear that the bulk of this knowledge disappears remarkably quickly. Oddly enough, this phenomenon, i.e. the similarity between speed of charge and speed of discharge, is mirrored by other natural as well as human-made devices and processes, as will be briefly outlined in Section IV. At present, however, let us explore some of the major reasons behind the adoption of TRAP by a large number of engineering students as their learning pattern of choice.

B. Economical Factors

The number one reason cited by students for their inability to follow a more continuous learning pattern is the lack of time due to full or part-time employment. Under the increasing pressures of modern life, more students find themselves having to financially support their education, especially in developing countries. As a result, the student job requirements stand in the way of developing a healthy, continuous learning pattern and may lead to significant educational difficulties. Another important but subtle economical factor is the financial limitation of the institution of higher education, which may sometimes reduce the resources and/or the number of staff available to the student and can even prevent the expansion of an undergraduate program to the postgraduate level, where the use of teaching and/or administrative assistants can have an indirect but significant impact on students' learning styles.

C. Social Factors

Another important element affecting students' learning pattern is the stability of their social and personal lives. It is no secret that the state of mind of a student living in the Middle East differs quite significantly from that of a student living in the West: frequently recurring security-related events, social unrest, political turmoil, politically motivated strikes, etc. are all elements that contribute to disrupting the students' educational path. In addition, family-related and personal problems seem to be on the rise in recent times. They can also dramatically influence the ability of students to focus on their studies.

D. Cultural Factors

In some parts of the world, there is a closer connectedness among people, due to historical and/or cultural reasons. This connectedness can sometimes have an adverse effect on the benefits of homework assignments and course projects given to students. Assignments and projects are largely intended to stretch the imagination of students, challenge their thoughts and expand their academic capabilities away from the pressures of exams, eventually leading to raising and expanding their learning curve. If the close cultural connectedness is coupled with a degraded sense of ethics (possibly related to social instability), it will significantly increase the level of ethically related breaches among students, reducing therefore the benefits of assignments and projects and their positive effect on the learning curve.

III. Towards More Continuity in Learning Patterns

Based on the belief that TRAP is nowadays one of the major reasons for the poor level of learning efficiency and knowledge retention among a large number of engineering students, and without loosing sight of the economical, social and cultural challenges leading to this situation, the need arises for a more efficient learning pattern. A reasonable objective would be to spread the learning activities over a longer stretch of time, instead of restricting them to three different occasions

only. Towards that aim, the following three educational techniques were adopted.

A. Paced Active Learning (PAL)

As mentioned in the introduction, Active Learning is a newly emerging educational approach that aims at improving class efficiency and student motivation [4], [12]. Unlike traditional approaches consisting of one-way lecturing, Active Learning encourages instructors to punctuate their lectures with short exercises, during which students would be questioned on an issue of interest [13]. As part of this approach, the instructor would then select one of the students at random to solve the short exercise (instead of waiting for volunteers to come forward). The value of this technique is undeniable in that it stirs the ideas and instigates resourcefulness and creativity, in addition to reactivating and reanimating the class environment. As suggested earlier, Cooperative Learning and Collaborative Learning are variants of Active Learning. With these methods students attempt to solve their short exercises in small teams. In this fashion, they learn the merits of cooperation, collaboration and teamwork [5], [6], [7], [14].

Paced Active Learning is hereby proposed as another variant of Active Learning tailored to the needs of engineering students and applied consistently at regular intervals. Since engineering students typically deal with complex, quantitative problems, they often require more than the “30 seconds to 3 minutes” prescribed by Active Learning experts [13]. Accordingly, in the Paced Active Learning technique, longer quizzes (about 10 minutes each) are administered to students on a regular basis (every about one week), in addition to the short in-class exercises.

This technique has proven to keep students on their toes, and minimize their chances of falling into sleep mode between major exams. At the same time, since quizzes are given in class, the technique has the potential of reducing ethical concerns to a minimum.

B. Regularly Assessed Performance (RAP)

The second technique is timely performance assessment and reporting. Quizzes need to be assessed promptly and returned to students so they can learn from their mistakes earliest. Equally important is the design of the assessment scheme such that each quiz is almost insignificant on its own, but taken collectively, quizzes should have a significant direct effect on the final grade. Needless to say, the indirect effect of the regular quizzes on the three major exams cannot be overemphasized, and their long-term benefit on the overall student performance cannot be stressed enough.

One of the effective ways to apply this technique is to create, regularly update, and transmit an assessment record for each student. Whenever possible, it is preferable to make the student records available through the Internet, upon taking the appropriate security measures to preserve confidentiality. The availability of a special student assessment record for each student, including some idea of his/her performance compared to the rest of the class (through the communication of the class average for example), can be quite significant; it is likely to affect the student attitude to learning, as witnessed by the anxious queries of many of the author’s students, upon consulting their student records, about their grades and the necessary steps to improve their performance.

At Notre Dame University – Louaizé, Lebanon, access to the student assessment records, as well as other e-resources is available via the Blackboard Learning System [15], which is “a comprehensive and flexible e-learning software platform that delivers a complete course management system […], in addition to advanced integration systems” (see Fig. 2). A typical student assessment record produced through Blackboard is shown in Fig. 3.

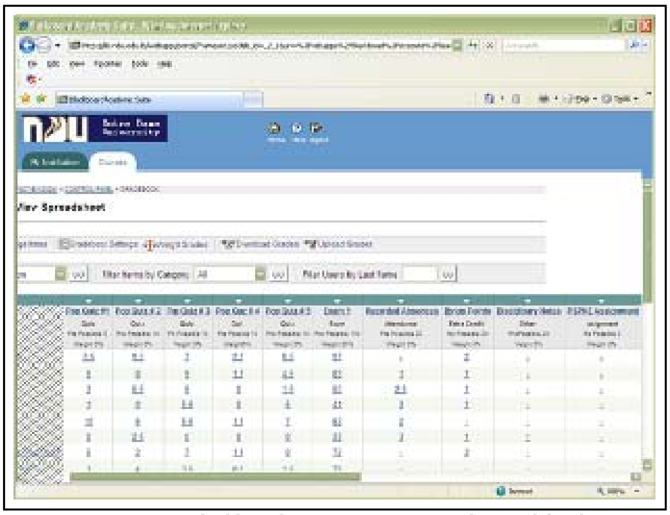

Figure 2. Blackboard Learning System – The Gradebook

It is important to note, however, that even if an e-learning software platform is not available to the instructor, the Regularly Assessed Performance technique can still be implemented. A simple spreadsheet communicated regularly to students by e-mail (or even hand-delivered to their mailboxes) can certainly do the job!

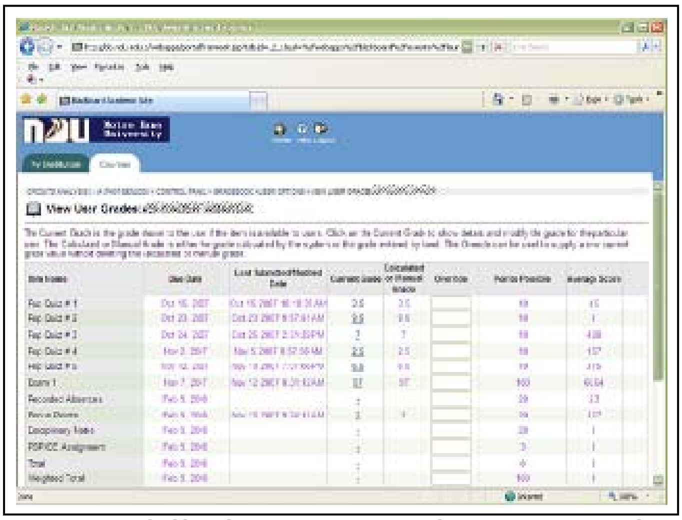

Figure 3. Blackboard Learning System – Student Assessment Record

C. Computer Assisted Presentation (CAP)

When approached about modern education techniques, many instructors raise their hands in the air and complain about the lack of time, particularly in view of the ever-squeezed modern engineering curricula. It is true that a number of in-class exercises and a formal quiz every week take away from the instructor valuable time needed for covering the curriculum; it is also true that grading quizzes for a large number of students every week is no easy task (especially if the instructor, not the grader, has to fulfill this duty). From past experience, however, it is much more efficient (and fulfilling!) to assess and grade 60 small engineering problems per week, than to play the ethical police trying to sift through the homework piles to distinguish the genuine from the fake and pinpoint ethical violators!

Moreover, with modern computer technology, it is quite possible to compensate for the time lost in the quiz, and for other valuable minutes spent in Active Learning, by presenting one's material using modern computer-based tools, e.g. transparencies, overhead projectors, LCD screens and the like. It is true that expert opinions seem to be divided over the true value of computer assisted lectures [1], [16]. Nevertheless, the benefits of using technology to alleviate some time-consuming tasks, such as drawing complex diagrams, or sketching multi-layered flow charts, are undeniable. Moreover, if slides and transparencies are used sensibly, they'll offer the chance of transforming the class session from a dull dictation period to a vibrant discussion forum, especially noting that they facilitate face-to-face engagement between instructor and students.

D. Continuous Learning Activity Pattern (CLAP)

Although the ideas behind the above mentioned techniques are not new to the world of education, it is not uncommon for many students to receive a small shock early in the semester, when they realize that they are being quizzed quite early in the semester, and that their activities are being closely and frequently monitored and recorded! As a matter of fact, the shock is deliberate and intended to awaken the students from their traditionally anticipated hibernation. Actually, different students react differently to these techniques: some of them react favorably and start bracing themselves for a course full of welcome challenges; some others act indifferently; while others completely reject the idea to the extent of refusing to do the regular quizzes until they realize that they are a minority falling behind compared to others! All in all, the three techniques appear to be achieving their intended aim, when integrated together, and the resulting class learning pattern becomes typically similar to the one depicted in Fig. 4, and entitled Continuous Learning Activity Pattern (CLAP).

Students now try to prepare for the more frequent quizzes and simultaneously increase their level of continuous readiness not only for everyday lectures but also for the 3 main exams and most importantly for their future careers as well. We note that, by increasing the rate of regular quizzes, CLAP doesn't only raise the level of long-term retained knowledge for students, but it also gradually reduces the need for students to push their learning activity to a maximum in preparation for each quiz. This peak reduction in the activity pattern is due to the cumulative effect of the knowledge continuum and means students obtain better performance while exerting lesser effort, which explains why the learning curve is smoother (i.e. has larger transients' time constants) in the later stages of the CLAP curve (see Fig. 4), and justifies the improvement in learning continuity compared with the TRAP curve.

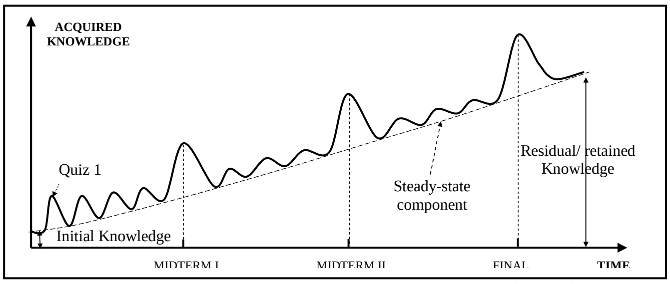

Figure 4. Continuous Learning Activity Pattern (CLAP)

IV. Continuous Learning Activity Pattern – The Rationale

The central concepts behind the benefits presented by the CLAP compared with the TRAP learning patterns are not only restricted to increasing the number/rate of quizzes per semester. They also have to do with slowing down/increasing the time constants of the excessively steep learning transients. This latter concept is related to the fact that the speed of knowledge dissipation is tightly linked to the speed of knowledge acquisition under the same circumstances, as will be outlined in the following paragraph.

A. Increasing the Transients' Time Constant

A close examination of the TRAP learning pattern (Fig. 1) reveals that the slow steady-state component is largely due to the excessively fast transients taking place around exam time, as suggested in Section II. In other words, when knowledge is acquired fast, it will likely dissipate fast. This phenomenon is quite familiar in many fields of endeavor. In electrical engineering, for example, a simple first-order system such as a capacitor, *C*, in series with a resistor, *R*, charging with a time constant equal to *RC*, will discharge with the same time constant [17] (see Fig. 5).

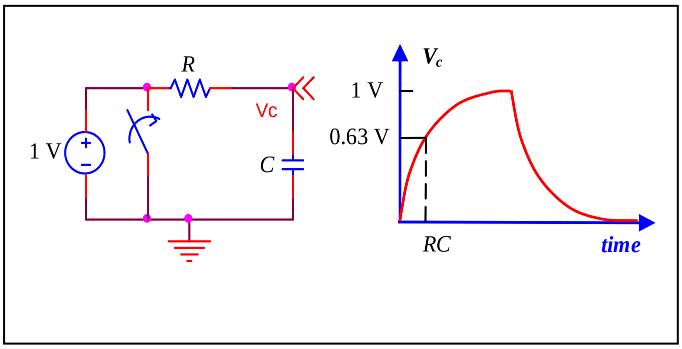

Figure 5. The charging and discharging patterns of a capacitor

As such, it would seem reasonable to slow-down the knowledge acquisition phase i.e. increase its time constant, in order to slow down the knowledge dissipation phase. This could be done by assigning a small amount of material (lower peak) to be tested in each regular quiz.

B. Increasing the Rate of Learning Events

The second factor affecting knowledge retention is the rate at which learning events/quizzes are scheduled. If the time between one learning/charging event and the other is too long (equal to or larger than 5 time constants for the capacitor-resistor system), the knowledge acquired risks of dissipating to a minimal level. However, if learning events are distributed evenly and sensibly across the learning period, and especially if these events build on each other's, students have a better chance of retaining a larger amount of information.

In addition to being common sense, this concept of "more training leads to better performance" is notably utilized in the emerging field of Neural Networks, where the neural network algorithm goes through two phases: the first phase is a learning/training phase, where the problem parameters are calculated and updated, generally offline, based on well known data. The second phase is an actual application phase where the algorithm is applied, typically online, to achieve a specific purpose. It is well known that the success of the neural network algorithm in its application phase is largely proportionate with the number of training/learning iterations performed during its learning phase [18].

C. Paced Active Learning: Decreasing the Steady-State Component's Time Constant

Far from methodically comparing the learning activity of a human brain with a charging/discharging capacitor, Paced Active Learning simply points out to the fact that if these concepts work out for a passive first order system, they are likely to be even more effective for the active brain.

As such, by increasing the time constants of the learning curve transients (i.e. slowing them down) and simultaneously increasing the rate of learning events, CLAP ends up decreasing the time constant of the steady-state component of the learning curve (i.e. speeding it up).

V. PRELIMINARY EVALUATIONS, RESULTS, & INTERPRETATIONS

In the short period since the adoption of the PAL, RAP, and CAP techniques, it was possible to conduct a short survey in the fall semester of 2007 for the purpose of probing students' opinions and attitudes towards these techniques.

In total, 43 students from 3 different courses (Circuit Analysis, Signals and Systems, and Electronics) responded to the survey, which consisted of three questions that were incorporated in the regular course teaching evaluation questionnaire.

In each question, the student was asked to rate the effectiveness of one of the three techniques on a scale from 1 to 5 (similar to the scale adopted in [19]). The resulting average ratings provided by each class are shown in Table 1.

From Table 1, we realize that the average ratings for the PAL, RAP, and CAP techniques generally show a good level of student satisfaction with the effectiveness of regular quizzes (PAL), and the blackboard records (RAP). However, it appears that many students weren't as convinced about the effectiveness of in-class exercises (closely linked to CAP).

TABLE I. AVERAGE CLASS RATINGS (SCALE OF 1 TO 5) FOR THE PAL, RAP AND CAP TECHNIQUES – FALL 2007

	Circuit Analysis (16 Respondents)	**Signals & Systems (15 Respondents)**	**Electronics (12 Respondents**
Effectiveness of Regular Quizzes	3.56	3.47	4.08
Effectiveness of Blackboard Records	3.75	3.13	4.00
Effectiveness of in-class Exercises	2.81	2.13	3.83

This outcome is somewhat understandable, especially knowing that the implementation of these techniques is still in its early stages and hasn't yet reached a level where a good balance is established between passive lecturing time and active (generally more interesting to students) exercise-solving time, in view of the heavy load of some courses.

In addition to the above survey, an experiment was conducted, in which the same exam given to a class before the adoption of the techniques was administered to a similar-size class (≈ 20 students) after the adoption of the techniques. This experiment was repeated for two different courses, and resulted in improved class grade averages ranging from 4 to 18 percentage points.

At this stage, however, the survey and the experiments could still be considered as preliminary. To improve the decisiveness of their results, they need to be supplemented by more experiments involving a larger number of courses and spanning a longer period of time. Needless to say, particular attention should be given to the adequacy of the course load.

VI. INTEGRATED ENGINEERING EDUCATION EFFICIENCY APPROACH

As previously mentioned, the three techniques described in Section III aim to smooth out the transient component of the student learning curve and transform it from a near-discontinuous pattern to a more continuous waveform. However, since learning continuity is not the only element of academic excellence, it is advisable to integrate these techniques into a more comprehensive educational approach, preferably consisting of a strategy defining the major principles and objectives of the approach, and a policy defining the rules necessary to reach the strategic objectives. The following strategy and policy have been devised and applied by this author at Notre Dame University – Louaizé, Lebanon, under an Integrated Engineering Education Efficiency approach.

A. Learning strategy

Dubbed the 4CE Strategy (pronounced: foresee), this strategy includes, in addition to (time) continuity - discussed in this article - four principles outlined herein as follows:

- **Creativity:** emphasizes creative and critical thinking and the importance of profoundly processing information instead of just memorizing it
- **Coordination/coaching:** defines the role of the instructor as a coordinator or a coach seeking to inspire

and motivate students who are supposed to act as the key players

- **Cumulativeness:** similarly to time continuity, this principle emphasizes the importance of content/subject continuity, which consists of building knowledge block by block in a cumulative manner in the same course and across different courses
- **Ethics:** one of the most important of all principles, it stresses the importance of maintaining a high level of integrity by all "seekers of truth".

B. Personal Effort Policy

In order to implement the educational strategy, a Personal Effort Policy was created and implemented so as to maximize the chances of applying the five principles of the strategy, using different techniques including Paced Active Learning, Regularly Assessed Performance, and Computer Assisted Presentation. This policy basically defines the modes of reward or penalization with respect to a number of elements including:

- **Quizzes**
- **Assignments and Projects**
- **Attendance**
- **Class Discipline**
- **Class Participation.**

VII. CONCLUSION

It could be argued that this article merely restates the obvious and over-simplifies the learning/teaching problem. However, and upon close observation of learning and teaching patterns, one may be surprised at the extent to which even the obvious has been forgotten or disregarded in modern times! Accordingly, this article has first examined the key reasons for the widespread adoption of a popular learning pattern, mainly among higher education students of developing countries; it then argued that the fast pace of knowledge acquisition exhibited by the transient component of this pattern calls for a fast pace of knowledge dissipation, therefore reducing learning efficiency. It proposes to adopt a more continuous learning pattern, using three educational techniques, namely: Paced Active Learning, Regularly Assessed Performance and Computer Assisted Presentation. The overall effect of these techniques on students' learning was observed to slow down their transient learning curve, while stretching out their academic activities more evenly over the semester/learning period, thus allowing for a higher level of long-term knowledge retention and better learning efficiency. The process of knowledge acquisition/dissipation was compared to simple familiar processes for illustration purposes. In addition, a short survey and two short experiments were described, with the purpose of evaluating the effectiveness of the three techniques. Finally, the article suggests the integration of these techniques into a more comprehensive educational approach, for the purpose of optimizing the overall educational experience of engineering students.

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The Role of Affect in an Agent-Based Collaborative e-Learning System

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***Abstract*—In recent years, there has been a growing interest in improving all aspects of the interaction between humans and computers. It is argued that to truly achieve effective human–computer intelligent interaction, there is a need for the computer to be able to interact naturally with the user, similar to the way human–human interaction takes place. Humans interact with each other mainly through speech, but also through body gestures, to emphasize a certain part of the speech and display of emotions. Emotions are displayed by visual, vocal, and other physiological means. One of the important way humans display emotions is through facial expressions. In this paper, we discuss the social intelligence that renders affective behaviors of intelligent agents and its application to a collaborative learning system. We argue that socially appropriate affective behaviors would provide a new dimension for collaborative learning systems. The description of a system to recognize the six universal facial expressions (happiness, sadness, anger, fear, surprise, and disgust) using an agent-based approach is presented. Then, we describe how emotions can be efficiently visualized in collaborative virtual environments, with an animated virtual head (Emotional Embodied Conversational Agent) that is designed to express and act in response to the 'universal facial expressions'. The objective of the paper is to present the emotional framework -EMASPEL (Emotional Multi-Agents System for Peer-to-peer E-Learning) - based on the multi-agents architecture approach.**

Keywords-facial expressions; affective e-learning; EMASPEL.

I. Related Work and Problem Formulation

Psychologists and pedagogues have pointed out the way that emotions affect learning. According to Piaget (1989) [14], it is incontestable that the affectivity has an accelerating or perturbing role in learning. A good part of the learners that are weak in mathematics, fails due to an affective blockage. Coles (2004) suggests that negative emotions can impair learning; and positive emotions can contribute to learning achievement. [11] Some educational systems have given attention to generation of emotion in pedagogical environments (emotion expression and emotion synthesis) [15] and to the learner's emotion recognition, [5] pointing out the richness presented in affective interaction between learner and tutor. We argue that socially appropriate affective behaviors provide a new dimension for collaborative learning systems. The system provides an environment in which learning takes place through interactions with a coaching computer agent and a co-learner, an autonomous agent that makes affective responses. One considers affect in our framework from various angles:

– The emotional state of the learner will be modeled by an event appraisal system.

– The emotional state of the tutor is modeled as well, including values for emotions and parameters such as satisfaction, disappointment, and surprise.

– The dialogue acts come in different forms, with variation of affective values.

– Various affective parameters are used to determine which tutoring strategy to use and which instructional act to perform (sympathizing or non-sympathizing feedback, motivation, explanation, steering, etc…).

Although, in the literature review we are not alone in our view that affect is inextricably bound to learning. Over the last few years, researchers have worked to incorporate assessments of the learner's affect into intelligent-tutoring-system pedagogical strategies. Barry Kort, Rob Reilly, and Rosalind Picard, for example, proposed a comprehensive four-quadrant model that explicitly links learning and affective states.[3] They used this model in their affective learning companion, a fully automated computer program that recognizes a learner's affect by monitoring facial features, posture patterns, and onscreen keyboard and mouse behaviors. Cristina Conati's probabilistic system reliably tracks a learner's emotions during interactions with an educational game.[4] Her system relies on dynamic decision networks to assess the affective states of joy, distress, admiration, and reproach.

Our work present some original and novel ideas: Firstly, the aim at reintroducing the emotional and social context to

distance communication to offering a stimulating and integrated framework for conversation and collaboration in Collaborative Virtual Environments (CVEs).[20] Learners can become actively engaged in interaction with the virtual affective world. Secondly, the use of avatars with emotionally expressive faces is potentially highly beneficial to communication in collaborative virtual environments (CVEs), especially when it is used in an e-learning context. Given this, an avatar head model with limited but human-like expressive abilities was designed to enrich CVEs communication. [8] This is the objective for introducing the Emotional Embodied Conversational Agent (EECA) [1] based in the PECS model [2] that we are the first of researchers that integrate this model in the embodied agent. Thirdly, one will combine Peer-to-peer topology and e-learning together to propose the emotional framework for an intelligent affective system. This system is called EMASPEL (Emotional Multi-Agents System for Peer-to-peer E-learning).[16] Moreover, we discuss the social intelligence that renders affective behaviors of software agents and its application to a collaborative learning system. We argue that socially appropriate affective behaviors would provide a new dimension for collaborative learning systems. The focus scope is to allow better recognition capability, the work described here considers the implementation of a facial expression recognition system based on intelligent agents; we are the first that used this. The key motivation is to demonstrate how an agent-based approach may be used to analyze facial images and automatically classify these into particular types of expressions.

II. AFFECTIVE MODELLING

Since 1970, many of research tasks was carried out in order to specify the whole of the criteria of the cognitive evaluation (appraisal) implied in the differentiation of the emotions:[10,24,21,23,7]. The theory of appraisal aims at explaining what distinguishes an emotional experiment from another type of experiment and what differentiates an emotional experiment, like the fear, of another, like sadness. The majority of the recent theories regard the emotion as a poly-factorial dynamic process made up of at least five components: cognitive activity, motor expression, physiological arousal, action tendencies, and subjective feeling states.

In order to produce emotion for each level, many researchers have hypothesized that specific emotions are triggered through a series of stimulus evaluation checks (SECs) [25,26] We link the SECs system that performs the emotion components' check in the internal state of the EECA for generating the appropriate emotion and in parallel with the emotional agents for recognizing the suitable expression giving by the learner. As a consequence, the SECs will be used in the input and output of our EECA.

III. EMASPEL FRAMEWORK

An Intelligent Tutoring System (ITS) is a computer-based educational system that provides individualized instruction like a human tutor. A traditional Intelligent Tutoring System decides how and what to teach based on the learner pedagogical state. However, it has been demonstrated that an experienced human tutor manages the emotional state (besides the pedagogical state) of the learner to motivate him and to improve the learning process. Therefore, the learner model structure needs to be augmented to include knowledge about the affective state. The ITS needs the ability of reasoning about the affective state to provide learners with an adequate response from a pedagogical and more precisely affective point of view; that's why we require the affective e-learning system that it has two main functions: i) to infer the affective learner state; and ii) to establish the optimal tutorial action considering the learner affective state. In this way, our proposed framework (cf. fig.1) improve learning within our virtual learning environment by means of a more personalized environment through recognizing the learners' affective state with the aim of reacting appropriately from a pedagogical and affective point of view. The affective system considers the learner affective state and the tutorial situation to establish the affective action (via the EECA). The affective action helps the tutor to establish the next pedagogical action based in the knowledge base (KB), and it also helps to the curriculum agent to establish the physical realization of the pedagogical action based in the DB1 and DB1. So the learner receives a tutorial action with an affective component and a pedagogical component, which is our main contribution in this paper. The other novelty of our paper is the use of the multi-agent methodology that can certainly bring several advantages to the development of e-learning systems since it deals well with applications where such crucial issues (distance, cooperation among different entities and integration of different components of software) are found. As a result, multi-agent systems, combined with technologies of networking and telecommunications, bring powerful resources to develop the affective e-learning systems. So, in this research work, we propose affective framework for an intelligent affective system.[20] This framework: EMASPEL (Emotional Multi-Agents System for Peer-to-peer E-Learning) [16,19], where we have integrated **five kinds** of agent (Interface agent, emotional agents, EEC agents, curriculum agent, and tutoring agent) in order to promote a more dynamic and flexible affective communication between the learner and the affective system.

A. *Emotional embodied conversational agent*

We developed the internal state of the EECA based on the PECS (Physical Conditions, Emotional state, Cognitive capabilities and Social status) model proposed by Schmidt (2000) [2] because agents are virtual human beings. They are designed to imitate or model human Behavior. Human Behavior is complex and many-sided. Nevertheless it is possible to argue that human Behavior can within limits be modeled and can thus be made comprehensible and predictable. Physical, emotional, cognitive, and social factors occur in all forms of human behavior. Approaches, which regard human beings exclusively as rational decision makers, are of limited value. The modelling of human Behavior plays an important role in all areas in which action planning, decision making, social interacting and suchlike play a part.

These areas include in particular: Sociology Teaching and education. These are the four main building blocks of a particular PECS agent architecture adding a Sensor-Perception module and a Behavior-Actor module.

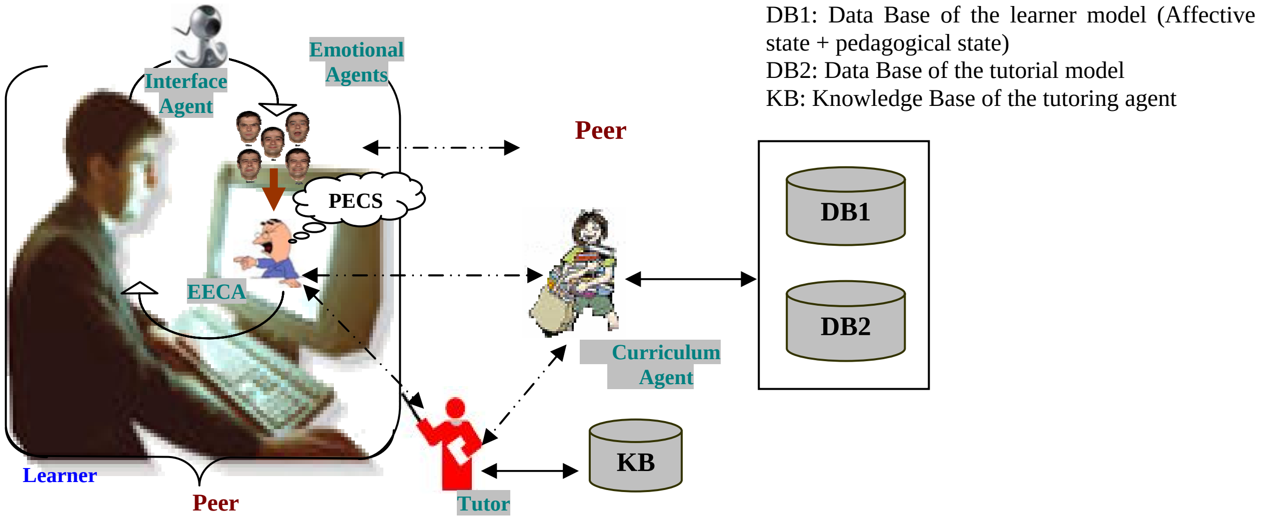

Fig. 1: EMASPEL architecture

The purpose of an agent-based virtual character is to stimulate cooperative learning among learner by motivating their interaction and mutual assistance with the focus in the affective state dimension. The affective virtual character (EECA) was integrated to a learning environment, communicating with the learners in verbal and in non verbal language such as facial expression, suggesting readings according to the activities being performed. When a learner needs assistance to learn a given topic, the EECA is capable of finding other learners that may play the role of a tutor after recognizing and processing his affective state via the emotional agents. In the case that the EECA not found the appropriate learner hi can address this request to the tutor for giving any explanations and/or remarks. **(R7, R8)**

the effective communication between an EECA and a learner, they need to be able to identify the other's emotion state through the other's expression and we call this task emotion identification established by the emotional agents. Extracting and validating emotional cues through analyzing the learner's facial expressions is of high importance for improving the level of interaction in man-machine communication systems. Extraction of appropriate facial features and consequent recognition of the learner's emotional state that can be robust to facial expression variations among different learners is the topic of these emotional agents.

The emotional agents have been successfully integrated in a learning environment and aims at capturing and managing the emotions expressed by the learner during a learning session. **(R5)** They currently capture emotions only through facial expression analysis and they are in charge of learner emotion detection. They recognized the learner emotional state by

B. The emotional agents

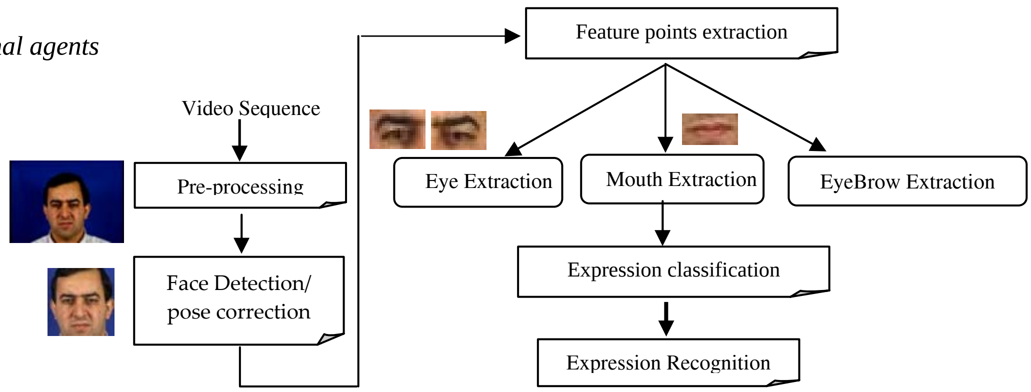

Fig.2: Diagram of the proposed methodology.

Facial expression is a fundamental carrier of emotional information and is used widely in all cultures and civilizations to express as well as perceive emotion. In addition, for making

capturing emotions he or she expressed during learning activities and send it to the EECA. **(R6)** [22] Nevertheless, to

develop a system that interprets facial expressions is difficult. Two kinds of problems have to be solved: facial expression feature extraction and facial expression classification. Facial features' extraction uses a standard webcam and requires no specific illumination or background conditions. Emotional classification is based on the variation of certain distances from the neutral face and manages the six basic universal emotions of Ekman [6]. An overview of the proposed methodology is illustrated in Fig. 2.

1) Facial expression feature extraction

First of all, the algorithm automatically detects the learner's face based on the YCbCr space. The components Cb and Cr offer the advantage of being a little sensitive to the variations of luminosity. Then, it is possible to define the initial learner's face region to start the search of the learner's facial features based on the pattern recognition algorithms described in details in [17,18] for extract the contours of the eyes, the eyebrows and the mouth.

2) Facial expression classification

Facial expression classification is a classic example of a problem that is relatively easy for humans to solve yet difficult for computers. In this section, we describe a novelty approach to the problem of rapid facial expression classification. The Classification is based on the analysis of the distances computed on face's skeletons. At this stage, it is assumed that an image of the learner at neutral expression is available. The distances considered make it possible to develop an expert system (for classification) which is compatible with the description MPEG-4 of the six universal emotions. The segmentation step leads to obtain what we call skeleton of expression. Six distances were defined: D1: opening of the eye. D2: outdistance between the interior corner of the eye and the eyebrow. D3: opening of the mouth in width. D4: opening of the mouth in height. D5: outdistance between the eye and eyebrow. D6: outdistance between the corner of the mouth and the external corner of the eye (cf.fig.3).

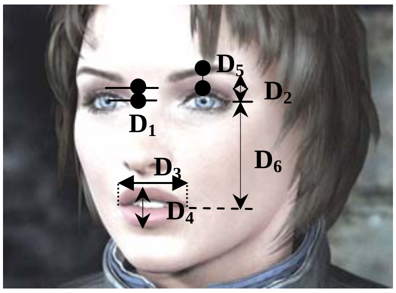

Fig. 3: Definition of the distances D_i

- Joy: {D4 increase}, {D3 decrease and D6 decrease}, {the other distances remain constant}
- Sadness: {D2 increase and D5 decrease}, {D1 decrease}, {the other distances remain constant}
- Anger: {D2 decrease}, {D1 increase}, {D4 either decrease D4 increases}
- Fear: {D2 increase and D5 increase but more that D2}
- Disgust: {D3 increase AND D4 increase}, {the other distances remain constant}
- Surprised: {D2 increase}, {D1 increase}, {D4 increase}, {the other distances remain constant}

C. Curriculum Agent

The agent Curriculum saves the trace of the evolution of the system in interaction with the learner. The trace constitutes the history of progression of the learner in the exercise. While analyzing the profile of the learner, this agent proposes sessions of activities subsequently to apply. Our novelty is to add in the learner model the affective state of the learner during the learning session. **(R9)** The learner model must contain knowledge about the affective state of the learner, in addition to knowledge about his pedagogical state, in order to give him an affectively adequate response and at the pedagogically appropriate time.

The agent curriculum carries out the following operations:

- To save the learner model and mange the tutorial model
- To initialize the session of training by communicating the exercise to the learners according to their model and their competencies

D. Tutoring agent

The tutor's role is **(R10)**:

- To ensure the follow-up of the training of each learner;
- To support learners in their activity;
- To support the human relations and the contacts between learners;
- To seek to reinforce the intrinsic motivation of learner through its own implication from guide who shares the same objective. These interventions aim at the engagement and the persistence of learner in the realization from its training;
- To explain the method of training and to help to exceed the encountered difficulties;
- To help learner how evaluate his way, his needs, his difficulties, his rhythm and his preferences;

The tutoring agent realizes pedagogical expertise on the learner because he has knowledge taught on the field (theoretical knowledge and practical skills). His diagnoses are based not only on the session learning courses, but also on the learner historic actions. It may make requests to the model of the learner (through the Curriculum agent) to find out his history and proceed to the necessary strategy. In his diagnoses, the tutoring agent is based on the results of evaluations provided by the Curriculum Agent, as well as indications of EECA (which provides information on the emotional state of the learner). These data are analyzed to decide the need for its urgent intervention mainly due to a situation of panic or stress (or stop using the simulation) and save all diagnoses for later use. At the end of the e-learning session:

- It updates the assessment curves and calculates the final score and deliver its report;
- It takes the decision on the next exercise to achieve;

E. Interface Agent

- Their role is to act as mediators between the human and the computer cyberspace and to be capable of personalizing an

interface by monitoring and sensing individuals' capabilities, interests, and preferences

- An interface agent can also be a service agent with a particular role. It must communicate and negotiate with other agents in a multi-agent system to determine which and how services are to be provided.
- Transmit the facial information coming from the learner to the other agents of the Multi-Agents System (MAS).
- Assign the achieved actions and information communicated by the learner **(R1)**, to agents Curriculum **(R4)**, EECA **(R3)** and the emotional agents. **(R2)**

IV. Results

A. *The Interaction among Agents*

The interaction among human agents is not restricted to the proposed computational model. On the contrary, the computational interaction among the artificial agents aims to contribute even more for the communication and the exchange among the human agents. The interaction will be one of the main goals of this model, because the proposal is about a model of collaborative learning. The several interaction forms involved in the model are interaction among artificial agents; interaction among artificial and human agents, and interaction among human agents. In respect to communication among the human agents, the system offers tools (synchronous or asynchronous) when physical presence is not possible (for example, in the case of virtual classes).

B. *The organizational model*

Our organizational model (OM) (cf. fig 4) is based on the Agent Group Role Meta model (AGR for short). [13] This Meta Model is one of the frameworks proposed to define the organizational dimension of a multi-agent system, and it is well appropriate to the e-learning context. According to this model, the organization of a system was defined as a set of related groups, agents, and roles:

• An agent is defined as an active communicating entity, no constraints other than those triggered by the ability to play a role or not.

• A group is defined as a set of agents.

• A role is defined as "an abstract representation of an agent function, service or identification within a group": the role encapsulates the way an agent should act within a group. Roles are local to groups. An agent can simultaneously play different roles in different groups: groups can freely overlap. An agent can enter or leave groups by acquiring or resigning a role: groups are dynamic structures.

There are several reasons, which justify the interests of this Meta Model. The main reasons are the following: (i) it is possible to construct secure systems using groups viewed as "black boxes" because what happens in a group cannot be seen from agents that do not belong to that group. (ii) it is possible to construct dynamically components of system when we view system as an organization where agents are components. Adding a new group or playing a new role may be seen as a plug-in process where a component is integrated into a system. (iii) Semantic interoperability may be guaranteed using roles because a role describes the constraints (obligations, requirements, and skills) that an agent will have to satisfy to obtain a role.

For platform EMASPEL, the Organizational Model comprises the following elements (cf.fig.4):

- Five types of agents who are represented by candles: an agent interface (A), the emotional agents (B), a EECA (C), the curriculum (D) and the tutoring agent (E).
- Four types of groups which are represented by ellipses: Interface, Emotional, EECA and Manager.
- Ten roles since every agent play a specific role in the group which it is involved. Graphically, a role lies at the intersection of a candle and an ellipse. Multiplicity in a role is represented by a star.

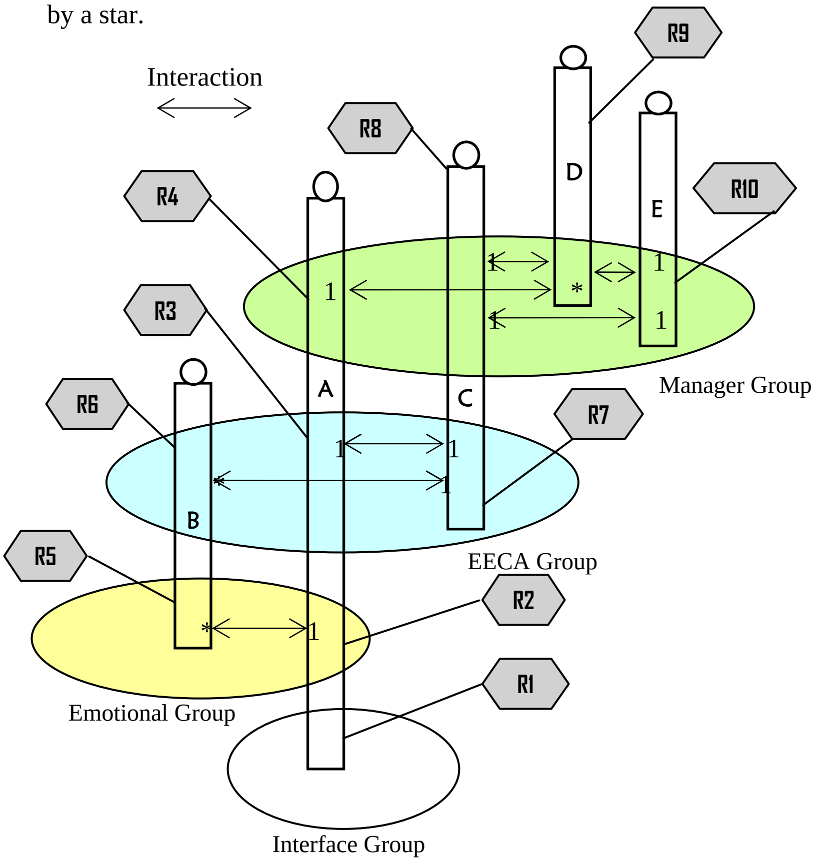

Fig.4: the OM of EMASPEL Framework

C. *Implementation*

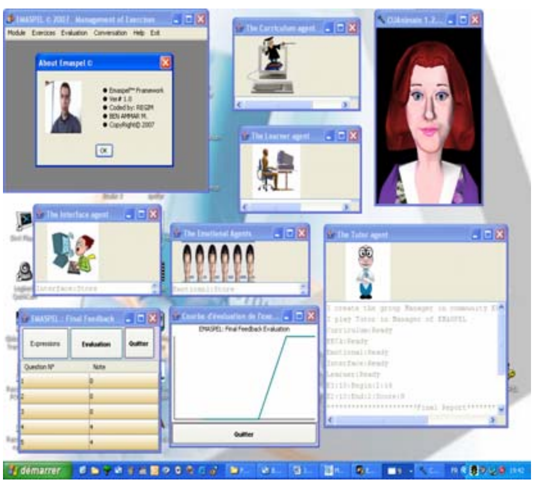

Fig. 5: EMASPEL Framework

We developed agents used in the EMASPEL framework (cf.fig.5) with the MadKit Platform. [12] MadKit is a modular and scalable multi-agents platform written in Java and built upon the AGR (Agent/Group/Role) organizational model: [13] agents are situated in groups and played roles. We plan to extend the proposed framework to integrate the new AGRE (AGR + Environment) model, which includes physical (or simply geometrical) environments. MadKit allows high heterogeneity in agent architectures and communication languages, and various customizations. In fact, MadKit does not enforce any consideration about the internal structure of agents, thus allowing a developer to freely implements its own agent architecture. Communication among agents is implemented by a set of communication primitives, which is a subset of FIPA-ACL extended with specific primitives. [9] We used the JXTA[1] Framework to build an open source Peer-to-peer network.

V. Conclusions

Learning process implies cognitive aspects as well as socio-emotional aspects: in real world, teaching also implies to observe the student's affective behavior in order to detect affective responses, which can express interest, excitation, confusion, etc. and suggest a review of the actual interaction flow. This paper presented an Intelligent Tutoring System (ITS) equipped with emotional management capabilities, which make it possible the capture of learner emotions during learning and affective response to learners' actions. We proposed a multi-agent system with agents that manage both cognitive and affective model of the learner and that are able to express emotions through embodied agent. Our interest to integrate emotional embodied conversational agents (EECAs) in ITS is motivated by the use of animated agents in computer based learning environments as a tutoring paradigm can be benefit, increase the learners' motivation and with the main purpose of stimulating cooperative learning among learners. Our goal with looking at the facial expressions during tutoring sessions is to get information about the learner that may be useful to know for the system in order to adapt its teaching strategy. We have implemented our affective e-learning framework (EMASPEL) in order to validate the quality and exactitude of its prediction based in the recognition of emotional information with the completely automated real-time system for facial expression's recognition based on facial features' tracking and a simple emotional classification method. Facial features' tracking uses a standard webcam and requires no specific illumination or background conditions. Emotional classification is based on the variation of certain distances from the neutral face and manages the six basic universal emotions of Ekman.

As far as future work is concerned, we plan to consider the recognition of gestures jointly with face expressions corresponding to certain emotions. Several applications in the systems of communication between the learner and the systems of communication may be improved by incorporating the information from the gesture and face signs.

[1] JXTA is a set of open protocol specifications that makes it possible for virtually any kind of electronic device (from cell phones to PCs) to communicate with other such devices in a Peer-to-peer way. (Gradecki J. D. (2002): Mastering JXTA: Building Java Peer-to-peer Applications.)

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Pass it on! Shared knowledge and competence

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Abstract- This article describes a flexible learning course in educational science with a focus on ICT-supported learning. The target group was 20 academics in higher education with an interest and need to develop and improve their usage of modern information and communication technology in didactical teaching and learning situations. Data were continuously collected during the one-year training through questionnaires, informal interviews and the participants' presentations.

The paper concludes with five concrete recommendations for course mangers and academics involved in flexible learning: i) quick feedback; ii) holistic course planning, iii) well-working technology, iv) relevant course literature and clear goals.

Keywords: ***Distance learning; Flexible Learning, ICT, Mentorship, Pedagogics***

I. INTRODUCTION

Transformation has in recent decades been in focus in university education in Europe and the USA. Several researchers in the West have described the development as 'mass education' (1; 2). More and more students are supposed to be educated with the support of fewer and fewer resources. To reach 50 % of those who leave upper secondary school annually has long been the goal of Swedish universities. At the same time the parliament auditors have shown that the number of students who leave university without any results has increased. One way of supporting and improving the throughput may be found within the transformation of teaching and learning known as flexible learning. Using flexible forms of learning supported by information and communication technology (ICT) to develop solutions facilitating and reinforcing student learning may be crucial to Sweden's welfare and competitive edge. The information society enforces new learning strategies and the development of information technology will probably erase the boundary between teaching aids and other information.

Earlier on the Council for the Renewal of Higher Education has supported projects aiming at stimulating pedagogical development in Swedish universities. Neither the Department of Foreign Affairs nor the National Agency for Higher Education has unambiguously defined and explained what is meant by pedagogical development, but it has been left to each university to set up its own appropriate goals and forms of activity. Flexible learning and teaching with the support of ICT have been given priority in the last few years, since there are a number of educators who lack experience in teaching distance courses or applying flexible learning on courses conducted on campus. For this reason it is especially important that a strategic campaign for promoting flexible learning should include support to the teachers of the universities.

II. UNIVERSITY EDUCATION IN TRANSFORMATION

The role of ICT will become even more prominent in higher education. Traditional communication will be supplemented and often supplanted by new communication. The young generation is growing up with a new kind of learning, where sound, picture and text are conveyed via modern information technology, which will force universities to plan their education in accordance with the demands made by the new target group. The Swedish government in its demands on universities has specified that they must be able to offer programmes to new groups of students, which means a pedagogical challenge for traditional academia. Another influential factor contributing to the importance of flexible learning is the pedagogical insights into how different people receive information, process it and transform it into knowledge. Flexible education must be viewed in a larger context than distance courses alone. The question must be asked whether some flexible education elements can be integrated into traditional on-campus programmes in order to safeguard and increase their quality and contribute to the optimal use of resources. The direction of tendencies

affecting higher education throughout the western world, largely based on new communication technology, is summarized below.

The move is from :

- ‘passive learning for reproduction to active process-oriented learning
- teacher-centred education to student-centred education
- fixed knowledge content to flexible optional content
- focus on individual work to focus on teamwork
- strict discipline-oriented content to thematic interdisciplinary content
- traditional printed teaching aids to interactive dynamic teaching aids
- traditional academic subject blocks to professionally oriented education
- university computer laboratories to distributed web solutions
- local stationary learning resources to global learning resources
- classroom-based courses to network-based courses’.

III. AIM

Against the background of the global changes taking place in higher education and the attendant demands for pedagogical renewal the aim of the evaluation research presented here is to use a critical formative and summative examination of an in-service course to provide university teachers with a foundation for developing and improving their work with the focus on flexible learning and ICT-supported education.

IV. PEDAGOGICAL DEVELOPMENT WORK

Pedagogical development work is multifaceted and requires a constant focus on and discussion of the field (3). To actively direct resources by educating and influencing one’s co-workers on the management level is becoming increasingly important in pedagogical innovation work (4). To furthermore exert an influence on the policy level while carrying out pedagogical educational activities for university teachers may be an effective combination for the development of one’s work (5; 6).

The teacher role may change when modern information technology is introduced into the education system. It is the content of the teacher’s duties that changes, not the role of helping students to acquire knowledge. What happens is that the focus on the *content* of education must now be shifted to the *form* of education. This requires comprehensive planning and close cooperation with other teachers, technicians and study administrators. Introducing IT-based tools into teaching is neither simple nor self-evident but can often be a complicated and time-consuming process (7). One way of increasing the confidence in ICT is using technology in simple frequently occurring presentation exercises. A greater emphasis on introductory courses in technology may thus be a good idea. If the university employs skilful course leaders and if the students are used to working with ICT resources there may be less danger of negative teaching experiences.

The in-service training course described in this article was inspired by ideas of learning organizations and the creation of a positive learning environment shared by everyone, a *Community of practice* (8) The ambition is that every teacher should be able to formulate a three-year competence development plan, presented and updated annually. This is the context in which the *University Pedagogics – Flexible Learning and Mentorship in ICT-supported Education* course has been created to become one of the prioritized competence development activities.

V. FLEXIBLE LEARNING AND DISTANCE EDUCATION

The flexible learning concept invites to discussion and in some degree to disagreement. In Australia and the Nordic countries the term is relatively firmly established. A common interpretation is that flexible learning ‘should make use of technical support, offer the possibility of choosing the direction and the material for one’s studies, make room for various methods of studying and allow it to be carried out independently of time and space’. Thus, flexible learning can be characterized by various factors such as an adaptable course schedule, study forms, study tempo, examination forms, various learning styles, geographical independence and variation in the form of communication between student – teacher and student – student. Flexible learning may be viewed from the student’s or the teacher’s point of view. One definition of flexible education reads as follows:

Flexible distance education enables students to choose place, time, tempo and work method for their studies.

Flexible distance courses consequently represent various ways of organizing education. It is essential that the teacher is available during study hours for guiding students, supporting processing and communication and providing an administrative study structure. Flexible education programmes must be viewed in a wider perspective than as distance

education per se. The distinction between distance and more conventional education, sometimes referred to as on-campus or neighbourhood education, is today on its way out. Flexible learning may contain several dimensions requiring several competencies such as subject knowledge, pedagogics, web design and layout. This means that developing a course is done in cooperation with more colleagues than traditionally.

VI. PEDAGOGICAL ATTITUDES

The pedagogical structure of distance education varies. There are models which are dominated by mediation pedagogics, where the teaching is based on lecture packages and pre-framed questions for students to react to. There are also models where students frame their own questions and where the teacher rather acts as a tutor. A great many programmes put greater emphasis on their availability than on personal contacts between teacher and student. To compensate for the absence of the teacher in person a well structured and often easy-to-read self-instructive study material is produced. This structure allows the teacher to formulate the student's problems and questions, which are often anticipated and answered (9). Through such an attitude the teacher is in focus and is the person who initiates interaction with the student, which consequently takes place on the teacher's terms. This is a static and linear structure, including explicit overarching and partial goals.

If, however, learning is viewed as a non-linear process with the student's own issues in focus, the teacher is given another, though very important, function. The point is to be sensitive to the student's method of learning. Learning which emanates from the student's own experience is, according to a great many researchers, a prerequisite for higher studies (10; 11). In the approach described here the non-linear process is very much in focus. In distance courses dropping out is far more frequent than in traditional on-campus education. Since this usually occurs soon after the start of the course it is essential that student support is introduced early on. There may be a number of reasons why students interrupt their studies. Summing up, Thorpe (12) attributes the reasons to five different categories, namely *course contents*, *institutional factors*, *the learning environment*, *the study approach* and *motivational factors.*

VII. IN-SERVICE TRAINING FOR TEACHERS

In order to strengthen university teacher competence in flexible learning and the use of ICT a course was planned with the aim of providing teachers with in-depth knowledge of:

• the theories on which flexible learning is founded,

• individual and group learning processes and what technology can offer to support these,

• mentorship and tutoring, as well as further developing:

• the competence and knowledge for planning and implementing flexible education,

• proficiency in using some communication tools appropriate for flexible learning.

In sum, the knowledge target aimed at focuses on qualitative action and understanding, in other words on increasing the awareness of what will and what will not work.

Course structure

On the basis of pedagogical theory a need analysis was conducted among the course participants, i.e. teachers in higher education plus a few teachers responsible for the in-school training in upper and lower secondary schools for teacher students. The 25 who enrolled were divided into three groups and obtained the support of six instructors throughout the course. After this they planned, implemented and evaluated a minor education activity. This meant that they had two roles to play in their in-service training, one role associated with their own learning and the other to apply their newly acquired knowledge in training colleagues in their pedagogical practice.

The course contents were shaped by the participants' need of in-service training and by their choices. The following contents were included:

- pedagogics and methodology in flexible learning,
- needs and target-group analysis,
- tools for course planning,
- the planning and implementation of flexible education,
- problem-based learning, portfolio and other pedagogical methods,
- work involving discussion conferences,
- IT support and pedagogical software,
- technical support in video conferences and web meetings,
- synchronic and asynchronic learning,
- success factors for flexible learning, and
- tutoring and mentorship.

The structure and implementation of the course was characterized by the large space given to

individual educational needs. All participants formulated and planned for their individual requests within the field. From an extensive smorgasbord of lectures, seminars and workshops, synchronic as well as asynchronic ones, the contents and the hours of participation were individually chosen. As for the choice of literature and examination task there was great leeway for individual requests. Clear demands were made on everybody with regard to continuous presentation, discussion and reflection based on the literature, on lectures and on the contributions of the others. A continuous discussion went on about the structure and quality of the course, which made up an essential part of the contents. Quite a few considered these discussions as the most important for the future use of ICT in their teaching. The course management met regularly to discuss the progress and suggestions for improvement were continuously broached with the participants.

Only e-based literature was used and the course could be followed on the Internet. However, hands-on tutoring and workshops were also offered. It started and ended with meeting physically, but in between most of the studying was done via the Internet. Permanent teacher resources in the form of recorded lectures from earlier conferences, for example, were frequently used. Active participation was required in discussions and the examination task consisted of a written documentation and oral presentation of the educational activities the participants had conducted among their colleagues. The participants' previous knowledge and experience were of great importance and were complemented by the recruitment of resource persons with experience of flexible education. In addition to the obligatory course literature the choice of pedagogical and didactic literature was made in consultation with the course management. On the joint course website suggestions for articles and other literature on flexible learning were presented.

The assignments examined in the course comprised:

- an *individual plan* of the need for competence development in flexible education (How do you conduct your own teaching today? What would you like to change? What skills/training/material will be required? Formulate your learning needs. Draw up in conjunction with your course leader a plan for your own competence development),
- *planning education measures* among colleagues (What is the digital competence among the colleagues? What do they wish to learn? Describe the target group. Draw up a training programme. How would you like to act as a mentor?),
- *implementing the training* (What went well? What turned out badly? Present and discuss your experiences for the future).

In addition to the three tasks above the course participants were also expected to attend five lectures of their own choice followed by discussions and reflections in the joint electronic forum set up for the course. They were also expected to relate their contributions to the course literature, which was their way of presenting the course literature.

VIII. RESULTS

Formative evaluation

After the course had gone on for two months it was noted that activities did not live up to the expectations of the management. In order to provide the opportunity for expressing their views anonymously an electronic questionnaire was sent out to all the 25 enrolled in the course, half of whom responded. What clearly emerged from the result of the questionnaire was that they all described their work situation as strenuous and that in many cases the department management had not made enough efforts to reduce the workload and facilitate the competence training of the employees. Furthermore, it was stated that the flexible structure and freedom of choice in the course were appreciated, while more structure and clearer examination tasks were requested. This may seem contradictory but the course management made the interpretation that the reins had been too loose. Requests were also made to increase participant and management activity in the various discussion fora set up. The overwhelming number of the respondents would prefer the course management to be more active in the conference than the participants. Some asked to receive quicker and clearer confirmation of when they were considered as having passed the various course elements. A majority were dissatisfied with using e-books as course literature, which meant that they had to sit at the computer reading the literature on line.

At this point the course management decided to take a number of steps. To achieve greater activity all those partaking in the course were gathered into one group so as to increase the critical mass, in hopes to increase their involvement in the discussion fora. The reporting of completed course elements was also made clearer and the course literature which was supposed to be integrated in all assignments was separated and reported as independent reflections on the literature. On account of the great workload the course period was extended by three months. The structure of the learning platform changed radically and became slightly more like courses based on a unidirectional educational structure with set

assignments. Since a great many participants were critical of the e-literature the course material was distributed in paper form to those who wished. To make the examination task clearer the examiner made his own recording where he illustrated the task with the help of pictures, sound and examples. No new assignments were added in the recording, but obviously a great deal of the insecurity prevailing about the courses was sorted out, which won approval. Another important measure taken was that the inactive participants, after some respite, were struck off the list.

In connection with this relatively formal part evaluation the course management decided to send out newsletters every week. They contained notification of what would happen the following week as well as a summary of the preceding week. Individual comments and participant contributions were also included in order to reinforce the course feedback. In various degrees all of these measures increased the participants' activity.

Summative evaluation

Individual planning

For the individual planning there was a great need of getting acquainted with the pedagogical resources becoming available through digital technology. There was a strong wish to tie learning platform, video conference, presentations and other elements to a pedagogical context. Some participants found it hard to choose among all the options, but in consultation with the course management they were given the chance of discussing and making priorities among the educational activities they considered themselves needing the most. They all presented their plans in the presence of their fellow students and attempts to coordinate the educational activities were made.

Planning and implementing an educational activity

In the part where the course participants were to perform a minor study of their colleagues' digital competence the approach varied greatly, but the majority made use of questionnaires as the method of gathering data. Some carried out individual or group interviews. One study was oriented towards understanding and using a particular ICT application and another mapped the general competence in the department. All told one might discern in the studies certain cautiousness in the colleagues' assessment of their digital competence. The needs that emerged were related to the teachers' current and future teaching situation and to the new requirements on ICT competence which had been formulated by the management on the basis of student demands. There were quite a few who wanted to acquaint themselves with the technology supporting picture and sound. The educational activities requested by the colleagues were of the same type as the ones which those attending the course had formulated for their own educational needs, albeit somewhat less comprehensive and advanced.

Most of the course participants did the study on their closest colleagues and only a few turned directly to students.

Examination

The final examination task, involving that the participants' newly acquired competencies were to be passed on to their colleagues, varied greatly. The educational activities differed in structure and implementation and the subject areas covered a wide span. In one of the last-mentioned projects the educational activities were directed at a representative of industry (the third mission). One of the participants staged a whole-day programme focusing on pedagogic fundamentals and the treatment of distance students. The problems of examining at a distance were also discussed. In the afternoon a workshop on digital learning tools was conducted. Another participant carried out together with an extra-mural business contact a thorough training programme in video conference technology. Two people produced educational material for an e-based booking system, which was then tested on their colleagues and one did a seminar in the form of a discussion via tele pictures.

Everyone chose practical elements for the educational activities. Many of them preferred to combine different methods, inspired by the principles of learning based on different learning styles. Somewhat fewer than half of the presentations lacked a clear pedagogical standpoint. Nobody presented any follow-up activities, which in itself was not necessary for passing the course requirements. (Some of the members of the group are planning for similar activities for the next semester, that is outside the course framework.) In the evaluation discussions following on the examination all the participants asserted that they felt the task to be meaningful, as their own training and the educational models that were realized and discussed had been of direct use to the department.

Those who completed the course, many of whom with a good ICT competence, give high marks for the course as regards structure, implementation and educational effect. These participants have fewer problems with the high flexibility characterizing the course but suggest some tightening of the structure. Several of those who interrupted their studies were worried about the choices that had to be made. There is a difference in attitude among those who dropped

out in comparison with those who finished the course. The dropouts put much greater emphasis on teacher responsibility and lay less responsibility on their own roles in the learning processes that are central to individual competence development. We have reason to assume that these participants expected greater conformity in the course approach. The management's intentions were to create a more dynamic course, something that obviously does not suit everybody. Distance students are not a homogeneous group united in their attitude to technology and pedagogics. Some choose distance education because they feel confident with the structure commonly used for examining students (9). In Figure 1 below this type of education is defined in column A.

A: 'Static and teacher-controlled education'	**B: 'Dynamic and student-centred education'**
The teacher actively controlling and giving feedback and support to the students	The students controlling and giving feedback and support to each other
A lower degree of dialogue between students	A higher degree of dialogue between students
A higher degree of dialogue between teacher and student	A lower degree of dialogue between teacher and student
Required joint and individual assignments	Assignments based on the students' own choices
Absolute deadlines	Flexible progress
Students with lower demands on initiative and responsibility	Students with higher demands on initiative and responsibility
Assignments and cases taken from fictive activities	Assignments and cases taken from practical student experiences
A restricted offer of obligatory lectures, workshops and literature	A larger offer and greater choice of lectures, workshops and literature

Figure 1. Different approaches to distance education.

It goes without saying that those who expect a teacher-controlled course have difficulties in adapting themselves to more student-focused education. The participants who completed the course were used to encountering flexible assignments and appreciated such elements. The dropouts consisted of people who expected more guidance and who had greater expectations on course management activities than on their own activities.

Newsletters were a positive ingredient, but it would have been even better to give more responsibility to the students themselves. Allowing them to compose the weekly letters together, two students per week, for example, would be one way of making them more involved.

Increased flexibility jeopardizes interaction

Devoting more work to group assignments is a good way of increasing student interaction. Individualization made it harder to get the participants together into performing joint tasks. If the assignment choices differ too widely the discussion fora turn more into a collective monologue than an enriching discussion. The risk of losing student interest and commitment is greater in distance than in on-campus studies.

Experiences from the in-service training course demonstrate that you can certainly apply a relatively open planning which takes individual needs into consideration. This structure probably surprised many participants who had previously attended traditionally structured distance courses. Students are often divided into those who like and those who do not like distance education. Nothing can be more wrong. Maybe the students who appreciate distance education on the whole are used to a firm structure with study guides and fixed deadlines. Distance education with an unusually flexible structure, like the in-service course presented in this article, runs the

risk of creating initial uncertainty and irritation resulting, for instance, in less interaction.

Conclusions

1) In an invitation to flexible education teachers must clearly describe how the course is structured and what is expected of the students.
2) Do not expect all course participants to be active in discussions, but make up pair assignments in which the participants are encouraged to discuss.
3) The platform is of central importance. Make sure the entire course team stands behind the system and that the platform fulfils the demands required by the course structure.
4) Formulate common assignments in which the students get together.
5) Give each student a mentor, so that every course leader clearly knows which students he or she is specially responsible for.
6) Use different methods to regularly confirm, involve and encourage the group as well as the individual, for example by emphasizing some activities in weekly summarizing letters (for which the students themselves may be responsible).

Feedback from the course management

In a dialogue with department leaders and those responsible for in-service training who continuously follow the educational activities directed to university teachers many people have expressed their approval of course structure and objectives. The fact that there are several examples that the course has made a positive impact on the competence of other colleagues and that it has in many ways developed work in the department has been appreciated. This ‘multiplication’ or distribution effect is something to aim at in all university pedagogical activities. There is no concrete or general solution to the problem of making time available for and actively supporting the competence development of the staff, even though many people realize the importance of this question. To raise the status of the problem those who run the department need to be aware of and more concretely support competence development focusing on flexible learning and ICT support.

Another positive consequence that has emerged is that the ICT support staff of the university has become naturally involved in regular university pedagogical education. That the ‘online distance education’ directed to university teachers must necessarily become more than a ‘one-way education’ is something on which those who have the overarching responsibility for university teacher in-service training are in total agreement.

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An ICT environment for teaching and learning sign Language

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***Abstract*— Nowadays, the fastest growing of Technologies of Information and Communication is empowering significantly education. Very sophisticated environments are developed to improve learning and education in both face to face and distant modes. However, more efforts have to be deployed to make these technologies beneficial for education of people with various disabilities. In this context, we present in this paper an ICT environment we developed to aid deaf people improving their social integration and communication capabilities. In fact, it is proved that sign language is not innate at deaf children and therefore it needs methodic and specific training. Our environment is a specialized LCS that generates multimedia courses to teach and learn sign language. These courses can be used either by deaf pupils to learn (or e-learn) sign language or also by hearing people to be able to communicate with deaf people. This educational environment uses mainly a web-based interpreter of sign language developed in our research laboratory and called Websign. It is a tool that permits to interpret automatically written texts in visual-gestured-spatial language using avatar technology.**

Deaf education; e-learning; avatar; 3D animation

I. INTRODUCTION

Disabled persons face insurmountable difficulties when they want to deal with the new technologies: the use of a computer, the access to Internet, the edition and the impression of a text, the reading of a document can be extremely complex tasks in spite of their simplicity for another user.

In this context, this paper presents a new tool for creating multimedia courses dedicated to deaf pupils. The course is useful by deaf pupil, by parents of deaf children to learn sign language, and it can help any person who is in contact with deaf to learn sign language. This tool would enable people who do not know sign language to communicate with deaf individuals. Therefore, contribute in reducing the language barrier between deaf and hearing people.

This paper is organized as follow: the next section is devoted to present the deaf pupils education and some applications used to teach them. In section 3, we describe our objective. We present the general approach we adopted to develop our tool in section 4. Finally, we give some perspectives and a conclusion.

II. DEAF EDUCATION

In 2003, the World Federation of Deaf confirms that 80% of deaf people lack education or are undereducated, are illiterate or semi-literate [2]. Moreover Sign language is banned in many countries and programs. In fact, the most information contents are inaccessible to the deaf community. Furthermore, many efforts are deployed to ensure a minimum of information in written text or sign language like the real time translation of some TV programs in sign language (the news) or the subtitles, the development of guidelines for the deaf education and the development of multimedia tools to teach sign language.

A. Programs for deaf and hard of hearing student guidelines

To guarantee best educational services to children who are deaf or hard of hearing, A program for deaf and hard of hearing student guidelines for quality standards is created by the California Department of education in 2000 [3].

These guidelines contain recommendations for parents, teachers, administrators, and governing boards to use in identifying, assessing, planning, and providing appropriate educational services to all children who are deaf or hard of hearing. They are also intended to assist in monitoring programs for these students.

B. French education system

In France, a specific education of deaf is organized in primary, secondary and vocational schools. In the Region of Paris, there are 5 specialized schools or institutions.

The parent has different possibilities to integrate his children to the public schools:

- The deaf can have some classes with hearing students.
- The deaf can also completely integrate classes and courses of hearing student. But, he should get an orthophony sessions and private courses.

This system of education does not lead easily the deaf student to the higher education. In fact 90% of them do not pass the third level. Moreover, in the region of Paris, only one high school takes deaf students up to “Baccalauréat” (the end of secondary studies).

C. New Technologies of Information and Communication and deaf education

Nowadays, introducing new technologies of information and communication in people with special needs education such as deaf peoples becomes a necessity. In fact, in schools we can use video, images and others multimedia technologies. In addition to this, deaf people must participate in all activities that any student can do and must be offered the same opportunity to access to these means of information using their own language: signs.

In fact multimedia can be highly useful for the deaf: every pupil can repeat watching sign as many times as required until he understand it or memorize it.

When creating an e-learning tool for deaf pupil it is very important to choose the most adequate representation of sign. This representation should respond to many criteria: first, it should be easily understood and adopted by the deaf. Second, it should not require a big memory space, and finally, it must be easily adapted with computer technology.

D. Some existing tools for deaf education

1) Systems using SignWriting

SignWriting [4] is a system of transcription of the hand and face expression of sign languages (figure 1). It was developed in 1974 by Valerie Sutton. The SignWriting system is a combination of symbols for hand configuration (hand shapes) body locations, contacts, movements and facial expression to describe motions in sign language (figure 2). SignWriting is used to write books, web sites and also to teach sign language.

Figure 1. SignWriting Web site

Figure 2. Hand shapes in SignWriting

2) LSF Lexique

LSF Lexique is a web site which offers to the deaf community a set of a video sequences representing a dictionary in French sign language. It is developed by 5 professional deaf from the national institute of young deaf of Metz in France. The website contains 1944 standards sign. It presents 3 search topics: by word, alphabetic order or hand shape.

3) Mathsigner

Mathsigner [5] is a system based on American Sign Language and 3D animation (figure 3). It contains a sets of activities designed to teach math concepts, signs, and corresponding English terminology to deaf pupil, parents, and teachers. Mathsigner is developed using virtual reality technology. This technology offers many advantages over others technologies:

- The control of the appearance and the orientation of the avatar.
- Real time translation with no limits of combination of sign.
- Sentences can be linked together smoothly.
- No need to a large bandwidth like the video.
- The controls of sign can be easily applied to other characters.

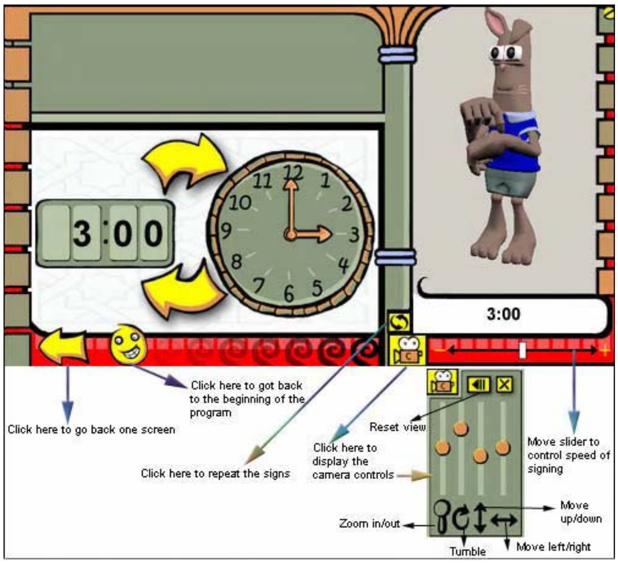

Figure 3. User interface of Mathsigner[5]

III. Our Objectives

The objective of our project is to develop a web-based tool for creating courses for deaf pupils. Our aim is to distribute this tool on a non-profit basis to educators, students, users, and researchers, and to disseminate a call for contribution to support this project mainly in its exploitation step and to encourage its wide use by different communities.

In fact, the automatic translation from the written language to the sign language is a promising way that requires the

mastering of several domains covering the field of the data processing, of linguistics, or mathematics. A sign language is a language which uses manual communication instead of sound to convey meaning - simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions to fluidly express a speaker's thoughts. The sign language remained nevertheless a fully-fledged language, with its own constructional method of the sentences.

IV. OUR TOOL

A. *WebSign system*

WebSign [7] is a Web application. It is based on the technology of avatar (animation in virtual world). The input of the system is a text in natural language (figure 4). The output is a real-time and on-line interpretation in sign language. This interpretation is constructed thanks to a dictionary of word and signs. The creation of this dictionary can be made in an incremental way by users who propose signs corresponding to words (figure 5). A word and its corresponding sign interpretation are added effectively to the dictionary only after its verification by an expert administering the system.

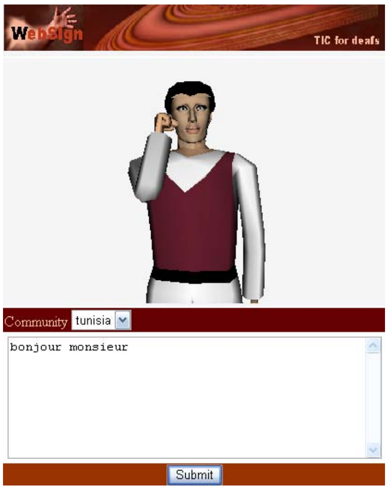

Figure 4. Real time interpretation

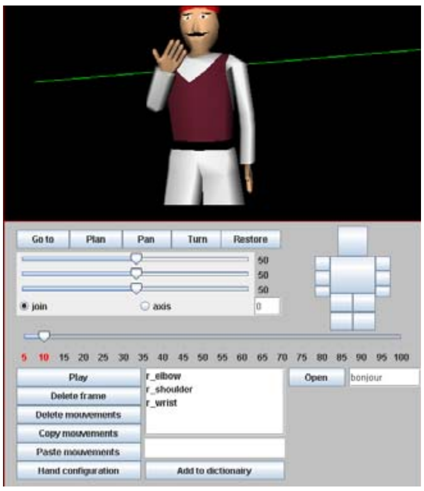

Figure 5. Interface for the construction of signs

However, contrary to popular belief, sign language is not universal. Wherever communities of deaf people exist, sign languages develop, but as with spoken languages, these vary from region to region. Hundreds of sign languages are in use around the world and are at the core of local Deaf cultures [6]. Some sign languages have obtained some form of legal recognition, while others have no status at all. For this reason, we introduced the concept of community. A community is a group of users that can build and share a common dictionary of sign language. A dictionary can be created totally by a specific community or can be just an instance of an existent dictionary where some specific words are interpreted differently to respect the intrinsic specification of the concerned community.

B. *The environment of creation of courses for deaf children*

Using WebSign, we have developed a web tool specialized in creating course for deaf pupils. The course is a group of lessons, in which every lesson is a group of web page containing a variety of images and their correspondent description. Our web tool provides an avatar witch play the sign already translated by WebSign.

It is proved that the use of graphics is an efficient pedagogical method to acquire new vocabulary items. In fact, this method is still used in traditional education in ordinary schools and in pedagogic games for young children.

The association of images and their descriptions offer the advantages of clarity and simplicity of acquiring information for both the lesson author and the pupil. The author generates the course, he can add delete and modify lessons. The pupil has the possibility to navigate in courses web pages created by the author.

1) *User interfaces*

Our tool offers two interfaces, one for the teacher and the other for the deaf pupil. The teacher’s interface is constituted mainly by a dedicated authoring tool to create, modify and delete lessons, edit links with different pages and visualize lessons. A lesson can integrate text, images and animations.

Animations consist of interpretation of text in Sign Language. Those animations are created by Websign and integrated in the lesson page in order to interpret automatically texts in visual-gestural-spatial language by the use of avatar technology.

Figure 6. Course interface.

The student's interface offers the possibility to the deaf pupil to consult the text and related images and to see the corresponding interpretation in Sign Language. In fact, every lesson generated by our tool is represented by a certain number of pages, in every page there are a limited number of images with their descriptions in full letter. When the pupil clicks on an image (figure 6), the avatar, which is in the left of the page, plays the associated sign. This action can be repeated as many times as the user need to understand or to memorize the description. Remark that the access to lessons is very simple. Our application is designed for young deaf. The interfaces of this type of application should be very simplified. For this reason, all buttons and links are represented by images and animations related to their sign animation. This allows pupils to explore easily the lessons.

2) Online and offline course

The pupil can use the tool by two different modes: the online mode and the offline mode. In the online mode, when the pupil clicks on the image, the web browser sends a request to Websign server (Figure 7), which sends him back the description of movement corresponding to the sign. The pupil can download the lessons and use it in an offline mode, which corresponds to web pages containing already the images, their description and the description of the movement corresponding to the sign. In such way no communication with Websign server is needed and by the way the pupil has no access to the update we can make on the Websign data base.

When the teacher creates the course, two copies are made. One, for an online mode, does not contain description of the movement which the avatar should play. The other copy is for the offline mode and contains all the description required in the lesson downloaded.

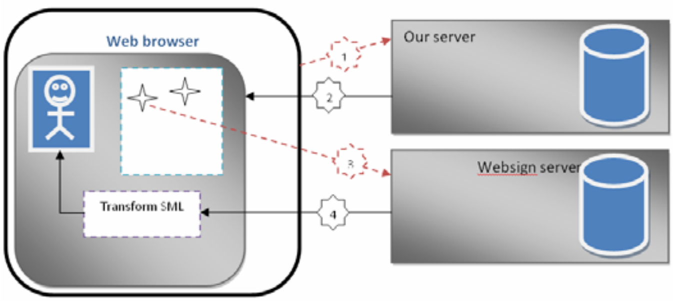

Figure 7. Getting animation on online mode

3) Getting signs from Websign

In the common protocol, for every request made by the web browser, the result is downloaded in a new web page. Such protocol requires the downloading of the three dimension scene every time a request is made for getting a sign. In fact this alternative is time consuming and its loading in the principal memory is too slow to be used by the system.

So we opted to Ajax technology, when we need getting sign which is actually a description for animation of the avatar. The contribution of Ajax technology is the recuperation of result of an http request into a variable, which can be manipulated with a script like JavaScript or VBScript and decoded before being played by the avatar.

V. CONCLUSION AND PERSPECTIVES

We presented in this paper a tool that aims to enhance the education of deaf, hard-of-hearing and speech disabled individuals. The originality of this tool, in addition to be an open source, consists on two points: first it combines the advantages of different computer techniques and recent technologies; second it allows to the teacher to create his course without need to programming skill to animate the avatar.

A first version of the generator is finalized and completely functional. We plan to make it available very soon in the Web.

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Intelligent Technologies for Medical e-Learning

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***Abstract*—Medical Intelligent e-Learning Systems (MILSs) are concerned with the construction of intelligent software that performs diagnosis and make therapy recommendations. Unlike other medical applications abased on other programming methods such as purely statistical methods, MILSs are based on symbolic models of disease and their relationship to patient factors. Many types of MILSs are in existence today and are applies to different medical tasks, e.g. generation alerts and remainders, diagnosis assistant, therapy critiquing and education . This talk presents some of the intelligent technologies used in developing intelligent medical learning systems at Ain Shams University, Cairo, are discussed as well.**

Keywords: e-Learning, Medical Informatics, Intelligent Techniques and AI

I. Introduction

Distance learning is a teaching method accepted worldwide by prestigious educational organizations. Distance learning has shown itself to be an option capable of facing up to the challenge of training a large number of students in a short time, with saving in human and financial resources while never losing flexibility of effectiveness. The rapid growth of interest in the worldwide web provides a unique challenge to conventional paper-based distance learning and opens up new possibilities. Increasing number of universities are developing virtual courses using computer-based technologies and virtual universities are beginning to emerge. On the other hand, the convergence of AI and web technologies is enabling the creation and implementation of the intelligent e-learning technology. Such technology will provide a unique opportunity to distribute learning/education/training across multiple sites while dramatically reducing travel related costs.

In this paper we focus our discussion around the AI-based technologies which are used in developing medical tutoring/learning systems at Ain Shams University. Section 2 gives a brief overview of the field of AI in education. Section 3 presents a brief overview about the knowledge representation techniques which are usually used in developing knowledge-based systems. Section 4 presents the main concepts of expert systems as a main technology for developing intelligent learning systems. Sections 5 and 6 are dedicated to describe briefly two expert systems for diagnosis of cancer and heart diseases respectively. Sections 7 and 8 present the usage of neural network technology in brain tumor diagnosis. Section 9 discusses the main concepts of data mining technology. Section 10 presents machine learning techniques, namely, rough sets, genetic algorithms and visualization which are currently used in developing data mining medical systems for thrombosis and thyroid diseases. The final section contains conclusion.

II. AI in Education

AI is science and technology and is based on many disciplines such as: computer science, psychology, mathematics, biology, linguistics and engineering. The goal of AI is to develop intelligent software models the human behavior, i.e., think, see, hear, walk, talk, and also feel. The field covers the areas; action and perception (vision, robotics, auditory scene analysis), automated reasoning, case based reasoning, cognitive modeling, connectionist models, constraint satisfaction, distributed AI, genetic algorithms, knowledge base technology, knowledge representation, learning, natural language, non monotonics reasoning, planning, qualitative reasoning and diagnosis, reasoning under uncertainty and temporal reasoning.

Based on the analysis of the topics of the World Conferences on "Artificial Intelligence in Education (AI-ED)", which held during the period 1993 – 2001, Table 1 shows the main areas of the AI in education [3].

Table 1: Areas of AI in education

• Intelligent tutoring systems.	• Social and cultural aspect of learning.
• Learning environment and micro-worlds.	• Cognitive development and errors.
• Visual and graphical interfaces.	• Student modeling.
• Human factor and interface design.	• Teaching higher-order thinking skill.
• Intelligent multimedia systems.	• Theories of teaching.
• Authoring system and tutoring shells.	• Motivation.
• Collaboration tools.	• Reading and writing.
• Training job skills.	• Computer-assisted language learning.
• Principles/tools for instructional design.	• Evaluation of computer systems
• Natural language interfaces.	• Assessment of learning outcomes.
• Knowledge representation.	• Conceptual change.
• Knowledge and skill acquisition.	
• Metacognition.	

III. KNOWLEDGE REPRESENTATION FOR ITSS

Knowledge representation techniques offer potentially powerful tools for the development of intelligent learning technologies. The variety of such techniques enabling the design of a robust intelligent tutoring and learning systems. The key to the success of such systems is the selection of the knowledge representation scheme that best fits the domain knowledge and the problem to be solved. That choice is depends on the experience of the knowledge engineer.

A variety of knowledge representation schemes are used including; lists, trees, semantic networks, frames, scripts and production rules. Lists are used to represent hierarchical knowledge. Hierarchical knowledge can also be represented visually with graphs called trees. Semantic networks use circles called nodes that represent objects or events. The nodes are interconnected with lines called arcs that show relationships. Frames and scripts are two types of schemes dealing with stereotyped knowledge. Frames are used represent facts about objects and events. And details are given in sub-elements called slots. Scripts describe knowledge that is a sequence of events or procedures. Frames and scripts permit a system to infer details of specific common objects and events. Production rules are the most commonly used knowledge representation methods. Production rules are two part statements with a premise and a conclusion. They also may state a situation and corresponding action. Rules take the form of an *if-then* statement.

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IV. EXPERT SYSTEMS TECHNOLOGY

Expert system (ES) is a consultation intelligent system that contains the knowledge and experience of one or more experts in a specific domain that anyone can tap as an aid in solving problems [4]. It consists of a knowledge base that stores the expertise, inference engine that thinks and reasons, and interface that communicates with the user. Expert knowledge is the key component of the success of the ES software for any application. The knowledge consists of facts, concepts, theories, procedures and analyzed to make it understandable and applicable to problem solving or decision making.

The field of reasoning is very important for the development of AI-based educational software. The research area in this field covers a variety of topics, e.g.; automated reasoning, case-based reasoning, commonsense reasoning, fuzzy reasoning, geometric reasoning, non-monotonic reasoning, model-based reasoning, probabilistic reasoning, causal reasoning, qualitative reasoning, spatial reasoning and temporal reasoning. In fact these methodologies receive increasing attention within the AI in education community. This section is dealing with rule and case-based reasoning systems.

A. *Rule-based expert systems*

Figure 1 shows the general structure of the rule-based expert system. The knowledge base and inference engine are analogous to the knowledge stored in memory and the reasoning capabilities of the human experts that the system is emulating. The inference engine contains a set of formal logic relationships which may or may not resemble the way that real human expert reach conclusions. The knowledge base is structured in a i*f-then* organization. The rules have to be defined in a limited number of formal ways. Typically they may be a set of some hundreds of *if-then* (or *if A and B but not C then D*) types of relationships that describe all the domain specific knowledge used by the human expert. The most difficult and time consuming part of the developing a rule-based expert system is the extraction of knowledge form the head of an acknowledged expert (or a group of experts) and then transforming it into a form acceptable to the expert system knowledge based structure.

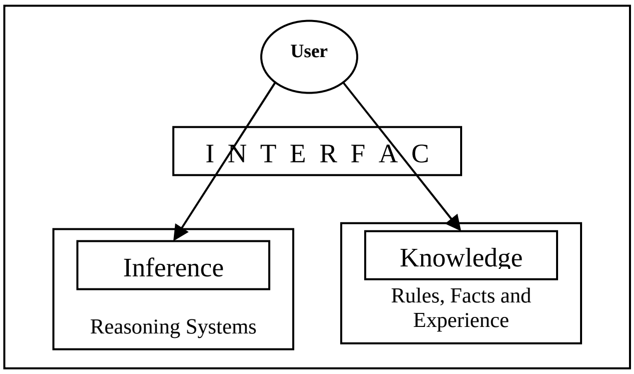


Fig. 1: General structure of rule-based ES

B. *Case-based expert systems*

The new generation of ITS uses a new AI paradigm of inference called, case-based reasoning (CBR). This systems uses an extensive case-based of exercises and examples to teach students. The case-based tutoring systems solve new problems by adapting solutions that were used for previous and similar problems [5,6]. In ITS, CBR is used to (a) compose lessons at various levels of knowledge by following the curriculum, (b) solve and generate problems, and (c) generate teaching material.

The methodology of case-based expert systems can be summarized in the following steps:

1. The system will search its Case-Memory for an existing case that matches the input problem specification.
2. If we are lucky (our luck increases as we add new cases to the system), we will find a case that exactly matches the input problem and goes directly to a solution.
3. If we are not luck, we will retrieve a case that is similar to our input situation but not entirely appropriate to provide as a completed solution.

4. The system must find and modify small portions of the retrieved case that do not meet the input specification. This process is called "case-adaptation".
5. The result of case adaptation process is (a) completed solution, and (b) generates a new case that can be automatically added to the system's case-memory for future use.

Research reveals that students learn best when they are presented with examples of problem-solving knowledge and are then required to apply the knowledge to real situations. The case-base of examples and exercises capture realistic problem-solving situations and presents them to the students as virtual simulations, each example/exercise includes:

- a multi-media description of the problem, which may evolve over time,
- a description of the correct actions to take including order-independent, optional, and alternative steps;
- a multi-media explanation of why these steps are correct;
- the list of methods to determine whether students correctly executed the steps;
- the list of principles that must be learned to take the correct action.

The technology of CBR directly addresses the following problems found in rule-based technology.

- Knowledge acquisition: The unit of knowledge is the case, not the rule. It is easier to articulate, examine, and evaluate cases than rules.
- Performance: A CBR system can remember its own performance, and can modify its behavior to avoid repeating prior mistakes.
- Adaptive Solutions: By reasoning from analogy with past cases, a CBR system should be able to construct solutions to novel problems.
- Maintaining: Maintaining CBR system is easier than rule-based system since adding new knowledge can be as simple as adding a new case.

V. EXPERT SYSTEM FOR DIAGNOSIS OF CANCER DISEASE

Cancer is a group of more than 200 different diseases; it occurs when cells become abnormal and keep dividing and forming either benign or malignant tumors. Cancer has initial signs or symptoms if any is observed, the patient should perform complete blood count and other clinical examinations. Then to specify cancer type, patient need to perform special lab-tests.

This section presents briefly ITS prototypes for the diagnosis cancer diseases [7]. The system provides recommendation for controlling pain and providing symptom relief in advanced cancer. It can be used as a tool to aid and hopefully improve the quality of care given for those suffering intractable pain. The system is very useful in the management of the problem, and its task to aid the young physicians to check their diagnosis. Fig. 2. shows the architecture of the hybrid expert system. The system's knowledge base is diverse and linked through a number of indices, frames and relationships. The bulk of this knowledge consists of actual case histories and includes 70 cancer patient cases; some are real Egyptian cases and some from virtual hospitals on the internet. The system uses the case-based reasoning strategy to record and retrieve its knowledge. The initial diagnostic process is done through firing of rules in the Rule-Based inference. These rules encode information about patient's symptoms and pathological examinations.

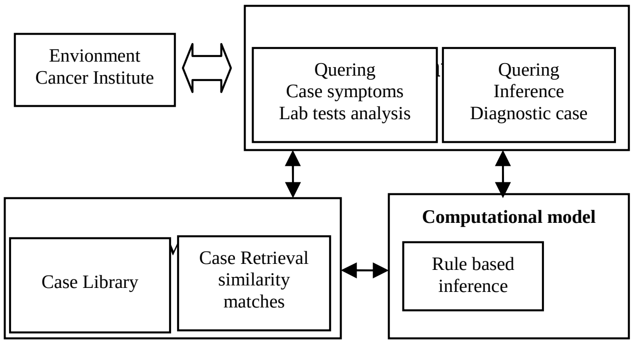


Fig.2: Architecture of the hybrid ES for cancer diagnosis

The main purpose of the system is to serve as doctor diagnostic assistant. It consists of three main modules; user interface, case base reasoning model and computational model all are interacted with the main environment of cancer diseases. The user is cancer expert doctor, the interaction is through menus and dialogues that simulate the patient text sheet contain symptoms and lab examinations. Computational model uses rule-based inference to give diagnostic decision and new case is stored in case library. Patient cases are retrieved in dialogue with similarity matches (nearest neighbor matching). The system is implemented using Visual Prolog for Windows. Prolog is composed of, empty knowledge-base, inference engine, and simple graphical user interface. Fig. 3 shows a real sequence of diagnosis for Hodgkin's cancered patient.

The system's knowledge base uses if-then rules and semantic networks for representation of cancer diseases. The system uses backward chaining, where the diagnostic goal expression is initially placed in the working memory, and the system matches rule conclusions with the goal until reaching certain hypothesis. Examples of encoded rules are:

Rule 1: IF the symptom is changes in bowel habits, OR the symptom is unusual bleeding, OR the symptom is thickening lymph THEN cancer is infecting.

Rule 2: IF cancer is infecting. And the symptom is sever headache, AND the symptom is seizured THEN brain cancer.

Rule 3: IF brain cancer then treatment can be surgery.

Rule 4: IF brain cancer THEN staging can be anaplastice, or staging can be glioblastoma, or staging can be ependmomas.

Rule 5: IF brain cancer THEN diagnosis by CT/CAT scans.

Frames technique is used [8] for patient case indexing, storage and retrieval. The patient case will include age, sex and weight occupation, pathologic, medical history fanily, physical exams and treatments. Example of an Egyptian liver cancer case description of old women was given as:

Patient: 65-years old female not working, with nausea and vomiting.

Medical History: cancer head of pancreas

Physical Exam: tender hepatomgaly liver, large amount of inflammatory about 3 liters, multiple liver pyogenic abscesses and large pancreatic head mass.

Laboratory Findings: total bilrubin 1.3 mg/dl, direct bilrubin 0.4 mg/dl, sgot (ast) 28 IU/L, sgpt (alt) 26 IU/L.

Initial situation: one day, the patient felt a tender lump in her neck
Several days after, the lump was still there
The patient called the doctor; he looked at the skin area in her neck

Doctor and patient dialogue:

Have you had fever?	No
Have you had night sweats?	No
Have you had general itching?	No
Have you lost weight?	No
How about fatigue?	Yes

Decision 1: the patient made blood tests and chest x-rays
Result: a tab finding reveals that patient chest x-ray shows an enlarged mass in chest
Decision 2: a Biopsy for the node in the neck
Final Result: The patient is developing a Malignant cancer of the body lump system a Cancer called HodgKin's disease.

Fig. 3**:** Real sequence of patient diagnosis

VI. Expert System for Diagnosis of Heart Diseases

Heart disease is a vital health care problem affecting millions of people. Heart disease are of 25 different ones; e.g. left-sided heart failure, right-sided heart failure, angina pectoris, myocardial infraction and essential hypertension. This research deals with the development of a rule based expert system for diagnosis of heart diseases. The system is able to give an appropriate diagnosis for the presented symptoms, signs and investigations done to a cardiac patient with the corresponding certainty factor. It aims to serve as doctor diagnostic assistant and support the education for the undergraduate and postgraduate young physicians [9].

We have developed two versions of the expert system. The first one uses the rule-based reasoning methodology while the second one uses case-based reasoning. The first system [9] is composed of the following three components: knowledge base, user interface and computational model (see Fig. 4). The knowledge was gathered from expert doctors in EL-Maadi Military Egyptian hospital, Egyptian Health Insurance Institute and medical books. Due to the presence of similar symptoms in heart diseases, clustering techniques for both symptoms and signs were applied. *if-then* rules were used for representation of knowledge, where certainly factors are used with both the role premise and conclusion portions. We have built the system's knowledge base for the 24 heart diseases and it is composed of 24 facts and 65 rules. The system is implemented in Visual Prolog. The system has been tested for 13 real experiments (patients). The experimental results have shown 76.9% accuracy in estimating the right conclusion.

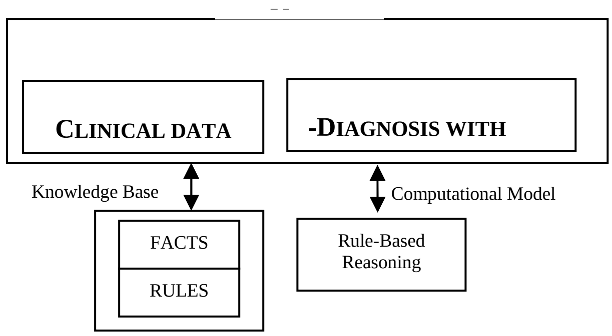


Fig. 4: Architecture of the rule based ES for heart diagnosis.

The Second system uses case-based reasoning methodology [10]. We have represented the knowledge in the form of frames and built the case memory for 4 heart diseases namely; mistral stenosis, left-sided heart failure, left-sided heart failure, stable angina pectoris and essential hypertension. For the case retrieval, we have developed two algorithms namely; nearest-neighbor algorithm and induction algorithm so that we can measure the system performance in both cases. The system searches for the most adequate cases for the current case, a similarity value between each retrieved case and the current case is calculated and the retrieved cases are ranked according to these values. The system has been implemented in visual prolog for Windows and has trained set of 42 cases for Egyptian cardiac patients and has been tested by another 13 different cases. Each case contains 33 significant attributes resettled from the statistical analysis performed to 110 cases. The system has been tested for 13 real cases. The experimental results have shown 100% accuracy in estimating the correct results for using nearest neighbor algorithm and this percentage is dropped to 53.8% in case of using the induction algorithm.

VII. NEURAL NETWORKS IN MEDICINE

Artificial Neural Networks (NN) are widely employed in the area of medical image processing [11,12]. Many techniques now exist for the acquisition of images for use in clinical medicine, such as Magnetic Resonance Imagining (MRI), Computerized Tomography (CT), X- rays, Positron Emission Tomography (PET). MRI has a unique advantage over other modalities is that it has excellent soft tissue differentiation yielding a detailed images with good boundary contrast between anatomical structures [11].

NN can be applied to medicine in four basic fields: modeling, bioelectric signal processing, diagnosing and prognostic (see Table 2). There are a variety of techniques used to obtain good classifiers. The most widely used and well-known technique is statistical pattern recognition. This is based on a minimum distance, k-nearest-neighbor and Bayesian classifiers. NN is preferred when data distribution is difficult to understand. Feed forward NN can naturally integrate anatomical knowledge with the information contained in the images without requiring the formulation of explicit description of the images. On the basis of these ideas we used MLP architecture for classification (see Fig. 4).

Table 2: Fields of NN in Medicine.

1. **Modeling**. simulating and modeling the functions of the brain and neurosenory organs.
2. **Signal processing**. Bioelecteric signal filtering and evaluation
3. **System control and checking**. Intelligent artificial machine control and checking based on responses of biological or technical systems given to any signals.
4. **Classification**. Interpretation of physical and instrumental findings to achieve more accurate diagnosis.
5. **Prediction.** Neural networks provide prognostic information based on retrospective parameter analysis.

VIII. BRAIN TUMOR DIAGNOSIS USING NN

A brain tumor is a mass of unnecessary, and abnormal, cells growing in the brain. There are many types of brain tumors. Each type may appear in different grades which indicate the degree of malignancy and different stages which determine if a tumor has spread beyond the site of its origin. So study of brain tumors and differentiating of their types is very difficult. Some types of tumors related by certain locations these tumors can be well diagnosed using MRI. In other types MRI is not definitive. Only examination of a sample of tumor tissue under microscope provides an exact diagnosis.

In our research group we have a research project dealing with neural network for brain tumor diagnosis. This section presents the hybrid neural network system for automatic brain tumor diagnosis using three types of tumor which are acoustic neuroma, astrocytomas and optic glioma [13]. The proposed system is a combination of unsupervised and supervised networks.The unsupervised segment of the networks is principal component analysis (PCA) neural network, which is a linear procedure to find the direction in input space where most energy of the input lies. In other words PCA perform feature extraction. The projection of these components correspond to the eigen values of the input covariance matrix. The supervised segment of the network performs the classification of these features using back-propagation networks (MLP), as shown Fig 5. The performance of PCA method varies with the number of principal components. It has good performance when the number of principal components equal to 10. Experimental result of PCA show that peak recognition rate of 100% is achieved. A database of MR images from different patients (10 cases for each type of considered brain tumors) have been assembled and the tumor present in the images have been labeled by hand and each case presented by 15 slices of the brain. The data used to train and test the network is a gray level images.

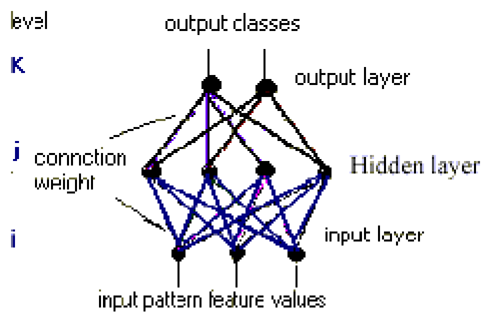


Fig.5: Architecture of Multi-Layer Perceptron.

Fig. 6 shows samples of 4 slices from 15 slices of 30 cases. We first performed an experiment to determine the number of principal components and the number of cases per tumor type yielding the lowest error rate . There are 3 different types of tumors , 10 cases of each. This gives a total of 30 cases. In our experimental configuration, the size of the training set varies from 1 to 9 and the remaining of 30 cases form the test set. Test set cases are chosen randomly. There was no overlapping between the training and test sets. Recognition performance can be improved significantly by increasing the number of training cases per tumor type. We found that all of the training cases were classified correctly. Good results were achieved with the test cases of 27 training cases (i.e. 9 cases per tumor type) The test cases cause the tumor classification network to classify all cases correctly using 10 principal component. We found that at case of taking 10 prncipal components MLP takes less number of iteration to classify cases correctly.

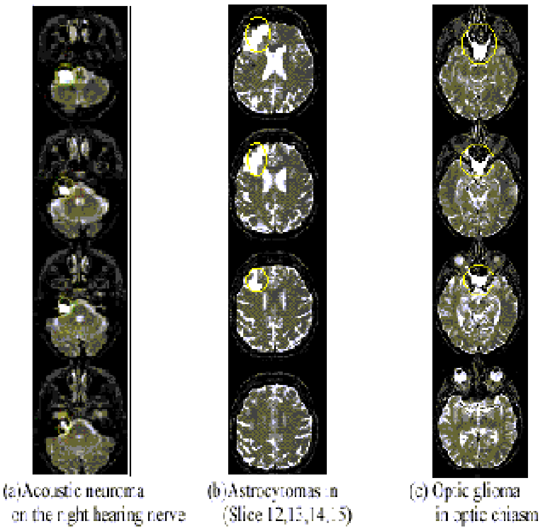


Fig.6: Samples of the data set used in the brain tumor diagnosis system

IX. DATA MINING TECHNOLOGY

Data Mining (DM) deals with the discovery of hidden knowledge, unexpected patterns and new rules from large databases [14]. Data mining and knowledge discovery is not a coherent field, it is a dwells upon already well established technologies including data cleaning, data preprocessing, machine learning, pattern recognition, statistics, neural networks, fuzzy sets, rough sets, clustering, etc. Fig. 7 shows the main functional phases of the knowledge discovery process. The preprocessing phase is often referred to as data cleaning. The cleaned data are stored in the warehouse. This is followed by data mining phase and its results are provided to an output generator (visualization) producing reports, action lists, or monitor reports. Each phase is supported by different methodologies. Data mining itself exhibits a plethora of algorithmic tools such as statistics, regression models, neural networks, fuzzy sets and evolutionary model.

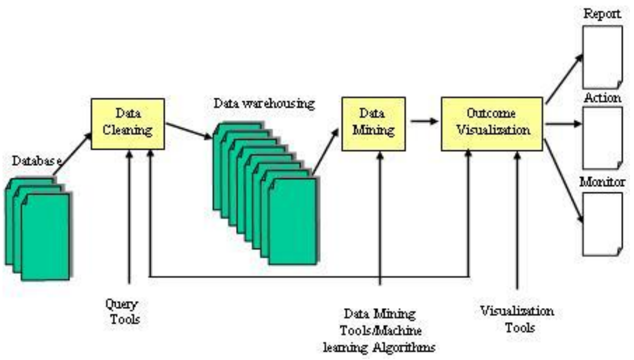


Fig.7: Phases of knowledge discovery process.

The knowledge discovery process is arranged into a stream of steps:

- understanding the domain in which the discovery will be carried out.
- forming the data set, its cleaning, and warehousing.
- extracting patterns, this is essence of DM.
- post-processing of the discovery knowledge
- putting the results of knowledge discovery into use.

Fundamental issues in knowledge discovery arise from the very nature of databases and the objects (data) they deal with. They are characterized as follows:

- huge amounts of data.
- dynamic nature of data.
- incomplete or imprecise data.
- noisy data.
- missing attribute values.
- redundant or insignificant data
- The knowledge discovery process is dynamic, highly interactive, iterative, and fully visualizable. Its main goals are to:
- extract useful reports
- spot interesting events and trends
- support decision-making processes
- exploit the data to achieve scientific, business, or operational goals.
- In spit of the diversity of the application areas, there are several common characteristic features:
- availability of massive sets of data
- high underutilization of data.
- access domain experts fully familiar with the area becomes crucial during the development of the knowledge discovery system.
- lack of expertise of the end users (thus knowledge discovery is a greatly welcomed activity).
- Data mining is supported by a host that captures the character of data in several different ways.
- Clustering: The key objective is to find natural groupings (clusters) in highly dimensional data. Clustering is an example of unsupervised learning, and it is a part of pattern recognition.
- Regression Models: These originate from standard regression analysis and its applied part known as system identification. The underlying idea is to construct a linear or nonlinear function
- Classification: This concerns learning that classifies data into the predetermined categories. The term originates form pattern recognition, in which a vast number of classifiers have been developed.
- Summarization: This is an approach towards characterizing data via small number of features/attributes. In the simplest scenario one can think of a mean and standard deviations as two extremely compact descriptors of the data. This technique is often applied in an interactive exploratory data analysis and automated report generation.
- Link analysis: It is concerned with determination of relationships (dependencies) between fields in a

database. In a particular case we may be interested in the determination of the correlation between the variables.

- Sequence Analysis: This type of analysis is geared toward problems of modeling sequential data. Pertinent models embrace time series analysis, time series models, and temporal neural networks.

X. MACHINE LEARNING-BASED MEDICAL SYSTEMS

Machine Learning (ML) aims at providing computational methods for accumulating, changing and updating knowledge in intelligent systems, and in particular learning mechanisms that will help us to induce knowledge from examples or data. ML provides methods, techniques, and tools that can help solving diagnostic and prognostic problems in a variety of medical domains. ML is being used for the analysis of the importance of clinical parameters and of their combinations for prognosis, e.g. prediction of disease progression, for the extraction of medical knowledge of outcomes research, for therapy planning and support and for overall patient management [15].

In what follows, we briefly present some of the ML techniques which are currently used in developing medical data mining systems at Computer Science Department, Faculty of Computer and Information Sciences, Ain Shams University, Cairo.

A. Rough sets

Rough set theory was proposed as a new approach to vague concept description from incomplete data. The rough set theory is one of the most useful techniques in many real life applications such as medicine, pharmacology, engineering, banking and market analysis. This theory provides a powerful foundation to reveal and discover important structures in data and to classify complex objects. One of the main advantages of rough set theory is that it does not need any preliminary or additional information about data. Information about rough sets software for data analysis was given in [14].

Since 1980’s, due to the rapid growing hospital information systems, electronic patient records are stored as huge databases at many hospitals. One of the most important problems is that the rules induced from each database (hospital) may be different form those induced form other databases, which are very difficult even for medical experts to interpret. Shusaka Tsumoto introduced rough sets based analysis in order to solve this problem

In our research group at Ain Shams, a rough set-based medical system for mining patient data for predictive rules to determine thrombosis disease was developed in [16] this system aims to search for patterns specific/sensitive to thrombosis disease. This system reduced the number of attributes that describe the thrombosis disease from 60 to 16 significant attribute in addition to extracting some decision rules, through decision applying decision algorithms, which can help young physicians to predict the thrombosis disease. Fig. 8 shows the block diagram of the mining methodology.

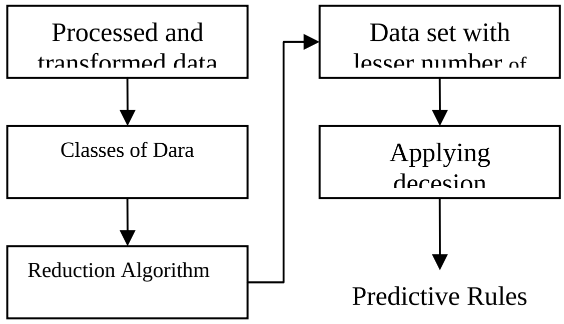


Fig.8: Rough set mining methodology.

B. Genetic Algorithms

Classification is an important DM task that has wide of medical diagnosis [15]. Many classifications models have been proposed in the literature such as distributed algorithms, restricted search, data reduction algorithms, parallel algorithms, neural networks and decision trees, genetic algorithms. These approaches either cause loss of accuracy or cannot effectively uncover the data structure. Genetic Algorithms (GA) provide an approach to learning that based loosely on simulated evolution. The GA methodology hinges on a population of potential solutions, and as such exploits the mechanisms of natural selection well known in evolution. Rather than searching from general to specific hypothesis or from simple to complex GA generates successive hypotheses by repeatedly mutating and recombining parts of the best currently known hypotheses. The GA algorithm operates by iteratively updating a poll of hypotheses (population). One each iteration, old members of the population are evaluated according a fitness function. A new generation is then generated by probabilistically selecting the fittest individuals form the current population. Some of these selected individuals are carried forward into the next generation population others are used as the bases for creating new offsprings individuals by applying genetic operations such as crossover and mutation.

In our research group we developed a hybrid classifier that integrates the strengths of genetic algorithms and decision trees. Fig. 9 shows the classifier methodology. The algorithm was applied on a medical database of 20 MB size for predicting thrombosis disease [17]. The results show that in our classifier is a very promising tool for thrombosis disease prediction in terms of predictive accuracy.

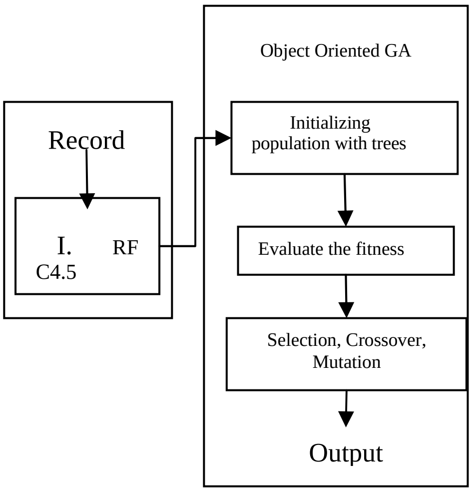
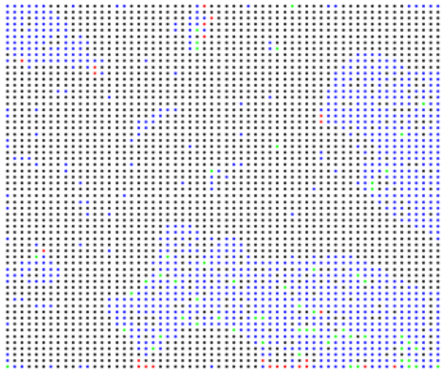


Fig.9: GA-based classifier methodology for predicting thrombosis disease.

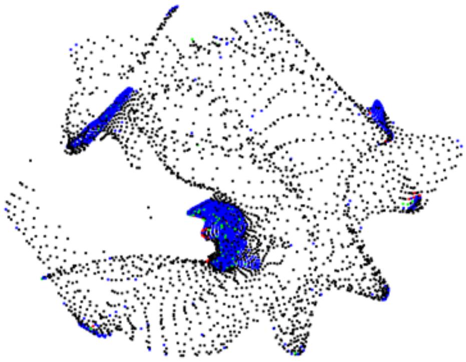
C. *Visualization*

One of the techniques used in data mining is visualization, which may be used at the beginning of the data mining step to obtain a rough feeling of the clusters and structures in the data. The visualization process consists of two main phases; vector quantization and vector projection. Vector quantization tries to find a smaller but still representative set for the original data set. Vector projection deals with the problem of finding a representation of the data in a human-perceptible dimension, i.e. 2- or 3-dimenional display for the data. So the visualization can be obtained by applying one of the vector quantization algorithms and then a vector projection algorithm [18]. Self-Organizing Map (SOM) is a neural network algorithm based on unsupervised learning. SOM is usually used for data visualization because it performs both the vector quantization and projection together. The projection implemented by the SOM is done on a regular 2- or 3-dimensional grid. Many techniques have been developed to visualize the shape of the data on the map grid.

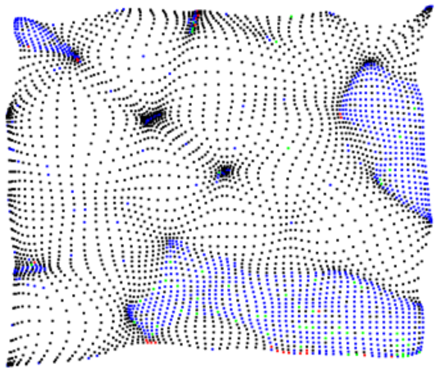
In our research group, two new techniques for the enhancement of the visualization of the SOM have been developed. The first technique is referred to as Segmented Distance Matrix (SDM) depends on the enhancement of the distance matrix visualization by performing a segmentation process on it to reduce the number of gray levels used for visualization. This causes a clear cluster assignment for the SOM vectors. The SDM was tested on artificial and real world data sets and it has been shown that it gives qualitative information about the clusters present in the data and intuitive assignment of clusters within the input data [19].



(a)



(b)



(c)

Fig.10: (a) Original SOM map (b) Using Sammon's mapping for projecting the map (c) FP-SOM visualization.

The second technique is referred to as Free Projection Self-Organizing Map (FP-SOM). It is an extension to the standard SOM algorithm in order to enhance the projection implemented by the SOM so that the clusters and possibly the structures present in the data could be visualized efficiently

and without need to run other computationally expensive algorithms such as Sammon's projection algorithm. FP-SOM algorithm has been tested on artificial and real world data sets of varying sizes and complexity. It has been shown that the projection error of the standard SOM can be reduced by values that range between 10% and 36% depending on the size and complexity of the data set and the time complexity of the standard SOM is not affected by the modifications of the FP-SOM. Both techniques do not affect the basic training process or the parameters of the standard SOM, because they work as extensions to the basic SOM algorithm. They can be used together as a powerful tool for high dimensional and large data visualization. Fig. 10 shows an example of the FP-SOM visualizations for a thyroid disease data set [20].

XI. CONCLUSION

This paper describes some of AI-based technologies which are used in developing medical tutoring/learning at Ain Shams University, Cairo, Egypt. The usage of expert systems, neural networks and data mining technologies in developing some of medical prototype systems are explained. Expert system technology is used for diagnosis of cancer and heart diseases. Neural networks technology is used for brain tumor diagnosis and for visualization of thyroid disease data. A rough set and genetic algorithms based medical systems for mining patient data for predictive rules to determine thrombosis disease are also presented.

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Computer-based Training (CBT) for Dependable Simulation of Digital Circuits Fault Detection Using Digital Signature

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Abstract: **This paper adopts the concept of computer-based training (CBT) and digital signature in training labs for fault detection of digital circuits. An algorithm is used for fault detection and back tracing for fault location using signature node-pattern in the digital circuits under test (CUT). . A vector of bits is developed as a third party for test-signature measurements. A message is popped up to highlight the fault and the location of the defected nodes. Bit pattern at inputs as well as that at output of the unit under test (UUT) are stored as templates (reference vectors) for later matching measurements. A comparator is assigned for the mission of matching between the group of the test nodes and the reference vector. The proposed algorithm intended to substitute the static nature and narrow area in real-time measurement in digital circuits and provides the property of dependability. In the proposed algorithm, if output is OK then there is no faulty nodes, otherwise backward nodes are traced and matching measurement is carried out to detect the reason for malfunction of the UUT . A Cookie is used in case of visited web pages to keep the student's-action history and his score . A well known general testing of digital circuit using signature matching (SM) is a technique that can be used to detect an error in data stream caused by hardware faults. A brief description of the adopted mechanism of SM to be used applying CBT is described. The paper considers the basic paradigms in this field in real time as well as workbench package to design a digital circuit. Fault detection and CBT technology emphasizes the cost effectiveness of E-learning in various learning systems environments. Digital circuits are simulated and broadcasted (downloaded for all students in a twenty-student digital lab.). Four groups design different faulty virtual circuits in different nodes. Tracing and testing are successfully performed with reasonable results. It is important to point at the significant capability of open sourcing that enables the trainees to modify the algorithm according to the digital circuit requirements (number of UUT and consequently the number of nodes). It is only needed to modify the dimension of the matrix of reference signature of the pointed UUT. The proposed algorithm simply, finds out the defected node directly from XOR output. Four different digital circuits are put under test to verify the algorithm. The pseudo code describing the proposed algorithm is illustrated.**

The proposed merging between the simulation of digital circuit fault detection and the concept of CBT is promising for virtual digital circuit labs. The underling objective is to reduce the number of the electronic laboratories. Great population will get benefits with reasonable effort and expenses by applying this idea. Now, trainees will have the chance to acquire more experiences by downloading the CBT-based algorithm supporting the mentioned technique. The fault detection algorithm provides simplicity, minimum execution test time, accuracy and universal testing. All these aspects signify the value of the E-learning methodologies with the proposed algorithm.

I. INTRODUCTION

The tendency to create a Virtual Learning Environment (VLE) which is sometimes combined with Management Information System (MIS), is strongly increased. This combination is related to Managed Learning Environment (MLE) in which all aspects of a course are handled through a consistent user interface standard throughout institution [3]. A growing number of physical as well as online-only colleges have begun to offer a select set of academic degree and certificate programs and virtual laboratories via the internet at a wide range of levels and in a wide range of disciplines. Some programs require students to attend some campus classes or orientations (that is what the proposed system tries to overcome). Several universities offer online student support services, such as online advising and registration, online textbook purchase, and others. E-learning is generally refers to cost-effective online training that what encourage to present the proposed algorithm in this paper. CBT which has been adopted in this paper, uses computers as the key components of the CBT educational environment. CBT services are where a trainee learns by executing special training programs (as it is proposed in the paper), on a computer relating to their occupation. Digital signature is an electronic signature that can be used to authenticate the identity of an authorized person, of a document,

and possibly to ensure that the original content of the message or document that has been sent is unchanged [4]. This term is customized to be used in the proposed algorithm for ensuring the identity of the UUT to be certified using the reference patterns stored for all the OK-data for the traceable points in the digital circuits. It is necessary to find a testing method that is simpler and less storage-intensive than conventional bit-by-bit comparison between measured and reference values [2]. The algorithm helps as a previous work in developing the proposed algorithm. Data compression (in the previous work) is the core of SM (long data stream is reduced to four hexadecimal-digit signature [5][6]. Simulation puts the mentioned system virtually for fault tracing and detection. Digital signature is browsed from the security field to represent the authentication pattern for reference-test matching measurement of t data stream under test.

The objective of applying the algorithm for the automatic fault diagnosis of digital circuits is to substitute the real-time fault detection with this algorithm to provide the advantage of software dependability. There are many principal dimensions to emphasis the training power of CBT in the mentioned field. The proposed algorithm is capable to perform the required main activities needed to test the UUT in the digital circuit. The helping (in previous work) algorithm illustrates the following activities [2]:

1. Exercising circuit's nodes, which needs gate control circuit generator (start-stop) linear feedback shift register (LFSR) to produce testing pattern.
2. Characterization of the unit under test (UUT), in which a set of nodes (test points) is defined as a pin or group of pins that generate the measure signature due to an electrically common or interconnected circuit relationship. Database files are used to record the selected nodes of the circuit. Each node is characterized by two sets of data; characterization data-set, and the dependency data set.

The characterization data set includes: node name, node signature, key nodes, and the status node. It is worthy to explore the selection mechanism of the key nodes as well as the status nodes. Key nodes are selected nodes specifying the summation of large amount of up-stream logic activity. In addition, VCC, GND, input , and final output nodes are considered as key nodes. Generally, these nodes represent good starting points to decide if UUT is faulty or not. Status node shows (True/Fault) relation between the measured signature of the UUT node and the reference signature from the corresponding node of the of the unit under the same measurement conditions. The dependency data set is a set of input nodes called "Dependency Nodes" on which the value of a specified output node depends. This set of nodes can be directly connected to the specified node which is considered as the "One Level Dependency", or indirectly connected then is considered as "Multilevel Dependency".

The algorithm is divided into two main parts: interface, and database as in Figure-1.
The individual blocks of the block diagram are briefly explained:

1. Node database file, this file is responsible for creating table to hold the data which are created automatically after the user draw the layout of the UUT.
2. Depend database file, it is responsible for representing the set of dependency nodes which belongs to each node in the UUT.
3. Output error database file, this file is created from the database files (node file) and the depend file, after application the new fault detection algorithm and the fault location to collect all nodes having the status fault.

The Pseudo-code-based algorithm for fault detection is summarized as follows:

```
Start
Initialization:
Set all status of all nodes
Select the tested nodes
Read reference and measured signatures
   IF reference signature = measured signature
   THEN SET status of the node =TRUE & UPDATE True-node file
   Else SET status of the node = FALSE & UPDATE false file
GOTO next node
    IF End of nodes
    THEN next node & UPDATE true and false file
END
```

This Aided algorithm is responsible for creating output error file through performing the necessary processes and interactions on the data existing in the two input files (node file, and depend file). Flowchart in figure-1explores the basic idea of the helping algorithm.

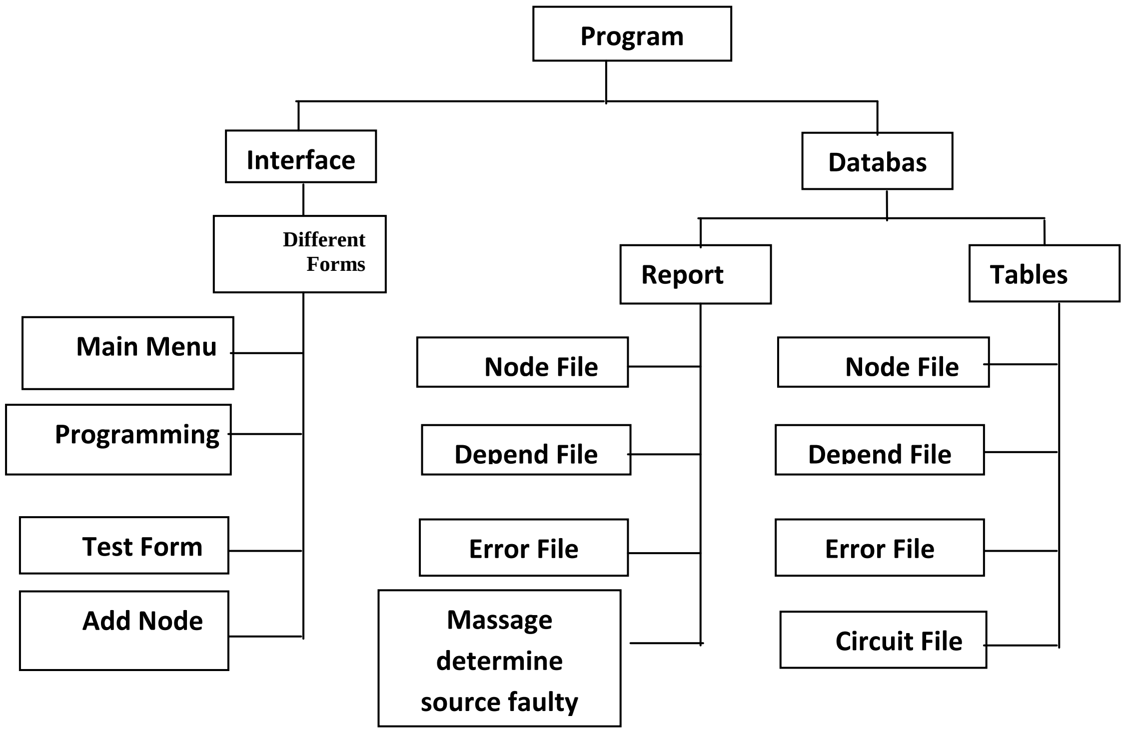

Fig. (1) Tree diagram of the software for the Automatic Diagnosis of real system

It is intended to develop the mentioned concept for virtual fault detection in digital circuits in the proposed algorithm that will be illustrated.

Coding can be developed depending on the intended model. The order of the algorithm can also can be analyzed for optimized source code to increase the efficiency of the fault diagnosing system. The customized model/software of the fault detection systems can be broadcasted through CBT technologies. Multimedia packages play an important role in simulating the moving of bits as inputs and outputs through the tested nodes and on the leads of the gates. The standardization of the symbols of the flowcharts as well as the syntax of the control structures used to develop the pseudo-codes, help very well in broadcasting CBT-based applications like the proposed system. The proposed algorithm emphasizes the simulation-based modeling. Outsourcing, as a developing concept, is considered for free digital circuit fault detection. Broadcasting also give chance for sharing the proposed algorithm in the digital labs. Cost effectiveness is underlined in applying all the proposed paradigms mentioned in the proposed algorithm.

The paper is organized as follows: Section-1 introduces the previous work and core of the paper. In section-2, E-learning is mentioned as an overview. The proposed adopted application for CBT is presented in section-3. The basic idea of trouble shooting in digital circuits is explored in section-4. Section-5 explain the algorithm and the driven results. Finally conclusion and future work are presented.

II. E-LEARNING OVERVIEW

Before the internet reached every life, classification of technology-based learning aids was simple: one could either divide the systems on the time scale, or on a place scale. The time scale show a division between synchronous (lectures, TV/radio broadcast, telephone communication…) and asynchronous (video bands, audio discs, computer-based training; CBT,…). The place scale is divided between tele-media (distance learning) and local media (e.g.; CBT). The internet is the one medium to bridge synchronous and asynchronous media, to be used at a distance, or saved for later local reference, to allow one-to-one or one-to many communication. [1].

E-learning is often associated with WBT (Web-Based Training). Reducing E-learning to WBT would leave out large number of useful internet services especially in the communication and broadcasting field. E-learning systems can be divided into different stages. First is the classical distance learning in which scripts, lectures, notes, are offered for download on the web-site or sent by e-mail. Second stage is the power point/video casts, in which a slide show (or even video) of the lecture is put on the web. In the third (hypertext systems), stage the hypertext and multimedia capabilities of the medium are put to use. Multimedia hypertext system is augmented in the fourth stage, by

interaction (self-test, group discussions,..) which needs integration and requires more knowledge of the WWW environment. In the last stage, (adaptive systems), the system adapts to the student's knowledge, interests, and progress and will involve the student in the generation of new content.

Classical arguments in favor of e-learning/web-based learning/computer aided instruction include: time independency (asynchronous learning), up-to-date material, possibility to evolve, collaboration, interactive, adaptive, and easier access to handicaps students. [1] . Development in the internet and multimedia technologies are the basic enabler of e-learning, with content technologies and services being identified as the three key sectors of the e-learning industries [7]. Technology of E-learning that can be, used in e-learning may be illustrated as: screen-cast, electronic performance support system, PDA's, MP3 players with multimedia capabilities, webbased teaching materials, multimedia CD-ROMs, discussion boards, collaborative software, e-mail, computer aided assessment, educational simulation, educational animation, learning management software, electronic voting systems, and virtual classroom[3]. Most of these technologies can be combined together according to the educational requirements.

Learning technology as well as educational technology are used interchangeably to refer to the use of technology in learning. This term in E-learning is much broader than the terms: computer based training (CBT), computer-aided instruction (CAI), on-line learning, or on-lime education. In case where mobile technologies are used, the term M-learning has become more common. E-learning is suited to distance learning and flexible learning as well as " Blended learning" in case when it is used in conjunction with face-to-face teaching.

III. COMPUTER-BASED TRAINING (CBT)

Computer-based Learning (CBL), refers to the use of computers as a key component of the educational environment. The term more broadly refers to a structured environment in which computers are used for teaching purposes. CBT is especially effective for training using the applications because its program can be integrated with the applications so that trainees can practice using the applications as they learn. CBT has been grown due to the increase in PC computing power, human resources professionalism in this field, developing CBT programs, prevalence of hardware resources needed to run it, and availability of computers equipped with CD-ROMs. Web technologies shares very much in CBT growth emphasizing the Web-based training (WBT) which includes interactive methods, such as bulletin boards, chat rooms, videoconferencing, and discussion threads [10]. CBT is adopted to provide facilities sharing in this paper.

IV. TROUBLE SHOOTING IN DIGITAL SYSTEMS

In a combinational logic circuits, the output of one gate may be connected to two or more gate inputs . The interconnecting paths share a common node. The driving gates and the load gates are connected to one node. Some failures are possible but are difficult to isolate to a single bad gate. Common types of failures are as mentioned below [9].

1. *Open output in driving gate :* this failure will cause a loss of signal to all lead gates.
2. *Open input in a load gate:* this failure will not affect the operation of any of the other gates connected to the node, but it will loss of signal output from the faulty gate.
3. *Shorted output in driving gate:* this failure can cause the node to be stuck in the LOW state (short ground) or in the HIGH state (short to Vcc).
4. *Shorted input in a load gate:* this failure can also cause the node to be stuck in the LOW state (short to ground) or in the HIGH state (short to Vcc).

Signal tracing is the more general trouble shooting technique, which is accomplished using oscilloscope or a logic analyzer applied on the logic circuit in real time.

The suggested simulation procedure consider each gate, then it begins at the input and working towards the output of the logic circuit with comparing operation (knowing the truth table and the logic operation of the gate under test). If the output is correct, then go to the next gate. If the output is incorrect, then the gate under test is faulty and tracing back is performed. Figure-2 indicates an example for a combinational circuit under test and logical tracing. The real time fault detection is substituted by the simulated model using the mentioned procedure. Another tracing is accomplished as follows: the output is compared (using simulated comparator) according to the documented signature measured bit by bit. If it is matched, then OK-status is recorded with notification message, otherwise Fault-status is recorded and back tracing starts. A simulated XOR is applied to check the input stream of each gate in the path, if it is OK then the bit at the gate output is checked by performing the parity checking to allocate the fault position. (gate-number). Back tracing continues for the load gates till the driving gate/gates. The underlined algorithm simulates the realtime CBT-based trouble shooting time. The open source capability is added to get chance for free design of pre-determined logic circuits on-line in lab (the nodes signature is known).

V. PROPOSED ALGORITHM & RESULTS

The proposed algorithm get shares some of the already exist ready-made software like workbench package to help in drawing the digital circuits needed for activation and exploring the suggested procedure. Input variables are determined for the driving gate for the circuit under test. Truth tables are deduced for driving gates as well as the load gates. Input nodes, for the driving gates and all nodes of the load gates are assigned to a vector for later matching measurement. The faulty node is detected directly as a result of bit-to-bit matching test. The consequence back tracing is carried out by performing the matching measurement for each node. The defected node will be announced due to mismatching between test bit and the reference vector with its location. A determined circuit is downloaded for all students in lab. One bit in the output is required to be changed, and the procedure of the algorithm is performed. On the other hand, one bit in the driving gate input is diverse and the output in the load gates is observed for later back tracing. Last, arbitrary errors are intended by trainees and the results are recorded and documented for each one for assessment and evaluation. One sample (from many) is illustrated for this purpose to validate the functionality of the algorithm The idea of open sourcing is tested through the modification of the algorithm according to the recommended circuits by a trainee. It is noted that in case of testing more than one digital circuit, a matrix of size MxN is constructed to represent the number of circuits and the number of the associated tested nodes respectively. This will greatly, help in providing the concept of mass production in fault detection. Figure-2 illustrates a digital circuit with driving and load gates associated by the nodes under test. The nodes are undertaken a mapping with the reference signature vector applying the comparator (XOR) gate. The mentioned nodes represent the vector entries as reference signature standard . A matrix (MXN) is driven if we consider M-circuits with N- nodes .

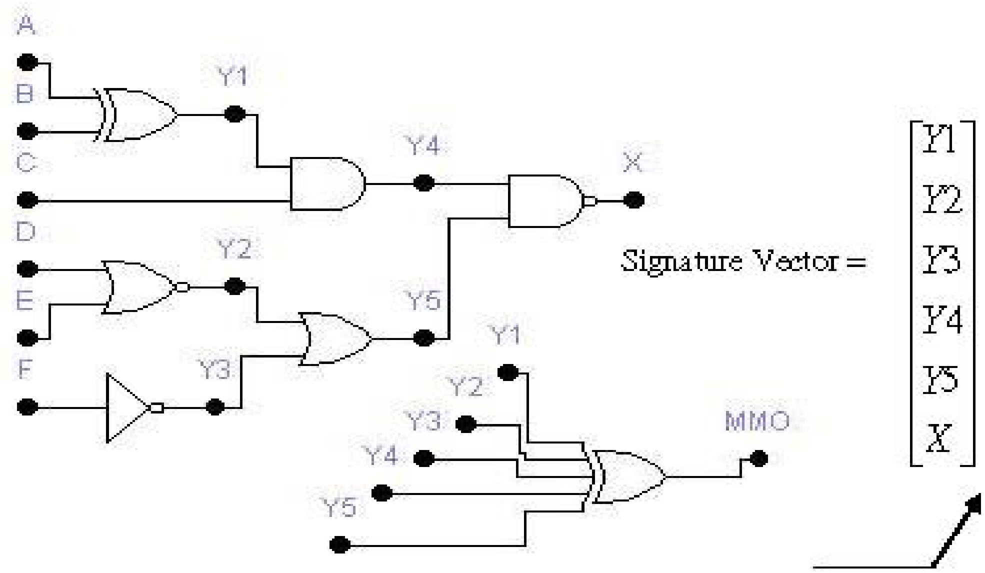

Fig.(2) Algorithm implementation of the digital circuit under test

Pseudo-code is one of the most expressible format to explore the algorithm logic for later coding. The following statements are the formal representation of the proposed algorithm.

1. Enter the number of circuits (row)
2. Create the number of blocks (gates) per circuit (Column)
3. Let Y [1][1] = [A.B] ; Y [1][2] = [Y [1][1]. C] ;
   Y [1][3] = [D.E] ; Y [1][4] = [Y [1][3]. F] ;
   Y [1][5] = [Y[1][2] .Y [1][4]]
4. Create a copy from the Matrix.
5. Change any array entry randomly at the array copy.
6. Compare The original array and the change copy.
7. Extract the random change (Column) and rows numbers (node location).
8. Print the error message (location of the faulty gate).
9. IF random change bit ! = original bit in the reference matrix, else no error exists.

10. Check back if error point with Y [rows] [columns] relation to discovers where the exact location of error.

IF random change bit !=X [1] [5]
Then gate X [1][5] is defected;
Else IF random change bit != y [1][2]
Then gate y [1] [2] is defected
Else IF random change bit != y [1][1]
Then y [1] [1] is defected
Else IF random change bit != y [1][4]
Then gate y [1][4] is defected
Else IF random change bit != y [1][3]
Then gate y [1][3] is defected
End Else
End IF

The illustrated proposed algorithm is applied for all layers of nodes in the circuit under test and can be modified for testing another type of digital circuits.

CONCLUSIONS

The above discussion has indicated that the fault detection for the digital circuits in real time needs somewhat complex configurations. Number of labs is directly proportional with student population. One can conclude that the suggested simulation is cost effective, simple to be used, has the capability of broadcasting and provides the privilege of open software for more training, great number of trainees in labs, and ability of maintenance via internet applying CBT concepts and technologies. Users pre-requisite for the recommended algorithm is introduction to digital systems that gives the chances to more trainees to attend the recommended system which has been illustrated in this paper.

The static nature of the real-time fault detection in digital circuits has been overcome. The proposed algorithm provides wider training area, less cost, and ability for modification and coding by a suitable and simple programming languages for more digital circuits. The underlined advantage is to access the algorithm via internet with a package like workbench which may be encapsulated for easy use.

It is claimed that the proposed algorithm is promised for many application alike. The algorithm complexity has the order of about to be N2 (loop for the matrix MxN). The mentioned complexity is reasonable and provides clear evolution. The proposed algorithm acquires one of the most essential features over the traditional real-time procedures, that is the "Dependability" that equates to its trustworthiness. The algorithm provides the emergent properties of a software. These properties can be summarized in availability, reliability, safety, security, maintainability, survivability, and the "error tolerance".

FUTURE WORK

Building a simulation algorithms for fault detection and location for the embedded digital circuits and conduct the performance analysis of the proposed Algorithm Machine maintenance.

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Smart Recommender System for E-Learning Personalization Based on Information Retrieval

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Abstract: **With the rapid growth of Internet technologies and web based environments, e-learning has become a major trend in the education area. Unfortunately, most of the known e-learning systems are still delivering the same educational resources, activities and services in the same way to learners with different profiles. Previously, we have presented the general principles of a proposed approach for e-learning personalization based on hybrid recommendations. In this paper, we will focus on the use of Content based filtering approach to build a recommender system for e-learning environments. This system must be able to generate, for an active learner, a set of automated recommended links using his/her recent navigation history and content similarities. First, we start by crawling and indexing learning resources to build content-based profiles. Next, we transform a new active user session into a query which, when submitted to the recommender engine, will return the recommended links. A prototype of this recommender system was developed based on "Nutch": an open source search engine, and integrated within RPL platform: the course repository of the Virtual University of Tunis.**

Keywords-component; E-learning, Personalization, Content based filtering, Recommendation.

I. INTRODUCTION

The use of e-learning platforms in education has been recently spreading out widely in schools and universities. Most of these e-learning environments are involving a large set of tools and functionalities used to support distance learning. However, similar resources are often given to learners in the same way within these e-learning systems, and generally, there is no way to a student to discover other resources based on his interests and needs. To remedy such shortcomings, several works have dealt with adaptive e-learning systems and adaptive educational hypermedia. These systems are generally based on using one or more types of knowledge (learners' knowledge, learning material knowledge, learning process knowledge, etc) to perform personalization. Most of these systems have relied on explicit information given by a learner (demographic, questionnaire, etc) and have applied known methods and techniques of adapting the presentation and navigation [5]. However, *automatic* personalisation and recommendation methods have not received sufficient attention in e-learning, even though they are well known and used in other fields. In fact, Web recommender systems have been used with success in e-commerce, information filtering, information retrieval, etc.

Previously, we have presented the general principles of a proposed approach for e-learning personalization based on hybrid recommendations [9]. In this paper, we will focus on the use of Content based filtering approach in order to build a smart recommender system that, when included in e-learning environments, will predict learner needs and recommend relevant learning objects.

The following section presents an overview of Web personalization including personalization in e-learning. Section 3 discusses Web recommender systems and recommendation techniques. Section 4 describes the proposed approach and corresponding phases of profiling and recommendation. Section 5 presents some concluding remarks and future work.

II. BACKGROUND ON WEB AND E-LEARNING PERSONALIZATION

In the last few years, the concept of web personalization has become an important field of research in many application areas that are based on hypermedia and the Web such as in e-commerce, information retrieval, web search system, e-learning, etc. The main goal of web personalisation is to deliver, to a given user, information tailored to his preferences and interests. Independently of the area of application, systems based on web or hypermedia are called hypermedia systems, dealing with adpativity, we speak about adaptive hypermedia systems. In adaptive hypermedia, adaptation concerns mainly content of pages and links from pages. Therefore, as explained in [2], two different classes of adaptation can be considered : adaptive presentation and adaptive navigation support. In [4], the taxonomy of adaptive hypermedia technologies was updated to add some extensions in relation with new technologies. Then, the distinction between two modes of adaptive navigation support becomes a necessity especially with the growth of recommender systems. In fact, adapting links already prepared and presented on a page is quite different from generating new ones. The link generation form includes mainly three types : discovery of new useful links between documents and then adding them permanently to the set of existing links, link generation for similarity based

navigation between items and dynamic recommendation of relevant links.

On the other hand, the ability of a personalization system to adapt content and recommend items induces that it can deduce user's needs and interests based on previous or current interactions of that user (and may be other users too) with a system. In fact, automatic personalization implies that the user profiles are created and eventually maintained dynamically by the system without explicit user information (or at least a minimum). Examples of automatic personalization include amazon.com's personalized recommendation, music recommender like Mystrand.com in commercial systems [13] and smart recommender in e-learning system [21], etc. In general, such systems differ in the input data, user profiling strategies and in prediction techniques. Several approaches for automatic personalization was reported in literature such as content based or item based filtering, collaborative filtering, rule based filtering, techniques of web mining, etc [14].

In [4], educational hypermedia is considered as the most popular area for adaptive hypermedia research. Many web based educational system have used adaptive hypermedia technologies by applying different forms of user models to adapt the content and the links of pages to the user needs and preferences [3]. For example, [1] applied adaptive hiding and adaptive annotation techniques while others used adaptive hiding and adaptive sorting techniques. PT [7] and AHA [6] applied full fledged adaptive presentation. An adaptive e-learning system is described in [19] as follows : "An adaptive e-learning system is an interactive system that personalizes and adapts e-learning content, pedagogical models and interactions between participants in the environment to meet the individual needs and preferences of users if and when they arise." In [15], a learning environment is considered adaptive if it performs the following tasks : monitoring users activities, interpreting them using specific models and using knowledge available on users to deliver content tailored to their needs. It should be noted here that personalization in e-learning systems concerns, generally, *adaptive interaction*, *adaptive course delivery*, *content discovery and assembly*, and *adaptive collaboration support*. The category of *adaptive course delivery* represents the most common and widely used collection of adaptation techniques applied in e-learning systems today. Typical examples include dynamic course re-structuring and adaptive selection of learning objects, as well as adaptive navigation support, which have all benefited from the rise of using recommendation strategies to generate new and relevant links and items. In fact, one of the new forms of personalization in e-learning environment is to give recommendations to learners in order to support and help them through the e-learning process.

III. Web Recommender systems

Web recommender systems are used to locate relevant items in which the user is interested. Generally, it is more efficient and user-friendly to provide users with what they need *automatically* and without asking them explicitly for it. Web recommender systems are used frequently in e-commerce and information access in order to assist the user in locating relevant products, items or services such as on Amazon[1] and CDNow[2]. A number of knowledge discovery and statistical techniques are generally used in advanced recommendation systems. The latter can be divided, depending on the techniques used, into content-based filtering, collaborative filtering, and hybrids, which are summarized below. Other approaches such as demographic or knowledge based, also exist (but tend to require extensive private user information or manual construction of knowledge).

Content based filtering: Content-based filtering (or item-based filtering) systems recommend items to a given user based on the correlation between the content of these items and the preferences of the user [11]. This means that the recommended items are considered to be similar to those seen and liked by the same user in the past. Thus, there is no notion of a *community* of users, rather only *one* user profile is considered while making recommendations. In most content based filtering systems, the content descriptions are extracted from web pages using document modelling techniques known in Information Retrieval IR and Information Filtering IF research. Furthermore, both user profiles and items are represented as weighted term vectors. Indeed, the process of building profile for a user in these systems requires two stages. First, the user's interest level in a subset of items must be determined. This task may be accomplished implicitly or explicitly. Second, each item is transformed into a list of terms with an assigned weight, represented by a vector (such in TF.IDF methods). Then, the profile is used to recommend other similar items to the user [13]. Classical examples of systems applying content based filtering approach include among other Personal webwatcher [12], syskill and webert [16], etc.

Collaborative based filtering: Collaborative filtering system recommends items that are liked by other users with similar interests. So, the exploration of new items, in this approach, is assured by the fact that *other similar* user profiles are also considered. Thus, the history of *community* of users is combined. Examples of such systems include GroupLens [10] and [17].

Hybrids: Hybrid recommender systems combine *several* recommendation strategies to provide better performance than either strategy alone. Most hybrids work by combining several input data sources or several recommendation strategies. There are many hybridization methods reported in the state of the art. Generally, content/collaborative hybrids are the most popular hybrid strategies.

IV. Proposed framework for building automatic recommendations in e-learning systems

We aim to build a recommender system that, when integrated within an e-learning platform, will mine learning material and determine what to recommend to an active

[1] http://www.amazon.com/

[2] http://www.cdnow.com/

learner[3]. The latter task can be considered as the online task of e-learning personalization, consisting in computing a recommendation set of URLs that the active learner may visit, based on content similarities. The recommendation is based on content based filtering approach which is used frequently when dealing with text based pages or HTML pages. We consider that learner preferences and interests on content are expressed by visiting this content. So, the recommended pages must have a similar content with the pages (items) visited recently by the active learner. To compute similarity between visited pages and all other content (course repository), each item or page must be represented as a term vector.

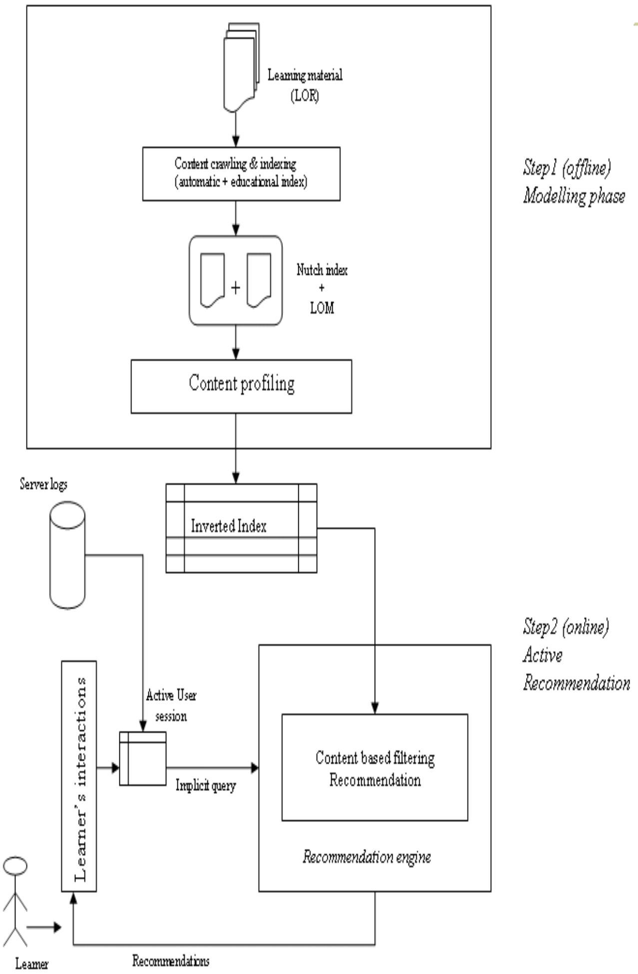

Figure 1. Proposed personalization approach

The proposed approach to build a recommender system is based on the following steps :

- ***Preliminary crawling and indexing of learning resources (done offline):*** this step consists of crawling the entire learning resources available in a course repository and forming an *inverted* index mapping each keyword to a set of pages in which it is contained;
- ***Query formation :*** mapping a new user session into a set of terms to use as an *implicit query* to submit to the recommender engine ;
- ***Submitting the obtained query to the recommender engine*** in order to retrieve related URLs from the inverted index.

Like most Web recommender systems, our proposed system is composed by two modules: an off-line module which pre-processes data to build query and content profiles, and an on-line module which make recommendations. The proposed approach, with main features shown in “Fig. 1”, is essentially based on three steps : *Content profiling, Query formation and* Generation of r*ecommended links*.

A. Content profiling

It involves generally applying indexing and text mining (Web content mining) techniques. Of particular interest to the proposed approach is the use of the Nutch open source search engine in the content modelling phase, followed by content based filtering as a recommendation strategy, using also Nutch as a recommender Module. In the content modelling phase, we will (1) automate the indexing of the learning material using crawling and indexing techniques as done in the Nutch search engine, and (2) automate the indexing of educational content based on norms and standards used in e-learning.

In fact, Nutch[4] is an open source *Web search software* built on Lucene Java (high-performance full-featured text search engine library written entirely in Java). Nutch aims to increase the transparency of the web search process and adds all needed functionalities of a search engine such as a *crawler*, a *link-graph database*, *parsers for HTML* and *other document formats*.

In fact, Nutch core is mainly based on four major components: Searcher, Indexer, Database and Fetcher. The Fetcher requests web pages, parses them and extracts links from them. The Database stores pages and links in order to be indexed later. For each web page that is indexed, only the *URL* and *title* are stored, while the *anchor* and the *content* are only indexed. The indexer creates the inverted index from which the searcher extracts results. Finally, given a query, the searcher has to find quickly a set of relevant documents and present them with an appropriate rank [8].

To experiment Nutch crawling process, we built an URL file containing 73469 URLs representing all learning objects available in RPL repository. The Nutch crawler (using the following command line : nutch crawl urls -dir crawldir -depth 6) use this file to create (accomplishing fetching, parsing and indexing phases) the inverted index which will be used to represent the model of educational content. In fact, the reverse index maps each keyword to a set of pages in which it is contained “Fig. 2.a”.

In order to adapt this content modeling method to the pedagogical area, we have to enrich the inverted index, that is automatically obtained via Nutch crawling and indexing mechanisms, by adding an educational index used in LOM (Learning Objects Metadata Standard). In fact, workgroups of

[3] A demo is available on RPL platform : http://cours.uvt.rnu.tn/

[4] http://lucene.apache.org/nutch/

IEEE which is including the participation of many consortiums as ARIADNE[5] and IMS[6] are using a set of descriptors known as LOM *(Learning Object Metadata)* and used to index learning content. Such educational metadata is providing descriptions and additional information (author, title, technical requirements, classification schemes, educational intent, rights management, etc) about learning resources (multimedia contents, electronic books, web site files, etc.). This information can be used not only for characterizing the resources but also for searching, cataloguing and improvement. This method of indexing has the advantage to give to learning objects more cense, semantic and pedagogical values in order to be accurately referred and found. But, despite of the librarian and author efforts to index learning objects, many of these entities stay without any added indexing information because of the difficulty of this task. So, adding indexing used in LOM for learning content (if available) to the preliminary crawling and indexing phase done by Nutch should improve accuracy of a final index and therefore searching and recommending mechanism. For that reason, other attributes should be added to the Nutch inverted index. These specific attributes are given by the educational metadata providing descriptions and additional information (author, title, technical requirements, rights management, etc) about learning resources. This information is added automatically to the inverted index thanks to imsmanifest files available in SCORM Learning Objects- and Nutch capability to crawl and parse xml files "Fig. 2.b".

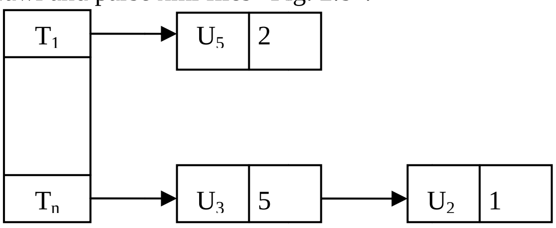

Figure 2. (a) Inverted index structure

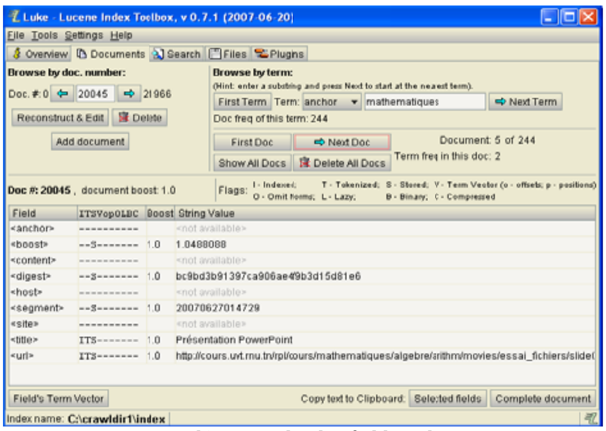

Figure 2. (b) Inverted index fields and terms

B. Formulating a learner's implicit query

It consists in transforming a new user session "Fig. 3" into a query that will be submitted to the search engine. This task is done on two phases : (1) delimiting the current active learner session and (2) representing this session as a term vector. The active user session, which is composed by the last access pages representing a short-term history for the current user, will be extracted from Web log files. In fact, in Web based systems, it is possible to get continuous feedback detailing a learner's access and usage information since every request received by the Web server is automatically saved in a specific file called the log file. In our experiments, we use Web usage logs collected from access server log files of RPL platform hosted on the Virtual University (*UVT*) servers.

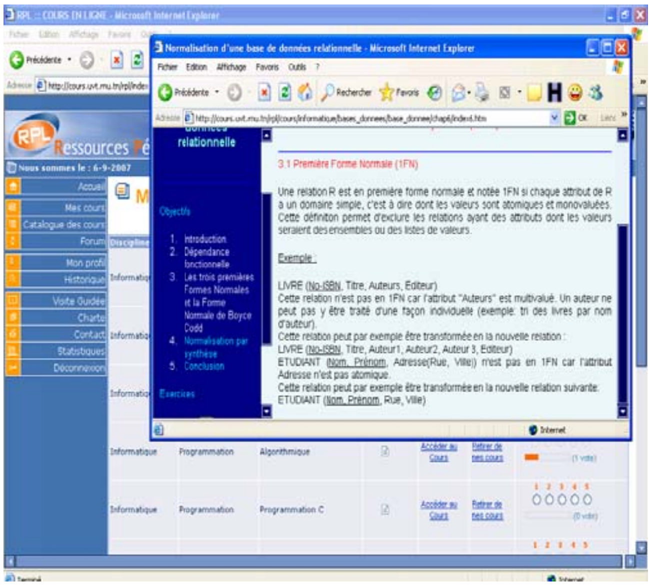

Figure 3. The active learner is browsing material (active user session)

Therefore, when a learner asks for a recommendation, we extract from the log file only the lines that represent current learner session. This could be done by taking into account the timestamp when a learner connected to the system and the timestamp of a recommendation demand "Fig. 4". So, the system will extract visited URLs from the Web log file from the time that the learner connected to the platform until he/she asks for recommendations. This log data must first be pre-processed, using tasks that include : data cleaning and session identification, which represent the main tasks of a Web usage mining process.

It should be noted that the obtained session is considered as a set of URLs recently visited by the learner. To express with more details learner preferences and interests, we can associate to each URL, composing learner sessions, a weight. These weights can be binary, representing the existence or non-existence of an URL reference in the session; or they can be computed as a function of a number of features based essentially on the frequency of occurrence of URL within a session and the time a learner spends on a particular page as a manner to determine indirectly the fact that a learner liked or

[5] http://www.ariadne-eu.org/
[6] http://www.imsproject.org/

disliked the URL [18], [20]. In addition to that, many other features could be added to compute page weight, but, generally, such features are considered as not a good indication of the user interest [10]. However, due to the fact that we don't use explicit rate of learning resources given by learner, we can thus choose to compute each page weight based on occurrence frequency and time spent to express user preferences. In the present work, we didn't consider the URL weight. These last visited pages in the active user session are called a sliding window. For example, let W be a fixed size for a sliding window, then if the active user session with W =3 is {A,B,C}, and the URL "D" was viewed last by a user, then the new sliding window becomes {B,C,D}. It should be noted that W can lead to lower or higher recommendation coverage. In our case, we consider a fixed window size W =3,, hence only the last three visited pages will affect the recommendation.

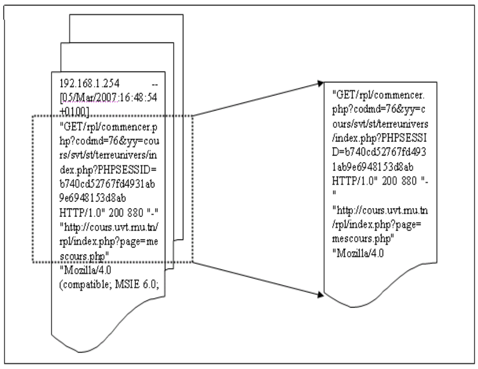

Figure 4. Delimiting the active learner session

Once we have these three last visited pages, each page is mapped to a set of content terms characterizing this page. So, we developed a java code (based on Nutch's built in functionalities for parsing HTML pages, and a plug-in for stop word elimination) that given a page, it returns the top K frequent terms ordered by their frequencies. In our experiment, we considered a fixed number of terms K =3. Obtained terms will represent a query vector "Fig. 5".

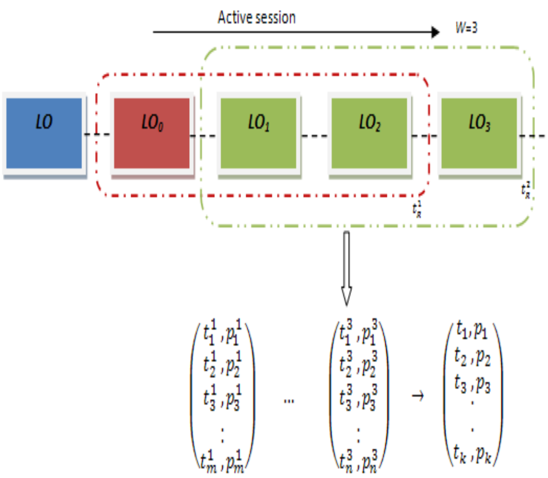

Figure 5. Term Vector Building process

C. *Generation of recommended links:*

The Recommendation phase is done *online*. The input to the recommendation module is deduced from the active user session by transforming a new user session into a *query* composed by relevant terms representing a short-term history for the current user. This query vector is submitted to the Nutch search engine, the query vector terms is compared to the inverted index terms and ranked results are provided. "Fig. 7" shows the recommendations based on Content based Filtering based On Nutch. The bottom window contains a list of set-link (shown as "Ensemble i"), each set-link is used to formulate a query whose top search results, as a set, are accessible by clicking the corresponding set-link. These results are shown in the window above. The top-most window contains the actual *content* of a recommended page.

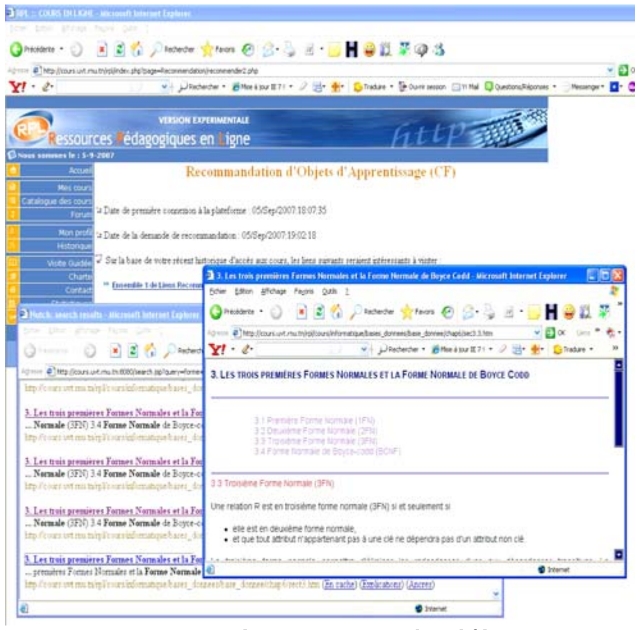

Figure 6. Recommendation using content based filtering

V. CONCLUSIONS AND FUTURE WORK

In this paper, we are interested in automatic personalisation based on recommendation in e-learning. We used Nutch's automated crawling and indexing techniques as well as standardized educational content indexing to build content profiles. We used Web usage mining tasks to extract the sliding window pages transformed into a term vector expressing learner's implicit query (user preferences). Next, these terms are submitted to Nutch search engine to compute recommended links. We are currently performing more experiments evaluations of the proposed recommender system. We are also exploring in detail several techniques and strategies to apply in the modeling and recommendation phase.

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M-Learning Styles and Supporting Technologies

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***Abstract*—This paper focuses on how mobile learning content providers could determine different types of students' learning styles to provide supporting technologies for their m-learning environment. In addition, this study was performed to allow an understanding of some technologies that is required for accessing M-learning materials by individual learners.**

Keywords-mobile learning; m-learning; learning styles; mobile technologies; mobile environments

I. INTRODUCTION

In the mobile revolution age, everyone can feel the effects of mobile devices on his or her life. Nowadays, cell phones and MP3 players are our intimate friends!

Additionally, mobile devices are multi-purpose handhelds, these days. You do not need a separated device for each of these tasks: phoning, taking photos or videos, GPS[1] navigation, playing games, sending E-Mails, or browsing the Internet.

Therefore, we could and we should take the advantages of these smart devices to facilitate and improve our learning experiences. In this paper, we will glance at some famous learning methodologies from mobile learning point of view, then, some supporting technologies will suggested.

II. M-LEARNING STYLES

Each person learns and process information in different ways and in different styles. Therefore, each individual student has his or her own learning style. Based on this idea, instructors should assess the learning styles of their students and choose a specified method for teaching to best fit each student's learning style.

Until now, many researches have been made in the topic of styles of learning and many theorists have been working and developing them. In the mobile learning perspective, the m-learning service providers need a specified learning (and teaching) method to follow. Mobility is an intrinsic property of learning [1]. Therefore, in this section, we are looking at some famous learning styles and providing a relationship between these studies and mobile learning world.

A. The VAK[2] Model

The VAK concept, theories, and methods were first developed by psychologists and teaching specialists such as Fernald, Keller, Orton, Gillingham, Stillman and Montessori, beginning in the 1920's [2]. It was originally concerned with the teaching of dyslexic children and other learners for whom conventional teaching methods were not effective [3; 4].

The VAK learning style model includes three basic types of learning: visual, auditory, and kinesthetic. Everyone has a mixture of these preferences; however, one or more of these sensory receiving styles is normally dominant. This dominant style defines the best way for a person to learn new information by filtering what is to be learned. In addition, the learner may prefer one style of learning for one task, and a combination of others for another task, depends on his or her senses [2; 5]. See Table 1 for definition of VAK modalities.

The VAK models expanded in other theories like VAKT[3] and VARK[4], which incorporate “Tactile” and “Reading” components, respectively:

- Dunn and Dunn VAKT model: Rita Dunn and Kenneth Dunn basically, divide their learning style into 5 major categories called stimuli: a) environmental, b) emotional, c) sociological, d) psychological, and e) physiological elements [6]. Each of these elements has its own influences on the way of individual students learn. For instance, environmental stimuli preferences are sound preference, light preference, temperature preference, and design preference [7]. One of the important elements that affect students' learning preferences is physiological stimuli modality that includes VAK model plus the “Tactile” preference. For more detailed information, refer to Table 1.
- VARK model: The acronym VARK stands for Visual, Aural, Read/write, and Kinesthetic sensory modalities. VARK, technically, is not a learning style. Although, it is an important part of learning style that is for taking in, and putting out information in a learning context [8]. More information about this approach is available in Table 1.

All of the models in VAK family have a same base structure but they may use different words to describe similar elements. Some other related theories are Carl Jung and Myers Briggs Type Indicator (MBTI), Howard Gardner's Multiple Intelligence Model and the Kolb's Learning Style Inventory [5; 9].

[1] GPS = Global Position System
[2] VAK = Visual, Auditory, Kinesthetic or Kinaesthetic
[3] VAKT = Visual, Auditory, Kinesthetic or Kinaesthetic, Tactile
[4] VARK = Visual, Aural/Auditory, Read/write, Kinesthetic or Kinaesthetic

TABLE I. VAK, VAKT, VARK MODALITY PREFERENCES [8; 5; 9]

Modality	Definition	Solutions
Visual	Learning via information that is represented graphically.	Pictures Diagrams Graphs Flow charts Images Idea maps Demonstrations Videos
Auditory/Aural	Learning via information when presented aurally.	Listening Lecture Discussion and talking Recording Reading lessons loudly
Kinesthetic/Kinaesthetic	Learning through doing, interacting, and physical activities.	Whole body movement Real-life experiences/ visiting Total involvement Acting/drama/puppetry Building/designing Interviewing Playing
Tactile	Learning via touching.	Use their hands Underline Take notes Highlighting
Read/write	Learning through reading and writing information that displayed as words.	Reading books Take notes Summarizing

B. Learner-led Learning

Learned-led learning is an e-learning style, also called stand-alone or self-directed e-learning, aims to deliver highly effective learning experiences to independent learners [10; 11]. Self-directed e-learning focuses on the independent learner, one who engages in education at his own pace, free from curricular obligation [12]. Content may consist of Web pages, multimedia presentations, and other interactive learning experiences housed and maintained on a Web server. The content is accessed through a Web browser [10]. More information plus solutions of implementation is available in Table 2.

C. Instructor-led Training

Instructor-led Training (ILT) is another e-learning, refers to learning events that are led by an instructor. ILT courses are most often synchronous events and they are typically held in a physical location such as a classroom. Technology is sometimes employed to broadcast the live event via a network, satellite TV, or collaborative meeting software to learners who are at different locations from that of the instructor. The event may also be recorded and made available to learners in an asynchronous mode [10; 11]. Table 2, provides more detailed information about this method.

III. SUPPORTING TECHNOLOGIES IN MOBILE ENVIRONMENT

The challenge for educators and designers is one of understanding and exploring how best we might use these resources to support learning [13].

In previous sections, some of commonly used learning and e-learning (and training) styles have been described in brief. In this part of the paper, we are going to focus on technological side of the m-learning environments.

TABLE II. E-LEARNING STYLES [10]

Learning style	Definition	Solutions
Learner-led Learning	Deliver effective learning experiences to independent learners.	Web pages Multimedia presentations E-Books Interactive computer applications
Instructor-led Training	Use Web technologies to conduct conventional classes with distant learners.	Video conferences Audio conferences Chat Telephone Screen sharing Shared whiteboards

As previously mentioned, many researches have been done in the field of learning styles. According to these fundamental studies, 1) learners, in the mobile learning perspective, must have some basic requirements to match their style of learning with m-learning environment, and, 2) mobile learning service providers must organize a comprehensive technological infrastructure to support different styles of their students' learning styles.

In Table 3, all of previous learning and teaching methods gathered with additional information about technologies and tools to support and facilitate accessing them, by learners, in the mobile learning world.

CONCLUSION

To summarize, each learner has its own mixture of learning styles. Instructors and learning material providers should assess their student' style of learning, to perform an efficient teaching and learning method. In mobile learning point of view, mobile learning developers should follow same approach and supply appropriated technologies to match each student's learning style.

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TABLE III. LEARNING STYLES AND SUPPORTING TECHNOLOGIES IN MOBILE ENVIRONMENTS [10; 14; 15; 16]

Category of Learning Style	Learning style	Supporting Technologies in Mobile Environments
VAK, VAKT, and VARK Styles	***Visual***	Multimedia player (3GP, AVI, MP3, MP4, MOV, WMA, WMV, FLV) Image displaying (JPEG, GIF, BMP, PNG) Multimedia presentations (Microsoft PowerPoint – PPT, Macromedia / Adobe Shockwave Flash – SWF, Java mobile applications) E-Book viewers (Adobe's PDF, Microsoft's Doc(x), RTF, CHM, Plaint text - TXT) HTML Viewer or Web Browser E-Mail Mobile TV Video conferencing (with secondary video call camera) High screen size and resolution
	Auditory/Aural	Multimedia player (MP3, WMA, AMR) Voice recorder Voice mail Text to speech tools Good speaker quality
	Kinesthetic/Kinaesthetic	Multimedia presentations Messaging; To send their activities to the instructor (SMS, MMS, E-Mail) GPRS Internet connection and Web browser Video conferencing
	Tactile	Touch screens E-Book viewer applications with a ability for highlighting and underlining Handwriting recognition tools
	Read/write	E-Book viewer Handwriting recognition tools
E-Learning Styles	***Learner-led Learning***	Multimedia player E-Book viewer Multimedia presentations Internet connection and Web browser
	Instructor-led Training	Multimedia player Video conference Audio Conference E-Book viewer Java mobile applications Multimedia presentations Internet connection and Web browser

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J2ME-Based Mobile Virtual Laboratory for Engineering Education

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***Abstract*— A mobile virtual laboratory is developed to help students perform virtual experiments using mobile devices to make it possible for teaching to be conducted anytime anywhere. In addition, resources and equipment can be integrated and shared efficiently where an environment is created to promote learning interests and efficiency by using mobile devices via the Internet and the GPRS telecommunication networks. Java wireless communication technologies were used in the design which implements a multi-tier architecture in order to integrate different fields of technology. The ultimate objective is to improve the scalability of the system and to allow for the use of Scalable Vector Graphics which makes it possible for developers to create interactive graphical content, with the ability to zoom and resize on displays with different resolutions and aspect ratios.**

Keywords-component; Mobile Learning, Virtual Laboratory, J2ME

I. INTRODUCTION

Over the past decade, mobile learning has grown from a minor topic into a significant research field with a focus on how can mobile technology offer new opportunities for learning that extend within and beyond the traditional teacher-led classroom [1-4]. Yet, the diversity of the field makes it difficult to capture the essence of mobile learning or to show how it contributes to the theory and practice of education. The situation becomes pronounced further by the availability of small personal computerized devices as an essential tool in modern everyday life. Furthermore, the ongoing penetration of computers into society leads to ubiquitous environments where networking capabilities are used everywhere. In fact, the rapid development of wireless networks has transformed cell phones, Pocket PCs, iPods and other PDAs into learning devices where data is transferred over the General Packet Radio Service (GPRS) network. As long as the users' cell phones are situated on a signal location, they can enjoy various network resources and services via GPRS [5-6]. As a consequence, teaching will no longer be limited by time or confined by location, and there is strong evidence that traditional education may easily leap through eLearning into to mobile learning or simply mLearning [7].

Mobile learning is particularly important in science and engineering education which requires for the students to learn theoretical foundations in classrooms and experiment in laboratory sessions. However, teaching of measurement science requires a vast practical experience in order to assure a good knowledge transfer from the teacher to the students [8]. The students should achieve such experience by working in actual conditions and on the actual instruments. Usually, the sophisticated and expensive measurement instrumentation involved makes it difficult to keep the technical staff up to date [8]. Moreover, there is the necessity for repeating the same experience many times in order to make all students able to operate the measuring instrumentation which makes the technician shortage even more severe. Online laboratories, virtual and remote, have therefore become a very useful support for practical aspects of teaching methods world wide. Teaching is thus conducted anytime anywhere and resources and equipment can be integrated and shared efficiently where an environment is created to promote learning interests and efficiency by using mobile devices via the Internet and the GPRS telecommunication networks.

In addition, it is very rare to combine both lectures and laboratory sessions at the same time due to the fact that in many occasions, laboratory equipment cannot be brought into a classroom due to its size and characteristics or it is simply not available in campus [9-12]. Thus, it becomes necessary to utilize mobile technology to implement a virtual laboratories network to allow remote interaction with laboratory equipment so experiments can be controlled as they occur [13-16].

In this paper, a mobile virtual laboratory is developed to help students perform virtual experiments using mobile devices and to remotely control real hardware and perform measurements wirelessly. The remote lab was designed and implemented using a cellular phone or a PDA because they are widely used amongst students. The experiments run on a server which is directly connected to the circuit under test via data acquisition card terminals. The user should be able to perform different experiments in the field of logic design, apply different gates, combinational and sequential circuits. The system is aimed to eventually provide an environment to train students to handle factory automation, data acquisition, data management, and manufacturing process using the various types of mobile devices. Java wireless communication technologies were used in the design which implements a

multi-tier architecture in order to integrate different fields of technology and the data generation and acquisition were controlled by J2ME. The ultimate objective is to improve the scalability of the system and to allow for the use of Scalable Vector Graphics which makes it possible to create and develop interactive graphical content, with the ability to zoom and resize on displays with different resolutions and aspect ratios.

2. Online Laboratories

Digital electronics education may be easily converted to a simulation-based learning environment to help students in acquiring the theoretical foundations of digital design, together with analysis and problem-solving capabilities and practical synthesis and design skills. Different formats of instruction, including lectures, exercises and lab assignments can be to adapted and delivered at different student levels. The system may be based on a set of tools that teachers can combine together and personalize to suit appropriate pedagogical needs by contributing to the lecture space their own learning materials. The system covers the following areas of digital electronics: combinational logic networks, sequential logic networks [17].

The logic design laboratory may be taken as an example to illustrate the proposed system. In the real lab, students use breadboards to mount chips, such as AND and OR gates, and they connect the chips with wires. Then, the students connect the board to the power supply and verify by observation whether the circuit is functional. During their physical presence in the lab, students are merely rewiring the breadboard, staging certain inputs, and observing the resulting output. If these three actions are performed remotely, the online Remote Lab is born. The first and third actions are simply the I/O part of the experiment, which could be replaced by a standard computer interface with the proper instrumentation device. Any computer on the Internet can perform these I/O operations, once handled by a local computer with software interface. The second action of wiring and rewiring offers the true challenge. Standard breadboards are replaced by special interactive breadboards whose pins are connected to a programmable interconnect network controlled by a local computer with a proper software interface. A connection between any pin to any pin is accomplished by a click of a mouse on the software interface. If all necessary components, gates and chips are placed on the interactive breadboard, then a full experiment is conducted through the computer software interface without touching the breadboard. Again, action that can be performed on a local computer could also be taken on any computer or mobile device on the Internet. This method liberates students from the physical labs; hence, real engineering experiments can take place through distance learning [18].

The use of a host computer in these instances should not be confused with software simulation because students are still manipulating physically working electronic parts and still have the freedom to make any connections they choose. The computer simply acts as a front-end interface to lay out the connection on-screen and for downloading it to the board [18].

3. System Architecture

A remote laboratory is defined as a computer-controlled laboratory that can be accessed and controlled externally over a communication medium. It may be considered as an experiment, demonstration, or process running locally on a software platform but with the ability to be monitored and controlled over the Internet from within a Web browser. The remote lab server can be an experiment connected to a computer through a standard interface such as a DAQ, GPIB or serial, parallel, and with the host computer connected to the Internet. The client can be any computer connected the Internet running a simple browser or mobile device. Once connected, the client will see the same front panel as the local host and also have the same program functionality [19].

A remote lab is designed to enable users to control a system via a mobile device, such as a cellular phone or a PDA, and to monitor its outputs anytime and anywhere as shown in Fig. (1). The hardware infrastructure includes a server and a client ends. On the server side, the equipment may include any equipment that can be connected and controlled by a computer. In addition, there is usually a camera on the server end which videos activities of the outputs on the control server interface.

Java language was selected for the development of the model of remote labs because it is well suited for interactive web applications and offers the feature of multithreading to enable many students to work on the same laboratory setup simultaneously. It is a very innovative language which allows one to write programs that can be embedded in Internet web pages. Java is a good candidate since the entire system of building remote laboratories relies on the Internet. The student in this environment could logon from any system. As Java is a machine also an independent language, which creates programs that run on a wide variety of computers using a range of operating systems. The Java program does not execute directly on the computer and hence it will not interfere with the operating system or users data. Instead, as it runs on a standard hypothetical computer called 'Java virtual machine'. This solves the problems of security and unauthorized access. In addition, Java is an Object Oriented programming language unlike others like CGI and HTML. Therefore, Java programs can be easily maintained, as reusability of code is possible.

Students at the client side can access and control the equipment in the lab remotely using a PC, a laptop, a cellular phone or PDA or any similar device. The design was based on transmit standards, including RS232, IrDA, and Wireless Local Area Network (WLAN), thus, students can use mobile devices operation in the remote sites [16].

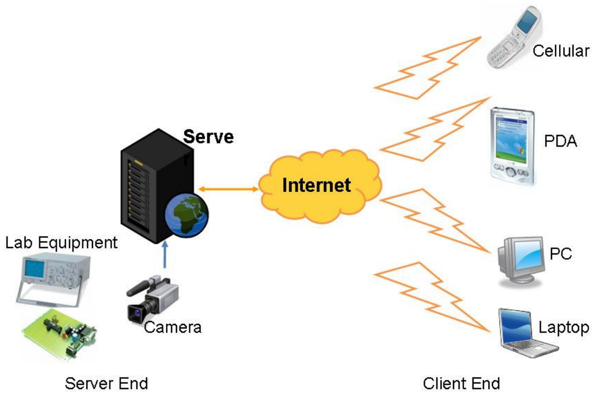

Fig. (1): Mobile Remote Lab Architecture.

4. System Software

Java Micro Edition (J2ME) was selected as the platform to implement the mobile virtual lab (MVL) because of its great connectivity and portability. What J2ME can do for mobile devices is just the same as what Java 2 Standard Edition (J2SE) and Java 2 Enterprise Edition (J2EE) did for desktop and server systems [20]. In J2ME the Connected Limited Device Configuration (CLDC) defines a generic "configuration" for a broad range of handheld devices through implementing a set of CLDC libraries on top of K Virtual Machine as shown in Fig. (2). The main benefits of CLDC devices involved are cross-platform where work is transferred between CLDC and other devices, dynamic content where content is determined by user experience, and information transfer between CLDC and other devices, security, and developer community where the developer talent needed for these devices already exists and is readily available for CLDC devices. A Java virtual machine (KVM) implementation and a configuration specification CLDC are very closely aligned. Together they are designed to capture just the essential capabilities of each category of device [21]. On top of the CLDC, the Mobile Information Device Profile (MIDP) is defined specifically for wireless devices such as cell hones and PDAs [22] as shown in Fig. (2). Wireless device manufacturers need to implement MIDP in order to support Java applications on their devices. A J2ME profile MIDP is layered on top of (and thus extends) a configuration CLDC. A profile addresses the specific demands of a certain "vertical" market segment or device family. The main goal of a profile is to guarantee interoperability within a certain vertical device family or domain by defining a standard Java platform for that market. Profiles typically include class libraries that are far more domain-specific than the class libraries provided in a configuration CLDC [21].

The KVM is a compact, portable Java virtual machine specifically designed from the ground up for small, resource-constrained devices. The high-level design goal for the KVM was to create the smallest possible "complete" Java virtual machine that would maintain all the central aspects of the Java programming language, but would run in a resource-constrained device with only a few hundred kilobytes total memory budget. More specifically, the KVM was designed to be:

• Small, with a static memory footprint of the virtual machine core in the range of 40 kilobytes to 80 kilobytes depending on compilation options and the target platform;
• Clean, well-commented, and highly portable,
• Modular and customizable,
• As "complete" and "fast" as possible without sacrificing the other design goals [21].

A user friendly client-side interface with circuit- and instrument like images to allow the experimental configuration and parameters to be controlled interactively by the user was developed. This interface was realized by means of the Scalable Vector Graphics (SVG) file format. SVG is a new vector-based, open-standard file format developed by the World Wide Web Consortium, which represents a new generation of dynamic, data-driven and interactive graphics. An interactive web page can be created with SVG and JavaScript, where the client may configure the measurement to be performed. Several setups may be prepared for direct selection, and the corresponding circuit diagram pops up by clicking on the various elements in the circuit diagram. A given setup may be further customized and the external wiring of the test chip is displayed. The experimental settings are entered and the external connections are physically implemented via the matrix switch once the "submit" button is activated.

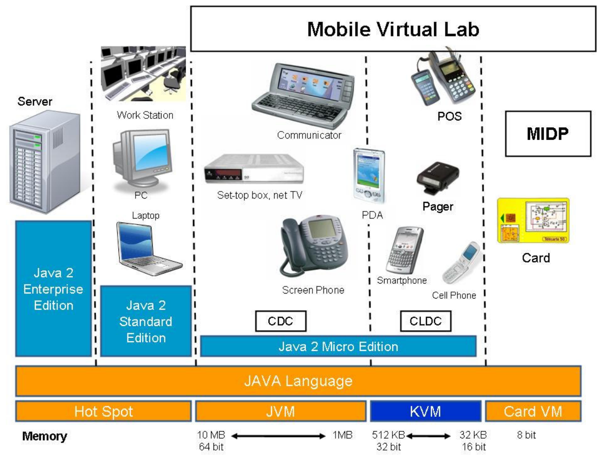

Fig. (2): Java-2 Micro Edition Platform Architecture.

5. System Design

In designing the MVL, the View Control Data architecture has been employed to separate the process of authoring experiments from the process of generating online experiments. The system architecture based on the wireless J2ME communication technology for the client tier, J2SE for the server tier and Microsoft SQL server for the data tier as dataflow diagram explains in Fig. (3). HTTP connectivity and data stream over GPRS used to utilize the remote connectivity between client and server tier [21].

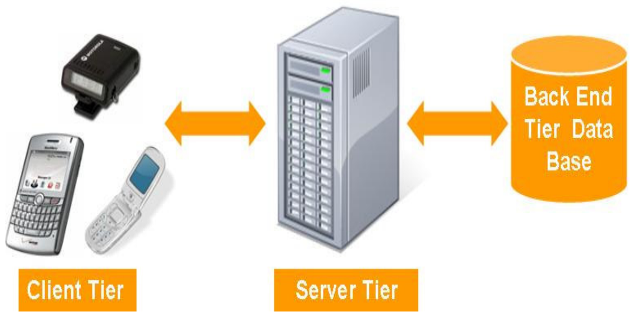

Fig. (3): The Mobile Virtual Lab Dataflow Diagram.

The mobile virtual lab system has two usage cases, the experiment author usage case and student usage case. In the author usage case, the author of the experiment uses an authoring tool on a PC to draw the diagrams and to generate the required interactivity and consequently store the final experiment in the database. In the student usage case, the student launches the mobile virtual lab client application on the target mobile device.

A typical scenario of a mobile virtual lab experiment thus involves the following steps. It should be noted that the server is assumed to be running and that the client is on the experiment's web page through the Internet.

- Registration: a student accesses the URL to perform the experiment. The system should ask the student to first register for the lab before trying to perform the experiment. Once the student registers, a user login and password should be given for future use. It should be noted that self-registration is not allowed for any user. A student's unique key-login name is checked against a database of students' list.
- Logging-in: once the student has a valid login and password, he/she can login to the remote real laboratory server and choose an experiment from the list of experiments to perform.
- Performing the Experiment: when a student starts performing the experiment, he/she is able to enter input values and submit them to the hardware. The hardware, then, acts upon the input parameter and generates results. The results are finally collected by the local host computer and sent back to the student's computer. The student can rerun (submit different values to) the experiment as many times as desires. Once satisfied, the student can submit the results for grading.
- Instructor Login: the instructor/TA login is recognized and thus taken to a different panel (page) where they can perform different tasks like viewing lists and results, grading students, and adding experiments.

The flowcharts of Fig. (4) illustrates all the necessary steps described above.

Consequently, the mobile virtual lab client tier application will send user credentials to the authentication servlet in the server tier. A servlet will authenticate user credential against user profiles database and generate result XML file as the flowchart shows in Fig. (5a). The mobile virtual lab client application will parse XML file, if valid login it will display a list of experiments dedicated for the specific student as shown in Fig. (5b). The mobile virtual lab client will then collect user selection and send it to the experiment generation servlet in the server tier. The experiment generation servlet will generate XML file which contains the experiment details based on a preset mad by the experiment author and stored in the database tier as the flowchart shown in Fig. (4). The mobile virtual lab client will eventually parse the XML file and generate the experiment interface as shown in Fig. (5c) and Fig. (5d) for various types of mobile devices. The latter figures depict and experiment which the student performs on an AND gate. The logic inputs A and B are entered by a click on the appropriate input and the output will be displayed instantly, with the corresponding truth table highlighted. Similarly, a 7-segment experiment is conducted, as another example, and the corresponding input, output, truth table are displayed. In all cases, the user will try each experiment and the login record will be sent to the server to be saved in the database.

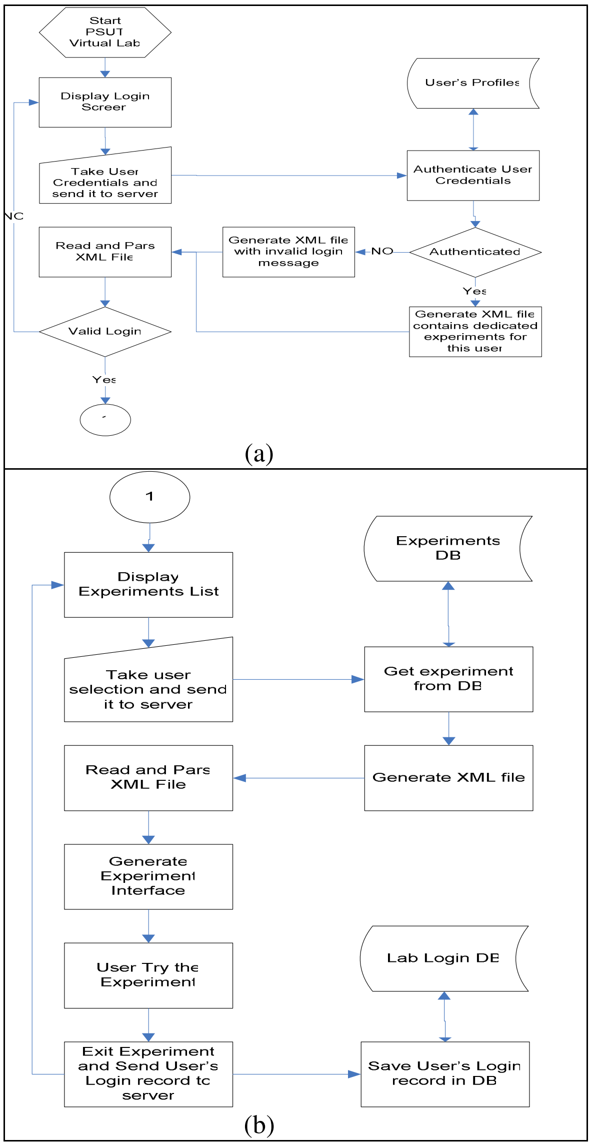

Fig. (4): System Software Flowchart.

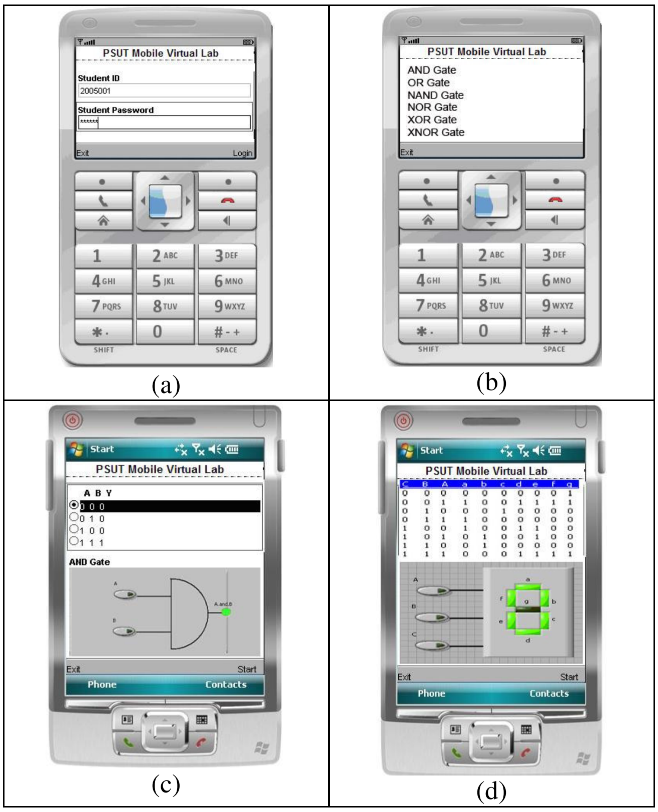

Fig. (5): Examples of Mobile Projects and Applications.

One main advantage of the mobile system is scalability which may be improved further using the Scalable 2D Vector Graphics API specification. This SVG defines an API for rendering 2D graphics in the World Wide Web Consortium (W3C) Scalable Vector Graphics (SVG) Tiny format. The SVG also makes it possible for developers to create interactive graphical content, with the ability to zoom and resize on displays with different resolutions and aspect ratios. Furthermore, J2ME also defines a subset of the Micro Document Object Model (μDOM) API to allow user interaction and dynamic manipulation of SVG content. Developers can take advantage of the large amount of available SVG content. Because SVG is based on the eXtensible Markup Language (XML), a developer accustomed to a scripting environment can also take advantage of the robust features offered by a full programmatic environment, such as the Java language [24].

Mobile Web Services is application logic accessible to programs via standard web protocols in a platform-independent way. Web Services are the fundamental building blocks in the move to distributed computing on the Internet. Open standards and the focus on communication and collaboration among people and applications have created an environment where XML Web Services are becoming the platform for application integration. Applications are constructed using multiple XML Web Services from various sources that work together regardless of where they reside or how they were implemented. One of the primary advantages of the XML Web Services architecture is that it allows programs written in different languages on different platforms to communicate with each other in a standards-based way [24].

Conclusions

A mobile virtual laboratory was developed to enable students to conduct experiments using cellular phones, a PDA, a smartphone, Palms, Pocket PC, Tablets PCs, or any other similar handheld devices. This allows for teaching to be conducted anytime anywhere and allows resources and equipment to be shared between various collaborating institutions. Java wireless communication technologies were used in the design which implements a multi-tier architecture in order to integrate different fields of technology. The ultimate objective is to improve the scalability of the system and to allow for the use of Scalable Vector Graphics which makes it possible for developers to create interactive graphical content, with the ability to zoom and resize on displays with different resolutions and aspect ratios.

The proposed system has been tested with a real classroom and the results related to system function and teaching efficiency are positive. However, much work remains to be made in the future to accommodate new technologies to improve the delivery of video and audio streams. In addition, audio interaction should also be an option in this mobile learning system, which can further improve its quality in courses other than logic design. Finally, the mobile virtual lab should be tested further in real classrooms to address many pedagogical issues to help build an effective virtual learning environment.

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Intervening Students with Special Needs Focusing on Rationales, and Utilizing Play Intervention Programs, Educational Technologies with Teacher Training for Selected Types of Disabilities: Autism (ASD), Mental Retardation, and Physical and Hearing Disabilities

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Abstract: This paper has several sections. In the first one, basic foundations of content included: significance of intervention, selected definitions and roles of behavioral teaching strategies. In the second section, the authors detailed various contemporary play intervention strategies for students with special needs. Next, the potentials for technology and special education and students with special needs and teachers were addressed. Critical are the needs for linking technology, teacher pre-service teacher training and using advanced technologies for intervention, assessment and evaluation and skill development and analyses of students with special needs. Finally, recommendations for technology and special education teacher training were identified.

INTRODUCTION

There are several critical areas of import in regard to special education, students with special needs and best practices in training. They include: intervention and significance of intervention for students, families and societies; perspectives, definitions on special education and students with special needs; and, student's play activities as behavioral strategies for improving and expanding their lives. Each is briefly examined in the following sections.

INTERVENTION WITH SPECIAL NEEDS

Intervening in the lives of students with special needs means identifying particular types, kinds and behavioral indicators of handicapping conditions that these students are experiencing (Hardman, Drew & Egan, 2008). Methods of identifying these conditions include: observation of these students, assessment and evaluation to determine valid and realistic levels of functioning for language, cognition and determining other deficiencies that may impact on these students at risk (Gonzalez, Brusca-Vega, & Yawkey, 1997; Venn, 2007).

In addition, intervention means using these data sources of identification to develop plans for educating, providing for health care and social services (Glecket, & Koretz, 2008). The objectives of intervening in the lives of special education students include enhancing development and learning, reducing disability effects on individuals and families, and maximizing effects of students with disabilities to live independently and at the same time contribute to their societies in productive ways (Layton, & Lock, 2008). Finally, the "flip side of intervening" also implies reducing educational costs of schooling. With identification of highly specialized needs, treatment includes particular behaviors targeted and taught behaviorally for observable outcomes of performance (Al-Shammari, 2005, 2007; Duncan, Kemple, & Smith, 2008).Linking intervening with evaluating and treatment planning make for greater efficiency and significantly higher and more positive outcomes with students with special needs. Ultimately, intervening as "early as possible" enhances the capacities of National Educational Ministries, Bureaus and Departments of Education to identify, evaluate and treat special education needs and needs of all students including low-income, inner city and rural students (Bagnato, & Neisworth, 1991;Gonzalez, Yawkey, & Minaya-Rowe ,2006; Salend, 2008**).**

Finally, intervening in the lives of students with special needs means connecting with their families in way that are meaningful, nonjudgmental and facilitative (Chen, & Yawkey, 2007). For example, Chen and Yawkey (2007, p. 66) speak about families with students having special disabilities diversities (i.e., aboriginal/culturally diverse). These families share much common ground. For instance, there is a very strong desire of families with disabilities and diversities to protect themselves

and their children. This idea of protecting themselves in a functional sense may mean refusing to talk about their children's learning difficulties and disabilities and keeping their distance from and increasing their distrust of schools and in work place settings.

Thus, intervening students with special needs means bridging to schools and families. Building productive dialogue and bridges between intervention programs and schools, work places and family provide for more productive lives and develop greatly the behaviors and work capacities of all of its citizens including children with disabilities and diversities and adults for the good of societies.

Definitions, Perspectives on Students with Special Needs

Special needs is a category of human growth and development including special education that focus on disabilities of children, students and adults (Al-Shammari, 2005). And , in a contemporary sense, special needs and special education also imply specially designed instruction in all settings including work places, "…classrooms, physical education facilities, the home and hospitals or institutions (Hardman, Drew & Egan, 2008, p.27)." The old classic term "handicapped" has been replaced with the term "disabilities" because increasingly the contemporary focus of societies is on intervention and training rather than institutionalization (Al-Shammari, 2007; McLoughlin, & Lewis, 2008).

Disabilities include mental retardation, physical disabilities, hearing disabilities and an increasing numbers of children and adults world wide being diagnosed with autism disability or autism spectrum disorder (ASD) (Al-Shammari, 2007). Briefly, mental retardation is viewed as a disability with intellectual and socially adaptive limitations (Luckasson, Borthwick-Duffy, Buntinx, Coulter, Craig, & Reeve, 2002).

Physical disability restricts the domains of motor, verbal, speaking, and so forth. And shows restriction of activities in these and other areas (e.g., motor) (Carpenter, & Readman, 2006). Hearing disability refers to the loss of sounds, pitch and other related abilities to discriminate (e.g., speech discrimination) **(**Cavallaro, Foley, Sauders, & Bowman, 2005).

Autism is characterized as a complex set of disabilities that impacts the neurological structure of the brain in such areas as communication and interaction in social settings (Bruckner & Yoder, 2007; Conners, & Smith, 2007). Autism is fast becoming increasingly diagnosed and statistics show that 1 child in every 150 births has autism spectrum disorder (see Autism Society of America. Retrieved on December, 11, 2007 from http://www.autism-society.org). For further information on autism and play settings , see Wolfberg (2003).

Table 1 in this manuscript shares further more detailed definitions and examples of these types of disabilities, mental retardation, physical and hearing disabilities and autism spectrum disorders. Table 1 as well shares references to explore for further interests. The placement of Table 1 appears before the References.

Table 2 below shows the number of these four disabilities in Arabic Gulf Countries. These data were gathered initially in 1998 (Executive Office for Council of Secretaries of Work and Social Affairs in The Cooperative Council of Arabic Countries, 1998) and updated by Al-Shammari (2005). Of special note are the numbers of special needs for disabilities such as autism spectrum disorders (ASD). ASD is an extremely new disability, new in the sense that measurement of ASD has just begin.

Note as well the disability labeled, Two Exceptionalities or "Twice-Exceptional Disabilities" (Hollingworth, 1923). Essentially, Hollingworth describes this disability as having advanced abilities in one area or domain as well as deficits in another.

Table 2: Disability Types and Numbers by Types within Arabic Gulf Countries Types of Disabilities in the Arabic Gulf Countries

Country	Types of Disabilities in the Arabic Gulf Countries									Total
	Mental Retardation	Physical	Hearing	Visual	Language	Emotional	Two Except.	Autism	Others	
United Arab Emirates	1019	362	398	46	6	4	218	Not available	Not available	2053
Bahrain	765	962	Not available	882	Not available	Not available	473	Not available	1032	4114
Saudi Arabia	2938	1483	199	173	157	174	Not available	Not available	Not available	5124
Oman	4418	5598	4334	13906	Not available	Not available	Not available	Not available	Not available	28256
Qatar	737	439	278	110	Not available	Not available	508	Not available	Not available	2072
Kuwait	344	394	121	135	Not available	Not available	Not available	20	Not available	1014

Sources: (1) Executive Office for Council of Secretaries of Work and Social Affairs in The Cooperative Council of Arabic Countries (1998). *Guidance for institutions of Rehabilitation and treatment of disabled people in Cooperative Council Countries of the Arabic* Gulf. 2 (1). (2) Al-Shammari, Z. (2005). Investigation of Special Education teachers' attitudes toward students with special needs in the State of Kuwait. Ph.D. Thesis. The Pennsylvania State University. University Park: PA.

PLAY INTERVENTION PROGRAMS: SOME RATIONALES

Children's and student's play behaviors and actions are special situations in which these students can be observed (Griffiing, 1983). In observing students at play and then assessing their play skills and abilities provide valuable keys to planning for adult intervention and determining which directions the teacher trainer intends to focus. McLoughin and Lewis (2008, p. 518) note that, "…evaluating play skills would be very important since the lack of or unusual play skills …." can be descriptive of behavioral disabilities and at the same time provide avenues to plan for intervention. Play assessment ".. gathers information about the child's play experiences (opportunities, settings, interactions with adults) play preferences (for people, activities and characteristics), social play style (friendships, play patterns , forms of communication and developmental play patterns…(McLoughin & Lewis, 2008, p. 518)."

Based on these data from playing students, intervention is planned. The following section in this article describes selected types of play intervention programs.

Intervention within play intervention programs is based on the use and utilization of various specific behavioral strategies to encourage children's learning using praise, external rewards, and so forth (Duncan, Kemple, & Smith, 2008, p. 201). Whether behavioral strategies have outcomes such as social reinforcers, activity reinforcers or tangible reinforcers, there is one lead critical characteristic of play intervention programs. The utilization of behavioral teaching strategies with lead-in repertoires must be identified first or prior to planned teaching (Duncan, Kemple, & Smith, 2008, p. 201-204).

These three areas provide baseline understandings for intervention with students with special needs (Dunlap, 1997). In addition, various definitions provide insight to selected disabilities and finally some rationales for using effectively play intervention programs.

DESCRIPTIONS OF SELECTED PLAY INTERVENTION PROGRAMS FOR STUDENTS WITH SPECIAL NEEDS

A vast number of play intervention programs that benefit children with special needs developed and practiced in so many educational programs worldwide. Examples of these programs include: (1) Play Intervention Training: Outside and Inside Intervention; (2) Play Enrichment Intervention; and, (3) Social-Behavioral Learning Strategy Intervention. Each of these programs are described briefly in the following paragraphs.

PLAY INTERVENTION TRAINING: OUTSIDE AND INSIDE INTERVENTION

For example, Johnson, Christie, and Yawkey (1999, p.196) described two types of a play intervention. They were: outside and inside intervention (see Smilansky, 1968). In the outside intervention, a teacher in this type of intervention program stays outside the student's

play activity (episode or frame). The teacher makes comments, coaches and guides the children so as to directly involve them in this play activity. By participating in this play activity, students are able to exchange communication and become involved in the action statements and movement. This activity verbal and motor involvement is a critical element in all intervention including play intervention (Duncan, Kemple, & Smith, 2008, p. 202-204).

With inside intervention the teacher participates with the children in the play activity. Here, the teacher takes and models a role or focused actions as part of the play episode. In a sense, the teacher in this program becomes involved and engaged in a directed way inside the play setting. In other words, the teacher participates with the children directly in the play frame providing specialized instruction to the children. In turn, the children model these actions, verbal statements and movements as they develop new behaviors within play group settings (Howes & Matheson, 1992).

Play Enrichment Intervention

A second approach to play programs is called Play Enrichment Intervention (Johnson, Christie & Yawkey, 1999). In describing this type of program, Johnson, Christie and Yawkey (1999, p. 204) note several important steps in implementing this form of play intervention. Similar to Play Inside and Outside Intervention, teachers impact children's communicative and cognitive growth in guided classroom play activities. The procedures for implementing Play Enrichment Intervention Program are outlined by Johnson, Christie and Yawkey (1999, p. 204) are as follows: (1) providing resources for play; (2) observing play; and, (3) becoming supportively and responsively involved in play.

Prior to beginning, nurturing a supporting environment for children to become familiar with their play environment, their peers and teachers as co-players. In the first procedure, "providing resources for play", Johnson ,Christie and Yawkey (1999) note that teachers should plan for getting ready by examining potential resources such as time and materials (For complete procedural steps, see Griffing, 1983). For example, time is needed to plan for play and assist the children in contributing to the play plan. From recruiting play peers to developing and carrying out discussion concerning what roles the students would be playing and how they would be carrying out their roles in peer settings. Materials as another important procedure include getting a variety of play materials such as props, open ended materials such as blocks, puzzles and so forth.

In observing , teachers need time to "kid watch" and determine what types of play children are using such as playing alone (i.e., solitary play) , engaging themselves with materials and another student in talking as they play. Here, the teacher may note that the conversations between the children do not match, interrelate or correspond (i.e., parallel play). Becoming involved, the third set of procedures for implementing Play Enrichment Intervention Programs focuses on the adults becoming involved in the children's play and supporting ways that support and extend their play routines and patterns.

The Play Enrichment Intervention approach is flexible and useful in working with students with special needs. With careful planning, observing and following through, the teacher helps assist these children's communication, interactions and learning (Yawkey, 1980).

Social-Behavioral Learning Strategy Intervention

In the third example of play intervention programming, Bock (2007, p.) describes these procedures as: Stop-Observe-Deliberate-Act (or SODA). These procedures focus on cooperative play-learning activities which help children who are autistic (i.e., Autistic Spectrum Disorders) begin to learn to master their social behavioral and social interactive skills. The S-O-D-A play intervention program attempts to train the students to use self-talk in social play settings. By using self talk, the students are able to develop with teacher guidance a specific series of self behaviors that they will say or use in talk situations. Then from identifying words and concepts they will say and communicate, the students move to the actual step of "doing." Here the students actually say what they were planning to say together to doing what they were planning.

In actual application, each of the four SODA strategies with self-talk the students are trained to begin and continue the social interacting using scripted or preplanned statements. The actual self-talk statements spun round the four identified strategies are quoted from Block (2007, pg. 259) in the following examples.

Stop. The three questions used as bases as

baselines for self-talk are:

1. Where should I go to observe?
2. What is the room arrangement?
3. What is the routine or schedule?

Observe. The following three questions teach the student to watch and see what is happening first before jumping into the play activities. These three guide questions which the students are trained to use follow:

1. What is/are _____doing?
2. What is/are______saying?
3. What happens when _____say(s) and do(es) these things?

Deliberate. The following five questions give these students opportunities to think about what they will say to their peers in play activities. This becomes the student planning time with teacher guidance for deliberate and directed thought. These five questions as examples of procedure three follow:

1. What would I like to do?
2. What would I like to say?
3. How will _____ feel when I do and say these things?
4. How will _____ act when I do and say these things?
5. Why will _____ act this way?

Act. This last procedure of SODA Training as play intervention program trains the student develop what he or she will do before they enter the play frame . This self-thinking uses teacher scripted questions gives the bases for actual real interactive communication between these students with autism or other selected learning disabilities. This guidance gives these learning disabled students a "list of things they will say and do when participating in the social activity (Block, 2007, pg.259." These questions follow:

1. When I go to _____I plan to:
   (a)_______
   (b)_______
   (c)_______
   (d)_______

The research results on the use of these SODA social-behavioral learning strategies are very important because they document the utility and functional nature of these strategies. The autistic student trained with these SODA procedures was able to increase his percentage of time in playing group board games cooperatively with his peer.

This section focused on descriptions of selected play intervention programs. These are useful in preplanning and carrying out very effective play training which develops communication, and interactive skills in students with special needs.

The following section focuses on technology with students with special needs. The emphases are on technology, communication and learning.

Potentials for Technology, Communication and Education with Special Needs Populations

This section focuses on three aspects of technology, communication and education. They are: training the special needs' students for special transitions in education; using technological advances to benefit students with special needs; and, educating and training pre-service and in-service teachers to work more effectively, productively and efficiently using advanced technologies and communication.

Training of Students with Special Needs Focusing on Transitions

Within contemporary special education research and practitioner literature, that current foci of special education are to permit a several transitions in the lives, education and growth of students with special needs (Salend, 2008, p. 15). These current foci are very different from decades ago when the single goal of special education was to institutionalize these special education students and put them away from "normal" students and adults (Bagnato, & Neisworth , 1991).

One current example of these transitions is bridging the students with special needs from intervention classrooms to other mainstream or "inclusive" classroom. Of course, these students with special needs do NOT transition to mainstream classrooms over night but by meeting appropriately designed, carefully constructed learning and training opportunities and assessment criteria. Another example of transition is from classrooms to work place possibilities near the end or at the termination of academic schooling.

Using Advances in Technology for Learning Benefits with Special Needs

Specialists such as Albright, Brown,

Vandeventer and Jorgensen (1989) and Salend (2008) stress the great potentials of technology utilization with special education students. Assistive technology used as tools with students with special needs provide opportunities for improving learning outcomes and lives of these students for inclusion in work places and in society (Salend, 2008, p. 15).Assistive technologies permit greater control of disabled students over their lives, settings, environments. Salend (2008, p. 15) notes that this increased control of students with special needs as they use assistive technology in turn widens access of these students to general education and to society including the work settings. Here, Salend (2008) and Albright, et al (1989) see two types of assistive technologies. These types using Salend's (2008) terminology are: assistive technology devices and services.

Assistive technology include high and low technology devices. By high technology devices, Salend (2008,p.16-17) means devices used in classrooms such as electronic communication and speech practices, motorized wheelchairs, adaptive keyboards with touch screen computers and so forth. Examples of low-technology assistive devices include speech feedback machines, and what Albright, et al (1989, p. 73-74) call individualized adaptations such as pocket calendars, DVDs, head pointers and "pencil holders and strings attached to objects to retrieve them if they on the floor (Salend, 2008, p.16)."

Assistive technology services is defined as, "..any that directly assists an individual with a disability to select, acquire or use an assistive technology device including physical, occupational and speech therapy (Seland, 2008, p. 16). " For example, National Ministries or Departments of Education create technology lending libraries for students with special needs to borrow what Salend (2008, p. 131; 265) calls informational devices. Examples of these informational devices include videos, DVDs, computers, books with auditory sounds, headphones, and so forth to hear stories while special needs students follow with parental guided assistance in these books.

In addition to National Ministries and Departments of Education, Salend (2008, p.131) recommends establishing partnerships between and among various agencies and business foundations. Also partnerships between schools, community centers, libraries and other agencies make available high and low forms of assistive technology. Azzam's research (2006) for example demonstrates clearly that a digital divide exists for students with special needs. These and other students (for example, low income environments) come across barriers that drastically reduce their access and exposure to technology usage. Thus, partnerships can reduce impacts of the digital divide with special education students and provide them with technology training and uses of technology for effective learning. For further examples of the digital divide see: www.digitaldivide.net. There are also guide available to families, teachers, counselors and so forth, that match students with special needs with appropriate toys, learning materials and gifts. An example of this kind of guide is, "Toys R US: Toy guide for differently-abled kids." For examples of this guide for purchasing materials, toys and gifts see; www.toysrus.com.

Training Pre-service and In-service Teachers for Technology for Special Needs

Training special education teachers at pre-service and in-service levels to use various forms and types of technologies with students with special needs offer unlimited opportunities to improve functional and baseline capabilities for disabled students (Layton & Lock, 2008). This technology training for teaching special education students demonstrates effective learning as outcomes with students with special needs. For example, finding and matching "text on text' by using computerized words on screen with words of the same size printed on hand cards creates instant awareness and with guidance immediate successes in learning.

This much needed training in technology with special education teachers actually becomes a lever to shift schools for benefit of sound teaching, of positive learning effects with students with special needs. This shift from classic and static schools with "factory" mentalities to information rich ,dynamic technology based- schools of the 21st and 22nd Centuries begin students with special needs on the path to sound learning and on-ward to continuing life's learning and employment (Kerr, 1996).

The need for assisting students with special needs to experience transitions, for example from intervention to inclusion classrooms provides greater control and outlook of learning by these children. In addition, technological advances with teaching and support materials such as computers, DVDs, and so forth benefit special education students.

However, these benefits are only realized if special education teachers at pre-service and in-service levels are trained to use advance technologies teaching and assessing and prescribing learning routines for children with special needs.

Recommendations for Technology and Education Training for Preservice and Inservice Teachers Working with Students with Special Needs and Some Selected Conclusions

Special education because of its heavy dependence on: (1) assessment and evaluation and (2) the "match between assessment and instruction" with special needs children (Gonzalez, Brusca-Vega, & Yawkey, 1997) has many contributions to make to need for training and technology. One such contribution is suggested by Layton & Lock, 2008, p. 60-61). Layton and Lock (2008) and Al-Shammari and Yawkey (2007, in press) see special education teachers linking assessment and evaluation methodologies with technologies. This assertion implies several recommendations. Special education teachers in training sessions learn to develop on line assessment systems for use in school instructional settings. This recommendation covers both forms of assessment, formative or short term day to day assessment and summative or long term assessment.

With linking technologies and classroom assessment methods on line, provides special education teachers with data-driven and data-based outcomes for decisions in curricular skills of school subjects. With immediate feedback from instructional decisionmaking and gathering and analyzing results, special education teachers can determine whether behavioral learning routings with skills based instruction was effective (Baron, & Wolf , 1996). Layton and Lock (2008, p. 60-61) term this linkage, "web-based data entry, analyses and retrieval."

Second, technology can efficiently and quickly be used to centralize technologies available and effective with students with special needs. Via technology, listings of types of technologies available, their descriptions and "pictorial representations of technology tools currently available (Layton & Lock, 2008, p.61), produce powerful state of the art technology linkages in service of special education.

Advanced technologies as well can be effectively used create and compile data summaries, for example, on special education students' performances. In turn technologies as well provide for compilations of data outcomes, mastery levels and instructional decision making. Albright, et al (1989) and Biklen, Ferguson and Ford (1989) suggest several examples of these data compilations. Data compilations can identify the number and types of skills of each student with special needs has acquired including the number of trials to accomplish those acquisitions along with amount of time needed for these skill acquisitions. Forgetting and re-learning ratios (called forgetting recoupment) can be determined and skills mastered can be examined for levels of complexity from basic or simple recognitory to more advanced syntheses of skills.

At another level, technology is extremely useful in building and recording functional skills those special needs students require for living. Of course these repertorires of skills could be developed for each disability and age of the student. For example, functional skills such as washing dishes at breakfast for a more mature slow learner might be a targeted skill.

Although preparation of special education teachers was addressed in the previous section, requiring greater subject and content masteries of teacher candidates is mandatory considering the information explosions and on demands of on the job work. These increases in content subject masteries for pre-service teachers are for all levels in public school curricula: at early childhood, elementary, middle-school and high school.

In conclusion, there are vast potentials for linking technology with students with special needs and training as well of pre-service and in-service teaches of special education. This linking benefits teachers, students with special needs, their families and society in general.

Programs for special education students that use play based curricula, developing and using behavioral strategies for guiding and training these students and play-based assessment provide for greater advances in intellect and communication than previous types of curricula. Finally, recommendations for technology and educational training of special education teachers point to the greatest need, That is, requiring technology training of pre-service teachers in training and intense workshop training for in-service special education teachers are critical to hurtle the transitions that students with special needs are making as they transition from differently focused classrooms to family settings and the world of work opportunities.

Table 1: Selected Terms Defined with Research Citations and Page Numbers that Focus on Developmental Play Intervention with Students Having Autism Spectrum Disorders, Mental Retardation, Physical Disabilities, and Hearing Disabilities

Selected Types of Student Disabilities	**Definitions**
1.Autism Spectrum Disorders (ASD)	Gargiulo (2001,pg.623)) states that a developmental delay is "a term defined by individual states referring to children ages 2 to 9 who perform significantly below developmental norms." For example, Connors and Smith (2007) indicated that children with literacy disabilities such as poor letter recognition may have to be tested further to determine if they have ASD. Asperger Syndrome is another related term and the difference between ASD and AS is that children with AS have a severity of symptoms such as not understanding social rules, and limited eye contact, and also to somewhat absence of language delays in which these children have good language and cognitive skills that fit them to interact with others. According to the Autism Society of America (ASA), autism is a "complex developmental disability" that appears in, 1 in 150 births, during the first three years of life. A neurological disorder has a direct affect on the brain functions that results an impact on the autistic children development in areas of social interaction and communication skills.
2.Mental Retardation (MD)	Luckasson, Borthwick-Duffy, Buntinx, Coulter, Craig, and Reeve (2002) stated that "mental retardation is a disability characterized by significant limitations both in intellectual functioning and in adaptive behavior as expressed in conceptual, social, and practical adaptive skills." (American Association on Mental Retardation).
3.Physical Disabilities (PD)	Carpenter and Readman (2006, p. 131) stated that a Physical disability "can be defined as the restriction of activity caused by impairments, for example, the loss of a limb, involuntary movements, loss of speech or sight."
4. Hearing Disabilities (HD)	Cavallaro, Foley, Sauders, & Bowman (2005, p. 37) stated that a hearing disability "relates to the ability to sense the presence of sounds and discriminate the location, pitch, loudness and quality of sounds. It encompasses functons of hearing, auditory discrimination, licalisation of sound source, lateralization of sound, speech discrimination; impairments such as deafness, hearing impartment and hearing loss."

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Implement A Framework For An Effective Asynchronous E-Learning Environment

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***Abstract*— E-learning system is one of the most important systems used in development of education especially in higher education. The proposed e-learning system involves a systematic process of ADDIE frameworks that are comprised of Analysis, Design, Development, Implementation and Evaluation to buildup a desired network that creates and offers e-learning system. The ADDIE framework processes and rapid prototype approaches have been integrated for establishing a derivative framework to enhance the e-learning system. In this study, a framework for e-learning and web teaching system has been designed and implemented to deliver courses, lessons, examples, exercises, exercise solutions, self evaluation test, sending and receiving report via web technology and database systems. The proposed e-learning system can be used over Internet or intranet and it represents a new technology of education to facilitate and improve learning process especially for universities. The designed system represents structure for e-learning system interfaces. The interfaces are administrator, instructor and student. They are implemented on a Web server and clients. E-learning Database has been designed to store all of data in an appropriate relational and independent table that related to the e-learning interfaces.**

Keywords-E-learning system design; E-learning framework; E-learning units;E-learning interfaces ;LMS; LCMS.

I. INTRODUCTION

E-learning is defined as delivery of learning, training or education program by electronic means involving the use of a computer or electronic device in some way to provide training, educational or learning material. However, e-learning has almost become the state of the art for the use of technology in education [1]. Today e-learning has been a very important way to learn because it makes possible for people to learn what they want anywhere and any time. One of the greatest advantages of e-learning is that it can fully shares and uses the learning resources based on good network hardware facility foundation which is already developed greatly during the past years [2]. The right starting point for any exploration of technology is the people who they technology need. Technology need to create e-learning, educational website, online tutorials, and knowledge management solutions [3].

II. SYNCHRONOUS AND ASYNCHRONOUS E-LEARNING

A. SynchronousE-learning

Synchronous e-learning includes geographically students who are connected to Internet and logged on in a virtual classroom at the same time communicating directly with each other and teacher or instructors. In most platforms, with their students and instructors can use a whiteboard (NetMeeting feature) to see their work in progress and share knowledge. Interactions done via audio, videoconferencing and Internet telephony [4]

B. Asynchronous E-learning

Asynchronous e-learning is more common because it creates just in time, on-demand student learning experience. Unlike synchronous training, students do not need to schedule their time around the predetermined plan of the instructor that means there is a complete flexibility with asynchronous training. Currently, the majority of e-learning systems use asynchronous communication technologies because they are as easier to develop and not expensive compared to the synchronous ones. Asynchronous e-learning is more flexible than synchronous because the student can choose the time he wishes to access a lesson [5].

III. LEARNING MANAGEMENT SYSTEM (LMS)

A Learning Management system is designed to administrate the web-based e-learning process. Most of LMS intends to provide learners with tools to facilitate their learning. LMS aims to accommodate a wider range of learning styles and goals in order to encourage collaboration and resource based learning among the learners. A learning management system simplifies the process of administrating education and training [6].

The primary LMS function is to offer a collection of courses. It also includes capabilities for assembling individual courses into organized curricula or certificate programs. The LMS integrates courses created in content creation tools (web-based and course authoring tools) [7]. An LMS shown in figure1 is a web-based database application that tracks learners and the courses they have access to or have completed [8]. Through an integrated, web-based interface, an LMS lets

administrators perform common tasks, such as registering learners, adding courses, enrolling learners into courses, launching courses for learners, recording course completions and regards, and generating reports [3, 9].

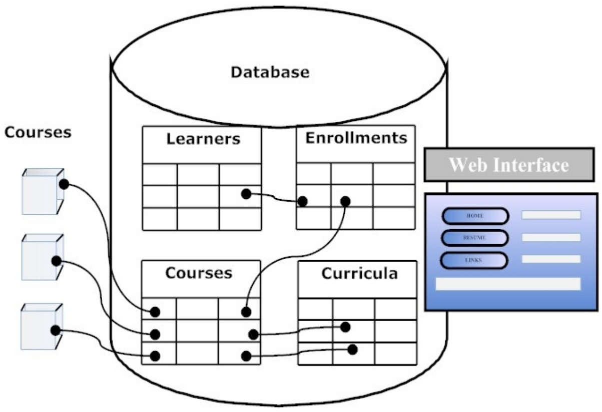

Figure1. Learning Management System (LMS)

IV. LEARNING CONTENT MANAGEMENT SYSTEM (LCMS)

E-learning tools (Web-based tools that support learning) can be roughly decomposed in two categories: (1) Content Management Systems (CMS) and (2) Learning Management Systems (LMS). Pure CMS environments are used for the off-line course creation and management, whereas pure LMS systems support on-line lectures with remote access [10]. Nowadays, a lot of e-learning systems are supporting the two functions: they are regrouped inside Learning Content Management Systems (LCMS). LCMS simplifies the task of creating, managing, and reusing learning content, which is the media, pages, tests, lessons, and other components of courses. LCMS manage learning content by maintaining items of content in a central repository. From database, instructional designers can organize, assemble, approve, publish, and deliver courses and other learning events [3]. An LCMS lets authors create, store, and refine learning objects or other units of content. Also, LCMS facilitates administration and authoring at the courses, lessons, and page level [6]. As the name suggests, LCMS are closely related to content creation and display tools. LCMS shown in figure2 is likely to find [9]:

1- Raw ingredients for courses, such as HTML pages, XML data, media components, and other raw materials.

2- Test questions that can be used to measure accomplishment of a learning objective.

3- Definitions of learning objects that combine raw ingredients and tests to completely accomplish a learning objective.

4- Definitions of lessons and courses that specify how to combine learning objects and other ingredients.

5- Templates and style sheets to control the appearance of a course and customize it for various delivery mechanisms.

6- A framework for navigation and user interface, including menus and course maps.

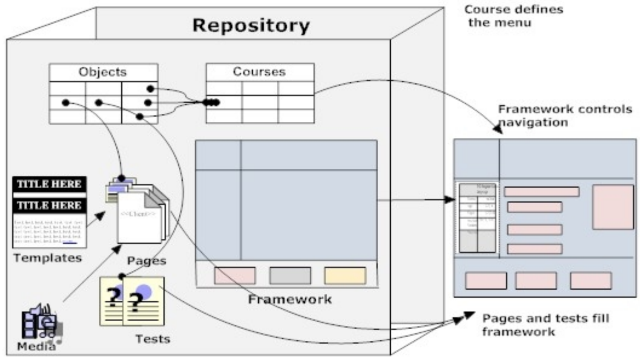

Figure2. Learning Content Management System (LCMS)

V. DESIGN ALL UNITS OF E-LEARNING SYSTEM

Designing must be applied at all levels of e-learning from whole curricula down to individual media components shown in figure3. It is important to understand these units because they influence design techniques that is used in this paper.

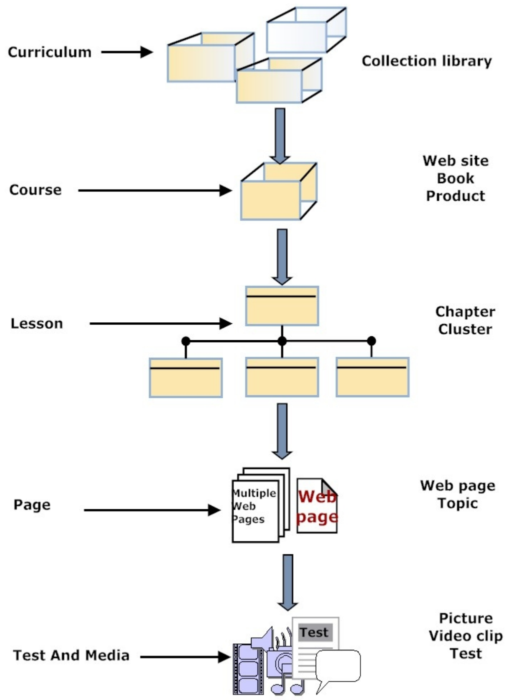

Figure3. E-learning units

Creating curricula consists of locating and integrating separate courses into a coherent sequence or other structure. Creating courses requires integrating separate clusters and pages of contents as well as providing overall navigational mechanisms such as table of contents or indexes. Creating lessons requires selecting and linking pages or other objects into a coherent navigational structure. Creating pages requires entering text and integrating it with graphics and other media. It may also include inserting cross reference hypertext links. Creating media components requires creating the individual pictures, animations, sounds, music, video sequences, and other media.

VI. THE PROPOSED E-LEARNING SYSTEM STRUCTURE

This paper, proposes an e-learning system that is implemented on a Local Area Network (LAN) by using Windows Server 2003 enterprise edition to administrate e-learning system. The system consists of three interfaces that are administrator, instructor and student. As shown in figure4. The

administrator interface manages the Web server by using Internet Information Services (IIS) manager, Active Server Pages (ASP) script files to control the system and SQL server 2000 for the database system but the instructor and student interfaces can use web clients. The instructor interface uses the web browser for the web clients to access the web server to achieve main functions that permitted by the administrator e-learning system. The student interface also accesses to the web server to get the teaching contents and discussion forum with their instructors and peers upon their own convenience.

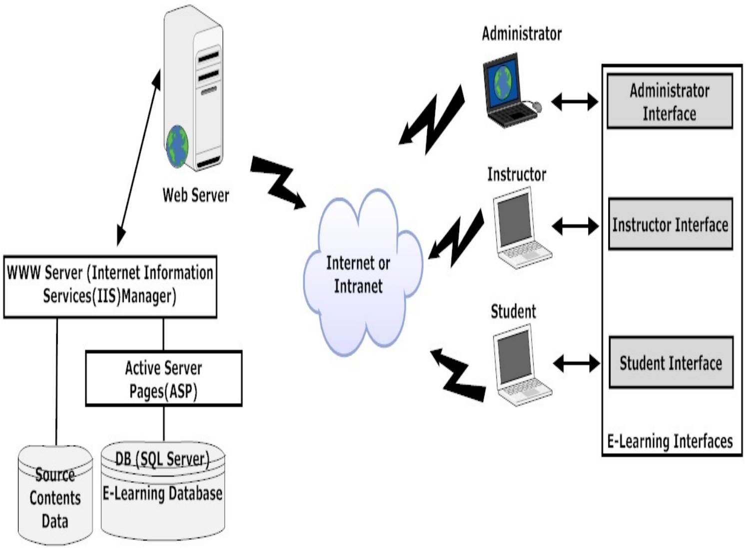

Figure4. E-learning system structure

The e-learning database stores administrator data, instructor data, student data, and course structure data. The source contents are stored as HTML files, PPT files and any other files that are stored on the hard disk computer. The course structure data such as the number of chapters or lessons, examples, exercises, exercise solutions, self evaluation tests, send report to instructor are stored in the e-learning database. The contents itself are stored as the source contents data and are linked from e-learning database.

VII. THE PROPOSED SYSTEM IMPLEMENTATION

The main idea of this proposed system is to design and implement an e-learning system with a new technique in the electronics world in the network or Internet. An e-learning website has been built using the following technologies:

- HTML (Hypertext Markup Language) used to create a web page layout.
- SQL Server 2000 (Structured Query Language) used to store all data in e-learning system, data manipulation and improving system performance.
- ASP (Active Server Pages) used to enable the dynamic webpage.
- ADO (ActiveX Data Object) used to access database from the webpage and displays data from a database on a website.

The designed website consists of three interfaces which are administrator, instructor and students.

A. *Administrator Interface*

The administrator interface has been implemented by using mentioned tools that is shown in figure5.

Figure5. Administrator interface

The administrator interface works as follows:

1- From the login page, the administrator can input login name and password. The system checks it with database. If it is correct, the system creates a session for this name and directly logon to the administrator interface.

2- Administrator can do:

   a. Add/Display/Delete the course information, lessons, examples, exercises, solution exercises, instructor id and name, and student id and name.

   b. View/Delete reports among instructors and students, instructor registration form and student registration form.

   c. Get instructor and student id and name that transmitted by the instructor.

   d. View instructors and students log files.

   e. Directly go to the instructor and student interfaces.

Figure5 administrator interface continuation

B. *Instructor Interface*

It elaborates the technology tools to implement instructor interface shown infigure6.

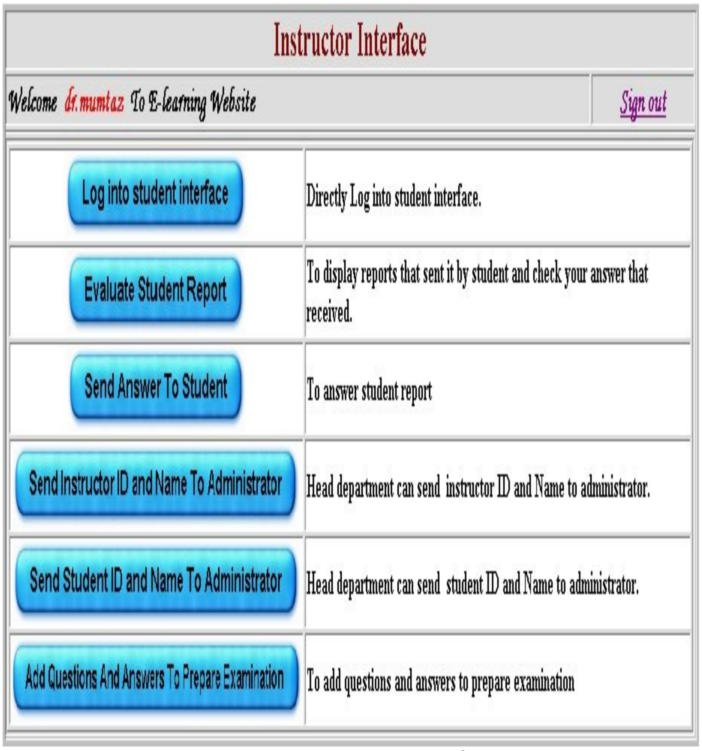

Figure6. Instructor interface

The instructor interface work as follows:

1. At the beginning the instructor can visit head department to register full name and id.
2. The head department inserts it into the e-learning database system.
3. Instructor can input full name and id. The system checks it with the database. If this information already exists the system creats a cookie to identify the user but if the database does not contain it the system display one of the error messages.
4. From the login page the instructor can:
   a. Fill up the registration form in correct to choose login name and password.
   b. Change password by entering login name and new password.
   c. If the instructor forgot the password, he/she can answer a security question to view the password.
5. After registration, the instructor can input login name and password. The system checking if it already exists to create a session and store the name but if not correct, the system directly return to the index page.
6. After logining, the instructor can:
   a. Directly log into the student interface.
   b. Evaluate a student report.

c. After evaluation he/she can sends an answer report.

d. Head department can send instructor id and name to the e-learning system administrator.

e. Head department can send student id and name to the e-learning system administrator.

f. Any insructor can prepare examination page for students.

C. *Student Interface*

The student interface work as follows:

1. At the beginning, the student can visit the head department to register full name and id.
2. The head department sends it to the e-learning system administrator.
3. The administrator inserts it into the e-learning database system.
4. Students can input full name and id. The system checks it with the database. If it already exists the system creates a cookie to identify the user. Otherwise the system displays one of the error messages.
5. From the login page the student can:

    a. Fill up the registartion form in correct to choose login name and password.

    b. Change password by entering login name and new password.

    c. If the student has forgotten the password, he/she can answer a security question to see the password.

6. After registration, the student can input login name and password. The system checks it if it is already exist the system create a session to store the name. Otherwise the system directly returns to the index page.
7. After login the student can print, visualize and download:

    a. Educational content.

    b. Information about each course.

    c. Theoritical lessons or chapters for each course.

    d. Exercise for each lesson or chapter.

    e. Previously exercise solutions for each exercise.

    f. Self evaluation test for each course.

8. Students can send reports to their instructors to request any file and comment on lessons, courses,...etc.
9. Stucent can receive instructors' comments and files.

Figure7. Student interface

VIII. DESIGN A FRAMEWORK FOR E-LEARNING SYSTEM

A successful e-learning system involves a systematic process of ADDIE frameworks that are consisted of Analysis, Design, Development, Implementation and Evaluation processes to create an e-learning system. The construction of this system is focused on finding out how to incorporate the increasingly powerful Web applications and technologies and content development tools into developing and producing a feasible e-learning system as well as enhancing the system functionalities and performance so as to improve its applicability. A feasible model of systematical building e-learning system is based upon design and development as well as the evaluation results. In this paper, we have proposed a model that involves a systematic process and tasks of building e-learning system. It is observed that effective design and construction of an e-learning system can be facilitated through the systematic process and prototyping approach. Moreover, integration of ADDIE and prototyping approach may be employed to find opportunities for establishing a derivative framework for enhancing e-learning system.

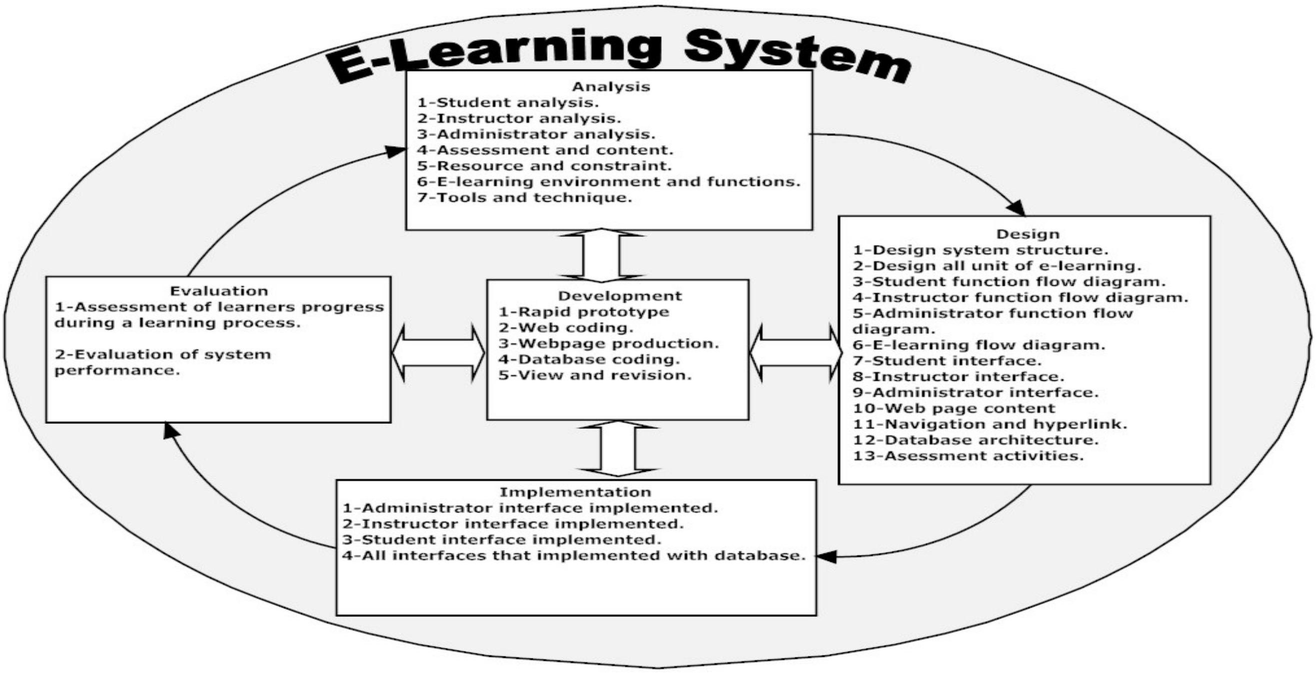

Figure8 The proposed ADDIE framework for e-learning

In this paper, an ADDIE framework for e-learning system has been proposed as follows:

1- **Analysis** deals with student analysis, instructor analysis, administrator analysis, assessment for each course, content of the course materials, resources, e-learning environment, tools and techniques. I.e. analysis strategy, gathering information and system proposal.
2- **Design** deals with designing system structure, units in e-learning system, and flow diagrams for the three participants and e-learning, flowcharts for the three interfaces, Webpage layout and content, and database diagram for e-learning system. I.e. design strategy, program design, database system, file specification, and architecture design.
3- **Implementation** deals with implementation for e-learning interfaces via network technology, Web technology and database system. I.e. coding system in housing or out housing and packaging software.
4- **Evaluation** deals with the assessment of learner's progress during learning process and evaluation of system performance.
5- **Development** deals with approach prototype, Web coding, Webpage production, database coding, view and revision.

The implemented ADDIE framework is illustrated in figure8. The analysis, design, development, implementation and evaluation processes are achieved sequentially. However, the development process is in the center of the framework and is connected to all of the processes. That is, the system can be maintained and developed through the development process to approve this according to the rapid application development in software modeling system, this type is prototype because of in this type after complete the software application for the system, we can do any modification or development from which process.

IX. DISCUSSION

The proposed of an e-learning system could solve some of the current problems in the system as follows:

1. **Engage students during online learning**: The synchronous learning system has more technical problems during online learning caused by those users who are engaged all the time. However, the proposed asynchronous system solves this problem.
2. **Not enough content for good understanding**: Many e-learning systems does not provide sufficient materials for understanding a subject. Some of them, for example, only provide PowerPoint slides of lectures and an online discussion forum, which are not enough for users to obtain a good understanding of the content. The proposed system provides extra information for better student understanding.
3. **Less interaction and user flexibility:** Unlike traditional classrooms in which students have live interaction with instructors and classmates. In spite of that an online learning environment separates students and instructors physically by time and location. The problem of getting online students more involved. The proposed system provides efficient interaction communication among instructor and students.
4. **Unstructured and isolated multimedia content**: In most current e-learning systems, multimedia instructional materials are simply posted on the Web without any processing. They are usually presented in a static, passive, and unstructured manner without close association among relevant contents in various media. While the proposed system enables the instructor to be synchronized between lectures in the class with the multimedia files that are uploaded to the e-learning system.

X. CONCLUSIONS

The proposed e-learning system has facilitated and improved the process of learning through providing of extra information for the learners like lectures, exercise, tests...etc. The system design has been strengthening through designing appropriate

interface implementation that constitutes the base for the e-learning system. This methodology design covers teaching, learning and administrating. It also provides a better strategy for understanding and presents dynamic e-learning activities. The system performance has been increased by the applied new web technology and database system: SQLServer2000, ASP, ADO and HTML. The developed system offers asynchronous communication technology and it is easier to develop and not too expensive compared to the synchronous system. In addition asynchronous e-learning is more flexible than synchronous because the student can choose the time he wants to access a lesson. The proposed system has implemented LMS (Learning Management System), LCMS (Learning Content Management System) and e-learning standards which are compatible with them. LMS and LCMS are vital to the basic understanding of e-learning system. LMS is designed to administrate the Web-based e-learning process, to simplify the process of administrating education and provides tools to facilitate their learning. LCMS simplifies the task of creating, managing, and reusing learning content such as media, pages, tests, lessons, and other components of courses. Also it manages the process of creating and delivering learning content as the names indicates. Learner's efficiency is increased with stimulating learner's motivation by collecting lectures of all instructors who has inserted to the system and providing extra information about the lectures like videos and presentation files. The system has improved the communication between instructors and students. The student sends the report to the instructor to demand any extra information file or examination solution. The instructor evaluates the student report to provide any comments or files.

A rapid prototype of e-learning system according to ADDIE (Analysis, Design, Development, Implementation and Evaluation) framework has been implemented which help other researchers to maintain and develop the system. For future study, the following points are suggested:

1- Reorganization of the administrator interface. The log files which just record access login time it could be convert to record anything.
2- System modification transition to Mobile-Learning (M-Learning).
3- Inclusion of Adaptive-Learning (A-Learning) which adapts to each individual student.
4- Enhancing system security by implementing a cryptographic scheme which has to be executed in order to achieve the desired security levels at each system stage.

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Exploiting Ontologies for the Pursuit of E- Learning Expert Information Security System

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Abstract— **The world has entered the information era with the launch of the most modern technologies & has earned a coveted place in the elite technology club. There has been a detonation in recent times & the humankind is in the vanguard of the gargantuan tramp. The flare-up in the technology, unprecedented with its applications, comforts humankind; envisages reliable information about everything in the universe. Quantum interdeterminacy, the insidious, omnipresent scenery of the network united with mounting concerns about computer-generated intimidation stipulate instant solutions for securing the information's. By equipping the software agents with the knowledge and by investing meta-data information sources we can provide the users with effectual information Services. So far, the investigation in Information Security first and foremost focused on securing the information rather than securing the infrastructure itself. Given the widespread intimidation state of affairs, there is a gripping want to enlarge architectures, algorithms, and protocols to apprehend a trustworthy network infrastructure. In order to attain this aspiration, the foremost and leading step is to develop an ample perceptive of the security threats and existing solutions.**

We have designed an Ontology e-learning system for Information Security which will help a tyro to study the fundamentals of Information Security ontology basics using a web browser. In this paper we challenge to fulfill this imperative step by providing categorization of Information Security, which are classified into six main categories namely, Access Mechanism, Security Mechanism, Security Issues, Risks, Threats, Policies. The paper also discusses the descriptions for each of these categories and, we heighten the utilization of an assortment (ontology) of meta-data in the semantic privacy technology for the design of an e-learning system that enables to provide apprentice with a more effective education support. The learning domain is a more general concept of Information Security. The strength of our ontology-based e-learning system as demonstrated through application examples other prototype system that we have been developing.

Keywords—**e-learning, information security, ontology, tyro.**

I. Introduction

The need for skilled Information Security professionals has spurred us to work to develop a general body of knowledge for the Information Security domain. A general body of knowledge is a framework and collection of information that provides a basis for sympathetic vocabulary concepts in the Information Security knowledge area. It defines the basic information that people who work in Information Security are expected to know. In our work, we pioneer an ontology-based agent model for the information retrieval and representation of Information Security knowledge. The ontology is realized in multi-agent system premeditated to aid abecedarian users, security researchers, users and experts in retrieving relevant information regarding Information Security techniques. The goal of autonomic computing strategy is to deliver users with improved self-management capabilities, such as self-suggestion, self-optimization, and self-configuration. They can also be used to perform automated and continuous analysis of data based upon user-defined configurable rules. In this paper, we discuss the use of ontologies as a sophisticated, meaningful, abstract modeling approach for unfolding the understanding upon which the processing of an engine is based. The foreword of overt models of state-based information technology assets allows the edifice of autonomic computing systems that are competent of dealing with policy-based goals on a higher abstraction level. Multi-agent systems use ontologies to prop up imperative processes implicated in the information reclamation such as posing queries by the user, problem putrefaction and assignment partaking in the midst of different agents, result sharing and analysis, information medley and amalgamation, and prearranged arrangement of the assembled information to the user. The ontology based multi-agent system has rewards like it ropes the toil of Information Security personals in gathering information on extremely particular research topic of privacy preservation, decide and select the best security mechanism.

A. Definition of Ontology

The word “ontology” comes from the Greek *ontos*, for “being”, and *logos*, for “word”. In philosophy, it refers to the subject of existence, i.e. the study of being as such. Ontology in computer science has been used for information understanding, knowledge sharing and reasoning. Gruber defines ontology as a specification of a conceptualization [9].

Specifically, it is the learning of the categories of things that subsist or may exist in some domain. Realm ontology explains the types of things in that sphere of influence. Unceremoniously, the ontology of a definite realm is about its vocabulary, indispensable concepts in the realm, their categorization, their classification, their associations, and domain axioms. Since ontology is an important part of the acquaintance concerning any domain all other knowledge ought rely on it and refer to it. There are many definitions of the concept of ontology in AI and in computing in general. The most widely cited one is “*Ontology is a specification of a conceptualization*” [4].

B. Ontological needs in Information Security

A quotation enlightens why ontologies are regarded to be necessary for the future of computer security [3];

“What’s missing [in computer security] is a broader context that we can use to organize our thinking and discussion. What the field need is ontology – a set of descriptions of the most important concepts and the relationships among them. [...] A great ontology will help us report incidents more effectively, share data and information across organizations, and discuss issues among ourselves.”

MARC DONNER

Ontologies endow with a quantity of functional characteristics for intellectual systems, as well as for knowledge representation in common and for the knowledge engineering process. Confining to our inadequate understanding, no proposal of this kind has been made. The disparity between outline and content is influential for understanding the anticipated ontological hypothesis, and it frequently escapes the formalism-based disciplines. Noticeably, ontology provides a responsible taxonomic machination for an infinite set of phenomena since every property-slot determines the category of concepts that have the property and each value a subclass of that class. A typical ontology has hundreds of properties.

II. RELATED WORK

To the paramount of our understanding, there is no associated work that aims to develop PPDM T ontology to be used as a general base for the development of PPDM applications. Other related work focuses only on access control issues [3],a model for computer attacks[9]. KAON [2] focuses mostly on the managing infrastructure of generic ontologies and metadata, whereas in [6] authors present a policy-ontology. Raskin et al.describe an ontology-driven approach to Information Security [8] in order to organize security attacks and support the reaction to these attacks by relating certain controls with specific attack characteristics, as well as attack prediction. The KAoS Policy and Domain Services is another approach based on ontologies for the representation of security related concepts [10].

The issue seriously viewed and inferred from the New Security Paradigms Workshop (NSPW) 2000 which took place in September 19 - 21, 2000 at the Bayview Hotel, Ballycotton was that the realization that the field would gain considerably by adopting ontology as a theoretical foundation and a methodological tool. Many people have outlined the issues and expressed concerns, for which the ontological advancement will be a precious resource in systematizing the phenomena in the ken, enabling the modular approach, and predicting new phenomena. Ontology is called for introduction of taxonomy and the dependence of the approach on it. The paper on anonymity at the IHW-01[7] was attempting suitable and acceptable definitions for anonymity, unlinkability, unobservability, and pseudonymy.

Against the background, that Ontologies explicitly identify objects, properties, and relationships in specific domains are essential for collaborations that involve sharing of data, knowledge, or resources among autonomous individuals Jie et al.,[6] motivated the need for collaborative environments for ontology construction, sharing, and usage; identified the desiderata of such environments; and proposed package based description logics (P-DL) that extended classic description logic (DL) based ontology languages to support modularity and (selective) knowledge hiding.

To better address the issue of, how trust negotiation requirements can be expressed as property-based policies that list the properties needed to obtain a given resource we introduce the notion of reference ontology, and formalize the notion of trust requirement. Anna C. Squicciarini et al.,[1] developed an approach to derive disclosure policies from trust requirements and formally state some semantics relationships (i.e., equivalence, stronger than) that may hold between policies. These relationships were be used by a credential requestor to reason about which disclosure policies he/she should use in a trust negotiation.

M. Karyda1et al.,[7] addressesed the issue of accommodating security requirements in application development by proposing the use of ontologies for capturing and depicting the security experts’ knowledge. In this way developers can exploit security expertise in order to make design choices that will help them fulfill security requirements more effectively. They have developed a security ontology for two different application scenarios to illustrate its use.

The remainder of this paper is organized as follows: Section 2 offers delineating the outline description of privacy in the milieu of Information Harvesting an overview of the related works in framework for Information security,

the different problems in Information Security, the existing solutions, and our solution to the problem.Section 3 discusses the problem statement, assumptions, notations used etc., for accomplishing our work..Section 4 presents the block diagram, architectural diagram and the work flow architecture. Section 5 discusses the system architecture design, datasets used, User Interface design, and subsystem architecture. Section 6 discusses about the implementation of the system. Section 7 analyses the results and discusses the results. Section 8 concludes this paper with a brief summary and outlines the future research directions to be carried out.

III. PROBLEM FORMULATION

Ontologies are used as a high-level, meaningful, theoretical modeling approach for unfolding the knowledge ahead which the dispensation of an engine is based. The foreword of explicit models of state-based information technology resources allows the edifice of autonomic computing systems that are competent of dealing with policy-based goals on a privileged generalization level.
We recommend a novel framework for enforcing Information security. Our framework attempts to unearth poise amid privacy and revelation of information by attempting to minimize the impact on transactions.

A. Problem Statement

Specification of an framework in order to compare and contrast each and every one of the techniques in a general podium which will be the basis for ascertaining the suitable technique for a given type of application. The goals were to design, develop and implement functionalities like User friendly framework, secure protocol for private data's and knowledge, Reusability, Portability.

We have designed an Information Security e-learning system in which an Abecedarian can learn the mechanisms using a web browser. It defines the vital information that Abecedarians who work in the area of security are expected to know as a basis for understanding the vocabulary concepts in the privacy preserving knowledge area. The ontologies are used as a chic, evocative, theoretical modeling approach for unfolding the indulgent upon which the dispensation of a contraption is based. In our work, we also pioneer an ontology-based multi-agent model system premeditated to aid tyro users, researchers, and experts in retrieving relevant facts regarding information security.

B. Problem Description

Consequently, it is anticipated that expediency for the tyro is better and easy indulgent of the learning contents is consummate, because words to be studied and the relations amongst them are comprehensible and the learner can easily image the whole learning domain. The ontologies can be used by multi-agent systems to buttress up crucial processes concerned in intelligent information retrieval processes to sustain a few important processes concerned in the information retrieval such as posing queries by the user, problem putrefaction and task sharing among different agents, result sharing and analysis, information medley and amalgamation, and structured presentation of the assembled information to the user. The system has rewards like it ropes the toil of security personals in gathering details on extremely particular research topic of information security.

IV. ARCHITECTURE OF THE ONTOLOGY BASED E- LEARNING SYSTEM

We bring out a diagrammatic schematic representation of the blocks as shown in figure 3. 1 involved in the proposed architecture.

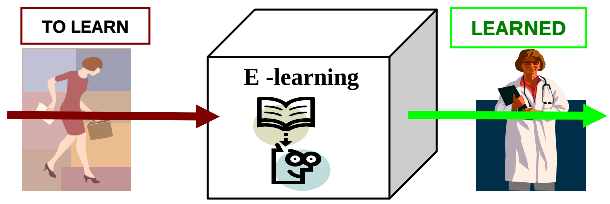

Figure 3.1: Ontology Based E- Learning System for Information Security

A. Block Diagram

We have specified a conceptual framework in order to compare and contrast each and every one of the techniques in a general plinth which will be the basis for ascertaining the suitable technique for a given type of application.

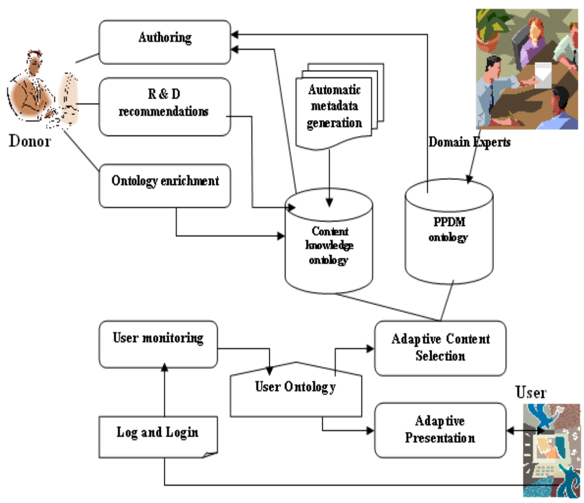

Figure.4.1. Framework of the Ontology Based E- Learning System for Information Security

Three ontologies are as shown in figure 4.1, used in our framework namely, the Domain Ontology containing the knowledge about the structure of the Information Security techniques to be taught; the user Ontology containing the

user profile, and finally the Content Knowledge Ontology, containing a structure of knowledge competent of providing concerto rules represented in a ethical way to facilitate construction of multifaceted wisdom things modified to the users profile.

A. Domain Ontology

The Domain Ontology contains the knowledge about the structure of the Information Security techniques to be taught. During the instigating process, the instigator can discuss with the Domain Ontology to be sentient of the make-up of the Information Security domain about which he or she is creating educative content. Also, he or she can consult the Content Knowledge Ontology to be aware of existing learning objects concerning a given subject to eventually reuse them. Each time that new content is authored, the Automatic Metadata Generation wrapper generates its fundamental metadata as RDF descriptions that are instances of the Content Knowledge Ontology.

B. User Ontology

The user Ontology containing the user profile . The user Monitoring agent continuously updates the user Ontology according to the user's activities. The Adaptive Content Selection agent selects the contents to be presented to the user by creating a learning trajectory tailored to the user's profile based on the knowledge available about the user and the educative content.

C. Content Knowledge Ontology

Content Knowledge Ontology contains a structure of knowledge competent of providing concerto rules represented in a ethical way to facilitate construction of multifaceted wisdom things modified to the users profile.
The Ontology Enrichment by edition makes the Content Knowledge ontology augmentation by human agents possible at any time. Recommendation of Web resources to be used as educative support material is possible by the specification of certain characteristics of the resource and the identification of the person who makes the recommendation.

V. SYSTEM ARCHITECTURE DESIGN

Intricacy of modern information systems imposes novel security requirements and ontology hypothesis aims to support knowledge partaking and salvage in an unequivocal and equally contracted comportment. In this paper we position the practicalities for establishing a knowledge-based, ontology-centric framework with respect to the Information Security.

In the middle of a defense episode, we have a conscientiousness to commune unmistakably and tranquilly about what's happening. We must be able to explain to fellow security experts, to other technologists, and to the universal community in an evident and effectual as to how they benefit. The ontology is a set of descriptions of the mainly imperative concepts and the relationships among them. Such ontology would include concepts like data, secrecy, privacy, availability, integrity, threats, value, owner, authorization, authentication, roles, methods, and groups. It should also restrain these relationships: "owns," "is an instance of," "acts on," "controls," "values," "characterizes," "makes sets of," "identifies," and "quantifies."

Our ontology will aid us systematize our thoughts and writing about the PPDM T field and help us educate our users. Students of medicine, information technologists must learn domain ontology as part of their tutoring, to avoid mistakes and improve the quality of care, so eventually should all gain knowledge of the meanings and implications of these stipulations and their relationships. The topical speedy growth in the field has left the old ontology behind; as a result, it progressively more feels like we're entering the precincts of the Tower of Babel.

VI. IMPLEMENTATION

We have been realizing an archetype of the learning system premeditated. The archetype has system been built on the LAN of our school. The basic OS is Windows-XP and the key implementation language is JAVA. In the following, we show the technology used in the implementation with an example. In order to realize the above functions, we have designed e-learning system as shown in Figure 6.1.

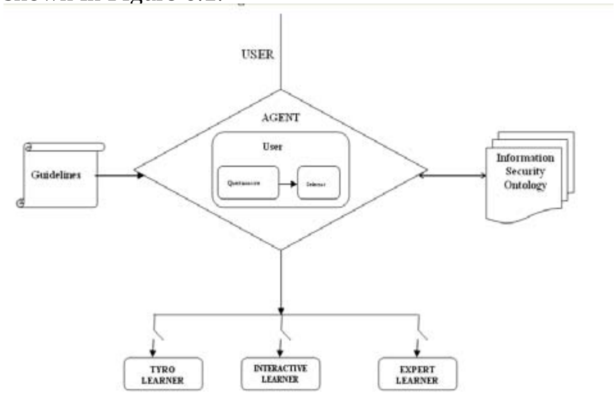

Figure 6.1. Agent based Ontology Based E- Learning System for Information Security

When a learner sends instructions to pursuit the learning of the system as, the servlet program dynamically generates HTML via the web browser and it responds the result to the Web browser. The requested dispensation is classified and Bean performing the processing is generated. It obtains the matching information from the database, referring to the ontology. SQL is used for access to the database. The acquired information is conceded to JSP and for making it easy embeds JAVA codes in HTML. The acquired information is delivered to the learner via the Web browser in HTML form. SSL is used for secure communication between client and server.

VII. RESULT AND ANALYSIS

The recompenses of our contribution are the following as viewed from the sample screen shots of figure 7.1:

- it aids the work of security researchers in garnering information and allows people or software agents to share common understanding of the structure of facts of Information Security on a universal foundation to astutely access new information much more quickly;
- pooled knowledge improves investigation competence and efficacy, as it helps to shun gratuitous severance in doing the same research;
- Assists in exploring novel techniques for information security, since, information in many instances is spatially distributed.
- Formulates Information Security domain assumptions explicitly, making it plausible to adapt these assumptions fluently.
- It facilitates reclaim of Information Security domain knowledge by integrating various existing ontologies that portray portions of a colossal realm or reuse a general ontology and expand it.
- Information Security Ontologies disconnect Information Security domain knowledge from the working knowledge thereby portraying a chore of configuring a product from its mechanism according to a required specification and implement a program that does this configuration independent of the products and workings themselves.

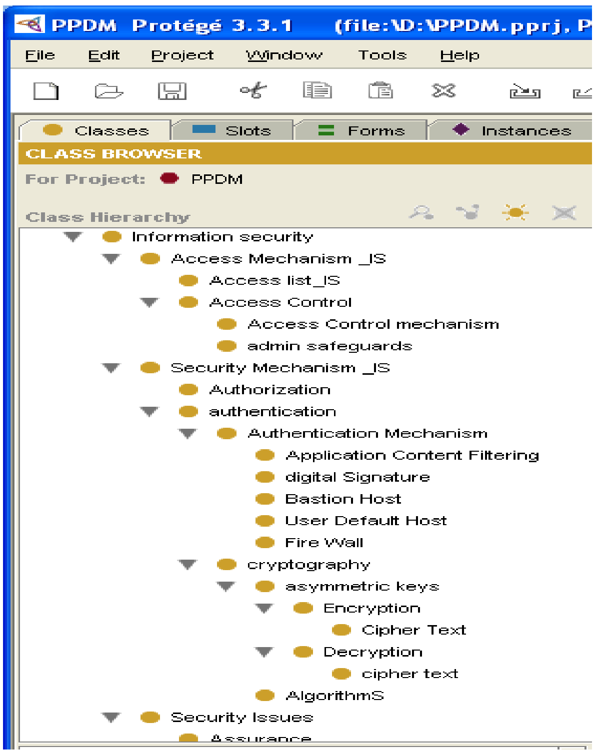

Figure 7.1. Sample Screen shot of the Information

Security Ontology

Figure 7.2. Ontology for Information Security (part)

VIII. CONCLUSION AND FUTURE WORK

In this paper, we have painstakingly pioneered a way of applying the technology to the design of learning system for information security as seen from figure 7.2, and described the development of a prototype system.

We designed an e-learning system in which a learner can study Information Security using a Web browser. This system introduces the concept of ontology, into the design of the system. By using ontology, not only the learning materials but also the vocabulary of the concepts contained in the learning materials and their relations can be delivered to the learner.

In this way, the following advantages are yielded in comparison with the traditional e-learning without ontology:

1. Ontologies will make it possible to share common understanding of the structure of Information Security among people or software agents.

2. Creating ontologies will facilitate salvage of domain knowledge by integrating numerous existing ontologies that portray portions of a huge realm or reuse a general ontology and expand it.

3. The use of ontologies makes domain assumptions unambiguous, making it probable to modify these assumptions effortlessly.

4. Ontologies disconnect domain knowledge from the working knowledge. It will be probable to portray a chore of configuring a product from its mechanism according to a required specification and implement a program that does this configuration independent of the products and workings themselves.

5. Ontologies are obliging in analyzing domain knowledge. A prescribed analysis of terms is

valuable when attempting to reuse existing ontologies and extending them. Developing ontology is analogous to defining a set of data and their structure for other programs to use.

6. Consequently, it is expected that expediency for the learner is improved and easy indulgent of the learning contents is consummate, because words to be studied and the relations among them are logical and the learner can easily image the whole learning domain.

The future sophistication can be an enhancement of the same using context or structure of the learning materials as knowledge; considering how to utilize the ontology for the feedback from the system in the process of learning or on an assessment. It is also important future works to investigate the advantages disadvantages of the system through its use by many learners arid to do an evaluation and improvement of the system.

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User Adaptive Interactive Courses in SCORM Compliant Learning Management Systems

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***Abstract*— Traditional on-line courses are static: Unaware of the learner, they present the same content to every user that participates in the course, independent of the background and the experience of the learner. Furthermore, content is often static and leaves little freedom to the learner. One might argue that this is because currently applied standards like SCORM 1.2 do not allow much more than static content linked statically within the learning management system.**

However, while the upcoming SCORM 2004 addresses adaptivity at the level of the learning management system, we present a class of dynamic interactive content objects in this paper that provide adaptivity at the level of the learning objects themselves while also leaving lots of freedom to the learner.

Since the data mining required for adaptivity happens outside of the learning management system, the presented learning objects already provide their full functionality within SCORM 1.2.

Keywords-SCORM, virtual laboratories, LMS

I. Introduction

A SCORM [17] compliant eLearning system consists of two layers: A learning management system (LMS) that regulates access to the contents, administrates the students, their scores and the assessment results, and sharable content objects (SCOs) that implement the content to be learned, let those be by simple text documents, images or interactive content like questionnaires or applets. The learner gains access to the LMS by a web-browser which embeds the content provided by SCOs into a common framework administrated by the LMS. The communication between the SCO and the LMS is done by javascript, a simple scripting language that is executed by the browser of the learner. For that reason, the LMS provides information on the user to the SCO, and the SCO returns information on the learning success back to the LMS.

Most SCOs are not very spectacular: Text files, possibly some embedded images and simple multiple-choice questionnaires make up most of the content seen by the authors. Truly interactive applets are rarely seen, and if so, the interactivity is often limited. If compared to lab-based interactive hands-on experiments as found in the curriculum of engineering or scientific studies, this type of learning material has little to offer and goes only little beyond an interactive book. By that, the LMS is degraded to a content management system for web-based data.

Here we present the concept of "virtual laboratories", a framework for students to freely perform experiments and simulations, quite similar to a real student lab. It is complemented by interactive courses run by an intelligent and user-adaptive course system. The overall system, laboratory and course system, forms a learning object (a SCO) in the sense of the SCORM standard, and thus can be plugged into existing learning management systems like Moodle [11] or Ilias [3]. Remote experiments and simulations are actively used in various experimental sciences, related training courses have also been explored in chemistry, see e.g. [12] and electrical engineering, e.g. by [19]. Virtual laboratories are also explored as on-shore educational tools to train the technical skills of sailors of the US navy, see [1].

SCORM 1.2 [16] treats all SCOs as separate entities and does not allow them to carry over information on the learning process from one SCO to another, and thus to establish the necessary data to setup an adaptive system. This changed with the SCORM 2004 standard [17]. Possible approaches how to reach adaptivity in SCORM have been studied by Mödritscher, García-Barrios and Gütl in [10], though the authors conclude that the lack of metadata standardization for the SCOs hinders adaptivity of a SCORM driven LMS. A suitable set of metadata has been identified by the "Knowledge On Demand" project [15] within which adaptivity and reusability will be possible [14, 13].

The work presented here only reaches adaptivity within a SCO, but does not require a specific ontology of the learning material. Any ad-hoc classification would work as the model is entirely driven by usage statistics. Clearly, if adaptivity should be extended beyond SCO boundaries, standardization would be required to compose SCOs from different vendors into a consistent course.

This paper is organized as follows: We first introduce the concept of virtual laboratories and discuss some of the technological aspects of our virtual laboratory VideoEasel [7]. After that we describe our course system Marvin and provide insight in how it organizes courses and allows adaptation to the learner, followed by a section that presents the interface

between course system and laboratory. We then describe how this two-component system interacts with SCORM and forms a learning object, and discuss some of the technological aspects. We conclude with future work items.

II. Virtual Laboratories

The focus of virtual laboratories is to offer highly flexible eLearning environments that offer much more interactivity than traditional static content. Very much like their “real” counterparts, virtual laboratories provide a framework to set up and perform experiments by combining the lab-equipment — here of course algorithms, which aim at either modeling real physical devices, or representing abstract concepts and phenomenon. Please note that a virtual laboratory is different from a simulation: While the latter allows the user access to one single phenomena, the former is rather a framework to carry out multiple experiments and simulations. That is, virtual laboratories are the computer version of a laboratory that, while providing elementary equipment for experiments, leaves it to the user to combine these to form an experiment.

The virtual laboratory VideoEasel developed at the TU Berlin and University of Stuttgart is one such virtual laboratory: Its main application target is to perform experiments in statistical mechanics and thermodynamics [9], but due to its flexibility experiments in chemistry, biology, mathematics or engineering sciences are available. Fig 1 shows a screenshot of the system running as a SCO in the moodle LMS.

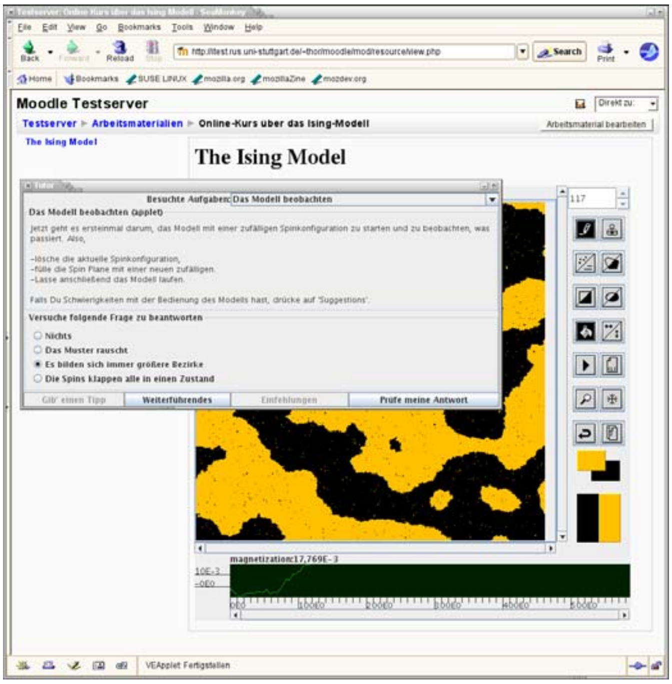

Figure 1. The Ising Model [5] SCO of the virtual lab VideoEasel running in the browser. The Marvin course system in the front.

A. Technological Aspects

The technology VideoEasel is based on a programmable cellular automaton [18] that not only implements the microscopic laws of the simulated physics, the very same idea is also used to define measurement devices that compute macroscopic observables. Typical experiments that can be carried out here are for example the Ising model of ferromagnetism, lattice gas experiments on thermodynamics, image denoising and much more.

The laboratory VideoEasel follows a classic client/server design: A number-crunching server performing the simulation and one or several clients that visualize the simulation and provide a user interfaces. The clients are either freestanding java applications or applets, even Maple [8] or LabView [4] interfaces exist, turning mathematical software into a user-frontend for the lab.

Several users can access the lab simultaneously and either share a session, that is have cooperative access to the same experiment, or work in isolated, separate sessions on distinct setups. A session identifies the complete laboratory setup — it can be understood as the room number of the student’s private lab within a virtual campus. Sessions persist for a while even when the student leaves until, at some time, an automatic garbage collector, the virtual janitor of the campus, cleans up.

III. Foundations of Adaptive Course Systems

An adaptive course system obviously has to gain some knowledge about its users: That is to one degree static data available from the environment and dynamic data obtainable from the usage patterns of the learner. The first type of data, called the audience in the following, includes for example the course and lecture the student is participating at — engineering, physics, mathematics, to give some examples — the second type of data has to be collected by the system itself by software agents observing the user while the course is running.

Note that even though the wording “audience” suggests that this data classifies students according to their study, this need not to be the case. An audience is simply a classification of users into groups of similar learning style and could also be applied to distinguish users that prefer a rough overview first from those prefering a sequential learning style. As far as our technology is concerned, this is just additional meta data used to select the proper learning material.

Obviously, to allow the system to adapt to the learner, more than one possible learning strategy towards a learning goal must exist, and the learning elements must have sufficient semantic annotation to detect and select suitable learning paths through the material. The elementary unit of such a learning system, i.e. one elementary learning step is called an asset in the following. Even though this follows the SCORM naming convention, the learning system described here is not compliant to SCORM in any way.

Our course system Marvin [6] structures assets within two hierarchical layers, see Fig. 2: First of all, asset nodes are grouped to exercise units by hard links that define a branch target and by that a reaction of the system given observed user input. Adaptivity to static data is ensured at this level by providing several versions of the same learning material designed for the needs of the target audience. That is, if a

certain asset node defines a reaction by providing an asset node to jump to for a specific user reaction, several versions of the jump node depending on the target audience might exist.

On the next higher hierarchy level, exercise units are grouped into mini courses. To this end, each exercise unit defines an abstract learning goal it provides, and also defines a set of preconditions that must be satisfied in advance to make this learning goal reachable. These preconditions are then, of course, satisfied by other course elements defining them as their learning goals. Since a mini course may define several alternative preconditions of which only one has to be known by the learner, alternative learning paths can be used. It is now the aim of our course system Marvin to detect and rate suitable learning paths, and to offer them to the user.

A typical learning unit would be the preparation of a suitable initial condition of the Ising model to demonstrate the effect of spontaneous magnetization, which again consists of the assets of first cleaning the screen, then selecting a tool that fills the screen with suitable data, then configuring that tool, followed by the application of the tool to the screen. Depending on the audience, the granularity of the assets might differ — more experienced users will prefer shorter and less granular assets, for example.

The adaption to the user now requires some elementary probability theory: The optimal learning path is the one that provides the highest probability of reaching the learning goal given the history of the user, and this probability can be estimated from the observed success ratio of learners having chosen a similar learning path. For details, see [6].

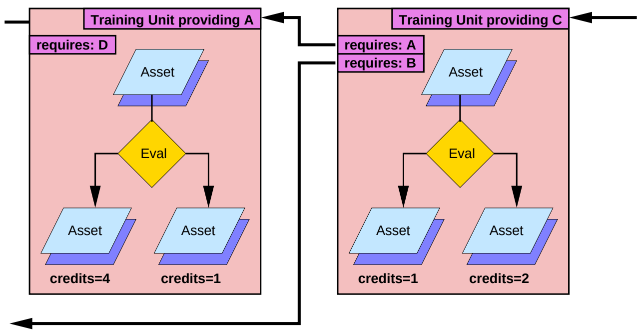

Figure 2. Design of a Marvin course: Asset notes contain elementary assignments to the students. Evaluators assess student behaivour and return results on which the decision for the next asset is based. Assets may exist in several versions (shades of blue) that are targeted to varying audiences. Assets are grouped to form training units that are terminated by a credit point assignment. Training units formulate objectives and preconditions which are resolved by the course system building a learning path for the student.

A. *Integration into Virtual Laboratories*

The Marvin course system by itself neither knows anything about laboratories, nor about SCORM. It only provides a simple GUI presenting the tasks to be performed by the user. However, to collect data on the user, it needs to observe usage behavior. To this end, it interacts with the virtual laboratory VideoEasel in the following way:

The laboratory — or rather, any client that wants to run a Marvin based course — defines a so called Resource Vector containing java references to core objects of the client. In our case these core elements are references to the drawing area, to the tool-buttons of the laboratory and references to the internal structures describing the laboratory setup. Since these elements are client specific, they are per se of no use for the course system. The linkage between the client at one end and the course system at the other end is provided by plug-in java classes that are specified within the asset nodes and loaded by Marvin on demand. The so-called Evaluators receive the resource vector from the course system, by that gain access to the client's internals, and return a textual evaluation to the system upon which it bases its decision.

A typical evaluator would, for example, return the current drawing tool selected by the user, allowing the course system whether the proper selection has been made to setup the initial configuration, or would check the configuration on the screen and return a description of it, again to provide input to the course system for checking whether the user performed the desired activity. That is, evaluators do not return yes/no answers, they rather provide a descriptive answer to the course system which then decides what to do according to the asset node.

B. *Technological Aspects*

The Marvin course system, as already said, is a separate program and not part of the VideoEasel front-end. Rather, it is loaded as a separate java class from the server as soon as demanded by the user, or by the learning management system. Similarly, the course data and thus the asset nodes are kept in a database on the server, and retrieved via the client-server interface as soon as Marvin requests them. The same applies to evaluators, forming the interface between the laboratory and the course system: To reduce loading time, evaluator code is also kept at the server side and requested only as needed. Because usage patterns must persist sessions in order to allow the system to learn from them, the corresponding statistics are also kept server-side.

IV. ON SCORM

A SCORM compliant system [17] consists of a learning management system (LMS) and several learning objects (sharable content objects, SCOs). The LMS administrates the student data, controls access to the learning material (SCOs) and evaluates the learning success of the student. The learning material, i.e. the SCOs, come primarily in the form of HTML pages that are rendered together with the interface of the LMS by the browser of the learner.

At a syntactic level, SCOs are ZIP archives containing the HTML code, XML meta-data defining the purpose of the SCO within the LMS, and any additional data required for the HTML code to display correctly in a browser. The pages defined within the ZIP can retrieve additional information from the LMS via a simple javascript interface that on one hand provides details on the learner — the name, an ID and so on — while on the other hand this interface also communicates the learning success back to the LMS.

A. *Integration of VideoEasel into SCORM*

The course elements and asset nodes defined by the Marvin system should not be confused with SCOs — they are defined outside of the SCORM standard, even though inspired by it. The VideoEasel laboratory and its courses can also be run as a stand-alone application. Instead, one entire mini course (e.g. on the Ising model of ferromagnetism [5]) within Marvin is to be understood as one SCO, i.e. one component of a larger course, and the credit points obtained by the learner within Marvin make up the assessment results of the SCO and are reported to the LMS.

Since we want to deliver the laboratory as part of the SCORM, the freestanding java interface is of course no longer suitable — instead the Java applet interface of the laboratory is used here, whose code is delivered to the learners' browser as additional data along the HTML page.

The student Id is extracted from the LMS by means of the SCORM interface by javascript embedded into the HTML data, and forwarded to the Java applet by the LiveConnect [2] interface between java and javascript. This Id is used as session authentication within the laboratory, and ensures that the same student gains access to his personal laboratory setup each time he re-enters the course. As SCORM Ids are unique, each user is granted a separate session within the laboratory. As soon as the user leaves the HTML page, the learning success data is retrieved by LiveConnect in the reverse direction, and delivered back to the LMS.

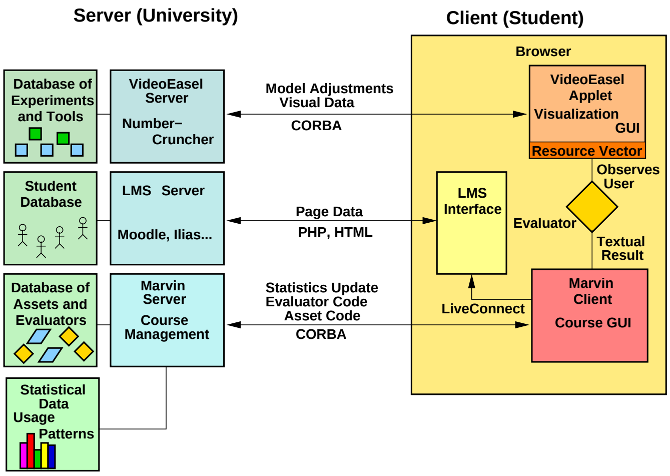

Figure 3. Overall architecture of the system: On the server side, the LMS provides content and the applet core code, the laboratory implements the physics engine, the Marvin server does the course management within the SCO. On the client side the LMS page contains the applet, which dynamically loads the client part of Marvin into the browser, which again loads course nodes and evaluators. The latter moderate between the Marvin course manager and the laboratory core.

However, one problem remains: The learning path collected within Marvin and by that also the state of the student within the course represented by the SCO is not part of the laboratory setup and thus neither part of the session — it must be kept elsewhere. Luckily, a SCORM compliant LMS is able to keep "suspend data" for its SCOs in its own database [17], unfortunately only in string (ASCII) format. To this end, we serialize the java classes representing the learning path of the user, and encode the resulting binary data in textual form by mildly expanding the data. The next time the SCO is re-entered, it is checked whether suspend data is available, and if so, the learning state is deserialized from it.

The overall system is completely transparent to the user: Learners can leave and enter the SCOs at any time they wish, and will return to the laboratory and the course within Marvin as they left it before.

V. Re-Usage of Course Data

One of the design goals of modern eLearning systems is the re-usability of contents. SCORM reaches this goal by the separation of the learning material into sharable content objects that, due to their classification by meta-data, can be re-used in various courses. The same applies to the mini-courses within Marvin, too: Meta-data describe requirements and preconditions of their sub-structures. The difference between a SCORM driven course at large and a Marvin course at small scale is that we introduce agent software that is able to combine these course elements dynamically into courses at run time. Even more, not only the course elements are re-usable, the "evaluator" agents forming the interface between the laboratory and the course system are re-usable.

VI. Conclusion and Outlook

The system at hand describes a SCORM based eLearning system that is adaptive within the SCOs. However, since usage pattern statistics are collected by the laboratory sessions for each user and made available to the Marvin server regardless of the particular user, the system can optimize learning paths for each Marvin driven SCO with the experience made by all users. Exchange between SCOs is, however, impossible within the SCORM 1.2 framework. SCORM 2004 provides advanced services and data exchange between SCOs for data describing the same student, and thus knowledge obtained from one SCO could be carried over to another. As far as both SCOs represent Marvin driven courses, this is simply a straightforward merging process of the collected statistics.

Another research topic is of course to gain experience on the efficiency of the course system and its adaptivity described above. As we have completed the SCORM interface only recently, not much data is yet available. However, the virtual laboratory itself — though as standalone application without its embedding into a LMS — has been deployed successfully in several courses at the TU Berlin.

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Prioritizing of MAS Architectures for Developing Collaborative E-Learning

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Abstract—**This paper focuses on the selection of the most suitable architecture for the development of a multi-agent system in the sphere of e-learning education with the help of collaborative learning. The Multi-Agent System for Collaborative E-learning (MASCE) is intended to be used to assist the teaching and learning process and to encourage collaborative learning among peers. In the whole system, intelligent agents and distributed system methodologies are employed to build a computer-aided collaborative learning and teaching environment. Clustering and match-making algorithms are used to build communities to facilitate learning from peers. The paper studies four different multi-agent systems architectures for developing MASCE. The paper shows that, as a first priority for MASCE, a hybrid architecture that includes both subsumption and a modular organization is feasible. However, the activation of the modular organization should be carried out after finishing the teaching process of the considered course. The paper also shows that a hybrid architecture that includes both the subsumption architecture and flat organization is not feasible for MASCE although it might be useful for other e-learning environments. Moreover, agent communication architectures are considered. It is shown that the facilitation communication architecture is the suitable architecture for MASCE.**

Index Terms—**Collaborative learning, E-learning, Intelligent agents, Multi-agent systems architectures.**

I. INTRODUCTION

The rapid increase in the volume and the complexity of the learning subjects is compensated with usage of different teaching methodologies and materials such as slides presentations, audio and video lectures, tutoring systems and virtual labs. Both of these aspects (the volumes and the material types) increase the complexity of the learning scenarios.

Agents and Multi-agent Systems (MAS) have emerged as a powerful technology to cope with the increasing complexity of a variety of Information Technology scenarios [1]. Dynamism in e-learning can be made more powerful with the help of intelligent agents [2]. In e-learning, Intelligent Agents – the so called e-assistants or helper programs – can sit inside a computer and make the learning in e-learning happen dynamically to suit the need of the user. They can gather information about the user's likes and dislikes in various areas, the level of knowledge and the learning style and accordingly recommend the best matching helpers for collaboration.

The development of multi-agent systems is a hot research topic that has not yet been standardized [1]. This paper focuses on the selection of the most suitable architecture for the proposed Multi-Agent System for Collaborative E-learning (MASCE). Four different architectures are considered for the development of MASCE.

The Multi-Agent System for Collaborative E-learning (MASCE) is intended to be used to assist the teaching and learning process and also to encourage collaborative learning among peers since collaborative learning has been proven to be very significant [3]. This system is used in a blended learning environment as a supplement to the face-to-face lecture where students can use the system in the lab or from home after attending the traditional lecture in the faculty.

The main objective of the system is to incorporate the intelligence of the multi-agent system in a way that enables it to actively and intelligently support the educational processes, where multiple agents can interact to exchange information so that students may collaborate on how best to gain knowledge. Clustering and match-making algorithms are used to build communities for facilitating learning from peers. The development of the multi-agent system is the first phase of the complete system (MASCE) that will provide functionalities essential in the educational process, such as real-time as well as offline data and information gathering, analysis and distribution, embedded feedback, assessment, and collaboration.

A multi-agent system is one that consists of a number of agents, which *interact* with one-another. In the most general case, agents will be acting on behalf of users with different goals and motivations. To successfully interact, they will require the ability to *cooperate*, *coordinate*, and *negotiate* with each other, much as people do [4]. Several architectural styles have been used in the development of multi-agent systems [5, 6].

In the next section, we describe the proposed system (MASCE) that is going to use the multi-agent systems to aid in collaborative learning from peers. In Section III, a part of the Foundation for Intelligent Physical Agents (FIPA) standards

and models is described. We are going to discuss different styles for MAS organizations in Section IV. The analysis of the most suitable one for the development of the proposed system MASCE is given in Section V. Finally, conclusions and future work are presented.

II. MASCE

The major function of MASCE is to supplement the traditional face-to-face lecture such that students can review lecture slides, view recorded instructor's notes and most importantly collaborate with their peers within buddies group recommended by the agents in the system, exchange views, have discussions and receive help from best-helper matches.

MASCE shall be installed on the lab of Faculty of Engineering, Ain Shams University. The lab is equipped with 25 state-of-the-art PCs in addition to two Tablet PCs that are used to record instructor's notes to be made available online. The following servers are provided to allow collaboration: Microsoft SharePoint Server, Microsoft Exchange Server, Microsoft Live Communication Server, Active Directory Server and Microsoft SQL Server. The lab is connected as an intranet and also there is access to the internet such that the benefit of the system is not limited to the lab.

There are two types of users of the system; mainly the students and instructors. During the traditional lecture, the instructor environment is equipped with a Tablet PC, a projector, a webcam, a wireless microphone such that the video and the audio of the instructor and what he/she writes (notes) on the Tablet PC is recorded and uploaded on the system for the students to make use of later on demand.

The proposed multi-agent system consists of three types of agents; namely Student Agent, Instructor Agent and Assistant Agent. The considered research focuses on the "Assistant Agent" since the proposed collaboration system will make a contribution to the field of multi-agents in e-learning environments. Other agents (Student and Instructor agent) have already been introduced in [7] so we will build a simple prototype for each to be used in the system.

A. Student Agent

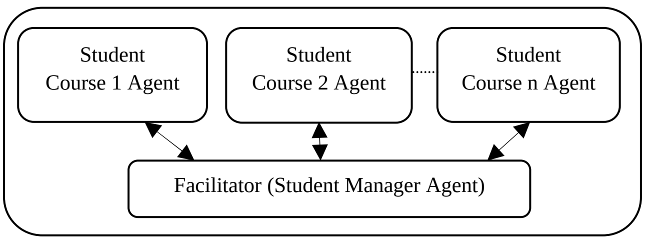

Figure 1. Student Agent

Each student has the corresponding Student Manager Agent that helps the learning process of the student. It acquires the student's preferences and profile. During the learning process, as the student enrolls in new courses, a dedicated student agent for each course is created. It tracks the student actions in that course. Accordingly, the tracking mechanism updates the student's profile and preferences. All the student agents of different courses of the same student are under the control of the Student Manager Agent as shown in Figure 1.

B. Instructor Agent

The Instructor Manager Agent or simply the Assistant Agent assists the teaching process while interacting with the instructor. It is assigned for each instructor. For each course that is taught by the instructor a dedicated instructor agent is created. It provides teaching materials when requested by Assistant agent for distributing to students' agents, assesses the progress and participation of different students through quizzes, and manages the progress of the course. All the instructor agents of different courses of the same instructor are under the control of the Instructor Manager Agent as shown in Figure 2.

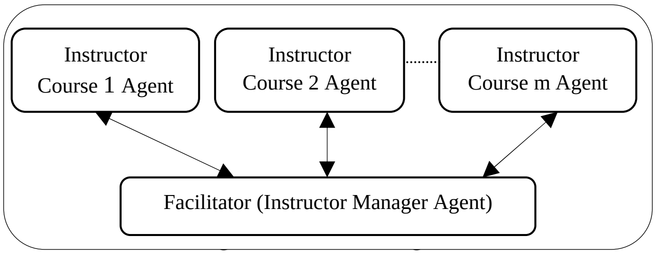

Figure 2. Instructor Agent

C. Assistant Agent

The innovation in the proposed system is the introduction of the Assistant Agent shown in Figure 3which is initialized as soon as any of the users starts to use the system. The Assistant Manager Agent or simply the Assistant Agent plays a centric role in the proposed system. For each course, a dedicated Assistant Course Agent is created. It has a collaboration mechanism which will be used for "match-making" and "community-building" to help increase collaboration between peers in a certain course. It also gives hints to the instructor of the course to help in the teaching process such as statistics of the results of quizzes and summaries of students' profiles to help in the final grading. It acts a mediator (facilitator) between Student Agents and Instructor Agent of a specific course. After receiving the preferences (goals) of the instructor and the students, it will run autonomously and self-dependently. All the Assistant Agents of different courses are under the control of the Assistant Manager Agent.

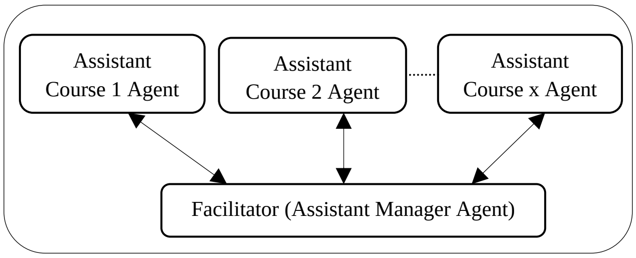

Figure 3. Assistant Agent

III. FIPA STANDARDS AND MODELS

The Foundation for Intelligent Physical Agents (FIPA) is an international organization that is dedicated to promoting the industry of intelligent agents by openly developing specifications supporting interoperability among agents and agent based applications [8].

A. FIPA Agent Reference Model

Agent Internal Architecture describes the modules from which a single agent is comprised, the relationships between these modules, and the interactions among them [9]. Figure 4 shows FIPA Agent Management Reference Model which provides the normative framework within which FIPA agents exist and operate. It establishes the logical reference model for the creation, registration, location, communication, migration and retirement of agents. The entities contained in the reference model are logical capability sets (services) and do not imply any physical configuration.

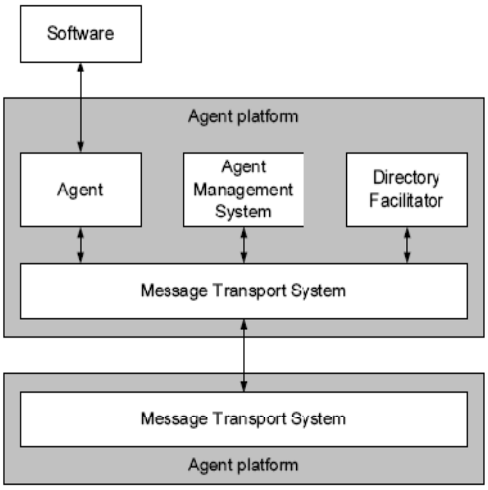

Figure 4. Agent Management Reference Model [8]

- Directory Facilitator (DF) is an optional component of the Agent Platform (AP) which provides yellow pages services to other agents. Agents may register their services with the DF or query the DF to find out what services are offered by other agents.
- Agent Management System (AMS) is a mandatory component of the AP. The AMS exerts supervisory control over access to and use of the AP. Only one AMS will exist in a single AP. The AMS maintains a directory of AIDs which contain transport addresses for agents registered with the AP. The AMS offers white pages services to other agents. Each agent must register with an AMS in order to get a valid AID [8].
- Message Transport Service (MTS) is the default communication method between agents on different APs Agent Platform (AP) provides the physical infrastructure in which agents can be deployed. The AP consists of the machine(s), operating system, agent support software, FIPA agent management components (DF, AMS and MTS) and agents.
- Software describes all non-agents, executable collections of instructions accessible through an agent. Agents may access software, for example, to add new services, acquire new communications protocols, acquire new security protocols/algorithms, acquire new negotiation protocols and access tools which support migration.

B. Communication Architectures

FIPA is concerned only with how communication is carried out between agents who are native to the AP (Agent Platform) and agents outside the AP. Agents are free to exchange messages directly by any means that they can support [8]. Three communication Architectures are commonly used. They are Blackboard Architecture, Facilitation Architecture and Message Architecture. In the following, each of these three communication architectures is going to be illustrated by a figure.

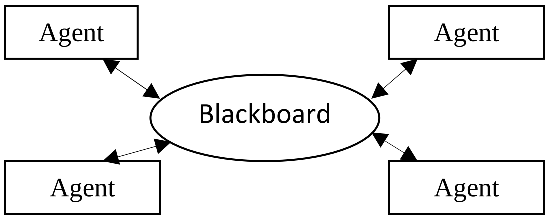

Figure 5. Blackboard Architecture

In Blackboard architecture, there is a blackboard where all agents can send and receive messages as shown in Figure 5. In the facilitation architecture, agencies can communicate only through a facilitator in each agency as shown in Figure 6. Regarding the message architecture, the agent (sender) sends the message to a specific agent (receiver) and waits for a reply from it as shown in Figure 7.

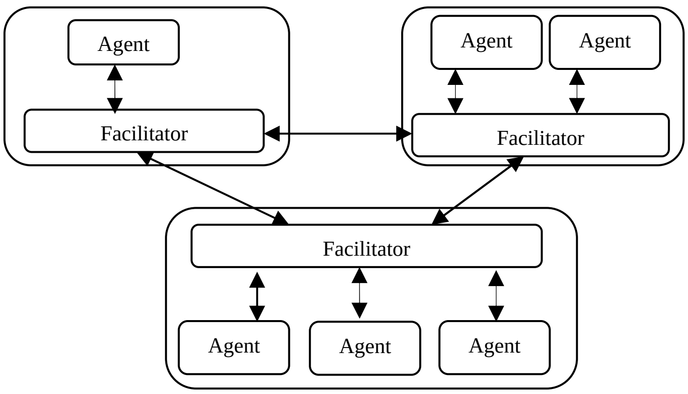

Figure 6. Facilitation Architecture

As for the communication architecture chosen for MASCE, we found that the facilitation architecture is the most suitable one. In each agency, there is a facilitator responsible for communication with the outside agencies.

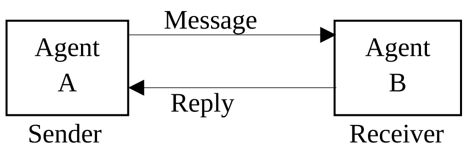

Figure 7. Message Architecture

IV. MULTI-AGENT SYSTEMS ORGANIZATIONS

Multi-Agent Organization describes the way in which multiple agents are organized to form MAS. Relationships and interactions among the agents and specific roles of agents within the organization are the focus of multi-agent organization. Although several organizational models have been used in the development of multi-agent systems [5], in this paper, only the four multi-agent organizations from [9] will be considered. These are hierarchy, flat organization, subsumption, and a modular organization.

A. Hierarchical Organization

Hierarchical MAS are organized such that agents can only communicate according to a hierarchical structure such as a tree. One advantage of this restriction is that there is no need for a mechanism for agent location. Another advantage of hierarchical structure in MAS is the significant reduction in the amount of communication in the system, and also the complexity and reasoning capabilities needed in the individual agents.

The disadvantages of this organization are the strict structure, which does not allow agents to dynamically organize themselves to best fit the needs of a specific task. Also, usually the hierarchy implies that the lower levels depend on the higher levels, and higher levels may even be in partial or full control of the lower levels. This may be in contrast to a requirement for autonomy of agents or for their being self interested. A hierarchical organization may also imply, to some extent, a centralized control, which is undesirable in systems which are comprised from components that belong to different organizations, and may be geographically distributed as well.

B. Flat Organization

A flat organization of MAS implies that each agent can directly contact any of the other agents. No fixed structure is applied on the system; however agents may dynamically form structures to perform a specific task. In addition, no control of one agent by another agent is assumed. Such an organization requires that either the system is closed, so that each agent knows about all of the others ahead of time, or when the system is open, an agent location mechanism must be provided as part of the infrastructure.

A flat organization is advantageous since it fully supports autonomy and self interest of agents as well as distribution and openness of the MAS. It also allows for dynamic adjustments of the MAS organization to changes in tasks and environment. These openness and dynamism, however, result in communication overheads, the need for agent location mechanisms as well as mechanisms for dynamic MAS reorganization. The amount of reasoning an agent performs with regards to other agents (and consequently the local computational overhead of an agent) increases significantly in a flat organization.

C. Subsumption Organization

There are MAS where some agents are components of other agents forming an agency. These agents are subsumed by the container agents, which in turn may be components of larger container agents. Communication and cooperative task execution are performed either among members of an agency or between different agencies, however not directly between members of an agency and the outside agents. The subsumption model is somewhat similar to the hierarchical model; however it takes it to the extreme by requiring that the subsumed agents completely surrender to the control of the container agent. From a software architectural viewpoint, such architecture resembles inclusion of objects within a larger object, except for the (important) difference in the control methods. That is, while objects are usually controlled and activated by (possibly remote) procedure call or by event invocation, agents are activated by high level communication, i.e., message transmission.

The strict control relationships in the subsumption organization results in efficient tasks execution and low communication overhead, however restricts the system to address a well defined set of tasks, with virtually no flexibility and adaptability. It is also not simple to modify a subsumption MAS (e.g., add a new component) in the face of long term changes in tasks and environment of the system.

D. Modular Organization

A MAS has a modular organization when it is comprised from several modules, where each of these modules can be perceived as a virtually standalone MAS. Typically, the partition of the system into modules is done along dimensions such as geographical vicinity or a need for intense interaction among agents and services within the same module. Often, the system is comprised of such parts as a result of its development process, during which new modules were gradually added to an already existing system. Modularity increases efficiency of task execution and reduces communication overhead. The communication between different agents in a module is referred to as intra-module communication. Moreover, within each module high flexibility is usually enabled, similar to flexibility in flat organization.

On the other hand, reorganization across modules is rather complex, flexibility is limited. In addition, the given modularity implies constraints on communication between different MAS modules (inter-module communication).

V. Feasible Organizations for MASCE

In MASCE, the Assistant Agent of a course acts as a mediator between Student Agents and the Instructor Agent of the same course. Messages which are sent from the Student or Instructor Agents are not addressed to specific agents. It is the mediator's role to handle and dispatch messages to the recipient agents. Agents can dynamically connect and disconnect from a mediator i.e. it is an open system, not a closed one. Each agent's facilitator handles the requests posted by the Assistant Agent (mediator).

MASCE as described in Section II is comprised mainly of three types of agencies; Student Agency, Instructor Agency and Assistant Agency where each agency is recursively a collection of several agencies (i.e., a subsumption organization is very suitable). Each agency is represented by a single responsible (manager) agent. However, the partition to agencies does not allow for dynamic changes in the structure of the organization and the grouping of agents on demand.

On the other hand, the flat architecture has no fixed structure on the system. Any agent can communicate with any other agent but on the condition that the system is closed such that each agent knows all about the others in advance, which is not the case in MASCE. The number of students who will join the system and who will have a corresponding student agent for each of them in each course in which they are enrolled, is not known ahead of time. The solution to this is to provide an agent location mechanism in the system, but which will increase the communication overhead. The complexity and reasoning in individual agents will also increase. That is to say that flat architecture is not suitable for MASCE.

Students who have finished taking a particular course are no longer connected through the Assistant Agent (the facilitator). To remain in contact and continue communication after finishing the course, the Student Agents can be arranged in a flat organization. In this case, each agent (Student Agent) can directly contact any of the other student agents and no control of one agent by another agent is assumed. However, there is an unavoidable overhead for agent location mechanism. For the first phase of MASCE, there is a need to keep track of the interaction between students to build the groups of the students for matching and clustering during the enrollment of the students in the course Therefore, for MASCE this hybrid architecture that includes both the subsumption organization and flat organization; will not be considered in this phase.

Another feasible MAS architecture for Student Agents during the enrollment of the courses or after finishing these courses is the modular organization. Here, the partition of the system (Student Agents) into modules is done along dimensions such as geographical vicinity or a need for intense interaction among agents and services within the same module. For the first phase of MASCE, the Assistant Agent is used to build groups of students for matching and clustering. Each of these groups can be considered as a module in the Student-Agents-System. Therefore, for MASCE this hybrid architecture that includes both the subsumption organization and modular organization will be considered in a later phase. However, this modular organization will be activated only after finishing a considered running course to facilitate the knowledge acquisition during this course.

VI. Conclusions

In this paper, four different architectures for the development of a Multi-Agent System for Collaborative E-learning (MASCE) have been prioritized. The main objective of this system is to incorporate the intelligence of the multi-agent system in a way that enables it to intelligently support the educational processes, where multiple agents can interact to exchange information so that students may collaborate on how best to gain knowledge. MASCE is to be used to assist the teaching and learning process and also to encourage collaborative learning among peers. This project can be seen as the first phase of a complete system that will provide functionalities essential in the educational process.

Four different architectures are considered for selection of the most suitable architecture for the development of MASCE. The advantages and disadvantages of each one with respect to MASCE are compared. The subsumption architecture was selected as a first priority for the development of the first phase of MASCE.

As a future work, later phases of the system can use the modular architecture to add modules for students who finished taking a course but who want to continue communication with each other without the help of the Assistant Agent. This added module is considered as a standalone MAS.

Acknowledgment

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SCORM specifications for an emerging world:

The linguistic diversity at work

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Abstract—**The world wide spreading of e-Learning models, techniques and solutions is imposing new challenges to emerging countries in order to face the digital divide by subscribing to this inevitable global educational process. Many projects, collaborations and initiatives are striving to find out the appropriate solutions to reduce and bridge the e-gaps in education through standards definition and implementation. Among the major initiatives that the Agency of French speaking Universities (AUF) has undertaken in this respect, is the assistance forwarded to its French speaking partners to produce standardized educational resources on basis of their own linguistic and cultural specifications. This paper illustrates the procedures, outcomes and perspectives of such an initiative with regards to AUF experience with SCORM specifications as a leading model in the realm of international e-Learning standards.**

e-Learning Standards, Linguistic diversity, cultural diversity, governance, AUF, SCORM

I. General overview

It is obvious, nowadays, that e-Learning standards gained a very large universal interest among all categories of actors working within educational, learning and training contexts. The pioneers' era when instances like AICC[1], ARIADNE[2], IMS[3] etc. were acting in closed clusters of e-Learning elite is somehow obsolete. After two decades of progressive improvements, the e-Learning standardization issue is becoming a strategic component of e-Learning governance and a guarantee of integration within the world wide dynamics of access to knowledge and education for all.

This generalized concern about e-Learning mechanisms and, in a second step, about its standardization procedures, induced a wider concern about the cultural and linguistic diversities in which international potential users and actors could find an obstacle to access and share educational resources and services. International programmes like Unesco project "Education for all"[4] or IUT WSIS summits[5] treating the digital divide, attribute to this linguistic and cultural considerations a key role in solving problems inherent to unequal ICT access and unbalanced STI resources between "haves" and "have nots".

The Agency of French Speaking Universities (AUF)[6], an international network composed of around 635 universities and research institutions having French as one of their working languages, is one of the stakeholders that strived to deal with these gaps through education, training and research on basis of equal chances, bilateral cooperation and mutual recognition of each partner's cultural and linguistic peculiarities.

II. AUF e-Learning framework

One of AUF concerns is to put forward an ICT competencies reference model for the definition of professional profiles and the appropriate trainings associated to them. Since few years ago, AUF has been developing a reference framework of ICT trainings capacities that fit with its French-speaking and multilingual partnerships policies.

The competencies reference framework is built upon 4 priority trends:

- ICT for basic use of Internet (an axis treating digital documents editing, collaborative working tools and communities of learning) ;
- Interconnection of systems and networks ;
- Information systems ;
- Educational technologies.

Among the expected objectives of AUF, while implementing this reference frame of competencies, we can mention:

- The tracking of learners' progression in their respective educational processes and their appropriation of the mechanisms that help them acquire competencies ;
- The use of a common vocabulary in the field of ICT between the trainers and learners using the collaborative environments.

These two issues synthesize the wide spectrum of AUF involvements in e-Learning resources and services in connection with its French speaking academic and research partnerships. This also justifies its current strategy to be aligned on the practices and the recommendations of e-Learning through international standards.

Two core activities are conducted by AUF to reinforce its commitment in this educational choice.

- On the one hand, the implementation of a centralized educational learning system (Transfer LMS)[7] to provide a set of free educational materials and services around its ICT competency reference model [8].
- On the other hand, AUF is sponsoring decentralized series of specialized workshops (Transfer workshops)[9] about education, e-Learning and standardization in developing French speaking countries.

Although starting as limited and free initiatives, without strong standards conformity, these both experiences are nowadays submitted to a large effort of synchronization with up-to-date standards and specifications.

III. TRANSFER LMS GETTING STANDARDIZED

The Transfer platform, an AUF open source GNU licensed LMS, is designed to provide a framework of integrated training services and resources in which the educational standardization requirements of e-Learning cope with those of the most relevant world specifications like AICC and IMS. The objective is to reach on the long term, a level of compatibility with the current standards largely inspired from IMS specifications: Accessibility (Accommodation), Competency definition (RDCEO)[10], Content packaging (IMS-CP)[11], Digital repositories (OAI model), Enterprise, Enterprise services, Learner information (IMS-LIP)[12], Learning Design (IMS-LD)[13], Metadata (IEEE LOM), Question and test interoperability, Simple sequencing (IMS-SS)[14], Vocabulary exchange definition (VDEX)[15].

A. Planning standardization priorities

In this respect, and in order to achieve advanced standardization stages of its reference frame of competencies, AUF established a set of priority levels dealing with the different components of its information and educational supporting systems, on basis of a logic ordering of fundamentals dictated by the nature of the on-line educational processes and the stakes that AUF has to deal with. These priorities can be summarized as follow:

1) Ongoing achievements:

- Drafting and structuring Transfer Workshops contents on basis of structured learning objects granularity (IMS organization compliant),
- Their referencing and indexing by standardized metadata (IEEE-LOM compliant),
- Their use on basis of standardized adaptive sequencing (Scorm-SN/IMS-SS compliant)
- Their delivery in the forms of content aggregation packages (IMS-CP compliant),
- Their interoperability between various LMS (AICC/IMS compliant).

2) Short terms objectives:

- Design of standardized educational contents (IMS-LD compliant),
- Definition of competencies, particularly those of Tutors (RDCEO compliant),
- Creation of standardized educational resources repositories (OAI and Cordra compliant),

3) Long terms objectives:

- User information: "Passeport TIC" (IMS-LIP compliant),
- Common multilingual vocabulary definition (VDEX compliant).

Success of such objectives is intended to be the result of an international dynamics that implies contribution to international standardization activities and e-Learning worldwide governance initiatives. It also implies implication of worldwide French speaking partners in developed and developing countries to reinforce the cultural and linguistic diversities to which AUF devotes a large activity programme in its educational strategy.

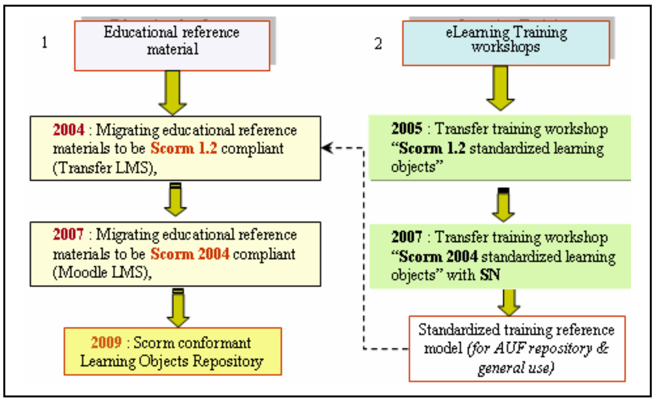

Figure 1. AUF standardization strategy

B. Choosing SCORM as a reference model:

Once the development of educational contents for the 4 training above-mentioned topics of the competencies reference frame has been completed (10 workshops, 71 sessions between 2005 and 2006, 1006 learners, 22 French-speaking countries), AUF undertook a standardization process of these training resources putting as a fundamental goal to make them "RAID" qualified (Reusable, Accessible, Interoperable, Durable) among and by all its French speaking partners. The Scorm reference model was selected to be the solution for this initiative.

A SCORM 1.2 compliant upgrading has been applied to the Transfer LMS to make concrete the above mentioned category of ongoing objectives: using a Scorm contents aggregation model (CAM) with Scorm Sequencing and Navigation (Scorm SN), applying a Scorm Runtime Environment (RTE) and using a Scorm derived metadata model. A minimal application profile has been defined using Scorm compliant metadata elements to which few personalized data elements have been appended to respond to particular system needs (Responsible, execution type). When choosing this reduced metadata model, the guidelines were to provide easy to use metadata categories in comprehensive taxonomy for the large educational French

speaking communities, still unprepared to these new trend of contents tagging forms.

Nowadays, the entire Transfer competencies educational reference is standardized on this basis. The next steps, as stated in short terms objectives, are standardization of learning design processes and creation of standardized educational resources repositories conform to OAI protocols and Cordra system architecture [16].

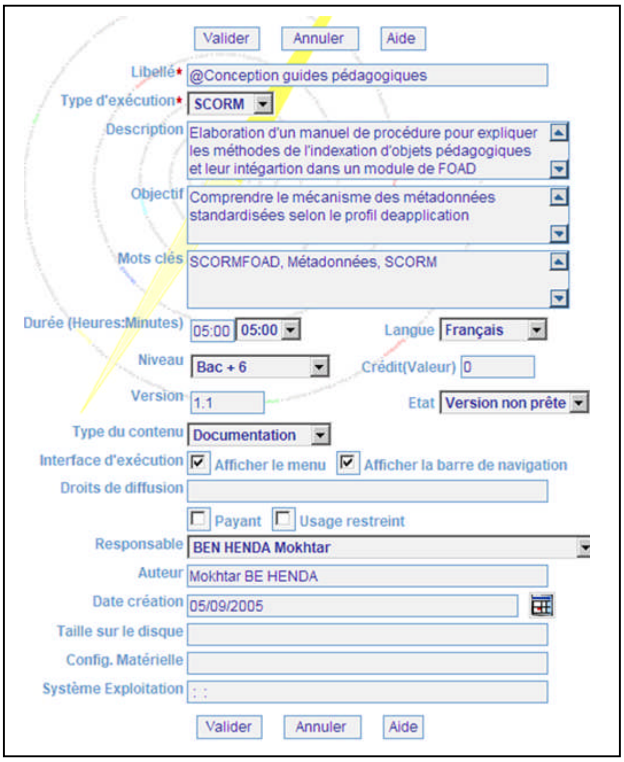

Figure 2. SCO Metadata template

However, when implementing such upgrading and introducing an innovative standardized layer to its educational and training mission, AUF is aiming at a higher objective: to endorse local governance and stewardship of these new standardized issues in French speaking countries and partners communities. Thus, it would play its intermediary role, which defines its core educational mission as a consortium of hundreds of French speaking universities in the world. This explains its commitment to set up the second solution of training national trainers in order to put forward its policy of technology transfer between North and South.

IV. Transfer Training Workshop on and by e-Learning Standards

Within the series of its 10 Transfer workshops covering various aspects of ICT and education, AUF has defined a Transfer workshop specific to the "standardized design of interoperable learning objects"[17] targeting a development of competencies around essential skills like use of metadata, handling the general Scorm environment, producing IMS aggregation packages, handling interoperability functions of Scorm/Aicc/Ims compliant LMS, and validation of contents and Scorm certification.

A. Transfer workshop about e-Learning standards: the basics of Scorm

The workshop is constructed around 5 topics combining theoretical basics and practical productions of learning objects:

- General introduction to standardized metadata models and XML documents,
- General overview about e-Learning standards and their implementation,
- Presentation of SCORM environment :

a) *Content Aggregation Model (CAM)*

b) *Run Time Environment (RTE)*

c) *Test Suite,*

d) *Certification*

- Scorm Sequencing and navigation
- Interoperable Content Packages between LMS : Ganesha, Moodle, Transfer

As a first training experience with learners arriving with classical assumptions of linear and monolithic one-bloc learning resources, the objectives of this first basic version of the Scorm workshop is to:

- Sensitise with the advantages of the standardization of learning resources,
- Encourage use of educational metadata when creating educational resources,
- Draw attention on the benefits of interoperability obtained through standards,
- Train on handling authoring tools for tagging Assets, SCOs and producing organizations of XML based e-Learning standardized contents (Reload),
- Train on using SCORM compliant learning resources and environments (LMS) on basis of RAID criterions.
- Train on validation of Scorm contents using ADL Test Suite.

Three sessions of Transfer 2.3 workshop have been already organized during 2006, two of them were in Tunisia and one was in Madagascar, registering totally 36 participants from 07 African countries.

B. Learner-oriented evaluation of Scorm applications

Transfer workshops are characterized by a final evaluation process performed by the learners themselves about their appreciations, difficulties and ways of considering the upgrading of any workshop they attend. Evaluation criteria are fixed through a common template concerning the agenda, the resources distributed, the pedagogical objectives and methods, the trainers' qualifications and the added value they may acquire following the training session.

Transfer workshop 2.3 about Scorm standards has consequently been submitted to this evaluation in order to consider the extents at which a second versioning is required to reach better performances.

Remarks have been generally formulated around the two following issues:

1) Metadata complexity:

Being rarely used to deal with metadata in electronic documents editing, learners find some redundancy in using so long application profiles and metadata forms to fulfil. The role of metadata for indexing and searching in an e-Learning system remains confusing to them. Taxonomies of some metadata categories and elements: When using LOM standards, some of them remain barely apprehended by learners. Some of these are, for instance, the recurrent data element "Catalog" appearing with 1.1.1 and 3.1.1 then 7.2.1.1 items, the "entry" data element 3.1.2 and the data element 9.2 "Taxon path".

In short, we can summarize the learners' difficulties handling metadata as follows:

- Superfluous taxonomy (e.g. 1.1.1 "Catalog", 2.3.2 "Entry", 9.2 "Taxon path"),
- Subjective (unqualifiedly) data elements (e.g. 4.7 "Duration", 2.2 "Status")
- Accessibility to controlled lists of vocabulary data types (e.g. 3.1.1 "Catalog", 3.1.2 "Entry")
- Complex data elements (e.g. 3.2.2 "Entity", 4.1 "Format", 9.2.2 "Taxon,")

2) Granularity:

Beginners with Scorm standards generally face the challenge of migrating from a classical cognitive schema of linear learning contents structuring to a Scorm-compliant learning model. Largely used to one bloc and linear data contents, learners find it relatively difficult to understand the real scope of Scorm learning items like Assets, SCOs and Learning Objects. Three issues are usually discussed in this respect:

- First, the ambiguous conditions when an Asset could be considered as a SCO or a SCO could be taken as an Asset in a content aggregation is sometimes confusing for learners.
- Second, the high level semantic autonomy of a SCO, that makes it reusable in different learning contexts, goes beyond the linearity constraints that classical course contents impose on the intrinsic sequential and semantic ordering between all their components. The fact that an asset is taken as a semantically neutral component in an IMS organization, contradicts the thematic dependency that it inherits in a classical course construction.
- Third, the prohibition of any physical links (hyperlinks) or logical ties (cross-references) between SCOs (prohibition necessary for SCOs reusability), constitutes another crucial change for learners by comparison to the deeply rooted cognitive schemas they inherited about course contents structuring.

3) Using authoring tool:

Transfer workshop 2.3 is mainly based on Reload authoring tools to produce and test Scorm compliant learning packages. Although originating a large world consensus as a reliable authoring tool, Reload Editor offers a relatively complicated interface for Scorm grass root users mainly those who did not follow any ICT previous trainings. Yet, the Java software solution of Reload tools constitutes a draw back problem for implementing the editing environment on some users' machines. An XML web based solution would have been of better impact for larger dissemination and use.

4) LMS Interoperability:

Interoperability of Scorm content aggregations is demonstrated and tested through three different Learning Management Systems: AUF Transfer LMS, Moodle LMS and Ganesha LMS. The strategy is to create a Scorm compliant aggregation package using Reload editor and to export it in-between the three of them. One of the recurrent problems in these experiments is the reproducing of IMS sub-manifest nodes in a large package when migrating from one LMS to another. This puts forward the interoperability problem between LMS that should be better addressed by LMS developers. This is one of the forthcoming upgrading features that AUF is planning for its LMS environment. Upgrading to Scorm 2004 is also another quality criteria among all those related to IMS compliant specifications.

C. 4.3 Evolution towards a Learning Design approach

AUF strategy today is to encourage local duplication of this first version of the SCORM workshop by national trainers who attended one of the three mentioned sessions, and work on a second version where Scorm advanced functions and specifications would be introduced.

AUF is working today to restructure this workshop so it could be merged with a previously designed workshop exclusively dedicated to Web based educational contents development without strong emphasis on standards. The issue will be that two complementary standardization workshops will be tied consequently to each other, the first one (Workshop 3.3) will be about Scorm compliant Web based XML learning objects and repositories, and the second one (Workshop 2.3) will cover IMS-LD compliant learning design using IMS Sequencing and Navigation specifications.

The result would be a quality upgrading of the impact that standardization workshops would have on the local final users involving them to further disseminate standardized e-Learning resources and services.

This delocalization process of e-Learning standards towards emerging countries has been planned by AUF to reach a second quality level by affording validated educational and training materials and developing local competencies in order to strengthen local expertise and appropriation of standardization issues. This will certainly encourage wide spreading of standards implementation, local governance and adaptive

stewardship of e-Learning standards to local cultural and linguistic needs.

V. SCORM & I18N: THE LINGUISTIC AND CULTURAL DIVERSITY AT WORK

Digital linguistic diversity is yet a worldwide concrete matter of fact. Internationalization (I18N) and Localization (L10n) of digital resources, applications and services are nowadays of common use owing to multi-byte characters coding sets like Unicode and its derived UTF-8 coding format [18]. Starting from the core definition of its mission and partnerships policy, AUF has adopted the principles of I18n to reinforce and help partner languages to integrate rapidly the information age and the ICT revolution. One of its initiatives in this respect is to upgrade its working spaces and resources to a multilingual framework where partner languages could find their own linguistic and cultural requirements for a balanced multilingual partnership. Experimental multilingual versioning of its LMS working space is on the way to become the official solution with integrated IMS compliant multilingual resources and services.

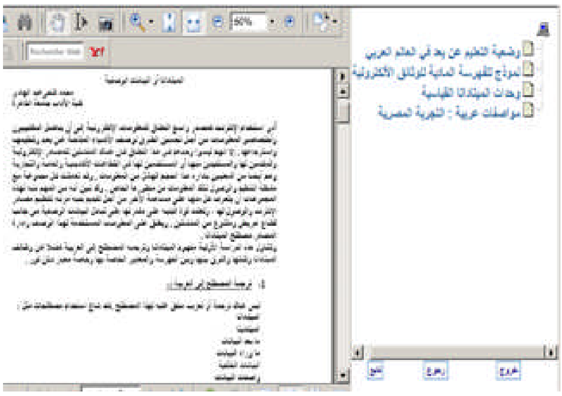

Figure 3. Multilingual Content Aggregation

Yet, some experiments have been conducted to test the extents at which existing IMS resources and Scorm specifications could comply with multilingual course content aggregations. Experimental e-Learning workspaces, similar to AUF Transfer® LMS, have been tested to produce multilingual IMS compliant aggregation packages and to run them within multilingual Scorm based learning environments.

The relevant fact in these experiments is that the multilingual encoding is no more limited to content materials, but the whole LMS is compliant with internationalization and localization global specifications regarding automated language detection for interface adaptation (i.e. directionality swapping), appropriate characters' glyphs rendering and adapted linguistic command based menus and instructions. Arabic language has been chosen as an experimental language considering its both complexity levels of character glyphs rendering and right to left directionality. The result has been outstanding at level of Content Aggregation Model (CAM) and metadata editing, Sequencing and Navigation (S/N) and Run Time Environment (RTE) Application Programming Interfaces (APIs).

Trying to put this multicultural and multilingual technological issue at a higher level of systems interoperability concern, the AUF effort is structured around a three step strategy as dictated by any digital information system layers: multilingual characters encoding, multilingual software Application Programming Interfaces (API) including system menus and dialogue messages, contents management including multilingual data indexing, retrieval and dissemination.

As mentioned before, the first challenge of multilingual characters encoding has been already overcome through international standards like Unicode. Data input is no more an obstacle for any software application conformant with Unicode multi-byte encoding character set.

The second issue, relevant with multilingual application programming interfaces, is currently considered in AUF projects through several initiatives to reinforce current Learning Management Systems and authoring tools with linguistic extensions coping with AUF partners' languages. The A6 Media Company [19] that has developed Transfer® LMS for AUF, is producing multilingual versioning of its educational tools for a wide range of languages. A Tunisian team of computer science students is also working on the localization of Reload authoring tools. This experience, still at its first steps, aims at a full linguistic and cultural adaptation of Reload software, the internationally recognized authoring and delivery tool of Scorm compliant educational resources. Localization process is targeting software windows bi-directionality, menu based commands, editing templates, localized calendar and currency use. Since Reload is an open source software, this initiative is expected to help duplicate localization and translation of this kind of applications and reinforce awareness about standardized learning resources in linguistic environments other than Latin language based areas.

An alternative project is on the way since September 2007 to migrate all the e-Learning resources and processes of AUF educational activity onto Moodle Learning Management System [20]. Being a free Open source application software, Moodle has been developed in more that 75 languages and upgraded to Scorm and IMS specifications ensuring an interoperability criterion with all Scorm compliant content resources in the world. AUF goal is to afford collaborative educational environment for its partners to develop and exchanges content materials and educational processes without linguistic constraints.

The third issue addressing multilingual contents management is basically constructed upon multilingual indexing techniques and resources. Multilingual retrieval and delivery are strongly dependant of indexing quality and semantic analysis. This is the most complicated task that AUF is actually challenging to afford semantically based educational multilingual solutions. With the Web 2.0 services and even the upcoming Web 3.0 services, semantic networks are an inevitable alternative for e-Learning applications (Berners-Lee, 2007). This challenge goes through development of specialized ontologies and semantic networks which results a very heavy burden when addressing multidisciplinary contents. Yet, only few disciplines like medicine have developed specialized

ontologies and semantic networks [21]. Still very recent and then rare in use throughout the Web, the Ontology Web Language (OWL), designed by the World Wide Web Consortium (W3C) in 2004, has not yet accomplished its major task to develop "standard representation formalisms that will allow ontologies to be published on the Web and be shared by different computer applications" [22]. AUF initiative in this respect has started by the compilation of a standardized vocabulary list as the basic for a multilingual e-Learning ontology. A standardized list of e-Learning vocabulary, referenced ISO 2382-36, is being converted into as many languages as possible with validation processes from authoritative bodies in partner countries. Already standardized in English and French, this list has been translated into Korean and Arabic languages and is in the final process of its validation by Korean and Arabic specialized institutions. Work is actually conducted to convert it also into other Asian and African languages. The goal is to produce a multilingual ontology which will serve all AUF partners while collaborating through standardized e-Learning environments without any language problems.

Figure 4. Reload localization into Arabic language

VI. CONCLUSION

No more doubt that standards constitute a worldwide challenge for the future educational systems and policies. The linguistic and cultural diversities, being one of the world's most emphasized issues to deal with the digital divide, they have to be considered with as much care as possible not only to disseminate content resources and technical solutions for emerging countries, but also to train local skills in order to produce appropriate resources and tools based on their proper needs and requirements. This requires much more implication of indigenous human resources in software engineering, computerized applications development, educational contents modelling and definition and local expertise training and education.

ADL initiative to forward the Scorm development to an international stewardship and to convert it into a *Core Scorm* reference model is a valuable initiative for an international governance of e-Learning standards [23]. Being largely disseminated as an e-Learning reference model, Scorm would certainly enhance the universal dynamics for more concrete e-Learning systems interoperability. The foundation of the LETSI international non-profit federation in March 2007 will certainly help promoting e-Learning and enabling innovation in learning technologies [24].

Some recommendations are however compulsory for the forthcoming evolution of e-Learning standards:

- End-user oriented solutions: the old questioning of adapting technologies to users or vice versa should be settled definitely to be user based solutions. It is recommended that in using standards, users are not evidently concerned by standards script coding or complicated set-up interfaces. Intelligent systems should replace users adapting their inputs to the required output standardized formats. Back office layers and routines are to be implemented to take over this function.

- XML Web-based solutions: for some users, sophisticated plug-ins (i.e. Java) could constitute problems of computer systems set-up requirements. Web based XML resources are today a more easy solution to handle.

- Free software solutions: any e-Learning solution should be open source and put free for the large world community. Appropriate and commercial solutions have demonstrated restrictive dissemination among low income communities and have induced large gaps of mutual conformity which is very critical for worldwide e-Learning systems interoperability.

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Management Systems of E-Learning Based Educational Organizations

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Abstract- **Electronic learning (e-learning) has been widely adopted as a promising solution by many organizations to offer learning-on-demand opportunities to individual employees (learner) in order to reduce training time and cost. While information systems (IS) success models have received much attention among researchers, little research has been conducted to assess the success and/or effectiveness of e-learning systems in an organizational context. The development of information technologies has contributed to the growth in online training as an important education method. The online training environment enables learners to undertake customized training at any time and any place. Moreover, information technology allows both the trainers and learners to be decoupled in terms of time, place, and space. This paper concerns with different management systems in virtual educational system and survey the properties of them.**

Keywords- E-learning systems; virtual learning environment; management systems

1- INTRODUCTION

Internet has significantly impacted the establishment of Internet-based education, or e-learning. Internet technology evolution and e-business has affected all industrial and commercial activities and accelerated e-learning industry growth. It has also fostered the collaboration of education and Internet technology by increasing the volume and speed of information transfer and simplifying knowledge management and exchange tasks. E-learning could become an alternative way to deliver on-the-job training for many companies, saving money, employee transportation time, and other expenditures. An e-learning platform is an emerging tool for corporate training, with many companies developing their own e-learning courses for employee on the- job training. Employees can acquire competences and problem solving abilities via Internet learning for benefits among business enterprises, employees, and societies while at work.

Virtual Learning Environments (VLEs) are computer- based environments that are relatively open systems, enabling interactions and encounters with other people and providing access to a wide range of resources [Wooldridge, M.,1999]. VLEs can supplement face-to-face teaching methods, or totally replace these teaching methods in the case of distance learning. VLEs offer a number of advantages over traditional teaching environments in terms of convenience and flexibility [Carrillo, C.I.P.d., 2004]. There are no geographical boundary limitations for using VLEs. They are capable of reaching potential learners in remote areas around the world at very low cost. For these reasons, VLE is becoming one of the fastest growing areas in educational technology research and development. Many traditional colleges and universities, individually or in various forms of partnerships, are embracing information technologies to create new learning models that enhance the effectiveness and reach of their programs [Alavi, M. and Leidner, D.E., 2001]. A VLE is presented in Figure 1.

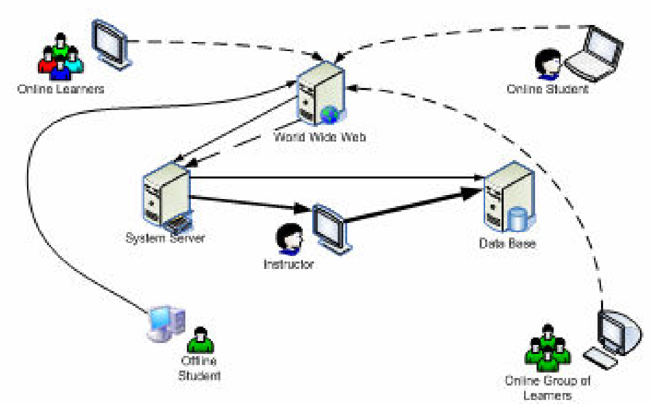

Figure 1. Virtual Learning Environment

Researchers and developers are making rapid improvements in the design and implementation of VLEs, resulting in continuous progress toward successful VLEs. However, online learning is not always effective and sometimes fails to meet learning objectives because of the following limitations:

1. Unstructured learning materials. Online learning materials are usually unstructured across different media, without any close associations with the e-learning processes [Zhang, D. and Nunamaker, J.K., 2003]. Learning material is distributed without consideration for learners' capacities and prior

learning, and therefore lacks contextual and adaptive support [Hiltz, S.R., et al, 1999].

2. Insufficient flexibility. In many current VLEs, the content materials and choices have been predefined, regardless of the learning process and learners' differences. Online learners have little flexibility to adapt the learning content and process to meet their individual needs [Alavi, M. and Leidner. D.E., 2001; Hiltz, S.R., et al, 1999].
3. Insufficient interactivity. Studying online, by its nature, requires online learners to be more actively engaged and interact with their VLEs [Fletcher, J.D., 1975; Hiltz, S.R., and Turoff, M., 2002]. However, some current VLEs are not very interactive. There is less opportunity for receiving instant responses and feedback from the instructor or VLEs when online learners need support.

In such environments variety of architectures are designed that will be explained in the next section.

2- VARIED MANAGEMENT SYSTEMS IN e-LEARNING

Currently e-Learning is based on complex virtual collaborative environments where the learners can interact with other learners and with the tutors or the teacher. It is possible to give the learner's different synchronous and asynchronous services [Neville, K., et al, 2005]. The former group includes virtual classrooms and individual sessions with the teacher or tutors. The latter group includes the classic didactic materials as well as Web-based seminars or simulations always online [Parikh, M., and Verma, S., 2002]. These functions can be usually accessed by means of software platforms called Learning Management Systems (LMSs) [Hackett, B., 2000], Training Management Systems (TMSs), Content Management System (CMS)**,** and Learning Content Management System (LCMS)**.** A short description of those systems is as follows:

2.1- Learning Management System (LMS)

The LMS manages learners, keeping track of their progress and performance across all types of training activities. It also manages and allocates learning resources such as registration, classroom and instructor availability, monitors instructional material fulfillment, and provides the online delivery of learning resources [Scigliano, John A. and Dringus, Laurie P., 2000]. A Learning Management System is a large Web-based software application comprising a suite of tools that centralizes and automates aspects of the learning process through the following functions:

- register learners
- maintain learner profiles
- maintain a catalogue of courses
- store and deliver self-paced e-learning courses
- download e-learning modules and tools
- track and record the progress of learners
- assess learners
- track and record assessment results
- provide reports to management

Not all LMSs are fully Web-based; some administrative functions, like loading a new course might be executed through desktop applications. Since this limits flexibility, all LMSs should be migrated to fully Web-based implementations [Scigliano John A., and Laurie P. Dringus**.**, 2000].

Some LMSs deliver additional functionality, for example, they can help:

- personalize content
- maintain job-based skills inventories
- identify skills gaps
- match staff to jobs
- manage compliance and certification
- manage classrooms and classroom resources
- track and report learning costs
- integrate Knowledge Management
- integrate live e-learning/virtual classes
- integrate collaboration tools
- support the whole learning value chain
- author content

Architecture of a LMS is shown in Figure 2.

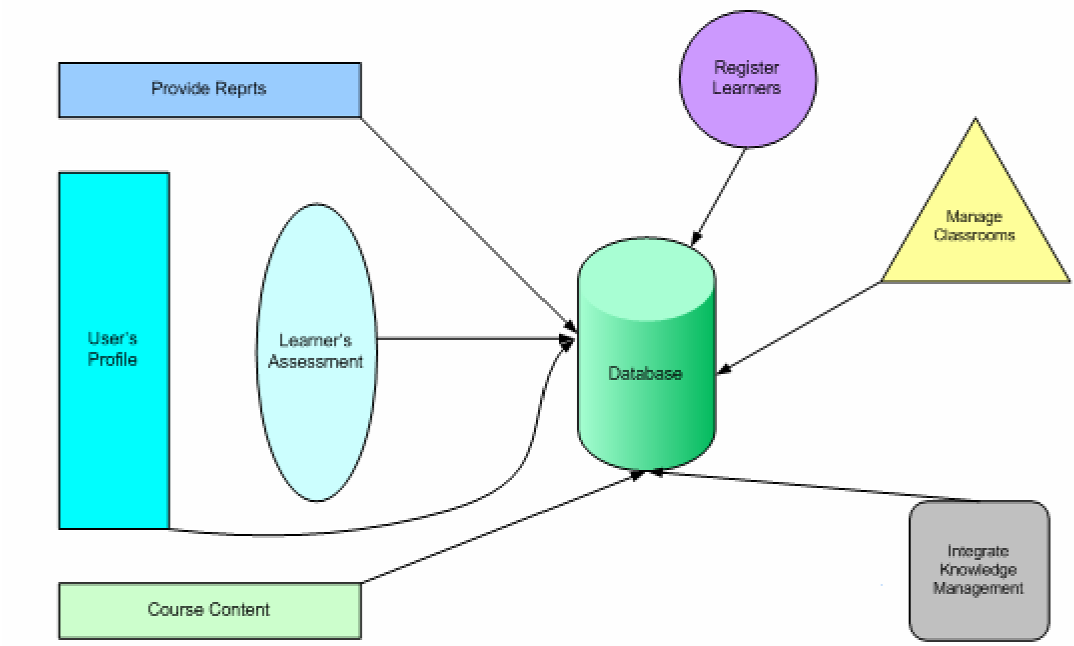

Figure 2. Architecture of Learning Management System

In the same way that few users take advantage of all a word processor's functions and features, few enterprises implement all the functions and features of an LMS.

2.2- Training Management System (TMS)

The TMS was around before the LMS. It's a network application that manages and automates all traditional training activity. Like an LMS, it registers and tracks learners; however, the TMS assumes all learning is face-to-face. It maintains a catalogue of courses and classrooms, classroom resources and classroom events.

Its calendar function allows a trainer to book a classroom for a specific number of learners on specific dates and to book a projector, a flip chart, and any other resources she needs. Learners can then register for the course using an authorization code issued by their manager. The TMS allows the instructor to note in each learner's personal records the sessions they actually attended. Behind the scenes, the TMS uses the authorization code to charge the cost of the course to the learner's business unit.

With the arrival of e-learning, TMS vendors simply added a new module to manage what was to them just another learning resource online learning.

When e-learning became more important, vendors changed the description of their product from TMS to LMS. Meanwhile new dot-com entrepreneurs were developing dedicated Web-based LMS applications that exploited the power of Internet technologies in ways the TMS-based systems couldn't. However, it wasn't long before prospective LMS customers asked the new entrepreneurs how they planned to handle classroom courses. The entrepreneurs simply added a TMS module to their LMS. Customers had to choose either a TMS with an LMS module or a LMS with a TMS module. That kind of confusion has dogged the market ever since.

2.3- Content Management System (CMS)

A CMS is not a dedicated e-learning application but it can be closely integrated with an LMS and used to support the effective development and delivery of course content—especially if you are working with learning objects [Dougla, D. E., & Van Der Vyver, G., 2004].

The principle underlying a CMS is the separation of content and presentation. Content text, graphics and multimedia files is stored in a central database in presentation-neutral formats. Photographs might be stored as BMP files an uncompressed format; video, as AVI files another uncompressed format. Separately, a series of templates are developed to reflect (1) a consistent visual interface and style, and (2) an appropriate technical specification. The templates provide the presentation layer. When a user browses to a Web page, its template is displayed and populated with content in real time. Photographs are rendered as Web-optimized JPG files; video, in a streaming file formation like WMF.

An online newspaper is a classic application of CMS technology. While content is updated constantly, the presentation layer is seldom changed. Journalists and picture editors don't have to worry about presentation; they just save content to the CMS. Neither has to have Web authoring skills; the skills and rules for applying them are embedded in the templates. When a user requests a page, content news, sports,

weather is automatically poured into the associated template. A CMS can manage real-time data, too like share prices and flight arrivals. Because data is stored in a presentation-neutral format, a CMS can support more than one delivery channel. A newspaper's CMS can deliver the same raw content to templates designed for (1) print, (2) the Web, (3) hand-held devices running the Palm or Windows CE operating systems, and (4) WAP-enabled devices.

This approach can be applied to self-paced course development. Create a series of templates to reflect typical course pages; develop content separately and store it in the CMS in channel-neutral formats. When the learner launches a course and accesses a page, the associated template automatically pulls in the right content on the fly. A CMS supports an object-oriented approach to e-learning content.

Because all learning objects are stored in a central CMS, they can be reused by different authors to build different courses. Here are other benefits of CMS-based e-learning content development and publishing:

- When centrally stored content is updated or corrected, every course in which it appears is automatically updated or corrected.
- When the e-learning application is given a facelift perhaps to reflect new branding, a merger, or an acquisition only templates need to be redesigned; content, by far the larger of the two elements, is not involved.
- By supporting automated workflow between instructional designers, subject matter experts, media developers and quality assurance, a CMS enables team-based rapid content development.
- Local templates can be developed to accommodate local language and culture.
- Alternatively, templates can be used globally but based on a learner's profile; content is displayed in the local language.
- As enterprises develop more and more channels to deliver the right learning at the right time, a CMS can automate and accelerate the distribution process while reducing development costs.

2.4- Learning Content Management System (LCMS)

A LCMS has more to do with a CMS than an LMS. It's a CMS dedicated to learning content and a learning environment. The simplest definition of a Learning Content Management System is a system that enables the creation, storage, management and deployment of learning content in the form of learning objects to serve the needs of individuals.

The vendor council is pushing the e-learning industry to view the LCMS product class as a major industry segment, which can be evaluated separately with or without a corresponding LMS [Cappel, J. J., and Hayen, R. L., 2004].

Generally, an LCMS will provide a content authoring module, an assessment authoring module, a publishing module, an administration module, a server engine, a data repository and from the learner's perspective, a module that presents personalized adaptive learning in a customized workspace.

An LCMS should simplify and accelerate the content authoring process allowing subject matter experts with the appropriate access rights to self-publish. It is this self-publish function that some people believe gives the LCMS the potential to act as a knowledge sharing and Knowledge Management tool. A LCMS can also link to content in knowledge databases inside and outside the enterprise.

A LMS and LCMS are not interchangeable nor are they mutually exclusive. They should work together. A LMS can manage communities of users, allowing each of them to launch the appropriate objects stored and managed by the LCMS. In delivering the content, the LCMS also bookmarks the individual learner's progress; records test scores, and pass them back to the LMS for reporting purposes.

In the same way that the functionality of TMSs and LMSs overlapped, most LCMSs offer some LMS functionality course administration, course catalogue, learner registration and learner tracking, for example. LCMS vendors either claim or have demonstrated interoperability with some LMSs.

Considering the stated systems and their specifications the following advantages between learner and trainer could be discussed:

- Learning motivation
- Training content
- E-mail communications
- Ease of use
- Support from supervisors (Trainer)
- Encouraging learning environment
- Learning performance

And also the following economic benefits are emerged of such systems:

1. Opportunity benefit. E-learning system is time boundless the learners have enough time for other activities like working which can compensate a large amount of costs, it is the value added for e-learning system. [Fletcher, D., 1990,].
2. Benefit of accommodation, food, traveling or moving and transportation that were costs in e-learning system. Learners would live in their own city and house that reduce the costs and alter them to benefits.
3. Omitting the cost of trainer's repeated teaching. In this case because everything is recordable there is no need for trainer to teach a same course for many times and the training simulator is used.

4. Benefit of quality. Because of being repeatable, i.e. the lesson which is taught can be repeated, and the property of being collaborative, i.e. learners can discuss a problem with other learners in all over world. Additionally, just one good trainer is required for supporting all the learners.

3- CONCLUSION

The purpose of this paper is to explore management systems in e-learning educational system. Generally for controlling and directing of any organization management play substantial role. Management systems in distance learning are also significant in proposing a comprehensive learning system. In this way Learning Management System provides properties of an educational managerial system, Training Management System concerns with special aspects of training, Content Management System gives information about the motif and courses of an educational system, and Learning Content Management System provides a flexible information system in pedagogical affairs. As a future study designing a learning system based on the learning properties of neural network corresponding to the user profile is under study.

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Ethical Issues in Distance Education and E-Learning

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Abstract— **This paper is an attempt to highlight some of the ethical issues pertaining to E-learning and distance education. Language, culture, fees, internet access, collaborative learning, quality control and academic cheating are discussed in detail. Suggestions to improve the ethical credibility of E-learning and distance education are presented.**

Keywords-E-learning; distance education; ethics

I. INTRODUCTION

The telecommunications revolution, sparked by Internet and computing technologies, has an enormous impact on education. It has changed the dynamics of education, overcoming the traditional constraints of time and distance by providing the capability for access and availability, improving usability and quality of implementing and delivering services. The telecommunications revolution is providing educational opportunities to those who would never be able to come to a traditional campus. It has already improved assessment, access to libraries, laboratories, classrooms and campuses. Information is at our fingertips. Discussion with colleagues has become easier and so has collaboration with them.

However, every technology is a two-edged sword. No doubt that there are both advantages and disadvantages to the impact of telecommunications revolution on education. If we are going to get the best from this impact, we need to pay close attention to its societal and ethical implications from its inception, rather than waiting until it matures with problems already embedded in society. As educators we must handle the changes ethically and provide quality educational experiences.

II. E-LEARNING AND DISTANCE EDUCATION

E-learning can be described as instruction that is enhanced by the use of interactive multimedia authoring and production software, personal computers, Web and/or Intranets, and learning management systems for delivering instruction and tracking learners results and other key training related data. Moreover, an E-learning management system can do a lot to enhance regular classroom teaching. It can be used to shorten, or even replace, some classroom sessions. It can reinforce concepts, run repetitive drills to enhance skills, conduct assessments with instant feedback, and allow students to achieve mastery through repetition. Learners can choose modules in an order and pace that suits their needs. The curriculum can be customized for individual learners; in some cases the software itself can make these adjustments.

Studies have shown considerable benefits to students using E-learning. This includes increased content retention, higher skill levels, increased pass rates, and higher levels of engagement with the class and subject matter through the proper use of communication tools such as online chat and discussions. Computers encourage collaboration, which has been shown to be a major factor in effective learning and a contributor to students' favorable impressions. E-learning systems are forgiving and patient, and will repeat content endlessly. Students do not feel embarrassment at having to repeat material in E-learning.

Distance education has also rapidly adopted E-learning, to speed delivery and cut printing costs. E-learning is ideally suited for distance education and working students, because it enables flexible delivery of learning components in both time and space.

At present, there appears to be a headlong rush into E-learning and distance education. Many lessons previously learned from older forms of print-based distance education still apply to these newer technologies, but have not been learned by

many of the newer players. Others are inventing new ways of doing things which are yet to be tested. Many see E-learning as a gravy train, with great profits to be made. In a rush to compete in distance education many institutions are doing distance courses that neither take into consideration the pedagogy nor the proper use of technology [1].

In order for distance education and E-learning to establish a stronghold alongside traditional university education, social factors need to be considered equivalently. It has been noted that ethical issues are not given the necessary attention in E-learning implementations, as they do in traditional formal educational practices. Although these issues arise from the application of new technologies in the educational context, the subject is not purely technological, but merely a matter of the design and delivery of the service, whilst considering the changes in the delivery and assimilation of education that E-learning technologies bring about.

III. International Distance Education

There seems to be several reasons why institutions in developed countries want to offer their courses internationally. Perhaps the most obvious is to make or save money. In international distance education, usually the program is designed by an institution in the developed countries and marketed, either directly or through partnership, to students in developing countries. With very few exceptions, in developed countries; for example USA and UK, it is not uncommon to charge international students higher fees than students supported by taxpayers. This is the case both for campus and distance students. Given that the costs of developing an online course are fixed, offering courses to students out of the developed country allows for excellent revenues. This raises some ethical issues. Should institutions in developed countries with the means to develop and deliver distance education programs into developing countries seek to subsidize their programs at the expense of poorer countries? Is education just another commodity or service to be marketed and sold abroad? On the other hand, if students in poorer countries want to access courses from richer and perhaps more prestigious institutions from outside their own countries, and hence have the chance of better jobs and more prosperity, why should they be prevented them from doing this? [2].

Moreover, for institutions in developing countries with less experience in distance education, this is a quick and less painful way to get into it more quickly, and hence develop their own expertise. Partnering with a prestigious institution in a developed country can also improve an institution’s competitiveness within its own country. A counter argument is that these international programs are available only to those who can afford them or have access to the technology, namely, those already privileged within a poorer country. Furthermore, taking money out of the poor country from its rich elite makes it harder for poorer countries to invest in their own educational provision. Finally, developing programs for international delivery can also enable institutions to prepare their students for an increasingly global economy and society, if programs are planned from the start with an international focus, especially if they involve contributions from or joint development with institutions in other countries. Programs that have students and instructors from other countries studying and teaching collaboratively can provide a strong international perspective that would be difficult to achieve in other ways.

Furthermore, there are clearly difficult issues of power and dependency here. It is natural that institutions in developing countries with less experience in online teaching and distance education will look to those with more experience, at least in the short term, for help and guidance. This help should be provided in a way that reduces rather than increases dependency, by enabling local institutions to develop their own capacity for online teaching adapted to the needs of their own society. This can be achieved through building local capacity for distance education in developing countries by combining delivery of courses with local training.

IV. Cultural and Ethical Issues in E-Learning and Distance Education

The world of education is changing through distance education. There is, therefore, a need to deal ethically with faculty and learners experiencing this educational revolution. Ethics is a sensitive and delicate issue. Ethics is the study to understand the nature of morality, to define that which is right from that which is wrong of an action, a way of life or a decision. The ethical problems are enlarged in an international distance education environment, with different cultural norms and institution, which provides instruction, support, assessment of results, and evaluation. Institutions,

technicians and users must be aware of the hazards facilitated by the Internet, hacking, swindling and damaging systems.

Educational institutions have always been confronted with behavioral incidents that constitute ethical and moral implications among students, teachers and/or management. In order to deal with these implications, academic institutions proceed in the development of policies, regulations and disciplinary procedures. However, the cases of E-learning and distance education are far more challenging, as physical presence and interaction are no longer required among students and educators.

Issues such as cheating, gender or racial discrimination, as well as complaint procedures, disciplinary procedures, student responsibilities and rights are addressed in codes of ethics of universities. Moreover, there are many other breaches of ethics with the Internet, such as harassment, defamation, and infringement of intellectual property rights [3]. Breaches of ethics may occur unintentionally, and often because users are unaware of policies that may be in place. Students coming from high schools do not understand the issues of collegiate ethics and academic honesty. Education institutions must, therefore, set policies that provide a model for students to follow, and incorporate technology ethics issues in the curriculum. Examples of what may be listed in an institution's policy are [3]: (a) attempting to hack into another computer, (b) using the institution's resources for personal gain, (c) sending threatening or harassing messages, (d) posting confidential material outside the institution, (e) report messages without permission and (f) disruption or interference of network activities, including the disruption of unsolicited advertising, propagation of computer viruses or worms.

As all interactions are virtual, all academic standards, policies and regulations need to be re-examined, in order to constitute an E-learning course 'ethical'. Issues regarding equity, legality, privacy and justice stemming from political, social, cultural and economical implications need to be studied for the design and implementation of web based courses, as they have been in traditional educational practices. In fact, the inquiry on ethics is the first and foremost task when evaluating an E-learning course [4]. The consideration of ethical issues within such a course is as important as in any other educational setting. However, although most -if not all- academic institutions have formulated codes of ethics and teach ethics in their curriculum, little work has been done in E-learning so far.

In order to help E-learning and distance education programs developers and designers, in the following subsections some cultural and ethical issues arising from the implementation of E-learning and distance education are reviewed, summarized and discussed. The major intention is to review the problems faced and reported by others and to pave the way for possible successful partnership and/or local development of distance education programs. In this regard issues related to language, culture, fees, internet access, collaborative learning, quality control and most importantly, the academic cheating, will be reviewed, summarized and discussed [2],[4]-[7].

A. Language and Distance Education

English is at the moment the most predominant language in terms of the international delivery of distance education. There are clear disadvantages of working in a foreign language in online courses, when students have to contribute towards collaborative assignments or participate in discussion forums with those for whom English is their own language. Online courses though also have some advantages over face-to-face teaching for students working in another language than their own. The asynchronous nature of online teaching allows students to take their time in composing responses in another language, whereas in classroom contexts often the conversation moves on before they have crafted an appropriate intervention.

However, providing distance education courses in a foreign language is not just a technical issue. As well as the actual language, such courses usually come with alien social and cultural contexts. Examples are drawn from another culture, idioms often do not transfer between cultures, and even the style of writing may be alien. For instance, using a chatty, personal and friendly style of writing might in some cultures be interpreted as being of poor academic quality [2].

B. Culture and Distance Education

There are also cultural differences in the approach to teaching. Courses from developed countries, USA, Britain, Canada and Australia, tend to encourage critical thinking skills, debate and discussion, where students' views are considered important, and where the views of teachers can be legitimately challenged and where student dissent is even encouraged. In other cultures,

there is great respect shown by students for the teacher, and it is culturally alien to challenge the teacher or even express an opinion on a topic. In distance education, it is a common practice to reward students through grades for participating actively and work collaboratively through discussion forums. These cultural differences will seriously disadvantage students for whom debate and discussion are alien or difficult approaches to take, even for those willing to work in this way [2].

C. Fees and Distance Education

Another interesting set of issues arises around deciding what fees to charge, or rather in deciding on the principles of charging fees. At present, in developed countries, there is a difference between fees charged to international students who study on campus, and those who study at a distance. Those who come on campus pay a substantially higher fee than those who study at a distance. This is because campus places are usually limited and hence scarce, enabling a high fee to be charged and all places to be filled. With distance education, though, there is theoretically no limit to the number of students who can be accommodated. Also, there is increasing international competition in the distance education market. If though distance education and face-to-face courses are considered of equal standing, then why should international students on campus pay two to three times the fee of those taking the course at a distance?

D. Internet Access and Distance Education

Comfortable usage of the media is a fundamental requirement of online education. Easy and appropriate interaction between facilitators and participants and among users, reflected in the quality of courses, services and technical facilities, is the requirement to maintain an E-learning community. Design principles are important to make the contents available in a broad range of users, computers and connections. Unbalanced design/contents makes a page difficult to read or slow to receive, or requiring additional plug-in to be installed, and users browsing this page will not gain the complete understanding or will not be able to interact with the contents. As E-learning seeks to reach the broader range of users, digital equity is a big concern.

Therefore, another criticism of on-line courses aimed at an international audience is that this merely widens the gap between the rich and poor in developing countries, as only the rich have access to the Internet. However, this argument is not as straightforward as it looks. There are many different ways in which people can access the Internet, without owning their own computers or having their own Internet accounts. In international distance education, one advantage of working with partner institutions such as universities in developing countries is that they usually have Internet access and computer facilities on campus, which may be available for students use. In developing countries, many employers have computers with Internet access for work purposes, and may allow or encourage employees to use this for improving their skills and knowledge. Internet access is expected to be cheaper and more accessible in developing countries, and it could be argued that it will be to the advantage of people in developing countries to access knowledge and experience of Internet learning as quickly as possible.

E. Collaborative Learning and Distance Education

Online courses offer the opportunity for course participants to work collaboratively where international students from different countries can share assignments. This is one of its major advantages. However, some students might object to working collaboratively. Some object to the principle of collaborative learning, irrespective of the nationality of the other students; they believe that they should be assessed solely on their own work, and feel that their grades may be adversely affected by working with someone who is not as ‘able’ or motivated. This is a reasonable argument. Not everyone contributes equally. For assignments assessment this would raise several questions. Should one mark solely on the output of the final assignment, irrespective of individual contributions? Should one mark the process as well as the output? Should one for instance split the mark into two, half for the final assignment, which is shared by all participants, and half for individual contributions to the assignment? This would be fairer to students who put in more work, but often contributions are not made in a manner always accessible to the tutor, such as through direct e-mails between students. Also, it increases considerably the tutor workload if all contributions have to be assessed individually.

On the other hand, students for whom English is a first language may object that because of differences in English language fluency, they will have to do more work in correcting English or expressing the group’s ideas more clearly. However, if one believes that learning to work collaboratively online is an important skill for the 21st century, then it seems reasonable to set

this as a goal, and to assess students skill in doing this, provided that students are forewarned before they begin the course that this is expected of them.

F. Quality Controlof Distance Education

One of the major concerns in international distance education is quality. It is essential to ensure that international students are receiving the same quality of program, and achieving the same standards, as students taking a program in conventional ways. For instance, will a student studying a program internationally be of the same standard as a student graduating from the same program on campus?

Currently, in developed countries, on-campus students taking a credit course at a distance sit exactly the same exam and are marked to exactly the same standards as on-campus students. Indeed, the degree diploma, while listing the courses taken, does not indicate whether or not the course was taken as a distance education course.

In international distance education, it is not always possible or realistic to ensure that students studying through another institution in a developing country will get exactly the same services and quality as students registered with the originating institution usually located in a developed country. In discussing the issue of comparable standards, it is important to separate the qualification to be gained, from the institution developing the distance education program.

G. Academic Cheating and Distance Education

Cheating and plagiarism are two of the most popular 'unethical' practices students engage in. Informal polls show that as many as three quarters of students on campus today admit to some sort of fraud [5],[8],[9]. However, a mere 1.3% of students has been reported as 'being caught' from the 50% to 75% of students which admit having participated in some sort of academic dishonesty [6]. This is an increased concern of faculty teaching at a distance - that the distance student doing the work is indeed the student enrolled and that the student is not cheating. Tesch [10] contends that the reason students are cheating is based on two factors; that students are no longer taught to respect the work of others and the ease of obtaining information through the Internet and/or other accessible resources. However, there is no evidence that the rate of cheating among distance students is higher than that among campus students. Cheaters, however, are not all the same. They can be classified into the following three categories [11]:

1. The unintentional cheaters: Those who do not have the proper understanding of how to cite resources.
2. The sneaky cheaters: Those who are aware it is cheating but use plagiarized pieces in ways that are difficult to detect.
3. The all-or nothing cheaters: Those who may be desperate and simply copy entire pages of other's works.

Unfortunately, today there are websites that support and encourage cheating by offering whole or sections of papers and specialized research for fee. Over time, this may reduce the quality of education and, eventually, may erode institutional credibility [12].

Dealing with the issue of cheating is not an easy task. It requires efforts regarding both academic and technological interventions. Due to the nature of the E-learning environment, these efforts need to take place from the design of the system and course rather than making adjustments, if they are to be mostly effective. Philips and Horton [4] have suggested four 'strategies for monitoring and discouraging cheating':

(1) Continuously update topics for projects and assignments and avoid 'classics'. This would make it more difficult for students to find reusable assignments, either from previous academic terms, or from the internet. Faculty will be required to always be current, and continuously look for new topics while searching for similar topics available on the web. Teaching material should also be updated and new events or e.g. case studies should be incorporated.

(2) Promote group effort. This can minimize cheating to a great extent. Apart from resulting in a 'moral obligation' towards other group members, it also reduces the possibility of actually having a whole project done by someone else, unless the whole group decides to do so. It would also be sensible to change groups often, based upon random choice of members.

(3) Police the internet for potential violations. Although it might not seem as the most preferable strategy, it is necessary to do so. Submitted assignments should be checked on the web.

(4) Develop a well thought-out set of policies and regulations regarding cheating. Before all, it is necessary to consider all possibilities that can potentially arise, develop a set of regulations and procedures and make everyone aware.

(5) In order for E-learning and distance education systems to be successful, they must be designed and constructed with care, using scientific procedures and techniques. This, in turn, calls upon ethical responsibility and professionalism in the design and development of E-learning and distance education systems [7].

V. CONCLUSION

Teaching at a distance raises ethical issues particular to the distance context. When distance teaching is also online teaching, the situation is even more complex [13]. If E-learning and distance education opt to grow of equivalent respect to traditional education settings such as universities, they must be designed and constructed with care, using scientific procedures and techniques. In turn, this calls upon ethical responsibility and professionalism in the design and development of an E-learning system. Ethics and morality are of the primary issues to be considered. In this paper, a discussion regarding the issue of ethics in E-learning environments has been presented with a focus on academic cheating. Apart from the above mentioned strategies, there are a few other suggestions:

1. Ethics should be included in the curriculum of every course. Students should be taught ethics, not only for the sake of academic ethical behavior, but professional ethics as well. Ethical awareness is perhaps more important than a new code of ethics [14].

2. Surveillance techniques should be established for E-learning. Technological advancements should be incorporated in E-learning applications that could, to a certain extent, monitor students.

3. Research should be conducted in the matter of what causes unethical practices. Crown and Spiller [15] suggest individual and situational factors that lead to cheating, such as age, gender, religion and previous education. Such work should also be done for E-learning, which would help in best understanding how to avoid and/or deal with unethical behavior.

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Virtual Classroom Visits:

A Use of Technology to Better Prepare Teachers

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***Abstract*— In an effort to create higher quality teachers, technology has provided opportunities to examine the teaching act within the context of the classroom. Specifically, Virtual Classroom Visits (VCVs) provide a method for developing professional interpretation skills of preservice teachers when making classroom observations. This use of videoconferencing technology (H.323) allows groups of 35 or more to observe a single class followed by a conversation with a master k-12 teacher.**

The Virtual Classroom Visit (VCV), which is only possible because of the technology, Classroom was developed to accomplish three primary purposes: (1) to improve noticing and interpretation skills of preservice teachers to facilitate the increase in their level of expertise as they enter the teaching profession, (2) to provide greater access for preservice teachers to kindergarten to grade 12 (K-12) classrooms with master teachers, and (3) to allow common class experiences related to preservice field experiences to be used in illustrating concepts in the college course.

(Abstract)

Keywords-technology; Virtual Classroom Visits; Videoconferencing; Learner Observation

I. Rationale

Political environments in the US and the world require better prepared, high quality teachers. In addressing this issue, Donovan, Bransford, Pellegrino, and the National Research Council (1999) proposed a research agenda for pre-service and in-service education. Included in this agenda is the expectation that current teacher education program content and practices be reviewed for alignment with principles of learning and effectiveness in changing teaching practice. One way to improve new teachers is to help them gain expertise as a portion of their pre-service experience because growth in learning is the "process by which novices become experts" (Bruer, 1993, page 46). Bransford, Brown, Cocking, and the National Research Council (1999) note that experts do not simply have a list of facts or formulas that are used to solve a problem. They approach problems differently by organizing their knowledge around concepts or "big ideas" (Bransford et al., 1999, page 36) that guide them in their problem solving. Experts determine meaningful patterns of information while the novices make only surface observations.

A review of current preservice observation practices indicated that these experiences were unlikely to change misconceptions of preservice teachers or to move them toward understanding classroom interaction in the manner of an expert. At the College of Education, University of Missouri – St. Louis, the Virtual Classroom Visit was developed in response to the need (1) to improve noticing and interpretation skills of preservice teachers that facilitate the increase in their level of expertise as they enter the teaching profession, (2) to provide greater access for preservice teachers to kindergarten to grade 12 (K-12) classrooms with master teachers, and (3) to allow common class experiences related to preservice field experiences to be used in illustrating concepts in the college course. Addressing these needs also facilitated a greater alignment with the principles of learning.

II. Development of the Virtual Classroom Visit

Large educator preparation programs such as UMSL's (2,000+ students enrolled annually) face challenges in providing students with adequate opportunities to observe and interact with practicing teachers. Traditionally, students complete classroom observations as individuals or working in pairs. This work is followed by reflections and analyses, referencing specific points from class or the text. Other than the observation partner, no built-in opportunity exists for the students to discuss the same experience with fellow class members. The process creates experiences that tend to reaffirm what the preservice teacher already thinks instead of bringing misconceptions to light or deepening the level of understanding. Several UMSL faculty members believed that a quality teacher education program required observations and field experiences that contribute to and support the knowledge, skills and dispositions to teach. Thus, the VCV must provide the unique opportunity for teacher candidates to develop pedagogical and professional knowledge as well as credible and targeted real world experiences.

Faculty planned for the VCV by identifying the following challenges of current classroom observations: (1) the difficulty of physically scheduling observations, (2) ensuring that quality teaching is observed, (3) ensuring that

college students can correctly interpret the actions of the P-12 teacher, and (4) providing options for observations in diverse settings. Additionally, a fifth consideration was the difficulty in selecting teaching demonstrations that give clear examples of theory in practice. Faculty identified three primary goals for the project. The first is to provide preservice teachers with more authentic classroom experiences. A second goal is to assist them in developing a deeper understanding of the teaching and learning process. Finally, the third goal is to develop quality teaching knowledge, skills, and dispositions, in alignment with state and national teacher preparation standards.

Observation skills were to form the project's core because exemplary classroom teaching requires continual observation and accurate interpretation by classroom teachers so they can understand and help each K - 12 student to reach his/her greatest level of success. Sherin and van Es (2002) define this capability as "learning to notice". In the classroom, the process of noticing begins with making observations and identifying which of the observations are important. The teacher then hypothesizes an interpretation of the selected observations and chooses a repertoire of strategies that could be used to address this interpretation. The Virtual Classroom Visit needed to encapsulate this process by involving observation, interpreting what is important, matching interpretation to teacher action, and moving from the specific observation to the generalized pedagogy. Preservice teachers that develop noticing skills would be better prepared to use them in their own teaching and thus employ exemplary classroom practices.

Virtual Classroom Visits (VCV) became a process that used videoconferencing technology to focus preservice teacher observations on interpretation of P-12 classroom actions. It was an innovative way of connecting theories of teacher preparation, academic content and classroom practice in preservice teacher preparation. The program uniquely provides instantaneous group analysis of a classroom observation and was grounded in national and local standards, the National Council of Teacher Accreditation's (NCATE) unit standards for educator preparation and the Missouri Standards for Teacher Education Program standards (MoSTEP).

III. Overview

A visit to a P-12 classroom is powerful experience when an entire class sees the exact same lesson followed by a discussion with the teacher. However, it is impractical to place multiple classes of 25-35 preservice teachers in P-12 classrooms. VCV uses technology to help solve this problem. The twin aims of a virtual visit are to observe master teachers in-action and to organize a process for permitting a conversation between the preservice college class and the master teacher immediately after the lesson. The virtual classroom visit's ultimate goal is to create a community of learners -- preservice teachers and professor -- with common experiences in which to model theory in practice and facilitate reflective practice based on enhanced noticing skills, ultimately creating greater expertise in preservice teachers.

A. About the Visit

A virtual visit is divided into two components: a 20 to 30 minute videoconferencing session in which the preservice teachers observe a classroom activity, and a 20 to 30 minute videoconferencing interview session, in which the preservice teachers ask the classroom teacher questions about the activity and the classroom. A facilitator from the university (a graduate student or faculty member with teaching certification) goes to the P-12 site and teaches the P-12 students when the classroom teacher is interacting with the college students. Because the observations involve minors, informed consent must be obtained and specific knowledge about the school site is not conveyed to the preservice teachers, so that confidentiality is maintained.

Virtual visits expose students to differing teaching styles and all age levels, providing them with insights to a variety of children's developmental levels. Students, regardless of their major, have noted how helpful they find this broadened exposure to learning development. VCVs were designed to accomplish the following:

- Connect pedagogy to classroom experiences
- Provide a common experience to facilitate discussion
- Expose preservice teachers to a broader variety of classrooms and school communities, particularly urban settings
- Provide preservice teachers access to multiple master teachers
- Develop processes to ensure meaningful learning experiences

The following are critical teaching skills that the process targets:

- Heightened observation skills
- Interpretation skills related to student classroom behavior
- Development of reflective teaching practices

VCV's can provide the unique opportunity for a teacher education program to ensure that field experiences and classroom observations:

- Are used in a variety of university courses
- Take place in numerous P-12 classroom settings
- Target specific topics or teaching theories

IV. Methods Supporting the Success of Participants

To prepare for a virtual visit, the classroom teacher and the facilitator meet to discuss the educational level of the preservice teachers, the purpose of the specific university class that will be observing, the type of lesson that will be presented, and examples of questions from other sessions. Preparing the classroom teacher for the technical aspects of the videoconference is also required. Special tips regarding clothing, movement, and voice level are provided. Critical issues in videoconferencing etiquette are outlined with the

teacher, such as one person talking at a time, being a good listener, speaking loudly, and pausing before starting to speak because of delay in transmission. The classroom teacher relays these protocols to his/her class. The preservice teachers are prepared with information about videoconferencing etiquette, a brief synopsis of the lesson, a general description of the classroom being observed, and information regarding their role in the videoconference.

A. Technical Issues

While technical issues require a significant amount of preparation and attention, they become easier with experience and with more advanced technology. The video conferencing system is brought into the P-12 classroom and a trial internet connection is established to provide the classroom teacher an opportunity to experience a videoconference and to test the technical aspects of the site at least one week before the scheduled session. With the stand-alone videoconferencing units that are H.323 compliant[1] setup is not technically difficult except for connecting through firewalls. Firewall issues comprise the most serious problems encountered in virtual visits. Most schools do not understand the technology of their firewalls and must call in consultants to reconfigure them. In addition, multiple ports must be opened for both the Internet Protocol (IP) and User Datagram Protocols (UDP)[2]. The final technical issue is that only one site may have a dynamically configured IP. The calls connect most often when the dynamically configured IP dials and the static IP answer the call.

B. Outcomes

A total of 10 master teachers have been recruited and now serve as a valuable resource for demonstrating best practices. After five years of use, more than 75 observations, and over 700 students participating in multiple Virtual Classroom Visits, the results indicate that the partnerships have enriched the preparation of teachers in the College of Education especially in understanding classroom diversity and meeting the demands of urban classrooms. Through the VCV journey, preservice teachers observe highly competent teachers in observations designed to fit specific criteria that exemplify the university's adherence to best practice in both curriculum and management. The VCV program is also valuable in preparing students for their in-person observations. Specific results include:

- The quality of understanding and the sophistication of students' questions increased over the course of virtual visits.
- Virtual Classroom visits created a context for developing and asking question that elicit in-depth, reflective responses from the classroom teacher, making explicit a mental model for reflective practice and de-privatizing the act of teaching. Specifically, preservice teachers inquired as to why classroom teachers took certain actions, asked for clarification on student behavior in relation to classroom expectations, tested the accuracy of assumptions made about the classroom environment, and confronted philosophical beliefs based upon inferences from teacher actions.
- As a group, the college class was able to focus on action within the P-12 classroom and to "dissect" what took place. This facilitated the connections between theory and practice that are so critical to teacher success in the teaching field. When responding to the preservice teachers' questions, the classroom teacher often confirmed (reinforced) many of the concepts covered in the class.

V. Evaluation

Evaluation of initial pilots took a two-prong approach: (1) To what extend do preservice teachers receive support in noticing and are they more reflective as they apply the process of noticing? (2) What types of professor/student interactions are most conductive to positive change in preservice teacher noticing skills? The impact on preservice teachers was assessed through a survey. Two themes emerged from the virtual visits: the preservice teacher valued the experience, and they felt the most beneficial portion was the opportunity to interact with the classroom teachers after the observation/visit. Preservice teachers particularly appreciated the opportunity to observe in grade levels/content areas other than their own. Although students mentioned some frustration because of occasional technical difficulties, they felt that the benefits far outweighed the inconveniences.

As the virtual classroom visits moved from the pilot to broader more general settings, earlier lessons learned were incorporated into the design of the project. During the Winter of 2005 semester, preservice teachers returned 106 surveys. These surveys asked the college student to give a description of the virtual visit experience, to tell what they like and what they thought should be changed. This open-ended prompt elicited various types of student responses. The responses were analyzed to determine engagement as evidenced by emotional words, impact in terms of reasoning or new knowledge, and whether a suggestion was made to improve the VCV.

The level of a preservice teacher's engagement with the observation was measured by counting responses in which preservice teachers expressed particular feelings toward the virtual visit. 61% of the students connected positively with the VCV. Neutral was identified when descriptions contained a list of describing facts, events, or attributes of the observation. Negative was coded when the expressed emotion was one of

[1] H.323 is an Internet standard that defines how data is transmitted across the network.

[2] User Datagram Protocol (UDP) is a communications protocol that offers a limited amount of service when messages are exchanged between computers in a network that uses the Internet Protocol (IP). Source: Search Web Services.

dislike, distrust, or discomfort and accounted for only 5% of the responses (see Figure 1).

Overall quality of the virtual visit as a learning experience was coded as positive, neutral, or negative. Positive was counted when a preservice teacher's response noted what they had learned or how they had grown. 50% provided direct evidence that the VCV was a positive learning experience in terms of reasoning (making and supporting conclusions) or through a direct statement of the value of the VCV. 45% of the responses either gave a general statement such as it was "good" without any specifics or made no statement regarding the overall experience (see Figure 2). 5% of the preservice teacher's responses included a negative aspect to the experience.

The third aspect coded in the preservice teacher responses was whether specific suggestions were made to improve the experience. Only 31% had suggestions on mproving the VCV experience and many of these were from one particular observation in which some technical difficulties occurred.

A. Summary

The data indicates positive experiences for preservice teachers. Also, these preservice teachers relate that it has helped them understand the complexities of teaching in a classroom. While Virtual Classroom Visits have the possibilities of improving teacher education today, it is the window that they provides into future alternative and powerful ways of addressing teacher training needs and development of expertise that compels us to develop new teacher education methodologies that incorporate technology.

Figure 1. Engagement Identified by Emotional Words

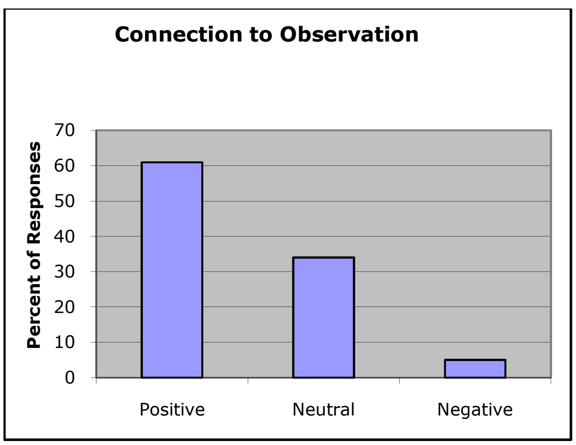
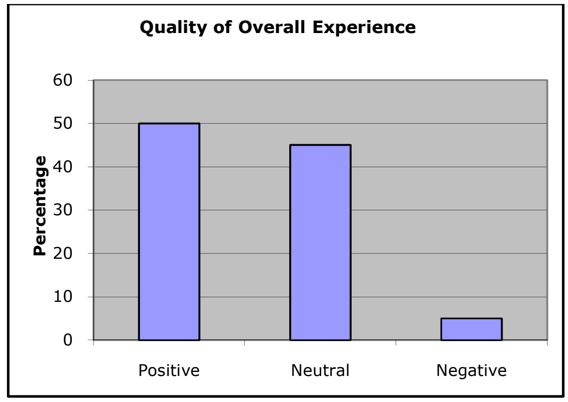


Figure 2. Benefit of Experience



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Students' Perception of Academic Integrity

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Abstract— **In order to investigate students' perception of academic integrity, more than one hundred and thirty undergraduate engineering students at an American style institution in the Gulf region were surveyed on academic ethical issues. The students who responded to the questionnaire were randomly chosen from different classes, including freshman, sophomore, junior and senior. The survey consisted of several questions about various aspects of academic integrity, such as plagiarism, inappropriate collaboration, dishonesty on exams, copyright violations, and complicity in academic dishonesty. Other questions were on the students' perception of the correlation between moral and ethical principles. The main objective in designing and carrying out this survey was to understand how students view academic dishonesty. The study showed that more than one-third of the students were not aware that the institution has a student academic integrity code, published annually in the university catalog. Further, students are twice likely to commit acts of academic violations on work which is not directly supervised by the instructor (such as homework, projects, etc.) than on work directly proctored by the instructor (such as quizzes, exams, etc.). The main reason why students cheat is because they are taking too many courses, thus they do not have enough time to do all the assigned work without external help. Finally, half the students who responded to the survey indicated that the most effective way in reducing incidences involving violations of academic integrity is by eliminating the atmosphere that encourages violations (e.g. reducing grades percentages on projects and homework, having exams in larger rooms, using more proctors on exams, etc.). The results of the survey will be useful to the administration at different academic institutions to come up with appropriate measures to improve the current state of ethics in education.**

Keywords-component; Academic dishonesty; cheating; education; ethics

I. INTRODUCTION

Although often neglected, academic integrity is of prime importance in education. In most cases, it can be more important than the technical subjects that professors spend more of their time on. This is because it forms the background by which a professional behaves in his/her work once he/she graduates from college.

Academic integrity is like a professional code of ethics for students. It requires students not to cheat on exams, not to do someone else's work, to give credit to the originator of ideas, and to not falsify data. While the above statement seems simple, however, things can be very complicated in practice, particularly if a student is accused of violating the rules.

Most institutions of higher education include their Student Academic Integrity Code in their annual catalog. Such a code describes in detail the student's rights and responsibilities as a member of the academic community. Just as professionals are expected to know the rules of their profession, students have to know what counts as misconduct. Claiming ignorance of the rules is not a valid defense. Therefore, students are expected to ask their advisor or professor when they are in doubt about a particular issue related to the subject.

II. LITERATURE REVIEW

Researching the literature on academic integrity showed a large body of work on the subject matter in the western world, but limited published research was observed elsewhere. This may be due to the fact that the subject is sensitive, particularly in the middle-east; hence, many universities are reluctant to publish data on the issue for fear of affecting their image.

Hendershott et. al [1] studied academic integrity understanding and application in a mid-sized, comprehensive, private university. They mainly concentrated on exploring the gender differences when and if such a factor affects cheating behavior. A sample of 532 undergraduate students completed the survey in their study. The final conclusions indicated that there are gender differences in student behavior when it comes to following academic integrity codes. The authors found out that penalties may be a good tool for reducing cheating by female students, but not by male students.

Kidwell et. al [2] conducted a two-year study at a university, which included surveying students about their cheating behaviors and their acceptance of an honor code. They found out that more than 70 percent of the respondent stated that they were common cheaters. Specifically, the students reported that they have committed in the past acts of dishonesty on exams and term papers on multiple occasions.

The effectiveness of student honor codes in universities was investigated by McCabe and Trevino [3]. They found out that students cheat less often at schools with an honor code than at other schools. However, McCabe and Trevino point out that for the honor code to be effective in reducing cheating a culture of academic integrity needs to be in place. Such an environment takes years to achieve and demands the commitment of all faculty members and administrators of the

college. The authors added that the greatest benefit of a culture of integrity is not reduced student cheating, but rather the lifelong benefit of knowing the value of living in a trusty society.

Over 300 undergraduates in the US were sampled for their attitudes toward different forms of cheating by Lord and Chiodo [4]. The objective of the survey was to gain an appreciation of the collusion rate of college students in science classes. The students were sampled from several different departments within the university. The results of the survey indicate that 83 percent of the respondents had cheated in science. The vast majority of students (86%) had shared homework answers with classmates and 81 percent of the students had told little lies to faculty to avoid getting in trouble. Further, a large number of students (75%) admitted to have copied phrases directly out of glossaries, encyclopedias, journals or reference books and turned it in as their own work. Most students (80%) had also used crib notes or written science terms on their shoes, wrists or other parts of their body to get by minor quizzes at times. Over 75 percent of the students admitted to cheating on large exams and major projects. When the results of the study are compared to students surveyed with the same instrument a decade ago, it is revealed that the cheating among students is growing.

Kisamore, Stone, and Jawahar [5] mentioned that most of the studies of academic misconduct have primarily concentrated on situational factors (e.g., integrity culture, honor codes), demographic variables or personality constructs. They showed that the perceptions and intentions affecting academic misconduct can be significantly influenced by the interaction of these classes of variables. Considering a sample of 217 business students, they examined the interaction between Prudence and Adjustment and the integrity culture to explain many factors related to cheating. The most significant factors were the personality variables as they explained the most unique variance. Also, Adjustment was a major factor that influenced the integrity culture.

Premeaux [6] considered a comparison between Tier 1 and Tier 2 accredited business schools. He mentioned that cheating is fairly common at both Tiers 1 and 2 AACSB accredited business schools. However, there are explicit differences between the students in Tiers 1 and 2 universities regarding cheating. There is a higher probability that Tier 1 students may cheat on written assignments. These students also believe that sanctions affect cheating, and a dishonor is attached to cheating. On the other hand, Tier 2 students have higher probability to cheat on exams, and almost the same probability, as Tier 1 students, to cheat on written assignments. The students in Tier 2 universities are more likely to accept the concept that moral and ethical people cheat. The categories of student who were more likely to cheat are the students who are working for 40 hours or more, married students, and married students with children. At both levels of schools, Asian students are less likely to cheat, but resident members of fraternities and sororities and those who drink frequently are more likely to cheat.

Etter, Cramer, and Seth [7] concentrated on the unethical use of Information Technology in cheating. They surveyed students at two institutions. The students at a major research institution did not consider cheating to be as offensive as the students at a private church-affiliated college. However, when the students were asked to rank academically dishonest behaviors, the ranking was very similar as the correlation coefficient between the two rankings was very high (0.90). Finally, the survey results showed that the students who are typically more conservative rated cheating to be more serious.

III. OBJECTIVES AND SCOPE

The objective for this study is to determine student perception and frequency of dishonesty at a university in the middle-east. The scope of the research covered a sample of 135 engineering students in all levels (freshman, sophomore, junior, and senior). Each student in the considered sample, completed a questionnaire, consisting of several questions about various aspects of ethical issues in academia. The questionnaire was given to the students on the spot, without prior notification. The allotted time to complete the questionnaire was ten minutes to ensure that the answers were spontaneous. The issues that are addressed in the paper are:

1. Students' perception of the percentage of students who plagiarize on homework and projects.
2. Students' perception of the percentage of students who inappropriately collaborate on homework and projects.
3. Students' perception of the percentage of students who cheat on exams.
4. Students' perception of the percentage of students who violate copyright laws.
5. Students' perception of the percentage of students who commit complicity in academic dishonesty.
6. Main reasons why students commit violations of academic integrity

IV. RESULTS

Out of the 135 surveyed students, 26% were female and 74% were male students. The percentages of each level in the sample were 45% freshmen, 21% sophomores, 23% juniors, and 12% seniors. All of the surveyed students were from the college of Engineering. These percentages are in line with the existing pool of engineering students in this relatively new university. The survey results showed that about one-third of the students were not aware of the student academic integrity code, published in the university catalog.

According to the University's catalog [8], plagiarism "may involve using someone else's wording—a distinctive name, a phrase, a sentence or an entire passage or essay—without using quotation marks. It may also involve misrepresenting the sources that were used." The survey indicated that the students believe that the majority of the students plagiarize on work conducted outside of the classroom. Specifically, two-thirds of the students believed that at least 25% of them plagiarize on homework and projects, as shown in Figure 1.

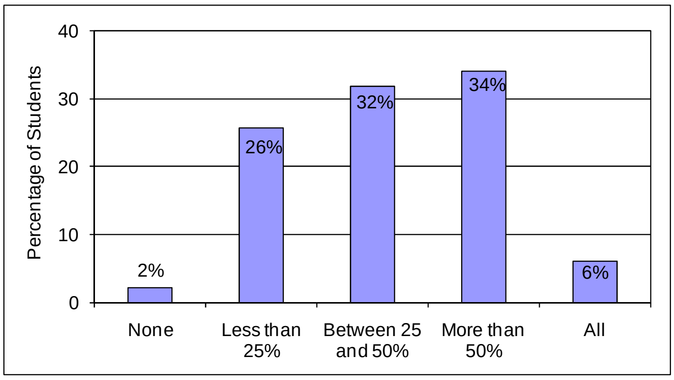

Figure 1: Students' perception of the percentage of students who plagiarize on homework and projects

The survey also asked students about their perception of inappropriate collaboration, defined in the university catalog [8] as "working with someone else in developing, organizing or revising a project (such as a paper, an oral presentation, a research or design project or a take-home examination) without acknowledging that person's help." When students were asked about this issue, most of them agreed that the majority of students commit inappropriate collaboration. Figure 2 shows that very few students believe that either none or all of the students inappropriately collaborate on work done at home. The majority of the surveyed students were, however, split on what percentage of students was involved in inappropriate collaboration; namely, less than 25%, between 25% and 50%, or more than 50%.

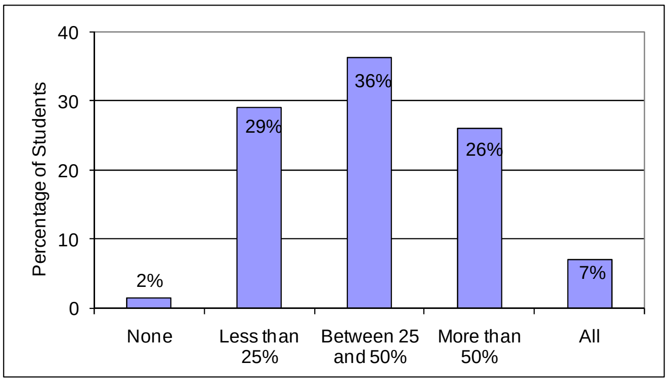

Figure 2: Students' perception of the percentage of students who inappropriately collaborate on homework and projects

The subject of cheating on exams is addressed in the student academic integrity code [8] and defined as "copying from another's paper, giving unauthorized assistance, obtaining unauthorized advance knowledge of examination questions, and the use of mechanical or marking devices or procedures for the purpose of achieving false scores on machine-graded examinations". As expected, more than half of the students believed that less than 25% of the students normally cheat on exams. This can be attributed to the fact that exams are always proctored by instructors, unlike take-home work.

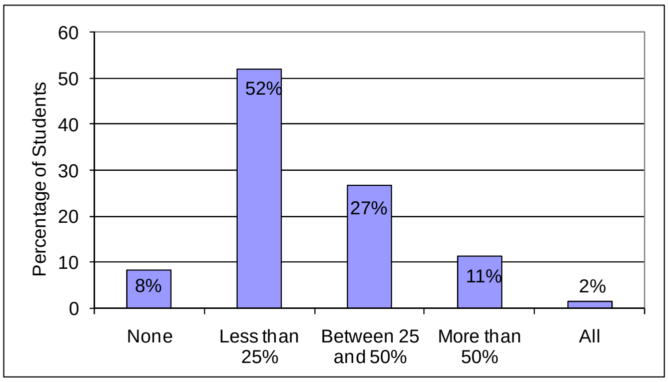

Figure 3: Students' perception of the percentage of students who cheat on exams

With the increase of the textbook and software prices in the international market, the authors wanted to get feedback from the students on observing copyright laws. The university catalog [8] covers this subject and states that "these laws govern practices such as making use of printed materials, duplicating computer software, duplicating images, photoduplicating copyrighted materials and reproducing audio/visual works." About 90% of the surveyed students indicated that copyright is often violated; however, they disagreed on the percentage of students who commit such an act.

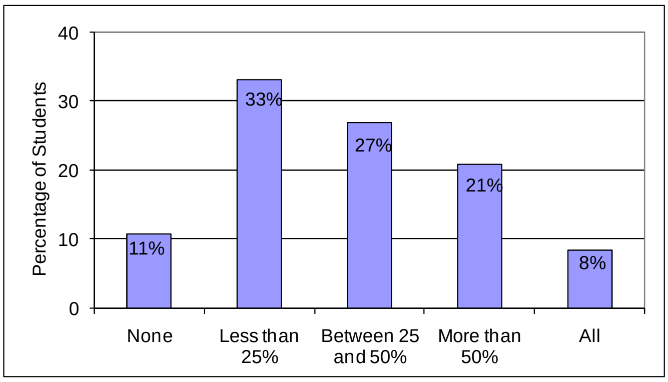

Figure 4: Students' perception of the percentage of students who violate copyright laws

The university catalog states [8] "Complicity in academic dishonesty consists of helping or attempting to help another person commit an act of academic dishonesty or willfully assisting another student in the violation of the academic code of integrity. Complicity in academic dishonesty is pre-meditated and intentional. This can include, but is not limited to, (1) doing work for another student; (2) designing or producing a project for another student; (3) willfully providing answers during an exam, test or quiz; (4) calling a student on a mobile phone while taking an exam and providing information; (5) providing a student with an advance copy of a test; (6) leaving inappropriate materials behind at the site of an exam or test; or (7) altering outcome results." The students responded to this question in an identical way to the question related to cheating on exams. This shows consistency in the students' answers as these two issues are related to each other.

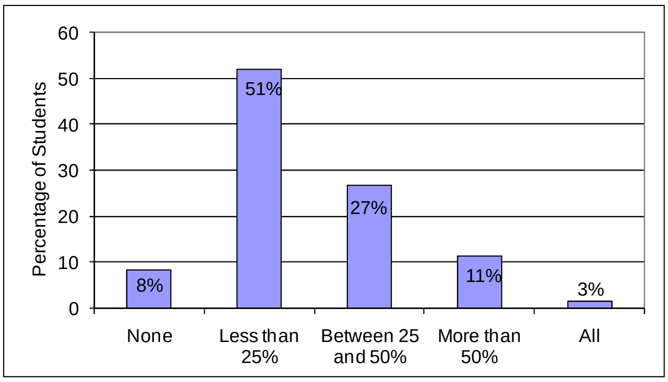

Figure 5: Students' perception of the percentage of students who commit complicity in academic dishonesty

Figure 6 shows that the main reason why students violate the student academic integrity code is the limited time available for them to complete their assignments, projects, and preparation for exams. Other reasons were the peer pressure and the academic culture they were brought in. It should be noted here that the students were allowed to select more than one answer to this question.

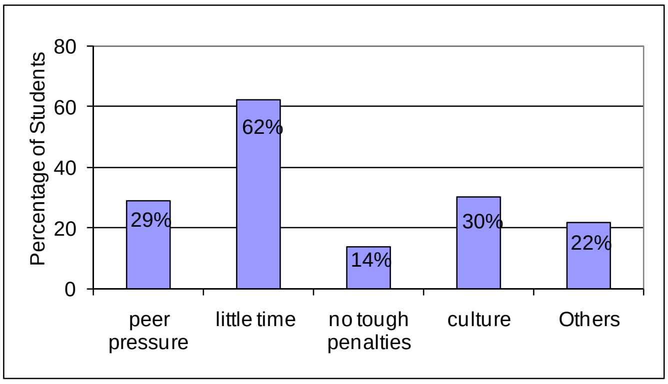

Figure 6: Main reasons why students commit violations of academic integrity

Finally, the survey collected information on the most effective ways to reduce the violations of academic integrity code, from the students' perspective. Having more proctors in exams, educating the students on the integrity code, and applying tougher penalties on code violators were perceived by the students as the most effective measures. Furthermore, the students indicated that eliminating the atmosphere that encourages violations (e.g. reducing grades percentages on projects and homework, having exams in larger rooms, using more proctors on exams, etc.) would also help in improving the situation.

When students were asked if there is a relationship between morality and academic integrity, about 75% of them believed there is a relationship between the two. This result is consistent with some other studies [7].

V. CONCLUSIONS

The main conclusions of this paper are:

1. One-third of the students are not aware that the institution has a student academic integrity code, published annually in the university catalogue.
2. Students are twice likely to commit acts of academic violations on work which is not directly supervised by the instructor (e.g. homework and projects) than on work directly supervised by the instructor (e.g. quizzes and exams).
3. Most students do not observe copyright laws in their work.
4. About twenty-five percent of the students see either no relationship or weak relationship between morality/religion and academic integrity.
5. Students mainly cheat because they are taking too many courses, thus there is not enough time to do all the assigned work without external help.
6. Most students believe that the majority of the engineering faculty members are doing their share by often talking about academic integrity in their technical courses and penalizing students who are caught in the act.
7. Half the students think that the most effective way in reducing incidences involving violations of academic integrity is by eliminating the atmosphere that encourages violations (e.g. having exams in larger rooms, using more proctors on exams, etc.).

VI. RECOMMENDATIONS

In order to reduce academic dishonesty incidents, the university may apply the following:

a. Warn the new students, during the orientation period, that academic dishonesty is a violation of University Regulations.
b. Educate the students of the *Student Academic Integrity Code* and the various definitions of academic violations.
c. Make the students be aware that it is their responsibility to behave honestly in their course work.
d. Inform the students of the possible penalties for each violation of the academic integrity code.

In addition, faculty may also help minimize academic dishonesty cases by:

a. Telling the students, in their courses, at the beginning of each semester that academic dishonesty will not be tolerated.
b. Include the student integrity policy in each course syllabus.
c. Encourage the students to report to the faculty if they witness such an act.

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Academic Institutions Are No Different To Any Other: Total Quality Management Does Enhance Performance

Can TQM be Translated from Business to Education?

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***Abstract*--There are many skeptics about the contributions of Total Quality Management (TQM) to education because of its roots in the world of business. TQM says nothing about actual production but stresses the process of management and collaboration within the system to reach quality output. Any quality-conscious organization, despite the nature, should understand this. This paper will not present any innovative ideas but will define TQM and stress its influence on the various facets of an institution of higher education. TQM helps to provide better services to its primary customers-students and the community. Moreover, TQM focuses on continuous improvement and growth that can offer an enhanced and challenging learning environment for all involved. Thus, a more effective and efficient corporate culture emerges.**

Keywords - organizational behavior; quality management; higher education; corporate culture; enhanced performance.

I. WHAT IS TOTAL QUALITY MANAGEMENT?

Total Quality Management (TQM) is a style of management that has been receiving growing attention for decades. The vision of TQM promises unity, teamwork, autonomy and empowerment. The phrase total quality comes from 'total quality control' originally coined by Feigenbaum [1]. Quality is whatever the customer wants it to be. The customer's needs, wants and expectations must be identified. The goal, hence, will be to satisfy the customer by following an effective and efficient strategy. The core values of TQM focus on customers, continuous improvement, top management commitment, system and process control, employee involvement, and managerial decisions based on facts [31].

The five pillars [2] as a foundation of TQM have been listed as Product, Process, Leadership, Organization and Commitment. They are interdependent and if one is weak, the others are influenced. The framework for a quality process [3] focuses on the mission, customers, a systematic approach to operations; leadership; vigorous development of human resources; and long-term thinking.

Building a quality organization takes a shared commitment, a common language and a workable blueprint [4]. TQM is not a passive description term but an energetic activity [23]. Atkinson [5] says that TQM is an organization-wide commitment to getting things right. Since TQM affects everyone in the organization, everyone without resistance must accept it. TQM is 'an approach to improving the effectiveness and flexibility of business as a whole' [6].

W. Edwards Deming [9] is widely recognized as the 'father' of the TQM movement. He did most of his effective teachings behind the scenes in Japan. Deming presented his fourteen points that basically stress on the constancy of purpose toward the overall improvement of quality in everything that an organization does. A critical step in TQM implementation is customer identification, in addition to leadership, cultural and organizational issues. While higher education institutions house learning and create knowledge, they still encounter challenges in embracing TQM. Research [27] [28] [29] [30] shows that quality in higher education is treated from various perspectives.

TQM requires the development and application of education and training programs for effective business management, knowledge and practices of specific tools and techniques that ensure continuous business improvements [7]. To illustrate continuous improvement, Deming [8] uses the Shewhart Cycle identified as the PLAN, DO, STUDY, ACT cycle which is a continuum of the process; it is on-going; it is never-ending; it is quality. Deming [9] also became familiar with 'The Three Cs'. These constitute a focus on Customers, Culture and Capacity to develop an organic and integrated set of relationships, gain the ability to

change and direct those relationships in the course of improvement as defined by the organization's internal and external customers.

TQM is not just about management but a complete change in an organization's culture and the behavior of people at work. One relevant and interesting definition [32] of TQM is "An approach to improving the effectiveness and flexibility of business as a whole. It is essentially a way of organizing and involving the whole organization; every department, every activity, every single person at every level. For an organization to be truly effective, each part of it must work properly together, recognizing that every person and every activity affects and in turn is affected by others."

II. HOW TQM INFLUENCES LEADERSHIP

Leaders are individuals who influence people positively and secure the objectives set by the organization. As a result, leadership is not an individual orientation, but a group one and therefore, involves other people. By providing an appropriate and comfortable environment, leaders offer group members the means of motivation for goal or task accomplishment.

A significant definition of leadership: … is a broad visionary activity that seeks to discern the distinctive competence and values of an organization; to articulate and exemplify that competence and those values; to inspire, even to transform people in the organization to feel, believe and act accordingly [10].

To ensure that the ultimate client is continuously satisfied, TQM requires increased effort from everyone in the organization. Shared power, responsibility and commitment mean nothing if staff and management move in opposite directions. Strategic quality leadership means developing everyone as leaders. This can be achieved through motivation by the delegation of authority where implementation of the plan is based on trust and confidence. The process is monitored and feedback is analyzed. Leaders then can exercise their power in accordance to performance and outcome.

Management's task has become one of being a leader in learning [11] and the quality-oriented organization is a learning organization. Essentially, management must cultivate a culture of leadership from top management through to all levels in the organization [24], where team-based leadership measures are emphasized [25]. The objective is to create an organization committed to continuous improvement, or as the Japanese term it, KAIZEN. Quality improvement is continuous, not only related to the final product but also to everything that the organization does and is involved with.

Any process involves three major phases – Planning, Implementing, Evaluating. Quality leadership is dependent on quality planning so that the others may be pursued. This revolves around developing the mission, objectives and strategies. Quality-oriented leaders ensure that their planning processes are effective by securing and emphasizing staff involvement, using resources – physical, human and financial – according to the quality plan and effectively implementing them.

Leaders are essential in creating a quality culture and they play a significant role in assuring that the required resources are available to support quality initiatives. There are many quality principles [33] that could help leaders to change the culture of higher education institutions and also encourage synergy within the whole system. The quality principles include leadership and creating a quality corporate culture, vision, mission, collaboration, and delegation of decision making.

III. HOW TQM INFLUENCES HRM

Human resource management (HRM) is the process of designing workforce measures and activities in order to enhance the efficiency and effectiveness of organizational performance [7]. In this respect, quality and HRM seem to be in tune. The major key to effective quality practices is the management of human resources. Today, the quality-oriented organization is specifically focused internally on effectively uniting systems and human relations, and externally, at ensuring communication to and from suppliers and customers.

In the case of educational institutions, the customers are the students and the suppliers are all administrators, faculty and staff. A production analogy [34] for higher education highlights the following: universities-suppliers; admitted high school graduates-raw materials; students-product-in-process; courses-process stages; graduates-finished product; employers-customers; number of graduates employed-sales; starting salary-price.

The vehicle of Investors in People emerges from Human Resource Management and is linked to managing and achieving organization-wide change by being a mechanism that supports TQM. By investing in people, management makes a public commitment to develop all employees to achieve business objectives [35]. Consequently, management communicates a vision of where the organization is going and how employees can contribute to this success. Moreover, the training and development needs of employees are visited to assess achievement and future effectiveness.

Human relations is about organizational processes, leadership style, motivation, satisfaction, and teamwork. An evaluation and reevaluation of the effectiveness of the practices that affect quality-

related activities must be implemented. Such information would be related to management, policies and procedures, individual opportunities, performance characteristics, performance appraisal, reward structure and process improvements. Furthermore, quality-performance characteristics include esprit de corps, problem-solving skills and the ability to develop and apply concepts [7].

IV. QUALITY MANAGEMENT IN HIGHER EDUCATION

The need for TQM to be adopted organization-wide is paramount. TQM is an approach to promoting the effectiveness and efficiency and flexibility of business as a whole; it is essentially a way of organizing the whole organization [6]. To do this, TQM must start at the top with the most senior management demonstrating their seriousness toward quality. Open and proper communication channels must be followed with a focus on teamwork. The importance of a positive attitude and commitment can't be overemphasized. Without them, there will be failure. In the 4thh International Conference on TQM, Cook [26] highlighted that if TQM is introduced without considering its consequences on people, it will lead to failure. TQM encourages quality working attitudes, quality awareness and focuses on guiding towards teamwork, continuous improvement and participation.

Higher Education (HE) is probably one of the most important service sectors in modern business. Quality management in HE refers to the totality of features and characteristics of product services that bear on its ability to satisfy stakeholder expectations [36]. "Supplier's activities at the interface with a customer, and the results of all supplier's activities to meet customer needs" [37]. Service-oriented organizations operate through a distributed delivery network and require a standardized approach for management and customer satisfaction.

Education is our business. Could it be more crucial to implement quality than in an educational institution? Our clients are our students whom we must serve with the best we have to offer. All levels of the organizational structure are involved. President, Vice-president, Provost, Deans, Directors, Chairpersons, Advisors, Faculty and Staff are all participators in the quest for quality performance. Collaboration among all players will result in effectiveness (doing the right thing) and efficiency (doing things right).

If institutions of higher education want to implement TQM to enhance productivity, participative management is to be contemplated. With a clear mission determined by objectives/goals, a well-structured strategy, distinct job descriptions, open communication, allocation of resources for implementation and top-management support, performance will be enhanced. The consequence will be quality productivity from one echelon to the other.

Bryan [38] describes TQM implementation in the HE context as: "…a comprehensive philosophy of operation in which HE institutions community members (1) are committed to continuous quality improvement, and to a common campus vision, set of quality values, attitudes, and principles; (2) understand that campus processes need constant review to improve services to customers; (3) believe that the work of community members is vital to customer satisfaction, and (4) value input from customers for further improvement."

Many skeptics find that TQM is just the 'latest jargon' for collaboration and participative management. No matter what terminology it is given, the common principles and philosophies of the renowned quality management gurus– Deming, Juran, Crosby, Garvin, Taguchi – are at the core of the movement. Despite the controversy, the quality movement is making its way into the arena of higher education because the concept of TQM as a possible remedy for their ills is being acknowledged.

Why is quality performance so important in educational institutions? By nature, educational institutions are in the business of education and change. Since TQM requires a high investment in education and training, the educational institution seems to be the perfect place to implement the concept. However, it is not as easy as it sounds. Individuals in educational institutions question and debate the philosophy of TQM and its challenges to the accepted management theory [12]. The rationale is that TQM creates problems of bureaucracy that are seen as detrimental to the 'effective' operation of the working teams or groups.

TQM can definitely assist the management in education by offering the customer-oriented concept where customers can be both internal and external [13]. The domains that differentiate the education from the manufacturing sector are objectives, processes, inputs and outputs [14]. "Education is different from industry. But managing people and resources is largely the same for any organization, whether in business or education, the private sector or the public arena [15]."

Moreover, education has its own set of values and practices with specific focus and objectives. These concerns could be overlooked if the educational institution is managed in a total quality way. Therefore, just like any other organization, educational institutions, especially those of higher education, need to learn how to learn about quality

and its implications in order to survive and grow. Consequently, quality issues also need to focus on internal politics as well as to determine effective quality measures that can empirically demonstrate improvement in process deliberations [7].

Furthermore, the justification for implementing TQM in the HE institution depends on the specific internal and external conditions that act as a basis of strategic planning related to TQM. The ability to establish suitable measures of performance is a key element for TQM success [16]. It is not easy to measure services; however, close interaction and continuous attention to customer satisfaction can determine a positive check point.

In higher education, there is a stark realization that poor quality causes waste. In addition, a distinction must be attained to improve profile or arrest any possible decline. Universities operate in an 'unstable and confusing environment' which has seen the loss of the sedate style of traditional university management [17]. Universities cater for their students – their customers – and such customers demand quality. The only way to supply such quality is to start at the top of the pyramid and secure each link in the chain so that the final product will be up to standard. For instance, students could withhold their fees to a university because they are dissatisfied with the changes made to their courses [18] and [19].

Academicians balk at using the term customer to describe students because they believe that it signals their acceptance of the cliché 'the customer is always right' [20]. TQM doesn't suggest that students hold sole proprietorship over content determination but that they are involved as active and creative participants in the education process. Quality education then results from a multi-faceted effort on the part of all involved. Such a quality movement fosters innovation, creativity, personal initiative and risk-taking.

V. TQM DOES ENHANCE PERFORMANCE

The President of Babson College, William F. Glavin, believes that TQM for academic institutions is a necessity and not a luxury. He says that our customers (students and those who pay tuition bills) must be kept satisfied by meeting their requirements. At Babson, quality has become the foundation for its future culture. The Office of Quality educated over 30% of all staff employees during 1993. They are committed to meeting customer requirements. For example, the graduate admissions office staff decided to seek ways to improve the enrollment process. They discovered that eight mailings were being sent to accepted students and they used the 7-step problem-solving process to combine these mailings into one package, which eliminated 220 staff hours of waste time.

Similarly, The University of Pennsylvania reduced trash removal costs and streamlined research cost recovery procedures. The University of Kansas reduced the time spent to generate a student work-study check from sixteen days to three. The Universities of Miami and Chicago have integrated TQM into their MBA curricula and into classroom and support service functions that have led to student (customer) satisfaction [13]. In 1989, Oregan State University brought in speakers and consultants, including W. Edwards Deming and staged retreats designed to educate colleagues and to build support. In 1990, TQM went institution-wide and among the changes were reduced remodeling job time by 23% and department journal voucher errors decreased by 94% [21].

From 2000-2006, I was Director of Admissions and International Recruitment at Notre Dame University (NDU) and a great advocate of TQM. The staff members of the office were entrusted to implement procedures. We discussed the flaws and suggestions for improvement based on individual cases. Engaging staff in quality circles was extremely rewarding with a translation into a high level of commitment. Communication was open with staff participating in the decision-making process and this instilled satisfaction and displayed enthusiasm. They were also given the opportunity to take personal initiative and thus, entrusted to take quality action. There was stress on teamwork and job rotation where all members of the office assisted one another and got involved. The 'WE' and not the 'I' was encouraged and dominant and developed a feeling of loyalty and commitment to NDU.

NDU has adopted the concept of TQM. The academic year 2000-2001 witnessed a total reengineering in administration and structure. Consequently, policies are being rewritten with the objective of reaching the maximum potential of all involved for the quality improvement of the institution. There have been a number of task forces and ad-hoc committees appointed to identify problems, offer alternatives, analyze the options, and choose the solution that is found to be the best for the enhancement of the respective process. One significant course of action has been the revolutionary revision of the curricula to meet the graduation requirements of our 'customers'. Most of these are specified in our revised mission statement: "Notre Dame University-Louaize (NDU)" Task forces have been appointed to suggest more effectiveness and efficiency with all operations that will facilitate activities institution wide in addition to allowing students smoother procedures. Technological advancements have been introduced with the implementation of an E-Learning center and the use of Blackboard. Registration can be finalized on-line. The

accreditation process has been launched. The strategy, mission and goals are being revisited and developed. Furthermore, institution wide surveys were conducted to review staff job descriptions and ranking scales. The overall objective is to keep human resources satisfied and motivated to perform in the most effective and efficient way possible.

In accordance to Bryan's definition [38] of implementing TQM in HE, NDU does practice the core values. Continuous quality improvement is enhanced through regular training sessions such as employee performance appraisals and these are based on needs analysis. The common campus vision is stressed through the strategy of NDU and deep and profound interpretation sessions related to the above-mentioned mission statement. We have incorporated the mission statement into our syllabi to ensure that students also are aware. The KSAs- knowledge, skills, attitudes- of all people at NDU are identified to encourage self-development. Moreover, a constant review of curricula and all services contributes to quality improvements and amendments. Organization wide the stress is on the satisfaction of our students and the community at large. Furthermore, constant evaluation and feedback have contributed to any changes, amendments and improvements.

VII. CONCLUSION

In the 21st Century, it is crucial that organizations, especially those of higher education embrace Total Quality Management as a means of improvement by ensuring that all stakeholders comprehend the complexity, challenge and functional interrelationships of a TQM system. Exposure to TQM appears to be growing, still many consider it the latest 'fad' and agree that it will not become a lasting legacy. In reply to this, one TQM guru, Philip Crosby [22] assets that T(Total)QM may be an illusion that will pass, like other management fads; however, Quality Management (QM) will never die. It provides the basis for grasping opportunities, enhancing organizational strengths and reducing the effects of weaknesses and threats.

TQM is not a panacea for the ills of today's business course. Nonetheless, it can be seen as structured, yet a flexible approach; cohesive, yet a loose amalgamation of methodologies and applications; constructive, yet it breaks down barriers; understandable, yet complex; changing, yet standardized; stable, yet dynamic; co-operative, yet independent [7]. The key to future strength is to perceive TQM wholeheartedly and re-engineer all processes in an organization so that they operate as integrated units. Managers and workers must collaborate as partners in the innovative quality revolution as the speed and complexity of change continues to accelerate. The decision for a university to adopt TQM must be studied carefully. Quality system failure in higher education [39] identifies the root causes as weak students (poor input); lack of focus in teaching (poor delivery services); lack of attention paid to performance standards and measurement; unmotivated staff (internal customer satisfaction); neglect of students' skills (quality potential). There may be either minimal commitment or total rejection of the whole concept. To avoid such mishaps, five common conditions must be met [20]:

1. Strong visionary leadership and top management commitment.
2. A sufficient base of support for change to manifest itself.
3. The costs of training, educating and reeducating must be recognized.
4. Acknowledgement of the problem and have the proper resources and enough time to solve it.
5. Faults must not be confined only to administration; everyone must be willing to accept the change.

In summary, no matter what country, what type of organization or even what kind of project, TQM will succeed only if customer/supplier needs and expectations are recognized. Processes and improvements must be managed with a policy that provides motivation through quality leadership. Moreover, the culture must change and empower people. Communication will formulate a network that will eliminate barriers and fear. Furthermore, commitment will be displayed through on-going education and training and a clear strategy.

VIII. RECOMMENDATIONS

Institutions of higher education will undergo educational reform through synergy, continuous improvement, a system of ongoing process and the support and leadership of top management. Everyone in the institution must believe and understand the TQM principles by redefining the role, purpose and responsibilities; planning comprehensive leadership training at all levels; and creating staff development to address attitudes and beliefs. To display a total commitment to quality management, all members of the institution must exercise extreme commitment to the organization strategy and mission; identify the resources needed to meet training and development; cooperate with top management for effective and efficient output; be encouraged to meet job-related needs; be actively involved in synergy; understand the importance of communication to the process.

Thus, to obtain the most potential from the Total Quality Management philosophy in the future, 'the new pillars of TQM' [7] should be developed as a single integrated system.

Consideration should be given to establishing a quality corporate culture, process and structure; to staying abreast of the contemporary technological developments; to the academically professional allocation of physical, financial and human resources; and to the satisfaction of both internal and external ‘customers’.

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Socially Conscious E-Learning Process

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***Abstract*— This paper seeks to explore a model to be used as a filter for refining the items and products of E-Learning process. In the last decades, there was a rapid increase in the quantity of information and knowledge received through E-Learning and in the number of its customers. E-Learning could overcome and break the borders between people and divulge some important personal data and information. Moreover, religious, cultural, ethnic and other social concepts were deployed sometimes incorrectly in the veins of E-Learning process.**

Keywords-E-Learning, customer, filter, social metrics

I. Introduction

For the success of process of E-Learning and for any other process, it is important to fulfill customer requirements and achieve his/her satisfaction. This objective was misunderstood and translated by some E-Learning sources and sponsors (institutions, companies, individuals) without taking into consideration the psychological, social such as cultural and religious factors which contribute effectively into customer satisfaction [1]. It is known that the traditional process proposed for customer satisfaction such as Quality Function Deployment has no explicit mechanism to include social issues in the course of program or product development and/or improvement [2].

II. Problem Definition – E-Learning gap

A. Sender-receiver relationship

Research efforts made over the last ten years have introduced new concepts tools and methods of communication between the two sides – sender and receiver - of an E-Learning process. However, the problem which was discovered in many programs is the quality of the input. This has changed the relationship between the two sides to be in chaos.

B. The current social impact tools

For measuring the performance and to achieve continuous improvement of a system, different companies use different tools and evaluation criteria. Social Impact Assessment (SIM) and other social management metrics are used by some organizations to measure the social return of their activities [3]. However, in these approaches social impacts of an E-Learning product are not clear before the feedback input of the customers and the investigations made by the companies [4], [5]. This will lead to costly changes in the content of the E-Learning process and activities.

III. A new Approach to social conscious e-learning process (Sc-e-lp)

The concept of social metrics as a filter

Social Metrics (SMs) are parameters used to measure E-Learning process improvement with respect to social goals. They play a fundamental role in the content development process of an E-Learning item, making them essential to the successful practice of “Design for Society”. Social metrics may also be considered as a resource of, by and for everyone interested in measuring social returns of any operation or process. The following metrics, called primary or high-level social metrics:

Religion metrics (Respect is the desirable goal) cover:

- Having the Holy book of any religion as a main source of information
- Accepting and respecting the beliefs and thoughts of others
- Taking into consideration the vital and positive roles of religious representatives and institutions of any group of people.

Culture metrics

Politics metrics

History metrics

Race metrics

Language metrics

Due to confidentiality reasons, the full statement and details of the social metrics cannot be shown here.

In order to use SMs as a filter, we first have to look at the nature and characteristics of the E-Learning product. The later may have and may have not absolutely any relations with social issues. In general, the evaluation criteria may not include any social metric, or any number of social metrics.

In the new approach to social conscious E-Learning process it is suggested to apply SMs as evaluation criteria for concepts and ideas which flow through sentences and phrases of a paragraph at the early stages of an E-Learning product development. This may reduce the size of the E-Learning product “e.g. text” by eliminating the concepts not matching the desirable goal of any social metric. That means SMs would

act like a filter, which can only be passed by socially friendly ideas, thus reducing the amount of conceptual work at the very beginning of the E-Learning process development (Figure 1).

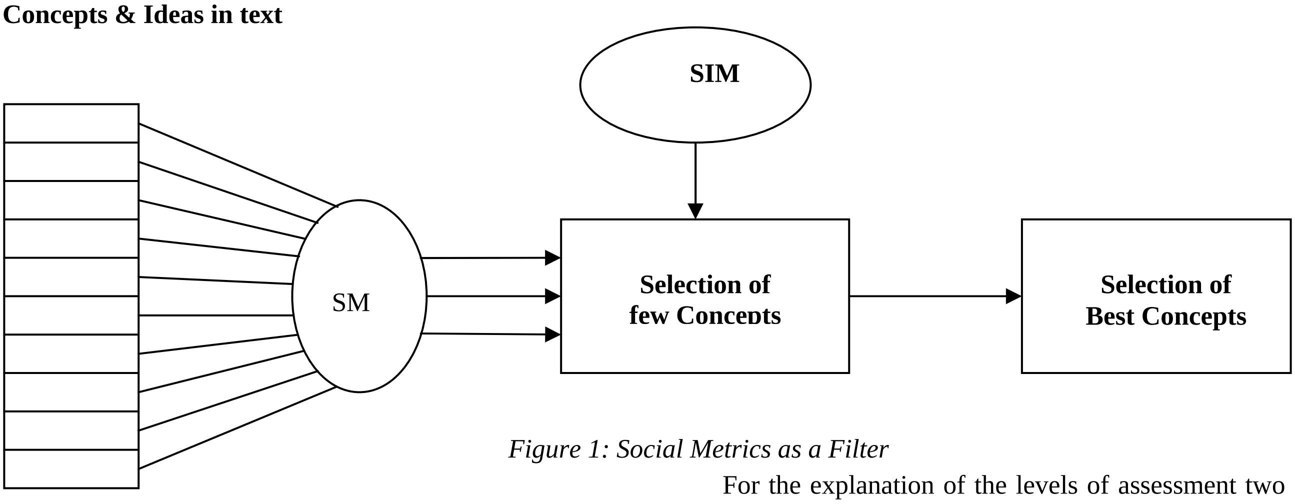

Figure 1: Social Metrics as a Filter

The usage of SMs as an evaluation criteria of concepts and ideas (CI) will lead to the establishment of a relationship matrix (SM – CI) –see table 1- which develops the different levels of relationship between the SMs and the concepts. The assessment of the social impacts at this early stage of product development can be done on a rough scale ranging as follows:

1 = very negative
2 = negative
3 = negligible
4 = positive
5 = very positive

For the explanation of the levels of assessment two examples are provided for the metrics of race and culture:
a) The concept "White people should have priority for employment" [6] has a very negative social impact as it clearly discriminates people by race and color. Such statement may destroy the relation between the E-Learning product and process designers and millions customers.

b) The concept "Australian aborigines have had a low level of culture and civilization before the settlement of Europeans in Australia" [7] has a very positive relationship with culture and history metrics.

TABLE 1. Example of an (SM – CI) Matrix

Social Metrics							
							Paragraph
							Sentences
							Ideas
Religion			5	1			
Culture			3	3			
Politics			1	1			
History			3	3			
Race			5	1			
Language			5	5			
Total							

A further development of Social Metrics may contain an interactive "Design for Society" Database listing specific units of social impact and consequences measurement, social benefits and provide realistic appraisal of possible social ramifications and suggestions for project content alternatives. Also, an Expert Forum where practitioners and experts can share, review and critique impact assessment methods and establish special social metrics towards "Design for Society".

IV. THE ADVANTAGES OF (SC-E-LP)

In summary, the advantages of (SC-E-LP) are as follows:

a) SC-E-LP adds a new dimension to the quality of the E-Learning process by deploying a social value to the quality function.

b) SC-E-LP extends the application of E-Learning process. It can also be used as a reference for social decision – making and design for society at the early stages of E- Learning product development

c) SC-E-LP reduces the percentage of having a customer socially offended by the incorrect content of E-Learning process which may increase the number of customers.

d) SC-E-LP may reduce or totally eliminate the extra costs paid by the organizers as fines for offending or insulting a receiver.

e) SC-E-LP reduces significantly the cause for E – Learning process failure, which is associated with the misunderstanding and/or ignorance of the psychological and social values and principals of customer.

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Challenges of Implementing Blended Learning in Saudi Universities

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***Abstract*— This study is an attempt to investigate the nature of obstacles and challenges encountered at Saudi Universities while implementing a blended learning approach. Practical recommendations to overcome these obstacles are discussed. A literature review of blended learning rationale and designs, and the status of web-based education in Saudi higher education are demonstrated. Although this investigation is specifically related to the implementation of blended learning in the universities of Saudi Arabia, we are confident that the assumptions and recommendations contained herein will be of great value to other populations facing similar challenges**.

Keywords: blended learning, challenges of blended learning, blended learning design, Higher education in Saudi Arabia

I. INTRODUCTION

The Saudi Ministry of Higher Education has encouraged the use of Information Technology (IT) for teaching and learning among its faculties and students. Projects are continuously developed to provide adequate IT infrastructure as well as content development for higher education students. One of the major challenges encountered in Saudi higher education is to provide college education to the rapidly growing student population in the country. The capacity of universities and colleges in Saudi Arabia is limited compared to the rapid growth of students applying for college education. To tackle this problem, Ministry of Higher Education endeavours to integrate web-based instruction with traditional instruction in universities.

Around the world, various academic practices have been used to explore blended learning, its effectiveness and challenges. Faculties are using blended courses to take advantage of the best pedagogical techniques of online and face-to-face learning. In this study, blended learning is defined as the combination of face-to-face instruction and online instruction where online instruction replaces a portion of the face-to-face class time. This definition is the theoretical concept on which this study is based.

In the next sections rationale for blended learning and various blended learning designs are presented. This study demonstrates the status of web-based education in higher education in Saudi Arabia. The challenges of applying blended learning in Saudi Higher Education are discussed. It is hoped that this study will help to provide insight for the faculties and the decision-makers throughout higher education in Saudi Arabia.

II. RATIONALE FOR BLENDED LEARNING

Innovations in technology had essential influence on improving teaching and learning. Several studies have been conducted to prove the effectiveness of blended learning. Blended learning has been implemented with various designs and has shown a considerable positive effect on the learning process. In 2002, Harvard Business School faculty DeLacey and Leonard [1] reported that students not only learned more when online sessions were added to traditional courses, but student interaction and satisfaction improved as well.

Obviously, the most common purpose of blended learning is the ability of combining the best of both worlds; traditional and online learning [2, 3]. Young points out that not all students learn the same way, therefore the traditional approach is not ideal for all students [2]. Blended learning provides more guidance to online learning by integrating face-to-face learning with distance learning, while it provides flexibility and accessibility to traditional learning by incorporating online learning.

Moreover, blended learning is appropriate for students who live far away from the university or have other commitments that conflict with the on-campus class time. Distance learning programs may not provide the learning environment students require or may not provide specific degrees such as studies that require experimental work. Moreover, Sharpe *et al*. point out that blended learning designs have been implemented in higher education courses to tackle problems created by large group sizes [4]. Studies have overwhelmingly shown that blended learning is used to improve pedagogy, increase cost-

effectiveness, access and flexibility, and simplify revision [5, 6].

A study by Owston, Garrison and Cook about blended learning in Canadian universities observed that instructors of a Canadian university assured that face-to-face contact was necessary for some first-year university students who need more guidance which was the purpose for transforming fully online course to a blended format [7]. Also, studies from institutions such as Stanford University and the University of Tennessee have proven that blended learning is better than both traditional methods and individual forms of e-learning technology alone; Singh and Reed state that "these researches give us confidence that blending not only offers us the ability to be more efficient in delivering learning, but more effective" [8].

A review of UK undergraduate experience of blended learning by Sharpe *et al*. concluded that a number of UK Universities utilized blended learning to provide flexibility of provisions, and enhance campus experiences. Some universities promote blended learning as a strategy, particularly offering flexibility in the time and place of learning. In addition, implementing blended learning in some universities was in response to practical challenges being encountered by faculties and/or in response to student feedback such as, poor staff-student contact, large classes and inconsistency in quality and quantity of feedback between markers. Finally, institutions that had been identified by Sharpe *et al*. as successful implementers of blended learning had highly contextualised and specific rationales for their adoption of technology [4].

III. Blended Learning in Saudi Universities

A. *Web-based Education*

Internet access has been available to the public in Saudi Arabia since 1999. In December 2000 there were approximately 200,000 Internet users in Saudi Arabia and by 2005, this number had grown to 2.54 million, making the growth 1,170% [9]. It is estimated that Internet use will continue growing rapidly in Saudi Arabia. One reason for the growth is that about 60% of the Saudi population is comprised of young people who are 20 years old or younger [10], and they are adapting to new technologies faster than expected. Supporting this view, a statistical study points out that the rate of computer usage among individuals is 64% [10], and this raises an issue of providing new learning strategies that include use of technology.

To meet the growing demand for higher education in the country, 19 public universities have been established and distributed around the country, four of which opened in 2005 [11]. A few private universities and colleges have been established recently such as the Arabic Open University and King Sultan University. There were only two public universities located in Riyadh, the capital of Saudi Arabia, namely King Saud University (KSU) and Imam Muhamed Bin Saud University (IMAMU) which are considered to be the two largest universities in Saudi Arabia. In early 2007, the public Girls Colleges located in Riyadh have been converted to a new public university known as Alriyadh University. The traditional didactic, lecture-based classroom is the standard in Saudi public universities with a few programs implementing distance learning. Recently, some universities have started to undertake web-based instruction in their distance learning programs.

In recent years, some universities and institutions have provided different commercial Learning Management Systems, such as Blackboard, WebCT, and Tadarus (an Arabic-based Learning Management System) to facilitate learning and teaching online. However, the number of the faculty members utilizing these systems is very limited. The reason could be that the universities and institutions do not provide enough training workshops for online learning systems. A few faculty members, who are interested in e-learning and have adequate skills, provide online materials as supplementary resources for their courses. A few years ago, two universities, namely King Fahd University of Petroleum & Minerals (KFUPM) and King Abdulaziz University (KAU), established e-learning centres that provide assistance to their faculties to develop interactive web-based supplementary material for traditional courses. King Abdulaziz University, located in Jeddah, was the first and only Saudi university that employed a virtual learning environment by offering bachelor degrees through online learning. IMAMU began offering a distance learning program that delivers instruction entirely through the Internet in August 2007.

B. *A New Trend in Higher Education*

For the sake of developing education systems in Saudi Arabia, the Ministry of Higher Education has established the National Plan for Information Technology which encourages e-learning and distance education in higher education. In 2006, the National Plan for Information Technology established a national centre called the National Centre for E-learning and Distance Learning (NCE). NCE provides technical support, tools, and the means necessary for development of digital educational content in higher education throughout the country, and is a vehicle by which all university sectors can become standardized. Due to the huge population explosion and few qualified faculty members, the National Centre for E-Learning has started several projects that aim to enhance e-learning in Saudi universities [12]. The NCE strives to provide rich multimedia resources to enable faculty members to integrate blended learning that fits their course and university needs.

NCE has established a learning management system called 'Gosoor' promoting materials for introductory undergraduate courses. The Society College at King Saud University started employing 'Gosoor' in Fall 2007 in a blended learning

application. The students have been required to use the system to download and submit homework, and to participate via the discussion board of each course. There have been not any pilot studies prior to this first application of blended learning in Saudi public universities. It is expected that the use of blended learning for teaching and training will continue to grow in the coming years. In addition, it is notable that asynchronous online elements will be utilized due to Internet bandwidth limitation.

C. Previous Research in Saudi Arabia

With the rapid evolution of IT in education in Saudi Arabia, many studies have been conducted to investigate the effect of online learning and the Internet on education and more specifically on students. However, studies on blended learning in Saudi Arabia are still very scarce and all except one study investigated integrating face-to-face learning with online learning as a supplementary resource.

Sait *et al.* conducted a study about the use and effect of Internet on instructors and students in Saudi Arabia and found that most instructors realize the potential of the Internet for education and understand the effort involved in effectively utilizing this valuable resource. The results of the study assert that training programs would be essential. The majority of instructors believe that the Internet resources have helped improve curricula and teaching methods. In addition, they urge for new technological methods to be supplemental to traditional classroom teaching and not as a replacement [13].

The only study that has been conducted in a Saudi Arabian University with the concept of blended learning that reduces seat-time is a quantitative study by Yushau [14]. The aim of the study is to investigate the effect of blended learning on students' computer and mathematics attitudes. Two modes of learning implemented during the experiment were face-to-face learning, three times a week, and online learning consisting of a weekly computer lab session with availability of online learning resources in the intranet and Internet to the students. The results indicate that the students have positive attitudes towards mathematics and computer.

Moreover, Al-Jarf conducted a study in a Saudi Arabian University to find out whether or not integration of online learning with face-to-face grammar instruction significantly improves EFL freshman college students' achievements and attitudes. The study concluded that in learning environments where technology is unavailable to EFL students and instructors, use of an online course from home as a supplement to in-class techniques helps motivate and enhance EFL students' learning and mastery of English grammar [15].

It is noteworthy that all studies have involved asynchronous virtual learning due to the limitation in the bandwidth in the country. Supporting this view, Al-Dawalij Manager (Saudi Educational Software Producing Company) said that his company had stopped producing online educational materials for schools because of the network connection problems that prevented schools from accessing the material. Thus, their product range is only available on CD-ROMs and DVDs [16].

However, Asymmetric Digital Subscriber Line (ADSL) connection has recently become available to homes and businesses in major metropolitan areas in Saudi Arabia, including all universities. This technology, which allows existing telephone lines to be used simultaneously for voice communication and as high-speed Internet access paths, is not yet available in all residential areas and will therefore affect tools selection for delivery of instruction in the short-term.

IV. ELEMENTS AND DESIGN OF BLENDED LEARNING

In blended learning, the face-to-face portion is conducted in an instructor-led classroom while the online learning portion could be provided as synchronous or asynchronous. Online synchronous elements could be online chat, video conferencing, and/or conference calls, and asynchronous elements could be online discussion boards, online tutorials, online self-assessments, electronic texts, and emails.

Lack of supporting technology could be a reason for adopting asynchronous elements instead of synchronous elements as is the case in this study. Asynchronous learning is self-paced, student-centred, and offers students learning materials that can be repeated at their convenience.

Blended learning designs differ according to the elements that are blended, the percentage of these elements in the course credit, and the objectives of the courses. According to Garrison and Kanuka, there is a shortage in blended learning designs that can be followed by instructors. They state that "[there] is considerable complexity in its implementation with the challenge of virtually limitless design possibilities and applicability to so many contexts" [17].

As discussed in the rationale for blended learning, students prefer blended learning over online learning. In a study achieved about students and blended learning techniques, Reichlmayr points out that 72% of the students liked having part of the course online and part of it in the classroom (17% disagree, 11% neutral) [18]. Also, in a study that explores transforming a traditional course into an online course gradually, students did not appreciate the instructor's efforts in organizing the materials because they expected a certain amount of instructor presence [19]. This raises an issue regarding the percentage of blended elements in the course credit.

Ross and Gage state that differentiation in the learning process would not depend on *if* they blend, but rather *how* they blend [20]. 'How to blend?' is a crucial question that has been considered by researchers to which there may be a vast number of possible answers. There are three categories of

blended learning systems based on the primary objective of the blend:

- First, enabling blends by providing the same opportunity or learning experience but through a different mode where learners choose the option that meets their cost and time constraints.
- Second, enhancing the blend by adopting Learning Management Systems to provide supplementary resources for courses that are mainly conducted face-to-face.
- Third, transforming blends by utilizing technology-mediated approaches in teaching as a main instruction method combined with traditional learning [21].

Moreover, University of Phoenix offers courses called FlexNet where classes meet one-third of the time in a face-to-face format and two-thirds in an online format. As a result, the face to face class time was then transformed into an active discussion session rather than a lecture [22]. In Brigham Young University, students enrolled in Introductory Accounting watch online videos of live class lectures including explanations of difficult concepts. A different design has been implemented by Brigham Young University, where Freshman English students are required to meet face-to-face once a week instead of three times a week. In this design, online modules provide writing instruction and teaching assistants use online and face-to-face contact to provide feedback and guidance on writing [23].

Another study that has responded to the challenge of delivering tutorials to large classes with timely assessment and feedback had replaced class tutorials by web-based activities. Obviously, this design is especially useful to technical field-of-practice subjects that aim to teach specific problem-solving skills. The initial findings of the study have shown excellent student performance. However, Rodanski claims that it is still too early to draw any definitive conclusions and he adds; “We hope that future results will confirm the validity of our approach” [24].

V. CHALLENGES OF BLENDED LEARNING

This section uncovers challenges that Saudi universities may face when implementing blended learning. In general, these challenges can be grouped into three major categories: (a) the culture and blended learning environments, (b) finding the right design, and (c) demand on time [3]. These three main challenges will be addressed individually below.

A. The Culture and Blended Learning Environments

One major challenge to be considered in the implementation of blended learning in Saudi universities is the adaptation of this element in the traditional university culture. Specifically, the issues that are likely to arise are related to a measure of: the extension of comfort levels related to the use of technology in education; the level of students’ self-discipline, organizational and managerial support, and student responsiveness [3]. It may be challenging for Saudi universities to get students to adapt to the use of new learning strategies when they have used to the traditional didactic, lecture-based classroom. Unlike a traditional approach, blended learning forces students to be actively engaged and connected. To address this challenge, a thorough orientation is required for new students and instructors. Applying blended learning to senior undergraduate classes is recommended in order to ensure appropriate levels of student discipline and responsiveness.

Moreover, the course instructor may have difficulties adopting the new learning strategy. This constraint may be overcome by providing orientation and training programs for faculties. The benefits of blended learning, such as increased learner satisfaction, understanding of materials, reduced training time and the ability to easily update training materials are powerful reasons for employing blended learning for faculty training programs. Professional development that teaches instructors strategies of online teaching is also important.

The technical skill level of students and instructors may be a key challenge to implementing blended learning. Because Saudi students have not experienced online learning, a number of students may struggle with acquiring the crucial skills to function well in a blended learning environment. In order to address this issue, extensive tutorials, support services, and a helpdesk are a sought for both students and instructors. Institutional support is a way of encouraging faculties to adopt blended learning. The instructors’ confidence in using new technology is an important factor influencing the delivery approach which is equally important to finding the right blend.

B. Finding the Right Design

The flexibility of blended learning addresses varying design needs, and is both a strength and a challenge [11]. For a program to be blended in design, not just delivery, blended learning requires an intentional approach to instructional design. If there were established design frameworks that could be used as guidelines, it would greatly simplify the task of implementing blended learning. The decisions made in the design process are critical to the effect the course will have on the learner but, with such a wide variety of delivery mediums, choosing the best combination of technology is a daunting task that not many instructors are eager to approach. In addition, the instructors who aim to implement blended courses may not have enough knowledge about how to ensure their effectiveness and there is a lack of a specific instructional design framework to be used for all curricula. Therefore, it is recommended that the National Centre for E-learning and Distance Learning provides a series of easy to use curriculum design ideas for instructors. In addition, the vast new activity resource combination of online and face-to-face learning should be considered within the overall design of the curriculum [25].

As shown in the design section above, an issue regarding the percentage of blended elements in the course credit is examined because students expect a certain amount of instructor presence [19]. Therefore, it is recommended that blended learning programs require 25-50% of the course credit to originate from web-based instruction. This percentage is stipulated in order to retain the advantages of face-to-face instruction. In addition, bandwidth access is a challenge that can be overcome by making required online materials asynchronous instead of synchronous. Also, computer labs must be available because some students may not have computers or internet access at home.

C. *Demand on Time*

The time required by instructors who implement blended courses will increase because they must develop both face-to-face and online instructional materials. Transforming traditional courses into blended courses will require more instructor time than developing traditional courses because of the necessity of redesigning the course. Moreover, instructors and students also typically incur an increase in the time they spend learning new techniques and skills, and interacting with each other in blended learning environments. Instructors will have to adjust their schedules to accommodate more frequent interaction with students who generally expect more frequent feedback in online environments than in face-to-face environments [3]. Universities should provide time management resources and orientation sessions to outline time-management strategies for both instructors and students in order to overcome this issue.

VI. CONCLUSIONS

Because the status of higher education in Saudi Arabia necessitates an urgent solution, it is recommended that the transition to a blended learning university environment is facilitated by providing the following: a thorough orientation for new students and instructors; student computers labs; instructor training programs, and a series of easy to use curriculum design ideas for instructors. In addition, it is recommended to use feedback from students and instructors via regular course evaluations and other means to accurately inform university action plans. Finally, although this investigation is specifically related to the implementation of blended learning in the universities of Saudi Arabia, we are confident that the assumptions and recommendations contained herein will be of great value to other populations facing similar challenges.

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Study Management and Allocation of Exercise Classes for large lectures at TU Berlin

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Abstract— **At TU Berlin the number of students in major classes for students in their first semesters easily exceeds 2.000 in a single course (Calculus I for engineering students, for example). Due to this large number of students, simple organizational duties such as assigning exercise courses to students or tracking admission criteria for final exams become challenging. We present an environment – the "MOSESKONTO" – that helps finding an optimal (in respect to student wishes) assignment into exercise groups and provides means for tracking and managing exam registration. Based on the data acquired in the summer term 2005, already 50% of all bachelor exams were managed through the MOSESKONTO at TU Berlin.**

Keywords-student management, mathematics, optimization

I. INTRODUCTION

A common problem for big universities, that do not provide fixed timetables for their students, is the distribution of students into small exercise groups (so-called "tutorials") accompanying the lectures. That is, many students with individual time constraints have to be matched to one or more tutorials on different time slots. Since the individual constraints are not known a priori, letting the students make ratings (often called "wishes" here) and finding a matching in that manner that as much as possible students are mapped on their highest ratings seems to be an appropriate procedure.

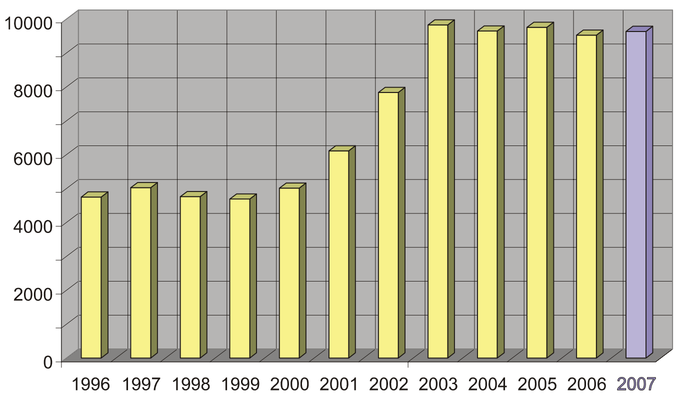

Figure 1. Number of students attending math-service lectures

II. ORGANIZATION OF CLASSES AT TU BERLIN

One of the major challenges facing universities is the organization of the study supporting processes, especially in freshmen courses [1]. With about 30.000 students, TU Berlin is among the largest (counting students) technical universities in Germany. As a service for other faculties, the department of mathematics is in charge of the mathematical education of most students, independent of their actual course of studies, making it the biggest "service provider" of the university. Since a major reorganization of the math-service five years ago, every year, 9.000 to 10.000 (cf. Fig. 1) students from 18 different courses of studies are taught courses in one of the six "math-service" engineering modules (Calculus I & II, Differential Equations, Integral Transformations & Partial Differential Equations, Linear Algebra). The largest module is the freshmen course in Calculus with a total count of more than 2.200 students per semester.

The modules are organized as follows: In order to guarantee lecture class sizes of less than 250 attendees, multiple lectures are held in parallel. The lecturers of the individual lecture classes take care of presenting the same mathematical material to all attendees. In addition to lecture classes, all students have to solve the same exercises as homework and, in the case of sufficiently good homework score are admitted to take the written examination at the end of the semester. Students also are eligible to attend a small-sized exercise class where the material of the lectures is manifested.

The following list summarizes the administrational duties for performing math-service:

- Assign all math-service students to exercise classes
- Manage homework scores for admission to final examinations and course credits
- Management of student registration for examinations
- Inform students about examination scores
- Collect and submit examination scores to the central office of examination.

Although all of the above tasks are typical administrational duties for student management at universities, the large course sizes make them very time-consuming and labor-intensive. This is especially true for the assignment into exercise groups for every module: All students have to be assigned to small

(meaning total sizes of 15 to 30 students each) groups such that assignments do neither conflict with each other nor conflict with the individual schedules of the students while respecting certain capacity restrictions. But, the large course sizes not only present difficulties; they imply a great opportunity of rationalization in the student-administration.

Against this background the development of MOSESKONTO [2,3] (cf. Fig. 3 for a screenshot) began in 2002 and was initially deployed and used since 2003 for all courses within the math-service modules described above. Since the winter term 2005/6, the assignment into exercise classes and management of exams has been extended to cover further courses, even across different departments.

III. ASSIGNMENT INTO EXERCISE CLASSES

Every student who attends a course in one of the math-service modules is eligible to attend an exercise class. The number of attendees for a particular course is not known until the semester starts, as the enrollment process does not end until then. The students do not know their complete schedule until this time either, and the variety (with respect to course of study) of students attending math-service courses implies a great variety in individual schedules. These two facts make it impossible to fix a set of dates for exercise classes in advance. Instead, one is forced to find dates for these classes in the first week of a new semester, by taking into account all students' timetables.

Until the winter term of 2002/3, the assignment of students into exercise classes was performed independently for every math-service module. The procedure required all students of a particular module (up to 1.000 people at that time) to gather in the main lecture hall to receive their exercise class dates. The students were numbered and subsequently drawn by lot to choose their most preferred date from the remaining dates in the global pool of exercise classes. Of course, this procedure did not guarantee that every student received his most preferred date, but it did ensure that the assignment of a whole course is feasible within 90 min.

The integration of additional courses (and thus increasing the number of students to be administrated by math-service) invalidated the above assumption about the feasibility of the assignment method. In fact, the last time the above method was applied, it took several hours and forced more than 2.000 students to be physically present in a completely overcrowded main lecture hall construed for 1.200 students (cf. Fig. 2).

Since this development in the number of attendees was foreseeable, the development of a web-based registration procedure (cf. Fig. 3) began in the spring of 2002; the new method has been used since the summer term of 2003.

The major goals of the new procedure were:

- Gather early information on the expected number of students for every module
- Take into account the student's individual schedules by collecting their "wishes" for dates
- Distribute students as even as possible among all exercise classes of every module
- Assign students such that no date conflict arises for students that attend courses in more than one module.

It was not possible (for various reasons) to access the personal data of the students from the central office of enrollment. Thus, to realize a procedure that respects the requirements above, students would need to register at MOSESKONTO and create a personal account. But, as a side effect, the same personal data can be used to manage the final exams. The latter is a great improvement over the established way of registering for an exam: students had to register at the central office of examination with a paper form, from which a press copy of their registration form is sent to the department of mathematics, where these copies are entered in an excel sheet. Of course, numerous transcription errors are produced that way.

Figure 2. Main lecture hall during the assignment of exercise classes at the beginning of Winter Term 2001

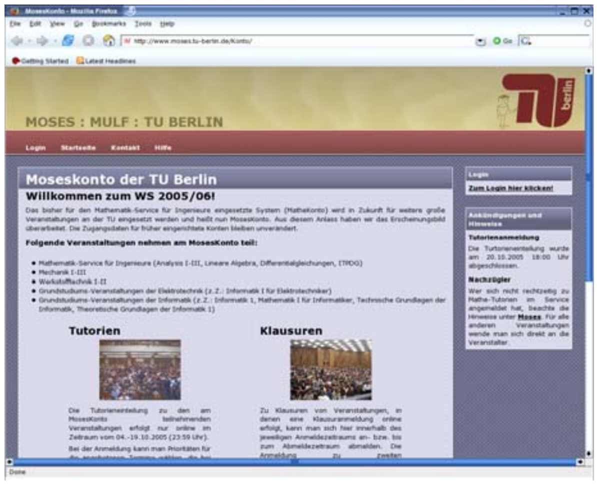

Figure 3. Web-interface of the MOSESKONTO

All of the above requirements could be easily met by means of an assignment procedure operating on a first-come-first-served basis. But it would favor those students over others,

who receive their certificate of enrollment earlier. And from a technical point of view, it would concentrate the registration traffic on a very short time span, which means that the system probably would not scale well for increasing numbers of students. This motivated our decision for a global optimization method: Over a given time span, say, two weeks, students have the opportunity to chose their personal priorities from a range of possible dates for every math-service module they would like to attend courses in. All students will choose their favorite dates using their MOSESKONTO account, and can revise their choices at any time. After the registration time span, the collected data is used to compute an assignment that is optimal in respect to all students' priorized wishes.

A. Student Groups

Often, students have organized themselves into groups of two or three to work collaboratively on their homework, for example. It is desirable, although not essential, to let all group members attend the same exercise class. MOSESKONTO offers the opportunity to register for an exercise class as a group, which implies that all group members have to choose the same priorities for the available exercise class dates. The functionality to mange groups (change groups, step back, etc.) is provided through MOSESKONTO as well. These groups are not formulated as constraints in the global optimization problem, but some care is taken to respect these wishes for groups if possible.

IV. THE GLOBAL OPTIMIZATION STEP

The optimization step involves the computation of all assignments of students into exercise classes, such that room- and teaching-staff capacities are respected and the computed solution is optimal in respect to the given priorization of dates. The problem admits a formulation as a constrained minimum-cost-flow network problem [4-8]. An example of this network is depicted in Fig. 4.

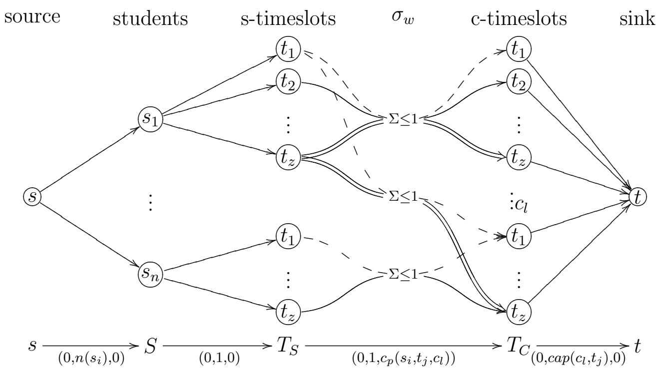

Figure 4. Network for several courses (The boundaries and costs for all edges are denoted symbolically in the lower row).

To describe this in terms of a network flow problem let $s_i \in S$ be a student. Nodes $t_j \in T_S$, representing distinct timeslots are linked to the student and each link of each such node to another $t_j \in T_C$ represents as a rating. Each $t_j \in T_C$ represents a tutorial then, and $cap(t_j,c_l)$ defines the capacity of this tutorial as the upper bound of the arc linking the tutorial with the sink. The total demand for tutorials is defined as the flow at the source *s*. To safeguard that every student is assigned exactly one place in a tutorial for each course, some bundle cuts w are defined, forcing this property.

The resulting integer linear program finds a solution in acceptable time, that is, less than one minute for the largest instances seen so far on a recent machine. The data from MOSESKONTO is accessed and preprocessed by the software TUTOP [9], which also formulates the integer program that is then to be solved by the commercial software CPLEX [10].

V. EVALUATION OF THE COMPUTED ASSIGNMENTS

The quality of the solutions achieved by the method described above is generally very good, even under rather tight capacity restrictions. As an example the results from the assignments in the summer term 2005 are discussed. In total, 4.198 "seats" have been assigned, where 4.392 had been available.

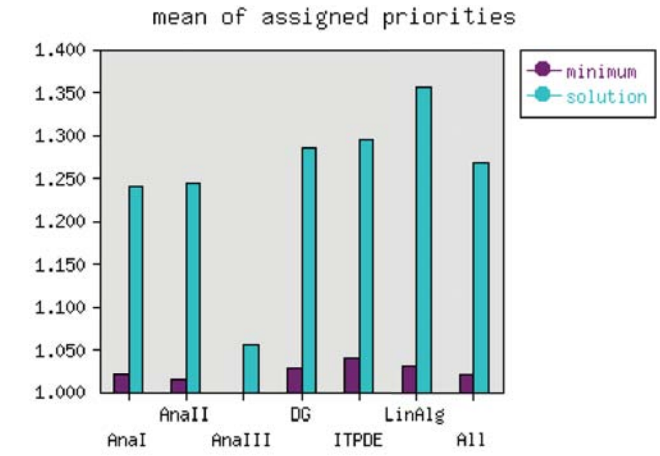

Figure 5. Quality for each module (left), overall quality (right)

Fig. 5 breaks down the above numbers into the six modules mentioned in chapter II.

It is worth noting that the good fill rates could not have been achieved without a preliminary calculus and allocation of available resources during the registration time span. By doing so, teaching staff can be moved from one module to another and additional room resources can be acquired ahead of time.

During the registration time span, students had to prioritize five dates for every module they would like to attend exercise classes in. The mean priority of the assigned exercise class dates was 1.27 and every student received a date among his prioritized dates.

An additional measure of quality can be derived from the "mean of assigned priorities. For every module, it shows the theoretically possible best mean (between 1 and 1.05) of assigned priorities and the achieved mean (between 1.05 and 1.35). The first is defined by the mean of an optimal set of assignments when an infinite number of rooms and teaching staff members would be available. Even in that case, the mean

is greater than 1, since students may choose the same date as first priorities for different modules.

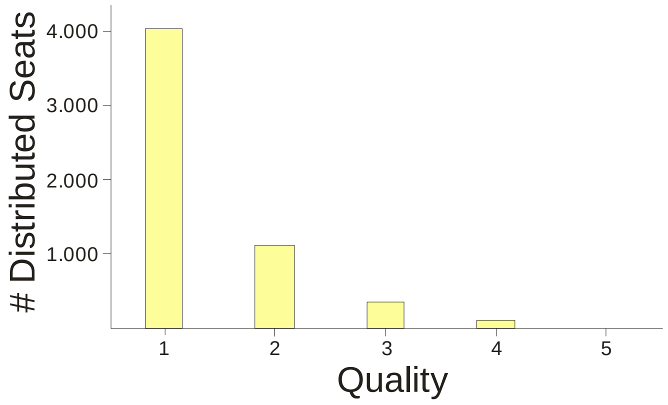

Figure 6. Quality for all Modules

VI. ADMINISTRATION OF EXAMINATIONS

As a rule, each student participating in the service courses "mathematics for engineers" has to pass a written final exam (consisting of up to three separate written tests) for each module. As a result, up to 8.000 written exams have to be handled, creating a substantial administrative overhead. The efficient organization of such large exams requires punctual registration on the part of the participating students. The results have to be published and forwarded to the central office of examinations of the corresponding departments, possibly followed by final corrections based on students' searching of the exam. Finally, the results have to be processed statistically to provide the responsible deans with information concerning the success of the courses.

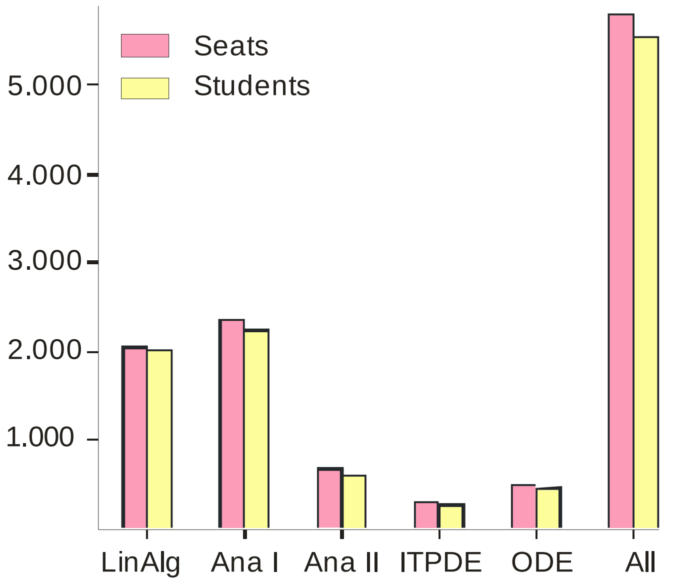

Figure 7. Numbers of places for different modules vs. no. of required seats.

To satisfy the regulations imposed by the different courses of studies it is necessary to hold up to three different (though identical in content) exams. As a result, the students feel insecure which exam they have to register for. To alleviate this problem, the students are only presented with the appropriate exam for their particular course of studies when registering for the final exam for a given module. Registration for final exams for compulsory optional subjects and exams governed by older or more "exotic" examination regulations has to be done in person at the service center, which also has access to the examination administration of the system.

When "creating" an exam in the database, the registration and deregistration periods have to be specified. Students have to (de-)register during that specified period only, deregistering for (officially certified) medical reasons being the only exception being handled exclusively by the central office of examinations.

Information for each exam is available for download by the service center or other authorized staff in the form of a zip-file containing the following:

- A list **of all students registered for this exam**, including their personal data and the results of the exam (in csv-format)
- **Separate lists for each course of studies**, containing the names and personal data of each student registered for the exam to be forwarded to the central office of examinations (LATEX -Format)
- A **complete list of all registered students** including personal data for proof of identity during the exam (LATEX -Format)
- **Separate lists for each course** of studies, containing the **names, personal data** and **exam score** of each student registered for the exam to be forwarded to the central office of examinations (LATEX -Format)
- A **complete statistic** including a graphical representation **of the results** (LATEX -Format)

The lists of registered students forwarded to the central office of examinations replace the more traditional registration forms handed in by the students in person. Similarly, the lists containing the result, once signed by the professor, replace the minutes of the examination previously required for each student separately.

The complete csv-format list of participating student is used as the basis for assigning the students to the rooms available for the examination and to determine the needed capacity and thus required rooms in the first place.

VII. ADMINISTRATION OF HOMEWORK

Most courses of study require mandatory homework as a prerequisite for admission to the exams. However, some few courses, that have a large number of students though, form an exemption from this rule. As a result, homework is a prerequisite for approximately fifty percent of all students. The homework-related criteria that are to be met for admission to the exams are currently dependent on both the module and the professor teaching it. In consequence, it is necessary to store the criteria (as a boolean) for each module and each semester separately.

Authorized staff can access the list of course participants at the end of the semester to add if the student met the homework-related criteria or not.

The system does not check if the homework-related criteria are met during the online registration for the exam as the last homework assignments are regularly neither handed in nor graded by the time the registration period has expired. The registration lists, however, contain the information about which students met the criteria, enabling the service center to deregister students if appropriate.

VIII. Access Rights Management

Typically, the users of the system fall into one of the following groups of people requiring fundamentally differing access right that can even vary between departments:

- **Students**, as a rule, are granted access to their own personal data and nothing else (exception: courses allowing team work, see section III.A). They are given write-access for their own data and for registering for exams or exercise classes, otherwise read-access only.
- The **Administrator** is given access to all information; he is provided with additional, special rights, such as the creation of new modules.
- **Employees of the Service Center** are usually responsible for all communication with the central office of examinations and is the central contact for all students.
- **Teaching Assistants** are often responsible for entering the results of exams and similar tasks.
- **Tutors** will input if the homework-related criteria are met and have access to the personal data of their students.

The growing interest of other departments to use the MOSESKONTO for the registration for their own exercise classes, examination and student administration outside the mathematical service modules requires an expansion of the access right management to facilitate the independent administration of their students. These changes have to account for different access right requirements for the above mentioned user groups.

As a solution, we have implemented a hierarchical access rights management system mirroring that of UNIX. All reading or writing rights for the different types of information (e.g. access to the students' personal data or to their examination results) are treated as a single, independent resource. Passing these resources (reading or writing) is treated as a third type of resource. User groups (e.g. teaching assistants) can be created and are defined by their associated access rights. The owner of a group (either because he created it or it was associated with him by default) has the right to add or remove members of the group or grant access rights to group members within the limits of his own rights. Students are outside this access rights management, as their rights do not have to be defined on a per-module basis. The right to register for an exam for example can be managed through the use of a registration time period.

IX. Experiences with the System

The MOSESKONTO has been deployed successfully at the TU Berlin for three years. The registration for exercise classes for the mathematical service modules would be impossible without the online registration given the steadily increasing numbers of participating students each semester. The online registration spares both the students and the teachers from time-consuming in-situ registration while better addressing the needs of students. The approach of a global optimization implemented in the system requires a significant amount of effort in the mathematical modeling of the problem but provides the following, significant advantages:

- **conflict-free assignment** of exercise classes across several, different modules
- optimal **adaptation** to the **wishes** of the **students**
- **optimal use** of existing **room resources**
- **optimal use** of existing **staff resources**
- **instantaneous information** concerning number of participating students

The deployment of the MOSESKONTO to administrate exams has been equally successful. Without the use of online registration it would have been impossible to keep up with the vastly increasing number of students in the mathematics service courses for engineers (almost doubled in the last few years). The online registration has saved students hours of waiting commonly associated with the registration for an exam.

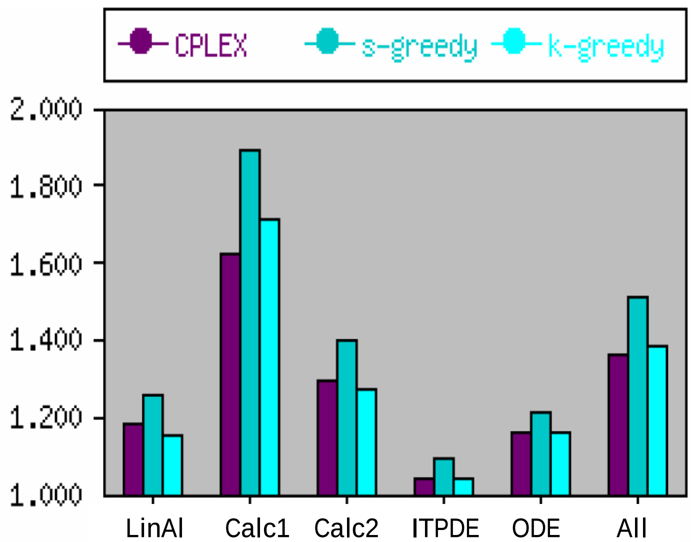

Figure 8. Comparison of the results currently achieved using CPLEX [11] and our own solver

Starting with the winter semester 2005/6 the use of the MOSESKONTO has been extended to cover modules beyond mathematical service courses. New modules administrated through the system include electrical engineering, modules in the computer sciences, mechanics and the material sciences. For the summer semester 2006 standard mathematics courses and the service module in physics for engineers courses will be added to the list of modules included in the MOSESKONTO. In

consequence, the MOSESKONTO will administer the exercise class administration for the largest and most important service courses for engineers. The conflict-free assignment of exercise courses for these important exercise classes represents a significant improvement in the course administration.

Next to the mathematical service courses, “physics for engineers” and “mechanics” are the largest single modules offered at the TU Berlin. Starting with the summer semester 2006 the MOSESKONTO will be extended to include the examination registration and administration of these courses as well, following the coordination of the transition with the central office of examinations.

X. OUTLOOK

One desirable future feature of the system would be a direct, automatic exchange of data, in particular, of the registrations for and results of examinations with the central office of examinations. This exchange could be realized in the form of the transfer of data in an XML-format, replacing the current, error-prone, manual transfer of data. Preliminary efforts of coordination have shown the general willingness of the central office of examinations to participate. However, certain adaptations to their software are required and are not yet implemented.

On the technical side we are working on our own solver in order to be independent of proprietary software and thus allow for the employment of the MOSESKONTO at other universities at no charge (cf. Fig. 8 for some preliminary results of our own implementation.

In addition to the inclusion of minor, new features, such as the ability to store the results of weekly assignments separately, that have resulted from the requirements of other departments, the MOSESKONTO is currently undergoing a redesign of the optimal allocation of exercise courses. The aim of the optimization lies in a single-pass allocation including the corresponding room assignment. This has to include additional constraints such as preferences for certain specific rooms expressed for a given module that are hard to quantify within the mathematical model.

For efficiency-reasons and student-contentedness, of course in the medium-term it would be desirable to manage all examinations and optimize all tutorials at TU Berlin using the MOSESKONTO. Anyhow, MOSESKONTO remains a service, offered by the Center for Multimedia in Education and Research (MuLF) and every department is invited to take part on a voluntary basis.

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Lessons Learned from Training Teachers on ICT: A Case Study from Jordan University

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***Abstract*— Since the past decade the Ministry of Education in Jordan was focusing on strategies to improve the quality of education through reforming the curricula and embedding ICT to prepare Jordanian teachers and students to compete in a world increasingly driven by information, technology, and knowledge. Despite the investment in new technology in schools in the form of computer labs, equipments and Internet connectivity, most schools in Jordan, however, are running slow in adopting ICT. The lack of ICT skills and good training programs for teachers are among the greatest hindrances to change the attitudes of teachers to use ICT in education. In this paper we present a full year experience of practices carried out at the University of Jordan to produce a blueprint for a rigorous training program to prepare teachers on using ICT in education to change their pedagogical beliefs and practices. We also provide the evaluation methodologies used to assess the program and our recommendations for improvements. During this pilot experience a total of 350 participants have been trained on cutting-edge software packages to be used through the school curricula in Jordan.**

Keywords-ICT in education; pedagogy; training; evaluation

I. INTRODUCTION

Preparing Jordanian teachers and students to face the challenges of using new technologies in education sits at the heart of any new education strategy. Integrating ICT in education promoted an urgent need to reform school curricula to cope with the new technology. The trend has caught most teachers not adequately prepared, intimidated to use technology in their teaching and are comfortable with their own teaching styles [1].

One of the key failures of past strategies was that schools were equipped with expensive technologies (i.e. computers, data shows, whiteboards, Internet, etc.) but with little support for teachers' professional development on how to use these technologies. For that reason, we won't see much progress in the teaching/learning process unless our teachers know how to use and integrate the computer technology in the curricula they teach. A motivated, enthusiastic teacher is important for improving student outcomes and, hence, teachers are in need for ongoing training and practices on how to integrate technology into their teaching. They also need to learn how to transform their passive traditional classrooms into dynamic interactive learning environments.

In 2006, and as part of its mission to serve the community, the University of Jordan along with the Arab Group represented by Al-Faisal International Academy of Saudi Arabia and Ohio University, USA, signed a partnership agreement to develop a high diploma program in Information and Communication Technology in Education (ICTE) [2, 3].

The ICTE program has been developed as a respond to the urgent need for training teachers on adopting ICT in education. Its main objective is to train and prepare Jordanian teachers for mobilizing the necessary technologies, skills, and educational resources to prepare their students to face the challenges of using technology in education.

In this paper, the term "*student participants*" hereinafter is used to refer to K-12 teachers participating in the ICTE program, which presently has over 350 student participants from both public and private schools. They are being trained on cutting-edge software packages to be used through the school curricula in Jordan. Around 200 student participants graduated last September, 2007 are applying what they have learned in their classrooms. Most participants attending the ICTE program state that their students are more motivated and attentive when computers and the Internet are used in class.

The continued goal of this intensive practical training program will be to incorporate these technological skills into the teachers' daily life through well-prepared courses and to transfer the program to regional countries.

II. ICTE BACKGROUND

The ICTE High Education Diploma program is a partnership between The University of Jordan, Al-Faisal International Academy of Saudi Arabia and Ohio University, USA. The program seeks to focus on teacher training as a component in the integration of technology in K-12 classrooms. Effective teachers who are attentive to the goal of quality instruction are using technology as a tool to improve the academic success of their students. ICTE has established a program for ongoing professional development on the applicability and benefits of technology in teaching and learning.

The program has grown rapidly. Presently, it has over 350 student participant within its two cycles. A third cycle is in the recruitment stage with more than 300 applicants. As with any

new endeavor, the program has experienced typical developmental challenges during its first year.

III. ICTE PROGRAM OBJECTIVES

The following objectives were in mind when the ICTE training program was initially developed. Among these objectives are the following:

1. To develop teachers who are committed to the pedagogy and understanding the roles of technology in preparing the new generation of Jordanian students to compete effectively in an evolving information society.
2. To upgrade teachers' knowledge/skills in using new technology in the teaching/ learning process.
3. To develop bi-lingual (Arabic/English) pilot training courses for effective use by teachers whose mother tongue is Arabic.
4. To disseminate the developed courses in the form of printouts, electronic material delivered through the Blackboard™, whiteboards, PowerPoint presentations, and in the nearest future through CD-ROMs and DVDs.
5. To develop the program at the local and regional levels.
6. To reach out teachers all over Jordan and within their environments and schools to introduce the program and its benefits.

IV. ICTE PROGRAM DEVELOPMENT

The courses of the ICTE program, including a final project, were developed to affect at two main categories:

1. *Education courses* (4 courses): These courses (shown in Table 1) concentrate on the integration of technology, constructivist practice, classroom management when technology is used, and emerging technologies for improving teaching and learning. The *Assessment Techniques* course allows teachers to practice the use of educational assessments during the academic school year.

TABLE I. THE EDUCATION COURSES

	Course Title		Course Title
1	Principles of School Curriculum	3	Instructional Design
2	Learning and Teaching Strategies	4	Assessment Techniques

2. *Information Technology courses* (5 courses): These courses (shown in Table 2) are the core of the training program. They aim at introducing the student participants to the software packages usually used in integrating ICT in the classroom curricula.

TABLE II. THE INFORMATION TECHNOLOGY COURSES

	Course Title	Software Package
1	Technology Applications in Education	Windows®, Word®, Excel®, Access®, PowerPoint®, Publisher®.
2	Internet Applications in Education	Adobe Dreamweaver®.
3	Instructional Multimedia	Macromedia Flash® & Authorware®.
4	Graphics Design for Visual Media	Adobe Photoshop®.
5	Programming Concepts for Teachers	VB.Net®.

V. ICTE PROGRAM DEVELOPMENT

All the way through training, and to overcome the fears of inadequacy, participants have been encouraged to be committed to the following strategy:

1. Pinpoint their deficiencies when they don't know how to do things and not to be afraid to ask for help.
2. Share their knowledge of computers and Internet with their colleagues.
3. Ask their mentors and colleagues for help.
4. Integrate what they have learned in the curriculum and get feed back from their students.
5. Find out what their students know about technology and ask them for help.
6. Set weekly goals regarding familiarity with technology.
7. Use e-mail and contact people having similar experiences.
8. Discuss issues, ideas, and suggestions with other people in the same field.
9. Practical tasks were set in every lecture at a ratio of 50% of the lecture time.

VI. DEMOGRAPHICS OF THE ICTE STUDENT PARTICIPANTS

The ICTE High Diploma program has grown rapidly and now is in its second year. It attracts teachers coming from major cities in Jordan. Sooner, the program will be refined and exported to neighboring countries. Present student participants coming from public schools are sponsored by the Ministry of Education, whereas participants from private schools are not financially covered. There is too much disparity in the participant's technology and English speaking skills. This inconsistency was problematic for both the faculty and students. The limited English speaking ability of the students required an additional burden of translation for the instructors. A remediation plan for students with poor technical and English speaking skill have been activated.

Fig. 1 depicts the distribution of the participants according to their ages. It shows that around 60% of the participants are over 30 years old and 60% of them are female students (Fig. 2). Although training time varies according to individual's previous knowledge of computers, age, mood, as well as other factors, we set the time required for training as whatever satisfies a teacher's need to learn and grasp the concepts to effectively use the computer as both a personal and educational tool.

The distribution of the participants according to their previous knowledge in computers is shown in Fig. 3. Around 80% of the student participants have good or below knowledge of using computers. Teachers teaching science, mathematics, physics, biology and computer science are the most intensive users of ICT.

Concerning their use and knowledge of the Internet, Fig. 4 shows the previous knowledge of the participants in using the Internet. Only 40% of the participants know how to seek information directly from Internet sites or through search engines like Google. The majority of the participants were

passive users; where they only know how to navigate through web pages.

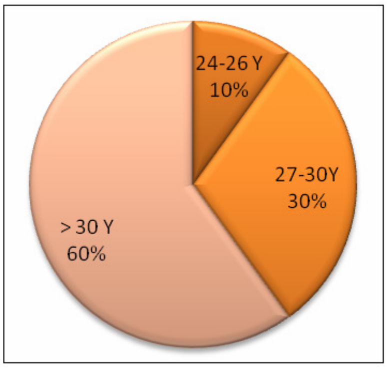

Fig.1. Age distribution of the ICTE student participants

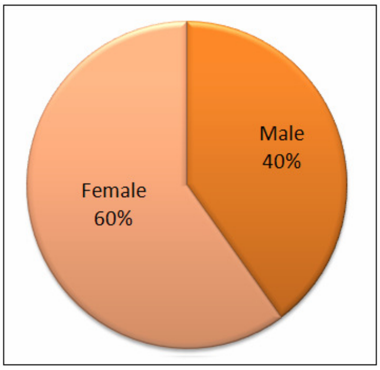

Fig.2. Gender distribution of the ICTE student participants

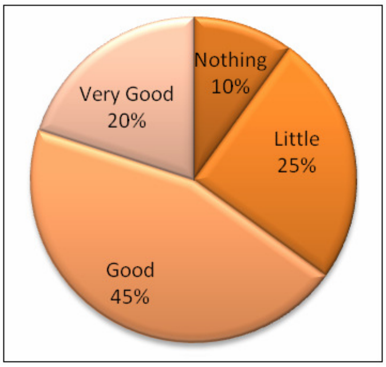

Fig.3. Participants previous knowledge of using computers

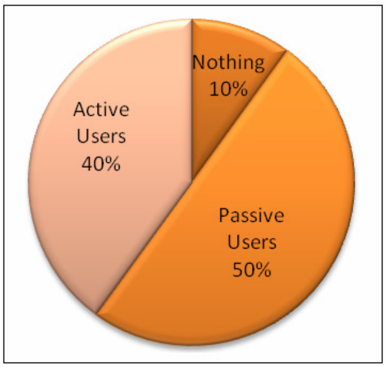

Fig.4. Participants previous knowledge of using the Internet

VII. ICTE PROGRAM EVALUATION

After one year since it was developed, the ICTE Program is evaluated. The evaluation aimed at providing the basis to guide the ICTE program improvements as well as to gain the support of policy makers in Jordan and other stakeholders to support the integration of ICT in education. Most of the surveyed teachers said that their interest and enthusiasm for teaching had increased greatly under the ICTE program.

The following section contains the qualitative data collected from interviews and the quantitative data collected through the Student Satisfaction questionnaire administered by Ohio University [4].

VIII. EVALUATION METHODOLOGY

To evaluate the ICTE program from students' side, a questionnaire was sent through email to student participants to collect the data used for the evaluation of the program. The questionnaire provides, among other data, quantitative data concerning the ability to meet the mission, goals, objectives and satisfaction with the program. Interviews with student participants were conducted. These interviews were recorded and written down for recommendations concerning the ICTE program.

A) *Statistical Analysis of Student Satisfaction Questionnaire:* Sixty student participants out of 150 responded to the survey with a return rate of 38% which may be indicative of the lack of Internet access away from the University of Jordan campus. The questionnaire examined the overall satisfaction of students with the ICTE program and was deployed by Ohio University. It used a Likert 4-point Scale in which a "4" indicates "very satisfied".

Findings:

Qualitative and quantitative data were used to examine the issue of student satisfaction with the ICTE Program. The overall satisfaction by students rating is (2.94). Each of these ratings suggests satisfaction by the students concerning their experiences in the ICTE program (see Table 3) for these findings.

The very positive statement "*My relationships and interactions with other students in the ICTE High Diploma Program*" (3.43), suggests that student participants value the opportunity to talk and work with other colleagues within the program. Such relationships help to prevent teachers from feeling isolated in their schools.

Students were proud of their accomplishments in this area are enthusiastic in their support of the program and its continuation. Their overall comments were very optimistic and thoughtful concerning the outcomes and the impact of the ICTE program on them personally, on their schools, and families.

B) *Usefulness of Information Technology courses:* The student's perception of the usefulness of the Information Technology courses to participants can be viewed in Table 4. Only the course, "*Programming Concepts for*

Teachers" in which "*Visual Basic"* was taught (3.51) was not considered useful. A Likert 6-point scale with "1 = less important" and "6 = most important" was used in this section of questionnaire.

Findings:

Students presented positive perceptions concerning the usefulness of the majority of Information Technology courses. Only "*Programming Concepts for Teachers*" was not as well received. Overwhelmingly students suggested the alternative software "Flash" to substitute for "Visual Basic".

TABLE III. OVERALL SATISFACTION WITH THE ICTE PROGRAM

Overall Satisfaction with ICTE Program	Scale 1 to 4
The ICTE High Diploma Program's reputation	3.11
ICTE High Diploma Program's ability to keep pace with recent developments in the field of educational technology	3.02
The effectiveness of the services and facilities which the program offers.	2.58
Quality of computer support	3.07
Quality of Blackboard site used for content delivery	2.89
Quality of Internet access	3.21
Quality of email connectivity	2.81
My relationships/interactions with other students in the ICTE High Diploma Program	3.43
The number of computers available in the lab	3.12
My overall experience as a student in the ICTE High Diploma Program	2.94

(Scale: 1 = very dissatisfied to 4 =very satisfied)

TABLE IV. USEFULNESS OF INFORMATION TECHNOLOGY COURSES

Usefulness of Information Technology Courses	Scale 1 to 6
Technology Applications in Education	5.12
Educational Applications of the Internet	5.19
Instructional Multimedia	4.91
Graphic Design for Visual Communication	4.29
Programming Concepts for Teachers	3.51
Project (Parts 1, 2, 3)	5.09

(Scale: 1 = less important to 6 = most important)

C) *Usefulness of Education courses:* Findings suggest that there is a need for professional development to learn new pedagogies and strategies for teaching for the more experienced teacher who has taught from some time. The low rating of "*Instructional Design"* (1.86) was strongly supported by student comments. Students suggested that the material was not practical for classroom teaching and should be removed. Other findings are in Table 5.

TABLE V. USEFULNESS OF EDUCATION COURSES

Usefulness of Education Courses to Participants	Scale 1 to 4
Principles of School Curriculum	2.54
Learning and Teaching Strategies	2.83
Assessment Techniques	3.21
Instructional Design	1.86

(Scale: 1 = less important to 4 = most important)

D) *The importance of the ICTE program to the participants:* The ICTE program has been evaluated based on data collected from the participants to compare the importance of the subjects presented in the courses offered in the ICTE program to their work as instructors in the K-12 schools. The evaluation used a Likert 5-point scale with "1 = less important" to "5 = most important".

Findings:

Table 6 indicates that the ratings were positive concerning the content of the ICTE and its application to the work of teachers in the K-12 schools. The majority of the ratings are between (3.27) and (4.28). Only "*Programming Concepts for Teachers"* (2.80) and "*Assessment Techniques*" (2.57) fell outside this range. The rating concerning the *Assessment Techniques* of this particular section (2.57) is an interesting contrast suggesting that within the educational setting assessment is highly valued.

TABLE VI. IMPORTANCE OF THE COURSES FOR THE PARTICIPANTS

Course Topic	Scale 1 to 5
Technology Applications in Education	4.19
Educational Applications of the Internet	4.28
Instructional Multimedia	4.16
Graphic Design for Visual Communication	3.72
Programming Concepts for Teachers	2.80
Principles of School Curriculum	3.54
Learning and Teaching Strategies	4.15
Assessment Techniques	2.57
Instructional Design	4.20
Project (Parts 1, 2, 3)	3.27

(Scale: 1 = less important to 5 = most important)

IX. THE IMPACT OF ICTE ON STUDENT PARTICIPANTS

There is considerable evidence of the impact of using ICT in education for student participants who joined the ICTE program. The following are worth to mention:

- There is evidence of immediate increases in ICT use in the day-by-day work of teachers such as increased efficiency in planning and preparation of work due to a more collaborative approach between teachers.
- Teachers gain a positive attitude towards ICT and considerably increased their confidence in using ICT. There relations with students have been improved dramatically.

X. RECOMMENDATIONS

Although student participants in the ICTE program appear to recognize the value of ICT in education and they gain a positive attitude towards using ICT in education, difficulties nevertheless continue to be experienced within the processes of adopting and using these technologies. The following recommendations result from the evidence of the review, from in depth discussions with the key stakeholders of the ICTE program and feedback from faculty, administrators, student participants participating in the ICTE program and partners including Ohio University, the University of Jordan and Al-Faisal International Academy. The recommendations are important to the success of the program:

- A strategic map and action plan with measurable benchmarks should be developed. The plan should include strategies to ensure compliance to standards articulated by the International Society for Technology

in Education (ISTE) and as implemented through the curriculum prescribed within the agreement with Ohio University. The action plan should also include an appropriate marketing plan identifying the appropriate target market (students) and promotional strategies to reach that market, quality assurance measures, evaluation and assessment procedures and a plan for long-term sustainability.

- Participants in the ICTE program must be provided with laptop computers, which will increase their positive attitudes and confidence in using 'hands-on' experience with using ICT in education.
- Participants should be provided with all required software, including virus protection, and Internet connectivity in their homes to facilitate the development of on-line instruction and enable them practicing the experiences of other teachers in their field.
- The ICTE program is a program for teachers and as such should continue to provide education methods courses which reflect emerging educational teaching practices and encourage teachers to upgrade their ICT skills and gain more pedagogical knowledge.
- Teamwork on projects and collaborative learning are powerful learning strategies and should be encouraged.
- Since most of educational context have been changed to adopt the new technologies, teachers should be encouraged to include new competencies in the curricula and ways of assessing them should be explored.
- Teachers complain about the lack of time to integrate ICT in education. Therefore, It is unrealistic to expect a teacher to work from 7AM to 4PM teaching and then spend four hours completing course assignments. A solution could be through teamwork, group projects and providing Internet access from home.
- Recruitment of qualified female instructors is essential to mentor the 60% of female student participants in the ICTE program and should be given a high priority.

XI. CONCLUSIONS

In this paper we have described the challenges facing the teachers and the students in an evolving information-based global society. To cope with the new technology, it is not enough to equip our schools with the top-technology computers, software, and network connections. The new era requires changes in the way we teach and learn and hence, it requires changing our teachers' pedagogical beliefs and practices. Therefore, our teachers should not left behind and they should be trained on how to use and integrate the new technology in the curricula they teach. We present our experiments, practices and evaluation of a training program named ICTE, established at the University of Jordan to train teachers on the best practices to adopt and use ICT in education. The program now is running into a second year of success. After the program has been evaluated by experts in ICT and provide positive attitudes, we are now very optimistic that this program can act as a blueprint for future teacher training programs in Jordan and the country region. Graduates from this program will facilitate the integration of technology through curricula and encouraging their colleagues to adopt ICT in education.

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Some Aspects of Information Privacy in Kuwait

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Abstract—**This paper explores the issue of information privacy in Kuwait. It seems that privacy, and information privacy in particular, receives little recognition in the region. Information privacy is the interest an individual has in controlling and influencing, the handling of data *about* themselves. This paper investigates the foundation of personal identifiable information theory: what is personal identifiable information? How is it distinguished from other types of information? Are there different types of personal identifiable information? A government agency was selected to determine how personal identifiable information is organized. Surveys were also conducted to determine how clients and workers value different types of personal information.**

Keywords: ethics, privacy, information privacy, personal information

I. INTRODUCTION

"Information Privacy is the interest an individual has in controlling, or at least significantly influencing, the handling of data *about* themselves" [4]. In this paper, we deal with a type of information privacy called the privacy of personal identifiable information (PII). In its conceptual perspective, PII privacy is the extent a person is afforded his/her claim of proprietorship of his/her personal identifiable information sphere. The relationship between different types of privacy is shown in Figure 1. PII privacy is concerned with personal identifiable information. Information privacy deals with any type of information that a person considers private, including such (non-personal identifying) information as secret receipts, pornography, etc.

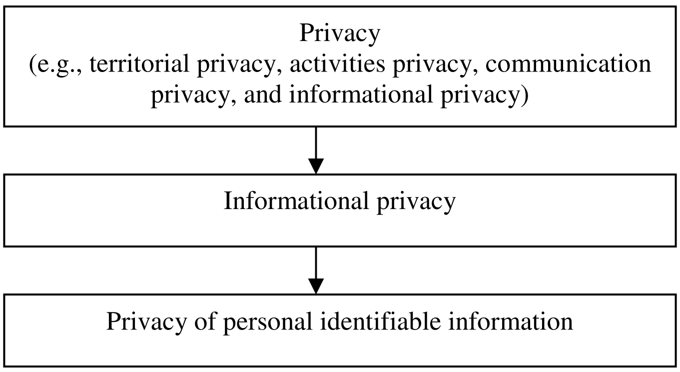

Figure 1. Different types of privacy.

II. PERSONAL IDENTIFIABLE INFORMATION

We use the term *information* here in it ordinary sense of factual report. Rapid advances in information technology and the emergence of privacy-invasive technologies have made information privacy a critical area to be protected. Personal identifiable information is used in making decisions about an individual's life. Regulations and laws (e.g., EU 1985 privacy directive) have been established to allow people to control the way in which such information is used.

Personal identifiable information indicates something *about* its proprietor. It is information that has referent(s) of type *person*. Human beings are *subjects* of this type of information. In logic, referents are anything that can be talked about. In our system, we concentrate on referents of type (natural) person that information is about.

Some information about persons is highly valued while other is trivial. Typically, the level of sensitivity is judged according to arbitrary criteria, for example, health information is more valued than hobby information. However, it is possible to create an objective scale of measurement by analyzing different types of personal identifiable information.

According to such an approach [1], there are two types of PII:

(1) Atomic personal identifiable information is information that has a single human referent. "Referent," in this case, implies an identifiable (natural) person.
(2) Compound personal identifiable information is information that has more than one human referent.
"Atomic" in this definition signifies the "subject" of information and not the composition of information that expresses that fact. Thus, *John is tall and handsome*, *John is tall*, and *John is handsome* are all atomic pieces of information, even though the first contains the second and third statements. Linguistically, human referents include the typical proper names, personal pronouns, and definite noun phrases (e.g., *John over there*). A single referent does not necessarily imply a single occurrence of a referent. Thus, *John wounded himself* has one referent.

Atomic personal information is the "unit" of personal information. According to this definition of atomic personal information, every piece of personal information *about* an

identified individual is his or her atomic personal information. An atomic piece of PI refers to its *proprietor* in the sense that it "leads" to him/her as a distinguishable entity in the world. This reference is based on his/her unique identity.

Any compound personal information is privacy-reducible to a set of atomic personal information. For example, *John and Mary are in love* can be privacy-reducible to *John and someone are in love*, and *Someone and Mary are in love*. However, it is obvious that the privacy-reducibility of a compound personal information causes a loss of "semantic equivalence" since the identities of the referents in the original information are separated. Semantic equivalency here means preserving the totality of information, the pieces of atomic information and their link [1]. This topic is not a main concern in this paper.

III. PROBLEM

The problem dealt with in this paper is determining the level of information privacy in Kuwait through measuring the sensitivity of personal identifiable information. Even though privacy has no special necessary attachment to any culture or any region of the world, examination of legal progress in the West shows that there has been a systematic history of legal initiatives related to privacy rights (e.g., against nonconsensual monitoring photography) [7] since 1890. For instance, "most of the modern statutory law that addresses monitoring by hi-tech devices is of American origin." [6]. The privacy concept is even described as "an Anglo-Saxon notion" [4] and "a creature of American history." [5].

In addition to technology, most laws, cases, controversies, social arguments, political debates, etc. pivot around Western society. Nevertheless, this does not negate the fact that the issues are of global significance. For example, legal issues in privacy have consequences that influence international relations. In this world of global computer networks, new legal concepts introduced in one country often have an impact on other countries.

Islamic ethics, the dominant ethics in Kuwait, is very sensitive to aspects of the "private world" of a person. One aspect of this privacy comes in terms of concealment of self, family, and others. Nevertheless, it seems that privacy, and informational privacy in particular, receives little recognition in the region. Al-Fedaghi [3] demonstrated that a great deal of personal identifiable information is freely available on different Kuwaiti government Internet sites, including: full name, home telephone number, civil ID, birth date, occupation, traffic violations according to vehicle number, address, vehicle registration, passport number, permits to possess arms, etc. The Kuwaiti national civil number incorporates birth date; thus if you have a person's number, you know his/her birth date. There is hardly any public debate devoted to the topic of information privacy in the region.

To determine whether there is concern regarding information privacy in Kuwaiti society, we have selected an environment that deals extensively with personal identifiable information to measure the relative valuing of different types of personal identifiable information in Kuwait.

The remainder of this paper is organized as follows:

1. Section 4 discusses the foundation of personal identifiable information theory: what is personal identifiable information? How is it distinguished from other types of information? Are there different types of personal identifiable information? Is it possible to simplify it to more primitive information?

2. Section 5 describes our selected environment of personal identifiable information, the Social Development Office (SDO). Its database was scrutinized to determine whether any special consideration is given to this type of data in the database. We saw no evidence of that, so we reorganized the conceptual schema of the database into simple PII that reflect proprietor aspects, relationships with objects, and relationships with other proprietors.

3. Section 6 presents results of surveys of users and clients of personal identifiable information in the SDO in order to determine how they value different types of personal identifiable information. This was accomplished through administration of three surveys, each with 30 participants.

IV. SIMPLE PERSONAL IDENTIFIABLE INFORMATION

Atomic personal identifiable information is a piece of information about its proprietor. Each (natural) person is the center of information about him/herself as follows [2].

• Aspects of the proprietor (identification, character, acts, etc.)

• His or her association with non-person "things" (e.g., house, dog, organization, etc.)

• His or her relations with other persons (e.g., wife, friend, employee, etc.)

To focus the privacy perspective in an atomic PII, we further categorize it according to the aspects, associations, and relationships of the proprietor. Naturally, a first concern when analyzing a piece of atomic personal information is to isolate any other entities besides the proprietor that the information might "talk" about. For example, *John's car is fast* is information about John and about a car of his. Such information embeds *John has a car* and *The car is fast*. *John has a car* gives information about a relationship that John has with another entity in the world. This information is an example of what we call *self* information. Self information is information about a proprietor, his/her aspects (e.g., tall, short) or his/her relationship with non-human entities in the world. So, just as we reduced compound personal information to a set of atomic personal information, it is possible to reduce atomic information to self information [2].

Atomic personal information is said to be self information if its subject is its proprietor and only its proprietor. Self information is personal information such that its "subject" is its proprietor. *The car is fast* is non-personal information because its "subject" is not a person but a car. The term "subject" here means the entity about which the information is communicated.

Self information is related to the concept of "what the piece of PI is about." It is a special case of the "theory of aboutness." "Aboutness" refers to attributes of a text: what is said in a text, what it is about, its content, subject, etc. In the theory of aboutness the notion of the "subject" is said to be vague. In personal information theory, the "subject" is always the proprietor. In our case, the question is, "what is this piece of PI about?" In the theory of aboutness, this question is answered by studying the text structure and assumptions by the source about the receiver (e.g., reader). In this paper, we reduce the piece of atomic information to a piece about the proprietor.

The process of reducing personal identifiable information to self information reflects the commonsense notion that information is about aspects of, or relationships among entities in reality that can be classified into different categories. Self information in turn can be classified into two types: *singleton* and *multitude* information. A singleton information has the general structure (proprietor attribute) where the attribute is an aspect (property, character, etc.) of the proprietor. Multitude information has the general structure (proprietor predicate object) where the object is not a non-person object. Consider the self-assertion "*Crazy Mary has a house*." It contains the following pieces of information [2]:

(a) "*Mary is crazy*," a singleton assertion in which the sole entity is Mary, and
(b) "*Mary has a house*," a multitude assertion that expresses a relationship between two entities: Mary of type *person* and house of type *non-person*.

V. ORGANIZING PERSONAL IDENTIFIABLE INFORMATION

We have selected the Social Development Office (SDO) as field study for two purposes

1. Personal identifiable information and its types are analyzed abstractly in the previous section; hence, the SDO provides a real-life environment in which to recognize such information.
2. Exploiting the issue of informational privacy can best be accomplished in such a PII extensive environment to discover the level of "informational privacy literacy," in terms of explicitly organizing and valuing PII.

Thus, in this section we explore how PII is organized in the SDO, and in the next section we conduct surveys to measure how clients and workers in the office *value* informational privacy.

The SDO is a government agency that handles social problems and collects a great deal of personal information. Three main agents are involved in this process: the clients, the consultants, and the administrators. The administrators include employees and secretaries who manage the information flow that includes registration, appointments, and organizing treatment sessions. Figure 2 shows the general schema of the SDO database.

Main information

ID	Name	Civil ID	Birth	Gen-der	Social	Ed.	Marr-iage

Address

ID	Area	Block	Street	House No.	Tel

Family

ID	Order in family	No. Sons	No. Daughters

Health history

ID	Hospital name	Date from	Date to	Reason

Consultant Information

ID	Consultant name

Administrator Information

ID	Administrator _name

Consultant with case

Case_ID	Consultant ID	Administrator _ID

Case appointment

Case_ ID	Date	Time from	Time to	Details of session

Figure 2. The Social Development Office database

One of the SDO secretaries collects the information during the first visit of the case, enters it into the database, then assigns one consultant to handle the problem.

The personal information in tables Main and Address is a collection of pieces of self information of the client identified uniquely by his/her SDO unique internal ID. The Family table includes the SDO unique internal ID as the key and attributes Rank (among children), (number of) Sons, and (number of) Daughters. Other tables can be described in a similar way.

The design of the database does not reflect any awareness of the privacy of personal identifiable information. In the SDO database there is no map that draws the boundaries of the proprietors' spheres. It mixes aspects/attributes of proprietor with descriptions of non-person objects. As an example, the Family table mixes the proprietor's ID and aspect of Rank-among-sibling (singleton PII) with the personal non-identifying information (number of) Sons, and (number of) Daughters.

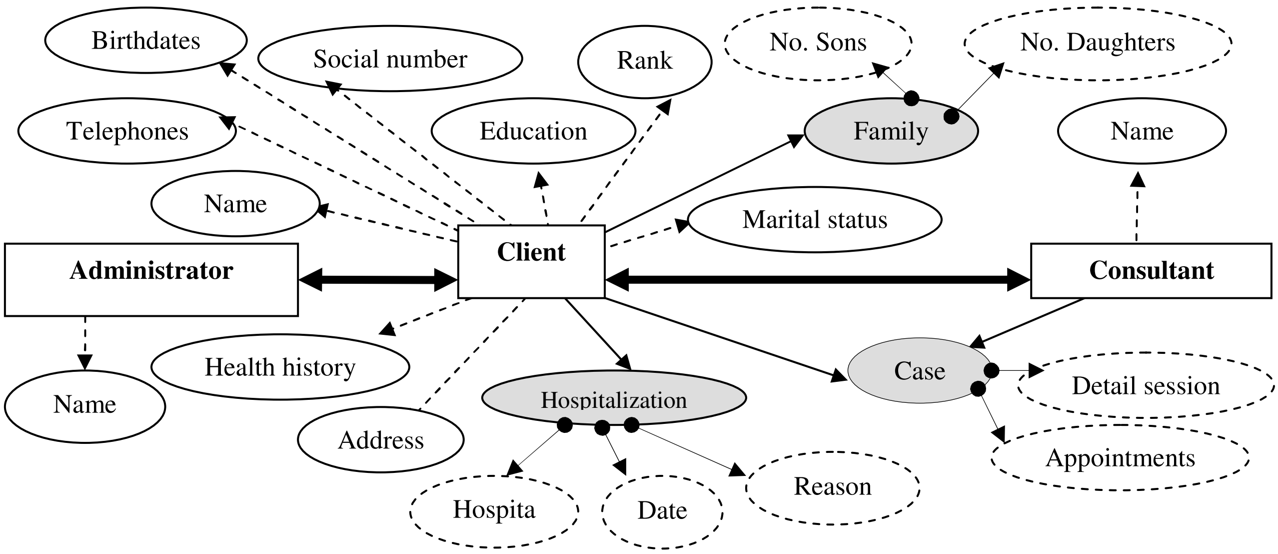

Figure 3. Conceptualization of the SDO in terms of different types of personal identifiable information.

This blurs the conceptual picture and causes inconsistency. For example, if there are two clients from the same family, updating information about Family necessitates updating the second information about the second client.

Redrawing the conceptual map of the SDO PII information, Figure 3 shows different types of PII that can be recognized in such a database. The database contains the following:

1. Three proprietor types: client, administrator, and consultants (rectangles). The relationships between proprietors (bold arrows) represent compound PII.
2. Aspects (singleton PII) of the proprietors (dotted arrows).
3. Non-person entities: Hospitalization, Family, and Case (dark ovals). The relationships between proprietors and non-person entities (ordinary arrows) represent multitude self atomic PII)
4. Attributes of non-person entities (double lines with dotted ovals).

A new entity called Hospitalization is created with attributes Hospital, Time, and Reason in order to separate information about client from information about health events. Hospitalization is a collection of events (with location, time, and description) that have happened to the proprietor, thus, it is (multitude) personal information that includes the entities Proprietor and the event of hospitalization.

In Figure 3 we attach Rank to the client as a simple personal information comparable to Birth, Gender, etc. Additionally, the Family, as an entity that is different from the client, is assigned an independent node with attributes (number of) Sons, (number of) Daughters. Family information, e.g., number of children, is not strictly personal information because it is not information about a uniquely identifiable person.

VI. VALUING PERSONAL IDENTIFIABLE INFORMATION

To examine the issue of the importance of personal information in Kuwaiti society, we conducted three surveys in the Social Development Office, as discussed in the previous section. The SDO is suitable for this type of study because it is an intensive personal information environment that involves handling of such information.

Part A

The following set of pieces of personal information, as described in the previous section, was used in our surveys:

1. Name (Na)
2. Civil number (Ci)
3. Telephone (Te)
4. Birth date (Bi)
5. Social status (So)
6. Education level (Ed)
7. Occupation (Oc)
8. Health condition (He)
9. Address (Ad)
10. Family information (Fa)

The purpose of the questions in this part was to arrive at indicators of the sensitivity of the person to the act of collecting different types of personal information by a third party.

Question A.1 Imagine that an outside agent asks you for one piece of information, as in the case of an offer to get a free commercial gift or as a requirement to shop in the place. Accordingly, rank the following required information in order of its importance to you. Number 10 indicates that the information is important and it is not easy to supply it to the requester, while number 1 indicates it is possible to give the information easily.

Table 1

Na	Ci	Te	Bi	So	Ed	Oc	He	Ad	Fa
6.13	7.90	6.57	4.30	4.23	2.90	3.87	5.47	6.77	6.90

This question measures the importance of identifiers in comparison with other information. The results indicate the following order of importance:

1. Civil number (PII)
2. Family information
3. Address
4. Telephone (PII)
5. Name (PII)

It is not surprising that, in general, personal identifiable information is more highly valued than personal non-identifying information. Interestingly, family information is more valued than name or telephone. This result may be a culturally based trend. Address seems to be important because by its nature it is close to being uniquely identifiable information. The same reason may be applied to family information.

Question A.2. Same as question A.1 but the information requester asked for two pieces of information, the name plus one of the information shown in Table 2. The range of values is 7 (most important) to 1 (least important).

This question measures the importance of atomic personal identifiable information that takes the form of a name plus one additional piece of information.

Table 2

Bi	So	Ed	Oc	He	Ad	Fa
3.80	3.17	2.10	3.00	4.27	6.10	5.57

The results indicate the following order of importance: (1) Address, and (2) Family information. Again, address and family information are highly valued. It is possible that, in general, address is understood to mean residential address.

Question A.3 Similar to question A.1, but the information requester asked for two pieces of information, the Civil ID plus one of the pieces of information shown in Table 3.

Table 3

Bi	So	Ed	Oc	He	Ad	Fa
3.73	3.47	2.30	3.03	4.37	5.63	5.47

The results were almost identical to the results of question A.2.

Part B

The purpose of the questions in this part was to arrive at indicators of the sensitivity of a person to the act of releasing different types of personal information to a third party.

Question B.1 Imagine that after giving your personal information to the Social Development Office, the office in turn discloses the information for other purposes such as statistics or for contacting you for commercial advertisement (new medicine, new services, etc.) Accordingly, rank the following required information in order of its importance to you. Number 10 indicates that the information is important and not easy to supply to the requester, while number 1 indicates it is possible to give the information easily.

Table 4

Na	Ci	Te	Bi	So	Ed	Oc	He	Ad	Fa
6.53	8.00	7.20	4.27	3.43	3.13	3.87	4.80	7.20	6.57

The results in Table 4 indicate the following order of importance: (1) Civil number (PII), (2) Address, (3) Telephone (PII), (4) Family information, and (5) Name (PII), which is are close to the results of question 1 in the first part.

Again, unique identifiers are more highly valued. Civil ID is the most highly valued. This is probably because such information is used in all transactions related to the proprietor. Address and Family information are valued as highly as personal identifiable information.

Comparing Table 4 with Table 1, we notice that the values in Table 4 have increased in comparison with their values in Table 1. We can conclude that releasing personal information to a *third party* raises more concern.

Question B.2. Same as question B.1, but the information requester asked for two pieces of information, name plus one of the pieces of information shown in Table 5. The range of values is 7 (most important) to 1 (least important).

The results in Table 5 indicate the following order of importance: (1) Family information, (2) Birth date, and (3) Address.

Table 5

Bi	So	Ed	Oc	He	Ad	Fa
5.73	3.53	2.37	3.00	4.07	5.53	5.73

Interestingly, releasing date of birth (i.e., age) to a third party is a matter of higher concern than address, education, occupation, health, and social status. In addition, address and family information were highly rated. Unfortunately, no gender information was collected. For example, if the majority were women, it is possible to speculate that the common belief that woman are more concerned about age information, can explain

this result. According to Westin [8], gender affects privacy perceptions.

Question B.3 Similar to question B.1, but the information requester asked for two pieces of information, the Civil ID plus one other piece of information. The results in Table 6 indicate the following order of importance:

1. Address
2. Family information

Table 6

Bi	So	Ed	Oc	He	Ad	Fa
3.50	3.33	2.47	3.30	4.23	5.73	5.43

In Table 6, releasing information to a third party about Birth (i.e., age) and Social Status (e.g., married) are less important than in Table 5 because the identification of the person is through the civil ID, This means that *The age of the person with civil ID 123456789* is less sensitive to the proprietor than the same information that mentions his/her name instead of the civil ID. Comparing Tables 1, 5, and 6, it seems that the civil ID is more valued than name; however, the civil ID in combination with other information (birth) is less valued than this last information in combination with the name.

Part C

The purpose of the questions in this part was to arrive at indicators of the sensitivity of a person to the act of releasing *different types* of personal information to a third party.

Question. Rank the importance of the following situations such that 1 indicates the most important situation and 4 is the least important one.
a. Compound PII: Giving personal information about the nature of your relationship with another person (e.g., husband, wife, boss) to outsiders without your consent.
b. Multitude-agency PII: Giving personal information about the nature of your relationship with a non-person entity (e.g., government agency, work place) to outsiders without your consent
c. Multitude-things PII: Giving personal information about the nature of your relationship with a thing (e.g., animal, car) to outsiders without your consent
d. Aspects PII: Giving personal information about your nature or character (e.g., tall, short, lazy, socially active) to outsiders without your consent.
The results are shown in Table 7.

Table 7

Question	a	b	c	d
	1.37	2.57	3.43	2.63

Surprisingly, the results indicate the following order of importance: c, d, b, and a. Concern about releasing personal information about the proprietor's nature or character can be explained by fear of being pre-judged on the basis of character. The importance of releasing personal information about the nature of a relationship with a thing (e.g., animal, car) is puzzling. Also, it is puzzling that personal information about the nature of relationship with another person (compound PII) is the least valued.

General observation
In general, we can conclude the following according to the 30 participating persons:
1. Concern about privacy of personal identifiable information is a realistic phenomenon even through it hardly appears in public debates.
2. Personal identifiable information is more valued than non-personal information.
3. Formal unique identification (Civil ID) is more valued than other types of identification (Name, Telephone)
4. Address and family-related information are valued almost as much as identifying information.
5. Releasing personal information to a third party raises more concern.

VII. CONCLUSION

In spite of the preliminary nature of our exploration of information privacy in Kuwait, we can conclude that such a phenomenon exists even through it hardly appears in public debates (media, national assembly debate, private complaints). This encourages further exploration of the notion of privacy in different societies in Kuwait.

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STUDENTS BARRIERS TO USING E-LEARNING AT THE UNIVERSITY OF LAGOS, NIGERIA

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Abstract – The purpose of this exploratory study was to find out the barriers students encounter in utilizing e-learning at the University of Lagos. The sample consisted of 67 undergraduate students enrolled in a 300 level research methodology course in the second semester 2006/2007 academic year. Students were asked to respond to the questionnaire to ascertain the barriers they experience in their use of e-learning. Quantitative methods were used for data analysis. Findings from the study indicated that students experienced major challenges with regards to ownership of personal computers, Internet accessibility, slow speed of servers, paucity of infrastructure and lack of encouragement from their lecturers. It can be concluded that universities in Nigeria and by extension other developing countries should improve on existing infrastructure before the introduction of e-learning as part of the teaching and learning process.

Keywords: Barriers, e-learning, Internet.

I. INTRODUCTION

Development of the Internet has started a revolution in teaching and learning that is providing new opportunity for delivering instruction through the Internet. Such a new revolution has been called several names – web based learning, online instructions, virtual learning or e-learning. Regardless of the name given to it, this form of learning integrates online educational telecommuting activities into the tutorial sessions. It took the form of web based asynchronous and synchronous discussion forums and using the web as an electronic reserve shelf.

Information and Communication Technologies have dominated universities attention in Nigeria; however, little is known about the prospects of the use of e-learning. Indeed, despite a plethora of general educational research on the implementation of e-learning, particularly the efficacy of e-learning in school environments especially in the tertiary institutions, the inquiries to barriers of web based learning environments in Science and Technology has been minimal. To this end, many universities are adopting e-learning and virtual university without a full preparation for its implementation.

A discussion of e-learning should begin with a basic understanding of the concept. It has been defined in a variety of ways by multiple scholars [5], [8], [9], [11]. Hoffler (2000) described e-learning as a specific learning technology that covers a wide array of applications and processes, including computer-based learning, virtual classrooms, and digital collaboration. In much of the current literature, e-learning has replaced the term online learning [8], [9], [11]. In this study, e-learning is used synonymously with the term online learning, and was defined according to the National Center for Supercomputing Application (NCSA) e-learning group definition. This definition states, "e-learning is the acquisition and use of knowledge distributed and facilitated primarily by electronic means" [12], e-Learning exploits interactive technologies and communication systems to improve the learning experience [1]. It has the potential to transform the way we teach and learn across the board. It can raise standards, and widen participation in lifelong learning. It cannot replace teachers and lecturers, but alongside existing methods can enhance the quality and reach of their teaching." [3].

II. LITERATURE REVIEW

The history of e-learning may be traced as far back as 1970 when the Internet was developed. Although at that time there was no e-learning, the Internet became the vehicle for e-learning. The increase in e-learning users and the amount of time spent online are favorable to e-learning and knowledge markets [2]. The pedagogical approach to training and education was the influence affecting distance-learning delivery in the past where the instructor imparts knowledge and the student absorbs, or learns. The current development of distance learning is beginning to use the principals of androgogy, placing the learner at the center of learning and the teacher as a facilitator of that learning. The move toward a more interactive type of distance learning curriculum supports this change [10]. This change was possible because of the invention of the Internet. The Internet connects many educational networks, commercial networks, and government networks around the world [7]. As a result

of the Internet, numerous computer-based training materials and programs including e-learning have been developed.

Jones and O'Shea (2004) explore how the existing practices and hierarchies have been challenged as a result of the introduction of e-learning at the University of Glamorgan. According to the researchers, the new teaching and learning strategy aimed at promoting greater flexibility in learning styles and strategies and supporting them through staff development programmes. They indicated that lecturers in many departments were starting to explore computer-supported learning to meet the aspirations of new students, however many of them complained about the lack of direction or support for development in this area. The university then got a structural fund from the European Union which led to the foundation of the 'E-College', collaboration in business and management education with six partners of the university across Wales to offer full online programmes.

During the transition from traditional learning arrangements to e-Learning a couple of (unexpected) issues arose: While in the prevailing administrative structures the boundaries between academic departments and support departments were well protected by tradition and culture, the development of an e-learning environment led to the creation of multi-disciplinary teams from different academic support and administrative departments. Also, legal issues emerged, such as the problem of obtaining copyright clearance, and the lack of knowledge of academic staff regarding rights regulations. The financial implications of e-learning, i.e. the necessity to allocate resources away from traditional delivery, have a far-reaching impact on the culture and morals of the university. The authors conclude that a dynamic and flexible interplay between deliberate and emergent strategies is needed to manage change in universities. To deal with the various issues that e-Learning brings up major shifts in human resources policies in universities are required.

In the past in many countries, there was no e-learning activity. The use of e-learning is increasing globally. As the interest in the use of e-learning expands, so should the interest in its effectiveness, quality, and barriers faced by the users. The purpose of this empirical study is to determine barriers experienced by the students in the use of e-learning. Further, this study explored the nature of relationships among (1) e-learning barriers; (2) students demographics (age, gender, ethnicity, and religion); and (3) background factors such as prior experience with e-learning and computers, computer ownership, computer training, and e-learning infrastructures.

1) Status of e-learning in Nigeria

In recent times, there has been a few e-learning educational provisions in Nigeria. There are currently 52 university centers and colleges of education who have their domain names registered while 15 are active email users. Also, there are several e-learning initiatives; these initiatives are either being undertaken by government, civil society or the private sector. Omwenga (2003) listed them as: Government e-education initiatives and NGO's e-Learning initiatives:

Government e-education initiatives include 1). The Nigerian Universities Network (NUNet) Project, 2). The Polytechnics Network (PolyNet) Project, 3). The School Net Project, 4). The Nigerian Education, Academic and Research Network (NEARNet), and 5). The Teachers Network (TeachNet) Project.

The Teachers Network Project comprise of National Open University, National Virtual (Digital) Library (Ministry of Education/ NUC), National Virtual Library (Ministry of Science and Technology/NITDA), National Information, communication and education programme of the presidency. The NGO's e-Learning Initiatives include examples of tele-centers such as Community Teaching and Learning Centers, Lagos Digital Village by Junior Achievement Nigeria, Owerri Digital Village by Youth for Technology Foundation, and Computer Literacy for Older Persons Programme by Mercy Mission.

Mungania (2003) developed a model of successful e-learning program namely "Three Pillars of Successful E-learning" Mungania indicated that successful e-learning demands social, cognitive, and behavioral skills. The three pillars that determined the success or failure of e-learning programs according to Mungania are the interconnectedness among (1) person, (2) behavior, and (3) environment. These areas are explained further:

1. E-learners' cognitive skills: E-learners must have the prerequisite knowledge and skills necessary to participate in e-learning. Computer competency through training, and practice, and time management skills are essential.

2. Environment: Organizations must support e-learning by offering a supportive culture, incentives, models, resources, and fostering e-learning self-efficacy.

3. Belief and behavior: E-learners' must have high e-learning self-efficacy and the appropriate behavioral skills such as taking responsibility for learning.

III. PROBLEM STATEMENT

As investment in human, time, and financial resources for e-learning continues to rise, so should the interest in its effectiveness, quality, barriers faced, and best practices. This study attempts to explore e-learning barriers in our institution. Specifically, it focuses on the perceptions of students that enrolled in the department of Science and Technology education at Faculty of Education, University of Lagos in the second semester 2006/2007 academic year. The following research questions guide this study:

IV. RESEARCH QUESTIONS

1. How is e-learning currently being used in the University of Lagos?

2. What are the common challenges and constraints faced by Students in the use of e-learning?

3. Is there a relationship between infrastructures in place and the use of e-learning?

4. Is there a relationship existing between students' ethnicity, gender, levels of education and the use of e-learning?

V. SIGNIFICANCE

This study contributes as detailed below.

In general, it contributes to an understanding of factors that students considered as barriers to starting and continuing using e-learning systems. Specifically, it has contributed to the following:

Practitioners - Identifying barriers and solutions is not a one-time event but should be a continuous process for practitioners due to the constantly changing environments, employees, course offerings, and technologies. The result of this study revealed some lessons learnt that would become useful for others. Those who want to collaborate or conduct training would understand some of our institution's need in term of e-learning infrastructure and Internet connectivity.

Education - e-Learning is an innovative piece of technology that serves many educational purposes. In fact, it is now being introduced into classrooms as an educational tool. Educators are aware that the introduction of the Internet as a teaching tool will change the classroom environment, as well as the teacher-student relationship

VI. METHODOLOGY

A quantitative research design was used to investigate the barriers students encounter in utilizing e-learning at the University of Lagos. Quantitative method is characterized by practices such as hypothesis testing, identification of predetermined responses, and commitment to a theoretical framework to guide the study. The researchers used research questions to guide the study. A quantitative research design was chosen because it would produce a formal, objective, systematic process in which numerical data could be utilized to obtain information about barriers students encounter. The data collected through a survey was helpful in answering the research questions in this study.

A. SAMPLE

The sample consisted of 67 undergraduate students that enrolled in Science and Technology education during the second semester 2006/2007 academic year at Faculty of Education, University of Lagos. Intact classes were used to keep disruption of the tertiary curriculum to a minimum

B. INSTRUMENT

Student's perceptions of the use of learning were measured using an instrument designed by the lecturers in charge of the course. The instrument was developed by the researchers and pilot tested through twenty students who took the survey and provided suggestions for improvement.

C. DATA COLLECTION

This exploratory study use quantitative methods for data collection and analysis. The data collected was used to determine the success of the university e-learning program by using the "Three Pillars of Successful E-learning" Data was analyzed using descriptive statistics. The instrument was administered toward the end of the second semester 2006/2007 academic year. Students were asked to respond to the questionnaire in terms of their learning environments.

D. DATA ANALYSIS AND DISCUSSION

To determine the relationship between barriers and demographic variables, various predictors such as age, gender, tribe, PC ownership, and Internet connectivity) were examined. Results indicate the following:

TABLE I. SUMMARY OF THE PARTICIPANTS PROFILES

Variables	Attributes	%
Gender	Female	45
	Male	22
Use of the Internet	Everyday	21
	2 to 5 times a week	3
Computer ownership	Own PC	38
	Do not Own PC	29
Age	Under 30	57
	30 - 43	43
Major		
	Chemistry	8
	Physics	1
	Biology	27
	English	8
	Mathematics	5
	Edu Tech	2
	Early Childhood	4
	Other	3

The participants consist of 67 students from the University of Lagos. The majority of them were female (45%) compared to 22% males. According to the data collected, there is an indication that female use e-learning more than male.

In regard to the participants' age, the majority of them were below 26 years old (43%). Thus the major participants of e-learning are a relatively young audience with approximately 57% are below 43 years of age. This study

found that there is a relationship between an e-learner's age and perceived barriers.

Although (age, tribe, gender etc) were not statistically predictor of e-learning barriers, most of these variables have a significant relationship with the Internet connectivity, and personal ownership.

Out of the participants, 57% are Christian, 9% are Muslim while 34% did not indicate their religion. A further analysis (t-test and Chi Square) (df=1) revealed that religion influences the use of e-learning among the students at the university of Lagos.

Tribe diversity in the e-learning population surveyed. The most dominant tribes among the respondents are Yoruba and Ibo. The majority of students participating in the study were Yoruba (30%) and Ibo (31%). Although tribe is not related to barriers, it has some relationships with the use of e-learning.

In regard to their PC ownership and Internet connectivity, the influence of computer ownership and Internet connectivity was determined by asking employees whether they had personal computer and Internet connection. Thirty eight percent of the participants indicate they owned personal computers while 29% do not own personal computers. Computer competency is a significant predictor of e-learning barriers. However, regardless of their skills, technological barriers were common among the participants.

The participants were asked to indicate their various cohorts. The aim is to track barriers that are pertinent to specific cohorts. They indicate as follows: Chemistry 8%, Physics 1%, Biology 27%, Educational Technology 2%, English 8%, Mathematics 5%, Early Childhood Education 4%, and other 3%.

The data collected was further analyzed based on the following research questions:

1. How is e-learning currently being used in the University of Lagos?

When participants were asked about the status of e-learning at the University of Lagos, 13% indicate that computers are available for students use, 16% indicate that computers are connected to the Internet for students use, 4% indicate that there are stand alone computer based learning resources, 10% indicate there are network computer based learning resources, and the majority of the participants (57%) indicate that their departments do not provide computer based leaning resources.

According to the data collected, 37% of the participants do not use learning technologies such as email, and the Internet; 24% use online learning technologies for other reasons other than educational reasons, 14% are learning online, but are unsure of their skills while 25% claimed to have learned and comfortable with online learning technology.

According to the data collected in the university online services, 25% pay school fees online, 9% check their results online, 24% register for courses online, 14% assess lectures online, and 2% submit assignment online while 3% did not respond at all.

The respondents were asked to indicate where they do most of their online learning. The majority of the respondents take their online courses in various locations: 65% accessed online learning materials from privately owned cybercafé, 26% acceded the Internet from home while 9% indicate that they accessed online learning from other various locations.

2. What are the common challenges and constraints faced by Students in the use of e-learning?

Fifty two percent of the respondents indicate that the lecturers are not integrating e-learning into their teaching; however, 27% indicated that the university is putting in place plans for e-learning implementation.

The respondents were asked to list their personal barriers to the use of e-learning. The top three highest barriers listed in the order of importance are: connectivity problems (13%), the cost of using private cybercafe (13%), and inaccessibility of needed technology (12%). Most of the respondent (98%) would likely accept e-learning as a means of instruction when it takes off in the university.

When asked how likely do they think that e-leaning systems would be introduced into the instructional process within the next year, majority of the respondent (57%) indicate it is likely, 30% were not sure, while the rest indicate it is unlikely (13%).

3. Is there a relationship between infrastructures in place and the use of e-learning?

Eighty percent of the participants were not aware of any infrastructures that the university has put in place to facilitate online teaching. Beside the awareness of e-learning infrastructures, many reported of the slowness in the server, the cost of expensive private cybercafe, and there are some prerequisite that the students reported lacking. For instance, 36% lack typing skills, and 24% lack the necessary communication skills for online learning

4. Is there a relationship in students' ethnicity, gender, levels of education and the use of e-learning?

Since the overall finding in this study did not find strong relationships between ethnicity, gender, levels of education and the use of e-learning, findings from this study can be of particular interest to the university management, international educators, and e-leaning designers. However, they should not overlook the fact that some relationships between ethnicity, gender, levels of education and the use of e-learning exist.

VII. CONCLUSION

The good news emerging from this study is that overall; students seem to experience very few barriers. However, this is somewhat challenged by the findings that followed. Students documented other barriers that they experienced such as Internet accessibility, lack of PC ownership, slow speed of servers, and lack of encouragement from their

lecturers. Participants' comments support and elaborate the findings emerging from the closed-ended questions, providing a richer and in-depth view of the kinds of barriers they are faced with when they engage in e-learning.

It is important to understand that e-learning barriers are heterogeneous encompassing personal, organizational, content, situational, instructional, and technological barriers. Many similarities and differences do exist among various cohorts. According to Mungania's "Three Pillars of Successful E-learning" and the findings from this study, successful e-learning demands social, cognitive, and behavioral skills. These are the factors that determined the success or failure of e-learning programs in the university of Lagos and many other universities in Nigeria. There are interconnectedness among the e-learning users, e-learning developers, the infrastructure in place and the policy makers.

The challenge for all stakeholders is that as more demands are placed on the use of e-learning, so will be the pressure to improve e-learning systems, infrastructure, and e-learning development efforts. This calls for more investment in time, people, and financial resources designated for e-learning. Recognizing barriers and developing strategies to remove the barriers would assist the university in planning for e-learning.

VIII. RECOMMENDATIONS

1. E-learners must have the prerequisite knowledge and skills necessary to participate in e-learning. Computer competency through training, and practice, and time management skills are essential.

2. Universities must support e-learning by offering a supportive culture, incentives, models, resources, and fostering e-learning self-efficacy.

3. Students also must be must have high e-learning self-efficacy and the appropriate behavioral skills such as taking responsibility for learning.

4. Funding must be provided to promote e-learning, provide needed infrastructures and enough computers for students.

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Innovative eLearning to promote sustainable development in Latvia

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***Abstract*—The article describes the three success stories of the Latvian eLearning development projects. All the projects were carried out by early innovators in universities and city and town councils. Our plan intends to promote the acceptance of eLearning in the regions. To achieve this goal we intend to employ the skills from diverse activity sectors (TV, Mobile phone), which will include eLearning, tLearning, mLearning and ePortfolio skills. We feel that this multi-informational approach better meets the skills, needs and expectations of the target group. The plan has the potential to become the platform for further innovation and large scale deployment.**

Computer aided learning, e-learning, regional development

Three Latvian success stories.

I. The First Story

The three ECDL-Riga Course modules were published on 20 May 2005 in the Riga City Council main portal, www.riga.lv. Headed by a long banner a massive advertising campaign was run for the courseware from 1st to the 30th of June in three highly popular Latvian Web Portals: www.tvnet.lv, www.delfi.lv, and www.apollo.lv [1].

The courses advertised consisted of a Text Processor, Electronic Tables and Presentation Systems modules. Each of these components was made of the following parts: a Text processor (31 Unit), Electronic Tables (22 Units) and Presentation Systems (14 Units).

The Scheme of ECDL-Riga is presented in Figure 2. The web address of ECDL-Riga is http://www.riga.lv/LV/Channels/About_Riga/Kaleidoscope/talmaciba.htm.
The ECDL-Riga installation is designed with Java based content management tools that include Flash Control Elements, Flash Videos, and MP3 audios. The Flash Sliders navigation system is easy-to-use to appeal to a broad popularly based target group to support the policy of "to closing the digital divide."

The new course window clearly lists the course units with corresponding links. Each course link opens to the learning objectives of a unit. A mouse click on the heading opens the next window to produce a video, interactive slider and voiceover. The user can easily follow the explanation of the content corresponding to the learning objectives of each unit. To repeat a part or all of a lesson, the user can conveniently manipulate a slider that appears at the bottom of the lesson frame. We recorded into log files the time users spent with the program, dividing time intervals into the following components: IP addresses, content study time and the particular units that were studied.

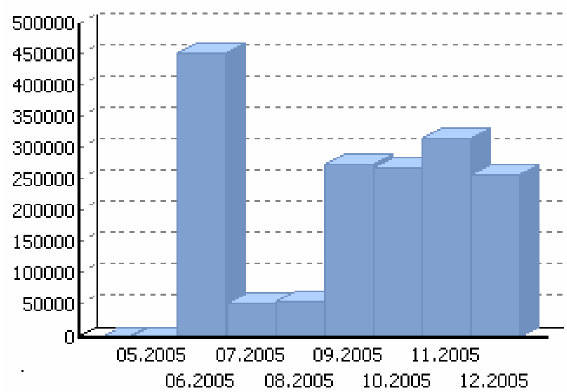

Figure 1. Requests per month for ECDL-Riga Courseware.

After gathering our data we analyzed the log files to learn how users responded to available free courseware; what sites they visited and the length of time intervals they spent at each site. Figure 1 represents the number of Mouse Clicks (requests) per month for ECDL-Riga Courseware from June 2005 until December 2005. The diagram demonstrates a rapid increase in response to the advertising campaign, but shows a decrease during summer holiday months of July and August. Yet starting in September, we observed an increase of the number of requests which steadily intensified, reaching 300, 000 requests per month.

It must further be observed that 300, 000 mouse clicks are proportionally a high number when compared to the 2 500 000 population of Latvia. This story demonstrates that well organized eCourses in popular public portals can contribute significantly to eLearning development.

II. The Second Story

The second success story is on six regional development projects with a strong human resource development component in the Latvian Livani region. The Livani region was among the

most economically developed in Latvia from 1980 to 1990 but during the period of transition to a free market economy and a knowledge society, 90% of the old industry collapsed, causing unemployment to rise up to 25% [2].

Business Planning
Basic IT skills
Advanced IT skills
Technical Communications
E-business

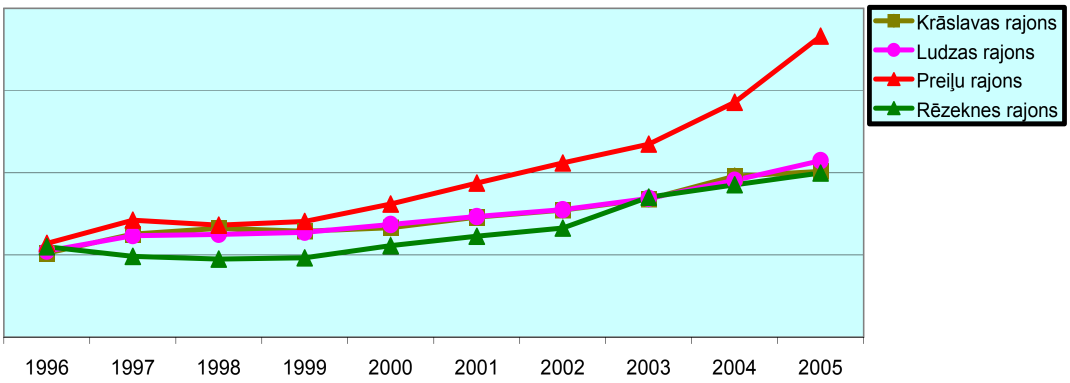

Figure 3. GDP in districts with e-Projects (Preiļu rajons) and neighbour districts after 6 years of e-Learning projects

The Livani leadership drew upon the new e-learning solutions that had emerged at the time and that had been captured and designed at Riga Technical University as an effective human resources development approach.

The Distance Education Study Centre at Riga Technical University (RTU) had a team that had participated in many international e-learning development projects and had the expertise to meet the development needs of the Livani community.

Modern e-learning solutions developed at RTU differ visibly from traditional training. They stimulate motivation by making learning activities more entertaining. To achieve faster and more effective learning results, RTU learning solutions were more user friendly, easier to understand, and more socially inclusive.

Six Livani development, social cohesion, and sustainable growth projects were implemented from 1999 to 2007

Most of the projects addressed infrastructure development. Because of the success of the first small-scale project, in the following projects a human resource development component was added. The first step was to establish an E-Studies Centre which initially included twelve PCs. The manager of the centre was a local individual who was also from among the first e learning participants.

The e-learning curriculum was composed of the following courses:

Innovation Management
English Language Skills, Intermediate Level

The courses content was designed to develop basic skills. All the courses included interactive multimedia CD-ROM learning materials and a printed Workbook. All the courses (except the English language course were 9 month) were organized to provide three to four face to face seminars with university lecturers and also made available individual IT consultations and training opportunities at the E-Studies Centre. A Final assessment project was presented at the final seminar. Most of the projects were designed to include the innovation management e-course game Marketplace.

It was understood that it was important to start with a small scale project with visible demonstration effect. In 1998 fifteen participants were enrolled in the course “Business Planning for Open Markets”. Twelve participants completed the course and produced a self-designed business plan. Four of the business plans were actually implemented and made the small businesses where they were put into effect stronger and more competitive. Participants of the course were also viewed as better credit risks by financial institutions. The participants informed us that they had to visit a bank only three times as compared to the eight times that was necessary for non-participants. Moreover, the non-participants often ended up paying a consultancy fee to design a business plan and their projects were viewed as a higher credit risks.

Recently we compared the GDP in Livani region to the neighboring regions. The data from Latvian Central Statistical Bureau www.csb.gov.lv (Figure 2) clearly demonstrates the difference in GDP growth in Preilu rajons (Livani District is half of Preilu rajons) and neighboring Ludzas , Kraslavas, and Rezeknes rajoni (regions).

The key success factors of the programme were:

- a small scale start-up project with tangible and visible results,
- use of advanced multimedia learning materials and internet study support technologies which were not available 10 to 20 years ago in traditional classes,
- availability of courses for the development of basic computer skills for the participants who needed it (IT for beginners),
- an appropriate share of face-to-face seminars (6 to 8 hours in a 25 to 40 hours course)
- ongoing availability of tutors by telephone and e-mail,
- ongoing availability of computers with Internet access at a local E-Study Centre, when needed,
- opportunity to move to a more advanced level, when required,
- rich, well designed, user friendly interactive multimedia CD-ROM study materials which the participants may retain after the course,
- final assessment assignments with real applicability in the business world or the job-related activities of the participants,
- the large scale funding projects had a synergetic effect; it increased the number of participants by more than 15% of economically active people in the region.

The package of six projects presented here are important examples of a long-term approach to rapid development and successful transfer to a knowledge society.

These "just-in-time" knowledge-training courses present an opportunity to transfer to a knowledge society without damaging the regional infrastructure and traditional values. This is possible because of the number of similarities between pre-industrial and post-industrial ways of working.

III. THIRD STORY

The first two success stories which achieved demonstrable effects encouraged the group eLearning innovators in six Latvian universities to design about 30 new project proposals in 2005. The funded projects (Figure 3) covered all the application areas of e-learning:

- eLearning research projects,
- PhD programme development project
- Master, Bc program development projects
- Course development projects
- Innovative technologies development projects
- Course delivery projects

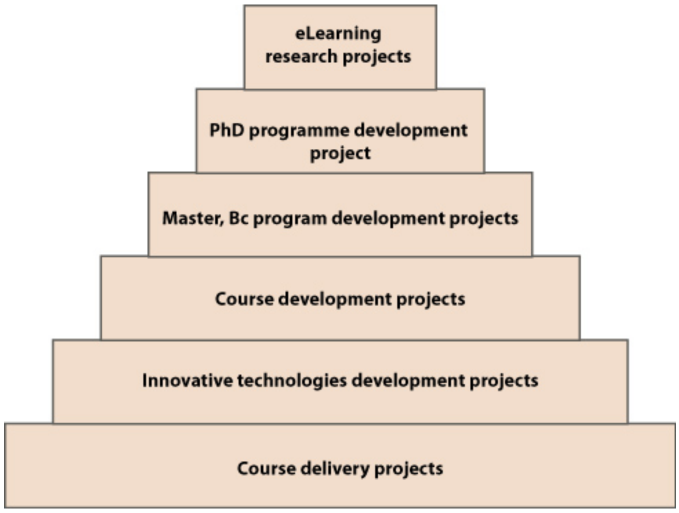

Figure 3. The Schematic of eLearning development projects funded in Latvia 2005-2007 (eLearning research projects / PhD programme development / Master, Bc programme / Course development / Innovative technologies / Course delivery).

Currently about half of the projects are completed, and we are in discussion about sustainability, impact, and a large-scale implementation strategy.

We are currently looking for new challenges and solutions.

The successful project development and implementation were carried out by early innovators in universities and city/town councils.

Projects were implemented because in Riga City and Livani Town councils a number of early innovators were in key positions.

Most town/city leadership is interested in supporting regional development, but they are not accustomed to take the risks of the early innovation.

Smart organizational and/or technological solutions could support regional development organizations in this situation:

1. Hire early innovators type staff in HRD development projects
2. Implement new technologies to encourage the gradual acceptance of eLearning (tLearning or TV-Learning).
3. Implement new technologies to strongly increase course availability - any time, any place (mLearning).
4. Implement new technologies supporting the reaching of HRD goals, demonstrate and register results, and promote and encourage the participation in learning support. (ePortfolio). EPortfolio is good example of creating the new jobs of tomorrow.

IV. CONCLUSIONS

1. The present state eLearning ensures wide-scale availability, but large scale acceptance is still not indicated.
2. The skills from other the activity sectors (TV, Mobile phone) could be employed to rise the acceptance level of eLearning [3,4].
3. The set of eLearning, tLearning, mLearning and ePortfolio instead of traditional eLearning better meet the skills, needs and expectations of target groups. These could provide the platform for further innovation and large scale deployment.

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