A Case Study of Designing an E-Learning Electrical Engineering Course

Abstract—This paper presents a case study of designing an e-learning course in the field of electrical engineering—Industrial automation program at Palestine Polytechnic University. The applied methodology consisting of few stages starting with formulating the major course objectives, extracting topics outcomes, design the appropriate teaching tools and storyboard, and as final stage the evaluation system is designed.

On other hand, an information communication technology (ICT) questionnaire has been designed and targeting attended in the course students with purpose evaluating student ICT knowledge, knowledge leveling, and treatment their weaknesses.

The designed topics are modified according to feedback evaluation obtained from students throughout designed for this purpose questionnaire. The observed weaknesses in course topics have been eliminated and finally the modified course was uploaded to the university e-learning platform. Electrical engineering core course with 300 level was carried out for department students, where the obtained results shows significant enhancement in teaching and learning performances of both course instructors and students.

Index Terms—E-learning, Blinded learning, On-line learning, WEB based learning.

I. INTRODUCTION

The development and increasing growth of the Internet has provided new opportunities for delivering instruction and has allowed educators to offer courses in a more convenient and flexible environment [1-4]. In countries around the world, the widespread penetration of the Internet has increased the demand for courses to be offered online, and many organizations and institutions are now offering entire educational programs over the web in a variety of fields[5,6]. Furthermore, offering on-line courses removes the challenges in form of geographical obstacles, boundaries and closers. E-learning courses in Occupied Palestinian Territories have been significantly grown up due to Israeli barriers, scattering the regions and therefore students inability to attend classrooms. This issue forced university academics in Palestine to look for alternative teaching strategy that overcomes aforementioned obstacles [7-9]. The unique solution was developing an e-learning courses in various engineering, humanities, health sector, business, i.e. The designed e-learning course entitled "Introduction to Electrical machines" was carried out during 2008/2009 academic year.

Experience has shown that online courses can provide the same opportunities for the teaching and learning process as those associated with traditional classrooms but only if teachers learn and apply new teaching skills and if their courses are designed with online delivery in mind. Online teachers need a variety of talents and abilities. Some distance education courses require the teacher to be course planners, instructional designers, technical experts, writers, or editors and troubleshooters when technical equipment fails [9,10]. These skills are not part of teaching in the traditional sense of the word, but may be necessary in online education.

II. RESEARCH METHODOLOGY

A. Course Requirements:

Design and implementation of an e-learning course is complicated pedagogical process that depending on large numbers of factors and requirements affecting design level, course quality and expected teaching outcomes. Figure1 illustrates the overall view of parameters that affects successful design of e-learning course, where the most important factors and requirements are as follows:

- Educational institution character: depending on the institution character, there are three major characters in Palestinian educational systems: Institutions with regularly attendance, with blended attendance and with distant and on-line learning.
- Student target group: in form of their academic level, freshman, undergraduate, or graduate students.
- Course character: pure theoretical courses have different e-learning approach with respect to courses having both theoretical and practical parts. Furthermore, the character of the course dictates the suitable e-learning methodology.
- Technical infrastructure: the existing infrastructure in form of internet and intranet performances, applied learning management system (LMS) [11], ease of student access to the e-learning portal.
- Communication skills of targeted learners are the most affecting factors, and must be taken into consideration in design and building of e-learning course. Student's communication weaknesses are treated and eliminated before involving students in learning process.
- Educators experience and readiness: Similar to student's readiness, course educators should have good experience in selecting suitable learning methodology, education tools, proposing fair evaluation system, good knowledge in multimedia & graphics design, and ability to conduct continuous development of proposed courses.
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B. Students' Evaluation Needs

According to Fig.1 the e-learning course hierarchy and dependency is illustrated where the acting factors are clearly defined, studied and processed. The present paper describes concrete case study with the following input parameters:

- The course is conducted in regularly university, where the e-learning course is applied as supporting educational source.
- The targeted group is undergraduate students in department of Electrical & Computer Engineering / College of Engineering & technology at PPU.
- The course character is introductory course entitled "Introduction to Electrical machines" as department compulsory course.
- Educational experience, the course instructors have good knowledge in information communication technology (ICT), graphics design and long-term teaching experience, so they have advanced knowledge in pedagogical issues and course measures.
- The university infrastructure in the field of ICT to some extend satisfied the educational system requirements.

- Communication and language skills: These skills are mandatory condition for successfully conducting teaching-learning process.

Therefore eliminating students ICT skills weaknesses requires conducting several types of field surveys such as skills requirement questionnaire and direct student interviews aiming at evaluating their specific needs and how these needs can be realized.

C. Student Requirement Analysis

Student requirements analysis can be formulated as follows:

- Identify the needs of the participants/attendee to the proposed course.
- Create an appropriate toolset for data collection.
- Data gathering and analysis about the final target group.
- Create specific training activities which meet the identified needs of the participants and help developing the use of knowledge information and learning technologies in the university.

Figure 2 illustrates the questionnaire structure used for data gathering, analysis and specifying students' needs.

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Figure 1. E-learning course hierarchy

Figure 2. Structure of the questionnaire
III. COURSE DESIGN

This course was designed as a result of two-years learning program sponsored by European Union [12,13] where various learning modules and management systems have been discussed and implemented during conducted training process in Italy. As result of this international activity this course was selected for design and being offered for PPU’s students.

Taking into account the proposed structure of conducted questionnaire, the applied methodology in building the proposed course is illustrated in fig.3 in form of functional flowchart, where several components are designed and implemented in predetermined manner with purpose fulfilling the course requirements and macro objectives.

Three major tasks:
- Course Performance Analysis and Outcomes
- Students skills requirements
- Storyboard & evaluation system design.

A. Course performance analysis & outcomes

Course performance analysis and ILOs are the most important tasks when e-learning course is selected for design. The functional block diagram depicted in fig.4 illustrates the sequence of determining performance analysis and intended outcomes.

B. Students skills requirements

Figure 5 illustrates functional diagram of student's skills requirements evaluation, where two kinds of evaluation have been conducted, skills survey in form of written questionnaire and oral interviews with participants in the course. The purpose of this activity is to determine students ICT knowledge level and their training needs.

The conducted skills survey covers the most important 16 tasks (questions) with different characters which related to students ICT knowledge level, infrastructure and students language and communications capabilities. Some of these questions are stated as follows:

Q1. Are you good involved with internet and web applications?
   a. I have satisfied internet skills and web applications
   b. I have some weaknesses in internet skills and web applications

Q2. Have you been involved in e-learning course?, (please you can choose more than one answer)
   a. I have experience with e-learning course as learner I
   b. I use e-learning as a trainer for my own trainings
   c. I have been involved in e-learning as an instructional designer, developing e-learning course.
   d. I am involved with e-learning as a manager in my organizations
Q3. Have you good internet access at home?
   a. Yes, I have good internet performances.
   b. Yes, I have, but I prefer to use the university computer labs.
   c. No, but I can use the university computer labs.

Q4. With which kind of e-learning tools have you made experiences so far? I have experience with learning……. (Several choices are possible).
   a. Using a multimedia CD-Rom for self study purposes
   b. In a Web based e-learning course without face-to-face sessions.
   c. In a web based e-learning course with fact-to-face sessions.
   d. Using the internet for learning purposes.

Q5. The following statements describe general ICT skills. Please choose the most suitable answer for you?.(only one answer possible)
   a. I have the basic computer skills (create text, file, saving,)
   b. I have the basic skills for finding my way around the Internet.
   c. I can send an email with a file attached
   d. I can carry out an online conversation with others using the Internet.
   i.e…………

The obtained results of conducted survey for above mentioned questions are illustrated in fig.6, where it is shown that enrolled students have extremely different ICT knowledge levels which complicate successfully conducting e-learning course. Furthermore additional training activities must be offered for students suffering from deep weaknesses in ICT knowledge. Training program has been designed and conducted for students enrolled in this course.

C. Design topic’s storyboard

Course storyboard is useful activity for design e-learning course topics, it presents the required interactive tools, techniques, animations, images, and interpretation of the topic content aiming at achieving the planned teaching objectives and outcomes. Figure 7 illustrates storyboard design procedure.

D. Assessment evaluation

For the designed course an evaluation system should be designed taking into account various activities applied in course topics.

Since the on-line character of the course, the applied assessment procedure relays mainly on time-free assessment and self motivation tools. Figure 8 illustrates functional flowchart of applied assessment procedure.

As a case study, the applied assessment procedure for e-learning course in the field of electrical machines has the grading system shown on table 1, where students interactive and critical thinking activities occupies 50% of total grade, which is major advantages of proposing e-learning course.
E. Design the course evaluation questionnaire

After completely design of e-learning course there is a need of overall course evaluation with respect to topics, educational tools, allocated time and finally the achieved intended learning outcomes. Realizing these tasks requires two evaluation procedures:

1) Expert and department evaluation

Expert and department evaluation aiming at providing course instructor with quality feedback with respect to educational quality, course content, outcomes, and allocated time. Figure 9 presents course evaluation chart.

2) Students evaluation:

Student's evaluation feedback presents key factor for successfully conducting of e-learning course. Because of that, it’s worthy to get evaluation feedback from targeted group involved in this course. Figure 10 illustrates some of evaluation results, where 45 students have been questioned and interviewed.

The following questions have been assigned:

Q1- Are the proposed course topics good prepared and arranged?

Q2- Is the proposed management system simple and friendly used?

Q3- Is the course content good designed with appropriate flow?

Q4- Do you face difficulties when browsing the required learning data?

Q5- Is there a variety in used learning tools and methodologies?

Q6- Is there a variety in evaluation system?

Q7- Is the proposed evaluation system exactly measure student knowledge?

As shown from fig.10 expert's and student's evaluation results gave clear feedback for further modification of e-learning course to be more motivated, with innovative educational tools, and more concentration over students teamwork and collaborative activities.
IV. CONCLUSION

The following conclusion can be drawn when designing e-learning course:

- Information communication technology estimating questionnaire is necessary for evaluation the student knowledge level.
- Designing e-learning course depends on course character and student targeted group
- The designed learning tools must take into consideration student's needs, educational level and course character.
- The designed course should be evaluated from both experts and involved in educational process students.
- Despite the evaluation results of field experts, students' evaluation results must take into consideration in modifying course content and educational tools.
- Student's feedback differs from one issue to another, with respect to course management and evaluation which ranges between 62% to 82%, which means further efforts are needed in design e-learning course.
- With respect to gained knowledge and satisfaction, e-learning strategy presents optimized solution for future learning strategy.
- Despite the observable benefits of applying e-learning course, students prefer blended learning rather than pure on-line e-learning. This is because changing student's educational mentality takes long time to be changed.
- As a result of aforementioned design procedure, first author was selected for teaching excellence award among Palestinian Universities offered by American Agency AMIDEAST-USAID [14] for his efforts in design and implementation of this course.

I. REFERENCES


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