Designing and Evaluating the Effectiveness of the Virtual Learning Environment (VLE) In Saudi Arabia: A Review and Recommendations

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Abstract: As the ease of the information through the internet increases, distance learning of many courses can now be made through web. Many good web sites programmed from various educational institutions are now available for their students to download lecture notes, study web-based material and attend web-lectures. Some of them even have web-based video lectures or seminars. However, there still exist problems of this way of teaching especially for engineering courses because the laboratory class is fundamental to understand theoretical notes, and has difficulty to be conducted through the internet. In the past, student cannot get any experiment via internet because most of them are only computer simulation rather than real experiment. This is understandable because the web-based hardware implementation is difficult especially in electrical engineering where high frequency, high power operation, and a lot of parameters are to be controlled and recorded and thus are difficult to be connected and controlled by the remote access. However today, with the rapid development of internet tools, electronics, and software this situation can be sorted out. It is primordial and interesting to let students have real practice and doing real experiment at anytime and everywhere with the condition that the internet connection is available.

This paper gives an overview of the recent development in the VLE and examines how Web-Based course may be delivered and the way of implementing and designing a particular types of Electrical Engineering Course (theory and laboratory), to assist and advance learning endeavors in electrical engineering programs at Riyadh College of Technology, and finally some recommendations are given.

1. Introduction

Due to the rethinking of the education concepts and policy, severe efforts are being carried out in order to reform and make high level education more efficient. It is initiated principally by two main factors. First, the achievements of the experimental cognitive psychology that conduced to the better understanding of the human learning process and lead to the rethinking of some conceptual principles on the education. Second, in the recent years the multimedia and IT have been developing very quickly hence opened door to more attractive and effective education methods [1],[2],[5][8]. Employment of these tools: the motion picture, sounds, simulation, interactive surfaces, etc. offer much wider perspective for up-to-date academic and industrial education than the conventional text. It has particularly important role when rather complex phenomena should be explained in the electrical
Presenting the dynamic of complex phenomena can be simplified and made more convenient by using e-learning tools. The objective is to settle down long term knowledge by means of new and flexible educational methods and tools. According to the psychological researches, extension of the learning process by audio-visual experiences substantially increases the learning efficiency. Using the interactive animation tools, the basic ideas can be traced on a relatively simple way and even the opportunity is given to modify one or more system parameters and check what happens, and gets the response immediately no lasting calculations are necessary after the intervention. The e-learning tools have additional advantages [18]. The e-learning curriculum is usually available via a high speed internet connection involving high flexibility to select the appropriate time and place of the study even individually. Another important target for the e-learning tools is the vocational training of qualified and practicing engineers. The aim of this study was to research ways of integrating Online Experiments into the curriculum of online learning in Riyadh College of Technology.

2. E-Learning and Virtual Laboratory

The cognitive learning is highly based upon the practical experiences. However to build up well equipped laboratories with appropriate equipments requires usually huge initial investments and sometimes considerable maintenance costs in the sequel [It is unfortunately out of scope of many institutions.

A virtual laboratory allows researchers and professionals from different physical locations to efficiently collaborate in an ongoing way. Such manner the resources can be extended and pooled while continuous communication is being maintained in order to reach the shared common objectives. The virtual laboratory has an important role, because it helps in integrating the technical, financial and human resources by sharing data, information, documents, multimedia means etc. the knowledge-base.

The traveling cost and time can also be reduced improving the productivity even further. It also facilitates the smoother cooperation between industrial and academic sectors.

The concept of virtual laboratories fits very much to the e-learning or distance learning. The virtual laboratory concept allows the utilization of the laboratory resources for educational purposes. Both the academic education and the industrial vocational trainings can be meant by education. There are many universities, academic institution and multinational companies working with this concept all over the world [22],[30]and[41]

Introducing virtual laboratory and e-learning in the education is advantageous and it effectively supports the learning process. Virtual laboratory can help very much in the promotion of the engineers and they will probably fill in more and more important role but in this sense the replacement of the standard universities by virtual ones seems inadequate. Namely one must not forget that most of the graduated engineers do not have to work at
virtual companies and in virtual factories but in real ones, that is, the practical knowledge coming from the real laboratories and workshops is also necessary.

3. Online Experiments

Online Experiments are a state of the art technology. There are many projects that are happening right now around the world that concentrate on investigating this technology further and coming up with new and improved solutions.

Online Experiments are experiments remotely conducted in a real laboratory, by the use of specific software, which steers the variables in the experimental equipment.

An experiment is composed of real laboratory equipment connected to a real server which has the specific software to control it. This server is connected to a network and is steered remotely by a client.

User interfaces are used for remote access to instrument, data analysis and multiplexed data access via network protocols.

The purpose of E-labs is to provide easy access to experiments to educational institutions which can not afford some equipment, to share equipment between institutions, as well as to increase the effectiveness of online learning.

4. Structure of Virtual Laboratory

Virtual instrument and multimedia has been subject of numerous publications multimedia training and remote operating laboratory are described in several publication [23-40]in these systems, client server system has been used on the internet to allow users to operate on a remote laboratory for experimental training. Also many engineering organizations use the networking of distributed virtual instrument in internet and intranet for effective operations and many commercial developers are responding to their demands.

In order to make the e-learning software tool available for a large number of people as convenient and flexible as possible the following points have to be taken into consideration.

- Independence from operating system of the computer.
- Usage of a widely accepted text-standard
- Possibility to make the tool web based
- Programs written in an efficient language being able to solve numerous calculations within an acceptable time
- Using software standard that are widely accepted backed by industry and long-term concepts also supported in the future.

All these requirements are perfectly fulfilled by HTML-text and embedded Java applets. To keep development time and costs low XML is the right chose for storing data used by java-applets.

Figure 1 gives a block diagram of the main hardware structure and components in VLAB. Specifically, the various hardware subsystems are:
5. Recommended Hardware

The remote experiment must be located in a room where nobody to attend. The web should be the gateway for the system to exchange the necessary information between client and machine and the servers. The web browser is a platform providing an environment to run the necessary program including java applets, java script and flash in the development of the laboratory. Webcam and microphone should be connected for broadcasting the environment of the hardware. They also give the student a feel of actual setup, a special care to the light should be made in order to give a well visibility. Flashing light gives information that the setup is being used and no disconnection or movement is allowed. The data acquisition cards (DAQ), the Ethernet card and desktop PC to select experiment is to be conducted. The Ethernet is wired to the LAN. The DAQ cards control the signals from www server through a TCP/IP Channel. A second desktop computer should be installed with GPIB (General Purpose interface Bus) controller card and an Ethernet card that will served to connecting GPIB measure instruments (oscilloscope, voltmeter, etc...) [Figure 3]

Figure 1: Hardware Structure of VLAB

Figure 2: Software structure of VLAB
6. Recommended Software

In the quest to develop the remote capability several option is considered:
- Lab view web server
- Data socket server
- Applet view
- LabVNC
- Measurement studio

A comparison between the above mentioned technologies is given on [21].
The results of this comparison show that the Lab view built–in web server is the current best technology to use. The construction of the code can be done as if the VI was running locally, no additional modification are necessary. With the web publishing tool it is very easy and fast to build a HTML page of the VI to remote control. Also a lot of additional possibilities like the user handling, timeouts, and so on are implemented which could be set within the configuration or programmatically in Lab view. A user interface should be developed in order to keep the student understanding. The user should conduct the experiment by following the lab sheet. Some competences acquired after the virtual laboratory session:
The student should be able to:
- Respect personnel protection recommendations
- Follow experiment’s protocol
- Know, name and use each type of equipment
- Built a setup experiment from drawing or description
- Design a schem required
- Chose the adequate equipment regarding the reference
- Analyze and compare the results to theoretical once
- Identify the parameters that affect the phenomena
- Give the model and the validity range of this latter
- Propose an experiment to validate the model

Figure 3: Online Laboratory Architecture
7. Student and Staff Feedback

An e-learning center that provides a thorough information on computer technology was created at Riyadh college of technology. http://elearning.edu.sa/center. The Mission is to enable educational innovations to improve the educational experience with Internet-enabled technology that connects student, academic staff, and the community in a growing network of education environments dedicated to better communication.

The e-Learning Center at Technical and Vocational Training Corporation, Kingdom of Saudi Arabia, offers the world's most comprehensive collection of online courses from the top companies and authors.

Many training courses were offered to almost 300 academic staff on blackboard learning management system. At Riyadh college of technology. 3200 students are taking computer-101 course through blackboard LMS.

The student’s feedback on the aforementioned course is very positive. Students enjoy the web based course when it is well designed. It also gives them a very systemic approach with plenty of media. Compared to face to face or synchronous learning session where students are limited in space and time however, the web based course does not have such constraint. The opening hour is not limited as there is no need to have instructor. Some students would like that the lecturer let them evaluate themselves, to permit them to have an active participation in the assessment process.

Students considered that often the trainer does not have a good overview over the level of the student he has, and does not make the exams at difficulty appropriate to the average level. One of the first challenges raised by the students was the lack of physical contact between the lecturer and students in virtual course. Other challenges would be the access to technology (computer) and the language barrier; many students do not know English as a whole and technical English as a part. As far as virtual laboratory is concerned the student feedback is also very positive and it can also give an alternative solution to conducting hardware laboratory when distance learning is used.

The motivation of the students can be another challenge. Studying from distance the student can lose his motivation and can start postponing most of his tasks and homework. From the college side, it is easier to have a virtual courses, it is saving money.

Academic staff could use some extra-training before teaching in a virtual course. Before taking this responsibility lecturers have to ensure that they have enough time to spend for any designed course because it could be more demanding than it seems. This type of course needs some special preparation from the lecturer's side (for 1 hour on virtual course spent by the student we have 150 hours of preparation)
The multimedia learning tool is costly in preparation time. There are some offsetting benefits, particularly if the learning tool is for a subject that does not change much from year to year and can be reused.

The e-learning project is worth considering as an alternative to the lecture/home work format. The student should accept proposition that student need to do more than just listen to learn “telling is not teaching“.

8. CONCLUSIONS

In engineering education written exercises are necessary for a student to master mathematical tools while virtual experimentation done by simulation serves to reinforce the understanding of the subject. Real experiments are indispensable for developing skills to deal with instrumentation and physical processes. Practical projects provide the framework for a group of students to learn to cope with real world problems.

There is no doubt that nothing will replace synchronous learning through face to face interaction but it is not always feasible for students to attend conventional classes. The goal of the “Virtual Laboratory” (VBL) is for engineering students to learn about experimental engineering without the need of actual experimental equipment or hands-on data gathering

Anyone will in the future do experiments over the Internet, from anywhere, using a client PC connected to a lab server at the Riyadh College of Technology "RCT". On the client screen students will see virtual front panels of the real instruments located in the lab at RCT. And thus, they may use the mouse to set the control knobs. The appearance of the virtual front panel and the real one is almost the same so later it should be easy to use a real instrument. The server supports several clients simultaneously.

RCT should provide training to the academic staff in empowering them with the tools and skills to carry out their educational roles properly using the most advanced technologies in Virtual Learning Environment.

All Departments must consider the amount of preparation time needed for each online faculty member, and include this as part of the training and induction program. The student is generally more isolated from other students in the virtual learning environment. Time and effort are common concerns that affect many online students. The online learning environment can have particular effects on international students. Although the assumption is that online learning allows flexibility and ease of learning, it may not be an attractive option to some students.

References


[29] Hamza KH. & Perez B., Creative Leaps in Distance Education Technologies, !, florida atlantic university

[30] The Soft Lab Virtual Laboratory,
http://www.cs.purdue.edu/research/cse/softlab/softlab-vlabs/softlab-vlabs.html

[31] O.F.Toader, “Remote data acquisition and instrument control using labview and appletview” iJOE


[34] J.Hamar, H,funato, S,Ogasawara, “E-learning in power electronics: The state of the art”.


[40] C. Ciubotariu, G Hancock. “work in progress- Virtual laboratory with a remote control instrument component’” 0-7803-8552-7/04 ©2004 IEEE


