HOW TECHNICAL COLLEGE COURSES BECOME SUCCESSFULL WEB-BASED E-LEARNING MODELS THROUGH THE INTEGRATION OF RESEARCH, TEACHING AND COMMUNITY SERVICE ACTIVITIES

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ABSTRACT

Since early times in human history, knowledge has been delivered using the face-to-face interaction between the learner and the teacher. It is universally accepted that this approach is the best way for education and training. However, with the advent of the Information and Communication Technologies (mainly the World Wide Web) it became possible to enhance further the methods we are using to teach our students and to share the teaching material within a broaden engineering and business communities.

The present paper is dedicated to show how teaching, research and community service activities can be integrated toghether using Web based education approach to produce knowledge, disseminate it and share it within virtual interest groups and networks of engineering students, academic teachers and working engineers and technicians and business managers.

Key Words: *Web-based education, Discussion Forums, Quality Education, Research, Community Service, Knowledge Society.*

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1. INTRODUCTION AND OBJECTIVES

1.1 INTRODUCTION

One of the major characteristics of modern society is the central role of knowledge in the production processes, to such an extent that the most frequent qualifier now used is that of the knowledge society. We are seeing the emergence of a new economic and productive paradigm in which the most important factor ceases to be the availability of capital, labour, raw materials or energy and becomes the intensive use of knowledge and information. Today's most advanced economies are based on the greatest availability of knowledge. This centrality makes of knowledge a pillar of the wealth and power of nations.

The 2003 World Declaration on Higher Education states that "the knowledge society implies increasing technological capacities by combining traditional and modern methodologies to stimulate scientific creation and lead to sustainable human development". It affirms that "Owing to the scope and pace of change, society has become increasingly knowledge-based so that higher learning and research now act as essential components of cultural, socio-economic and environmentally sustainable development of individuals, communities and nations. UNESCO has commited itself to promote the concept of knowledge societies; Three strategic objectives have been set: (a) to foster digital opportunities and social inclusion enhancing the use of Information and Communication Technologies for capacity-building, empowerment and social participation; (b) to strengthen capacities for scientific research, information sharing and cultural creations, performances and exchanges in knowledge societies; and (c) to enhance learning opportunities through access to diversified contents and delivery systems. The use of Information and Communication Technologies (ICTs) should be encouraged as a means of empowering communities and help them contribute to the building

of knowledge society. ICTs should contribute to enhancing the quality of teaching and learning, the sharing of knowledge and information. ICTs have the potential to introduce in the educational process a higher degree of flexibility in response to societal needs. Knowledge societies should offer opportunities to use ICTs as innovative and experimental tools in the process of renewing education. The production and dissemination of educational, scientific and cultural materials are regarded to be crucial elements of knowledge societies. Networks of specialists and of virtual interest groups should be developed, as they are key to efficient and effective exchanges and cooperation in knowledge societies.

1.2 MOTIVATIONS AND OBJECTIVES

According to the teachings of our prophete Mohammad, Peace be upon him, as muslim educators it is our strong belief that the producing and disseminating knowledge in the form of educational, scientific and cultural material is our duty.

The first verse of Allah`s revelation to his prophet talks about knowledge ﴾ *Read! In the Name of your Lord, Who has created (all that exists), Has created man from a clot (a piece of thick coagulated blood) Read! And your Lord is the Most Generous, Who has taught (the writing) by the pen, Has taught man that which he knew not* ﴿ *Al-Alaq, verses 1 to 5*. In many other verses through the Quran, Allah encourages muslims to take knowledge ﴾ *Allah will raise up, to (suitable) ranks (and degrees), those of you who believe and who have been granted Knowledge. And Allah is well-acquainted with all ye do* ﴿ *. Al-Mujadalah, verse 11.*

Many hadiths (the tradition) of prophet Mohammad, Peace be upon him, teaches muslims to take knowledge from scholras wherever they may be and to contribute in its dissemination through teaching and writing.

قال صلى الله عليه و سلم :" من علم علما فكتمه ألجمه الله يوم القيامة بلجام من نار" و قال أيضا :" إن الله سبحانه و ملائكته و أهل سمواته و أرضه حتى النملة في جحرها و حتى الحوت في البحر ليصلون على معلم الناس الخير".

Starting from these believes, we a group of educators at Hail College of Technology, launched a reaserch project with the aim to integrate teaching and cutting-edge research in the area of e-Learning to link technical and engineering students, faculty members and working engineers and managers in a successfully integrated educational environment. To achieve this goal, three major phases have been followed:

Phase 1 : Development of web-based courses based on academic research on the use of ICT in engineering education and technical training. e-Learning concepts have been searched and analysed. The golden rule presented by Broadbent [1] and Beal [2] which states that ***any one can build a web site*** has been adopted to successfully build web-based courses and post them on the net.

Phase 2 : Teaching technical college students in a blended e-Learning environment where both face-to-face and web-based learning approaches are combined together. Quality measures and good practices of the web-based courses have been adopted and implemented to continuously improve the different versions of the courses.

Phase 3 : Using the web-based courses in community service activities associated with technical discussion forums and email contacts. Here again research played an important role in determining best practices to construct knowledge, validate it and share it within a community from academia, industry and business sectors.

The results which will be presented in the next sections show clearly the efficiency of such an approach to promote the concept of knowledge society in Arab coutries through academic teaching, research and community services.

2. DEVELOPMENT OF WEB-BASED COURSES TROUGH RESEARCH

2.1 BACKGROUND AND MOTIVATIONS

The increasing popularity of the Internet and its ability to provide seemingly transparent communication between different computing platforms has simplified the processes of providing learning opportunities to learners. There is a growing maturity of learning management systems (LMS) and an increased sophistication of the communication tools within these systems. These have lead to a great awareness of the ability to duplicate many teaching practices available in face-to-face delivery by academic educators and vocational training practitioners. Computer–mediated communication (CMC) is now used by almost everyone in distance education training and comprises various forms of electronic communication including synchronous chat, audio and video and asynchronous conferencing, email, and file exchange. Also, support for the use of discussion forums in distance education is widespread.

As Muslim educators following the teachings of our Prophet Mohammad, Peace be upon him, and realising the power of ICTs and the potential of the emerging e-Learning concepts to provide the right information to the right people at the right times and places, we, a group of educators at the Mechanical Technology Department launched a project to develop web-based training programs. The aim was to develop and disseminate multimedia training packages for engineering education and vocational training students in the areas of Metrology, Quality Control (Aichouni, [3]), AutoCAD and Material Testing (Bedri [4, 5]). The purpose of these web-based courses was to improve the quality of the training in engineering, to facilitate the access to this training as well as to contribute to wider use of ICT in engineering education and vocational training. It was an aim for the group to find out how best to use these technologies as a way of delivering courses and how the importance of other web tools such

as discussion forums, email, group projects and virtual chats to influence the learning process among college students and to contribute to better serve engineering and technical communities and to dissiminate knowlegde in general. A through analysis of the available litterature on e-Learning allowed us to adopt a building model of the web-based courses based on the ADDIE model, which is adopted from statistical process control (SPC) approach used in quality improvement. ADDIE stands for Analysis, Design, Development, Implementation and Evaluation. During the project these important phases have been considered with a great care and careful consideration. Quality measures and good practices in web-based courses, described by Woolsey and Rodchua [6], have been adopted and implemented in the courses.

In this paper we mainly focus on the description of the metrology and quality control web-based courses and their achievements in serving both academia and community. It is worth noting here that these technical subjects are of crutial importance in nowadays global economy driven by the ISO 9000 Quality Assurance series and many other normative national and international standards.

Metrology which is the science of measurements, has a key position in the areas of science, research, industrial production, testing and certification and most obviously in product quality. Metrology`s results and Quality features are widely present in the every aspects of our daily life. Modern industries and organisations rely heavily on measurements and metrology to produce high quality products and to provide high quality services to their customers. Increasing precision of measurements, more sophisticated methods and means, continuing research as well as considerable amount of newly adopted ISO normative standards lay high requirements on the qualification and skills of persons working in all industrial and business areas. Adequate knowledge in both Metrology and Quality Control is rather necessary for industrial technicians, engineers and also managers in almost all

engineering fields and services (Mechanical, Petrochemical, Electrical, Electronics, Defense, Food, Pharmaceutical, Health, Trade, etc..).

2.2 METROLOGY AND QUALITY CONTROL WEB-BASED COURSES

Our starting point was based on a golden rule the research group believes on and confirmed recently by Beal [2]. It states that ***any one can build a web site*** through the use of usual Microsoft applications (MicroSoft word, Front Page, Power Point, Excel, Mind Jet). Beal showed that these basic applications which are available on standard personal computers (PC) can be easily used to build simple web sites for our students right from the scratch. This simple and valuable rule, which we encourage every educator to adopt, allowed the research group to build simple educational sites in very important technical subjects and to post them to the net as contribution to enhancing the quality of teaching and learning and to the sharing of information and knowledge.

The Metrology and the Quality Control web-based courses described in this paper, have been prepared in Arabic language; These web-based courses consist mainly of *multimedia courseware* including theoretical lectures, exercises, tests, laboratory reports, and supporting modules, in hypertext form and power point presentations, supported by graphical illustrations (including full color figures and computer animations). Figures 1 and 2 show the main pages of the two courses where the student can move to any subject through the hyperlinks available. Interactivity has been added to the web courses through different techniques:

- Web links to other educational sites (mainly to enhance the students training on different measuring instruments such as micrometers and Vernier Calipers and Quality tools)

- Continuous exams posted to the web by the teacher: The student has to work out the exam as home work and to submit it to his teacher within the week.

- Laboratory reports to be prepared by the student after each training session according to a pre-designed model available on the web site.

- An email address has been provided to students to contact their teacher and ask any question or make any comment about the lectures or the training laboratory session.

Students were encouraged to participate in technical discussion forums led by the first author on both Metrology and Quality Control.

Figure 1. The Dimensional Metrology web-based course
http://hctmetrology.tripod.com

Figure 2. The Quality Control web-based course
http://hctmetrology.tripod.com/quality

2.3 RESULTS AND ACHIEVEMENTS

The web-based couses described in this paper were designed mainly for educational purposes at Hail Technical College and to enhance the training process quality. As it will be shown in the next section, the research group believes that this objective has been successfully achieved. Another achievement added to the work was the fact that these two courses are classified by the major search engines on the web such as **Google** at first positions. It is worth noting here that these two courses were the only arabic educational courses available on the web at the time of the preparation of the manuscript. A google search on the general technical words for quality control (**ضبط الجودة**) and for metrology (**القياسات**) would give typical results such as those presented on figures 3 and 4 where both sites are found 1st among 137.000 sites for the Quality Control course and 1st and 2nd among 107.000 sites for the metrology course. A careful examination of the two figures shows that the sites are classified even before the

sites of official national and regional organisations of standardisation in the Arab world and even before Arab higer education institutions. The authors are proud of these achievements which are believed to be the results of a successful integration of academic research and teaching activities.

Figure 3. The Google search showing 1st position out of 137.000 sites of the Quality Control web-based course (date : February, 24, 2006)

Figure 4. The Google search showing 1st and 2nd positions out of 107.000 sites of the Metrology web-based course (date : February, 16, 2006)

3. E-LEARNING AS A TEACHING APPROACH

The two web-based courses developed here have been used as a supplement to regular classes for students erolled in the mechanical technology department at Hail Collge of Technology for the last two academic years. In order to make an evaluation of this experience within our technical college conditions, a survey has been designed and given to enrolled students attending the courses during the second semester of the academic year 2004/2005. The number of students who answered the survey was 50 out of 57 students enrolled on the course. Typical results for the metrology web-based course are summarized in table 1 and figure 5. From the survey results it was clearly hown that the e-Learning approach is well accepted by our students though some difficulties and barriers which still exist between the student and the internet. The great majority of the students agreed that most of the aspects related to the design, development, implementation and delivery of the electronic courses via

the internet are good. Most importantly is that the tested students showed a general acceptance to learn through this new approach while some of our colleagues educators and trainers still show some resistance to change from the face-to-face traditional method to the new method of teaching and training through the web (e-Learning).

Table 1. Survey Evaluation Results for the Metrology web-based course

|	Question	Answer		No
		Yes	No	Answer
Q1	The student **visited** the metrology **web page**	94 %	04 %	02 %
Q2	The page **content** is **useful to the degree** prepared	92 %	08 %	00 %
Q3	The **language** used in the web page is **correct**	92 %	08 %	00 %
Q4	The **access** to the web page is **easy**	62 %	30 %	08 %
Q5	**Navigation** through the different modules of the page **is easy**.	84 %	16 %	00 %
Q6	The student **visited** the **web links** provided on the page	18 %	66 %	16 %
Q7	The **page is important** and worth the time you spend reading it.	84 %	14 %	02 %
Q8	The **e-Learning approach is suitable** to mechanical technology education and training	72 %	24 %	04 %
Q9	This **approach** should be **generalized** to other **courses in the syllabus**.	74 %	24 %	02 %
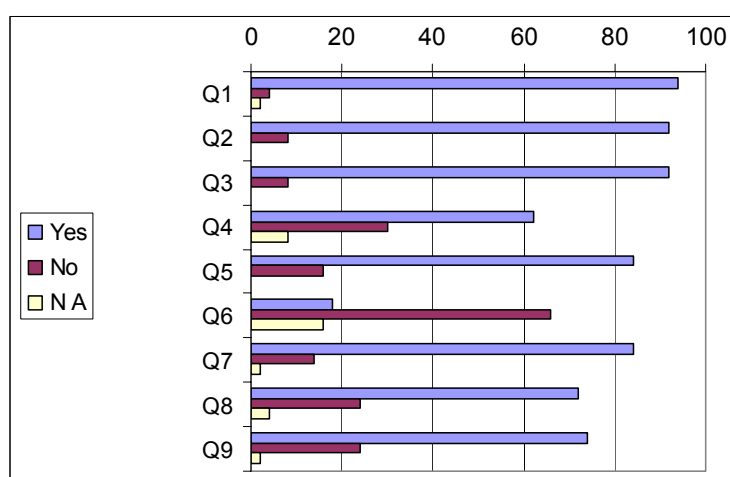
Figure 5. Students` Evaluation of the Metrology Web-based Course

4. COMMUNITY SERVICES THROUGH WEB-BASED COURSES AND DISCUSSION FORUMS

Among the objectives the research group focused on, were: a) to improve the quality of the vocational training at technical college and higher education levels, b) to facilitate the access to educational material and c) to create a network of specialists with virtual interests around a main technical subjects. By posting these courses on the internet and leaving them freely accessed, our aim was to share this information with other academic teachers and students and with practitioner engineers and technicians from industry throughout the Arab countries and hopefully to contribute in the building up of knowledge society in the Arab world. In a recent study, Korich and Hunt [7] showed the importance of other ICT tools such as discussion forums, emails and virtual chats in the learning process and their efficiency in contributing to better serve engineering and technical communities and to disseminate knowledge within the community. Online discussion forums are now regularly used as a component of distance education courses in engineering education as a means of promoting interaction between course participants. They create an environment similar to the face-to-face classroom environment where knowledge can be critically constructed, validated and shared. As the use of discussion forums has grown and its efficiency in e-Learning has been proved, it was decided to integrate this approach in our web courses. After a careful analysis of the existing discussion forums on the net in Arabic language it was decided to link the courses with the "Tikania" forum (http://www.tkne.net/vb) (Figure 6) and the Arabic statisticians (http://www.arabicstat.com/forums) (Figure 7) where sections of industrial metrology and quality control were created respectively. The integration of these two discussion forums with our web-based courses creates an interactive environment to both students and practitioner engineers and led to a substantiall increased interest of both categories on the topics. The quality of the postings from the participants coming from different horizons contributes in the

construction of knowledge around the main subjects and in building a collaborative learning environment where novice student benefits from the experienced industrial engineer and business manager.

Figure 6.   The "Tikania" Discussion Forum (http://www.tkne.net/vb)

Figure 7. The Quality Control Department at the Arabic Statisticians Discussion Forum (http://www.arabicstat.com/forums/forum12)

During a one year period, in the quality control discussion forum 25 subjects were discussed and 145 postings have been done with total readings of 14.450. The most popular subjects were the `Quality Control Charts subject` with 34 postings and 3.545 readings and the subject discussing `Quality in Education` with 12 postings and 1.581 readings. The industrial metrology discussion forum has been operated for 4 months. The number of subjects discussed was 23 with 86 postings and 5.937 total readings by all participants. Participants to these discussion forums have been from academia, industry, government agencies, and business in different Arab countries. They have shown their clear interest on this approach to disseminate and share knowledge among the academic, industrial and business communities. Table 2 summarizes the categories of the participants in the discussion forums and those who contacted us through the email provided on the web-based courses.

Table 2. Categories of people who benefit from the sites

Category	Nature of their organization	Country	Nature of use of sites
Engineering Students	Higher Education Universities and Technical Colleges	KSA, Palestine, Syria	Course supplement
Post-Graduate students	Higher Education Universities	Algeria, Syria, KSA and France	Research work (the sites helps in the translation between arabic and english)
Academic Teachers	Higher Education Universities and Technical Colleges	Egypt, Iraq	Using the sites to teach students at university / college.
Industrial Engineers	Petroleum, Cement, Food Industries	Egypt, Oman	Practical questions. Using the sites as an industrial training program at company.
Employees in Governmental Organizations	Government Organizations (Standards, Police)	UAE, Qatar, KSA	Practical questions. Relevant material on the sites.
Employees in Service agencies	Service agencies (Health, Banking)	KSA, Koweit	Practical questions
Business managers	Small business managers	KSA	Practical questions

5. CONCLUDING REMARKS AND RECOMMENDATIONS

The paper presents a successful integration of research, teaching and community services through the use of web-based educational courses and discussion forums. The results obtained from the project are in accordance with the recent panel discussion presented by Agogino et al [8] which showed clearly how boundaries of engineering education practice can be stretched through the integration of education, research and community services. Based on the present work, the following conclusions can be drawn:

- The research on e-Learning concepts and tools shows clearly that building an educational web site is not a difficult task, rather ***any one can build a site*** for his students. Basic Microsoft applications available on standard personnel computers can be effectivelly used to build a web site.

- Web-based courses on Metrology and Quality Control in Arabic language have been developed and hosted on the web for technical and engineering students; They are freely accessed at the links (http://hctmetrology.tripod.com) and (http://hctmetrology.tripod.com/quality/) for any one looking for training on these engineering topics which are of crucial importance in nowadays global economy.

- The web-based learning approach is well accepted by our students; It has been found to be very efficient in enhancing the quality of learning and training at vocational training and engineering education levels.

- More success to the e-Learning package was added by linking the web-based courses to Arabic discussion forums. This approach has been found effective to create an interactive environment to students, teachers and practitioner engineers where knowledge can be constructed and experiences can be shared and exchanged.

The authors believe that it is very possible to integrate teachning, research and community services through the use of Information and Communication technologies especially the web-based learning approach. It is our duty to make use of these technologies to duplicate our traditional course material into digital form and hence produce and disseminate it as an educational material through the web. This will certainly change us from pure consumers of the knowlegde produced by our fellow educators at the west to producers of knowledge to our Arab community and to the whole humanity.

References:

[1] B. Broadbent, 2002, `E-learning, present and future`, Ottawa Distance Learning Group. Retrieved from internet http://www.e-learninghub.com/docs/ODLG_2002.pdf on May, 5th, 2004.

[2] M. C Beal, Any one can build a web site : How to learn to use any software application you want and build a simple web site from your students from scratch, The 5th International Conference on Information and Communication Technologies in Education,

[3] M Aichouni, , and M. O. Al Nais, e-Learning in Technical Education and Vocational Training: From Concepts to Practice, The 3rd Saudi Technical Conference and Exhibition, GOTEVOT, Riyadh, Kingdom of Saudi Arabia, December, 11-15, (2004).

[4] R. Bedri, Web based Materials Testing dedicated tutorials`, hosted at the URL : http://members.tripod.com/saidhail/ (2004)

[5] R. Bedri, Web based AutoCAD dedicated tutorials, hosted at the URL : http://members.tripod.com/ramdhanhail/ (2004)

[6] R. Woolsey, and S. Rodchua, Quality measurement and good practices in web-based distance learning: A case study of the industrial management program at central Missouri state University. Journal of Industrial technology, Vol. 20 (4), September-December, (2004), pp. 2-9.

[7] S, K Corich, and L. M Hunt., Assessing discussion forum participation: In search of Quality, Int. Journal of Instructional Technology and Distance Learning, Vol. 1 (12), Dec (2004), Retrieved from internet http://www.itdl.org/Journal/Dec_04/article01.htm on June, 23, 2005.

[8] A. M Agogino, L. H Jamieson, G. Kalonji, D. F. Ollis, H. V. Poor, S. E. Powers and C. Rogers, Panel – Integrating Education, Research, and Outreach: Exemplars from the NSF Distinguished Scholars Program, The 35th ASEE/IEEE Frontiers in Education Conference, October, 19-22, (2005), Indianapolis, IN

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