EVALUATION OF IT-BASED ACTIVE LEARNING PROJECT AT THE UAE UNIVERSITY: COLLEGE OF ENGINEERING CASE STUDY

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Technology is a recognized part of the overall tools for supporting and enhancing teaching and learning. Many colleges and universities have responded by adapting technology in their education system. There is substantial evidence that using technology as an instructional tool enhances student learning and educational outcomes. The college of Engineering at the United Arab Emirates University launched its IT-based active learning (Laptop) project at the first semester of the academic year 2002-2003. After several years of implementation and substantial investment, the College of Engineering is reviewing its course development technology strategy and is asking a very important question such as, "Did our investment in technology result in enhanced learning outcomes and promote the new, learner-centered pedagogy or did it have little impact on learning?". The work presented in this paper is the outcome of a collaborative work of the "Laptop Project Review Committee" members. The committee developed two surveys, one for students and one for instructors. The surveys then were distributed to students and faculty members at the college. Many lessons have been learned about the benefits and difficulties in being a laptop college of engineering. These lessons are documented in this paper.

Keywords: interactive learning, laptop based courses, learning quality and satisfaction, online teaching, computing infrastructure, faculty training

1. INTRODUCTION

The challenges faced by today's graduating engineers are very diverse and stimulating. Imagination and ingenuity are required to convert recent advances into useful and effective applications. Although such developments may be forcing engineers to change quickly, job changes are more frequent. Such advancements and changes, ultimately, form a challenging task for educators[1]. Technology is a recognized part of the overall tools for supporting and enhancing teaching and learning. Many colleges and universities have responded by making technology more ubiquitous. The assumption behind most ubiquitous computing initiatives has been that access to technology would lead to its usage directly[2]. There is a substantial evidence that using technology as an instructional tool enhances student learning and educational outcomes. Past research suggests that compared to their non laptop counterparts, students in classrooms that provide all students with their own laptops spend more time involved in collaborative work, participate in more project-based instruction, produce writing of higher quality and greater length, gain increased access to information, improve research analysis skills, and spend more time doing homework on computer[3]. After several years of implementation

and substantial investment, many universities are reviewing their technology strategy and asking a very important question such as, "Did our investment in technology result in enhanced learning outcomes and promote the new, learner-centered pedagogy or did it have little impact on learning?"

In addressing this question it may be helpful to consider the case of the College of Engineering at the United Arab Emirates (UAE) University. The College of Engineering at the UAE University launched its laptop project at the first semester of the academic year 2002-2003. This project was initiated simultaneously with the introduction of Blackboard Learning Management System and wireless network technology as the backbone for the digital learning. Since then, students and faculty have been able to access the UAEU computing environment ANYTIME, ANYWHERE. Furthermore, the project's aims have been to enhance the learning and teaching processes at the UAEU. More than four years have elapsed since the first implementation, and classes have been taught using laptops in a variety of ways depending on the subject matter. Currently more than 65 courses are restructured to take advantage of the laptop and the wireless network as extra teaching and learning aids.

The work presented in this paper is the outcome of a collaborative work of the "Laptop Project Review Committee" members. The committee was appointed by the College of Engineering Council in May 2006, and is made of five members representing the five engineering departments at the college, these are Architectural engineering, Civil and Environmental engineering, Chemical and Petroleum engineering, Electrical engineering, and Mechanical engineering. The committee met several times to develop a means to answer the above mentioned question, the outcome of the meetings resulted in two surveys, one for students and one for instructors. The surveys were then distributed to students and faculty members at the college, and several interviews were conducted with the faculty members to gauge their opinions. Many lessons have been learned about the benefits and difficulties in being a laptop college of engineering. These lessons are documented in this paper.

2. THE SURVEY
2.1 Student Survey

A fifty four (54) structured question survey was developed by the committee and distributed to all students who are enrolled in the college of engineering and using laptop in all classes taught by the college. This includes College Requirement Unit (CRU), and the Department of Architectural engineering, Civil and Environmental engineering, Chemical and Petroleum engineering, Electrical engineering, and Mechanical engineering. A total of 476 students participated in this survey.

The survey was designed to include personal questions regarding student's academic department, number of Laptop courses registered in and number of years at UAE University. In addition, the survey included several questions about the student's use of Laptop both inside and outside the classroom and their perception of the usefulness of the laptop project. The survey covered four main areas, these are, learning quality and satisfactions, the use of e-learning tools in learning and teaching, laptop and online usage, and infrastructure and IT services.

2.2 Faculty Survey

The faculty survey was made of thirty three (33) structured questions and 9 interview questions. The survey was developed by the committee and distributed to all faculty members who are involved in Laptop teaching. A total of 51 faculty member participated in this survey. The survey was designed to cover five areas, these were: Learning quality and satisfactions, the use of e-learning tools in learning and teaching, laptop and online usage, infrastructure and IT services, and nine interview questions. The interview questions were aimed to gauge the variety of views and perceptions that faculty members have about the laptop project applied at the college, as well
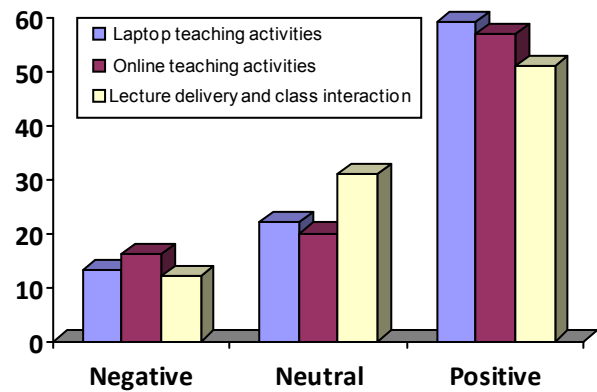

Figure 1. Student survey results on learning quality and satisfaction

as to communicate any further difficulties or remarks that might be raised by the faculty members.

2.3 Survey Results

Structured questions were given five choices starting with the least preference as Strongly Disagree, and ending with the highest preference as Strongly Agree, each preference is assigned numerical value as shown below.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

For the purpose of analysis the five choices were combined into three categories of responses as negative response, neutral, and positive response. Such that Strongly Disagree and Disagree were marked as negative responses, and Strongly Agree and Agree were marked as positive. Whereas neutral remained the third choice.

2.4 Students' Survey Results
Learning Quality & Satisfaction

This part of the survey was made of 15 questions. These questions can be grouped into three main categories; these were learning quality and students' added capabilities, class environment and interaction, and overall quality and satisfaction.

Students' learning quality and satisfaction is directly linked to students' opinion as to whether having laptop has enhanced students' learning, students' capabilities of self-learning, communication skills, in/outside class interactions and teamwork and class materials presentation. Students' perception and responses were significantly positive in all three categories, this is clearly illustrated in Figure 1.

Use of e-Learning Tools in Learning and Teaching

A total of ten (10) questions were developed in this part of the survey. The questions may be grouped into three categories, such as Laptop teaching activities, online teaching activities, and lecture delivery and class interaction.
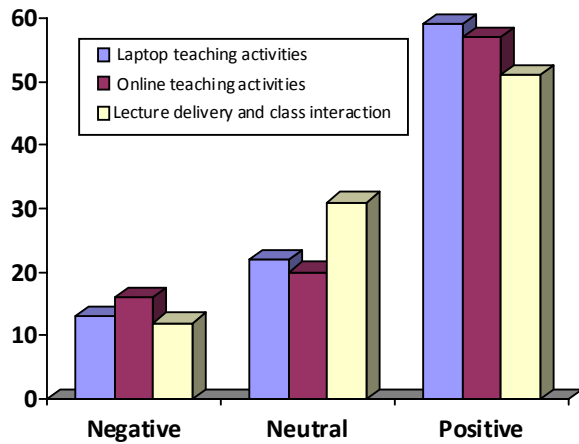
Figure 2. Student survey results on the use of e-Learning tools in learning and teaching

Figure 3. Student survey results on laptop and online usage

Figure 2 shows that close to 60% of the students surveyed believed that laptop teaching activities and online teaching activities have enhanced students' understanding of the material, and enhanced students' capabilities of communication and interaction with colleagues and instructors. More than 50% believed that lecture delivery with laptop is far more informative than the traditional way.

Laptop and Online Usage
In this part the questions were categorized as, overall usage of laptop, software usage, Blackboard activities, and traditional teaching during class.

As shown in Figure 3, students seemed be satisfied with "Laptop online use", both in and out of the classrooms, such as using the course website (Blackboard) and internet, simulation software, students' interaction among themselves and with the course instructor, and online assessment. Nonetheless traditional way of teaching (Chalk & Board) is still highly used by instructors; close to 50% of students believe that instructors are still teaching using the traditional way, along with IT-based methods.

Infrastructure and IT Services
The questions here are grouped into three categories, Figure 4, these are network accessibility and reliability, classroom environment and suitability, and software and technical support availability.

As for the quality and satisfaction with "Infrastructure and IT services" about 50% of the students seemed to have no problem and they are satisfied with network accessibility and reliability, classroom environment, and software and technical support, however, some students showed concern about accessibility of server based software such as MATLAB and AUTOCAD, due to the number of licenses and lack of accessibility from hostels.
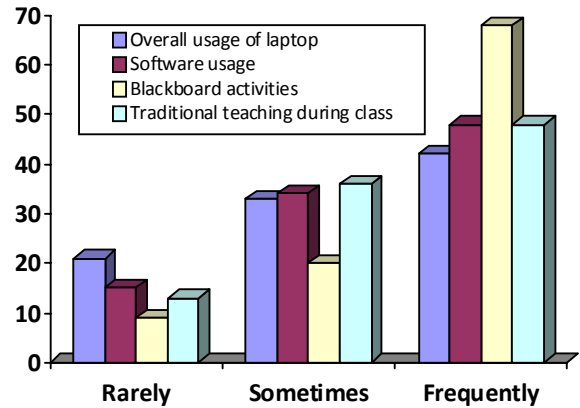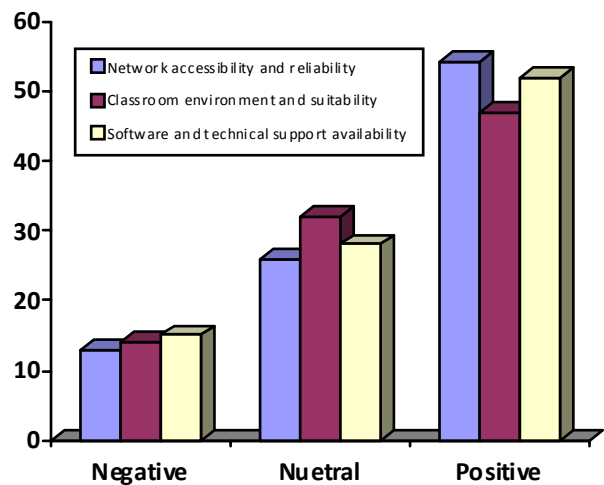

Figure 4. Student survey results on infrastructure and IT services

2.5 Faculties' Survey Results
Learning Quality & Satisfaction

This part of the survey was made of **6** questions. These questions were related to the quality of teaching and learning using laptop. Such as:

1. Laptops aid students to solve challenging problems that are needed to understand the material
2. Laptops aid instructors to present their materials more effectively
3. It is difficult/inconvenient to use my laptop during class
4. Students' attention is distracted due to the use of their laptops during lectures
5. Interactive teaching is directly linked to the laptop project
6. The improvements of interactive teaching using the laptop project are excellent overall
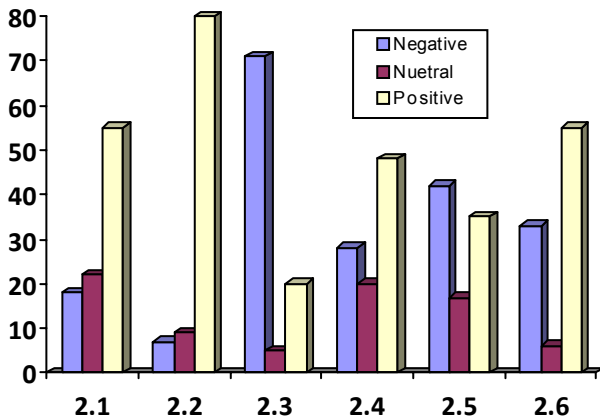
Figure 5. Faculty survey results on learning quality and satisfaction

Figure 6. Faculty survey results on the use of e-learning tools in learning and teaching

Analyzing faculty members feedback regarding the "Learning quality and learning satisfaction" as shown in figure 5, the responses were 50%-80% positive in questions 2.1, 2.2, 2.3, 2.4 and 2.6. Question 2.5 which relate to direct link between interactive learning and the use of laptop the responses were 40% in the negative side and 30% positive. This reflects the awareness of faculty members on the importance of incorporating other active learning tools and methods side-by-side with the IT-based methods.

Use of e-Learning Tools in Learning and Teaching
Five (5) questions were developed in this part of the survey; they were related to the convenience of using laptop, and developing student–instructor interaction.
1. Laptops are convenient for students to use during in-class exercises and exams
2. Laptops are convenient for students to use in homework assignments and term projects
3. Online (Blackboard) exams are appropriate for all course levels and types
4. The Blackboard system is the key towards IT-based active learning
5. Student-instructor interaction is directly linked to the use of laptops

In the questions related to "Use of e-learning tools in learning and teaching", faculty members believed that Blackboard is not appropriate for conducting online exams for all course levels and types (Question 3.3), close to 60% responded negatively to this questions, see Figure 6. Also, question 3.5 which relates to the link of laptop to students' interactions received 50% negative responses. This, again, reflects the faculty members' awareness of the relative importance of other tools and methods of interactive learning.

Laptop and Online Usage
In this part 12 questions were developed. The questions are designed to get a feedback on how often the instructor gets the students involved in on-line activities during lecture and tutorial sessions.
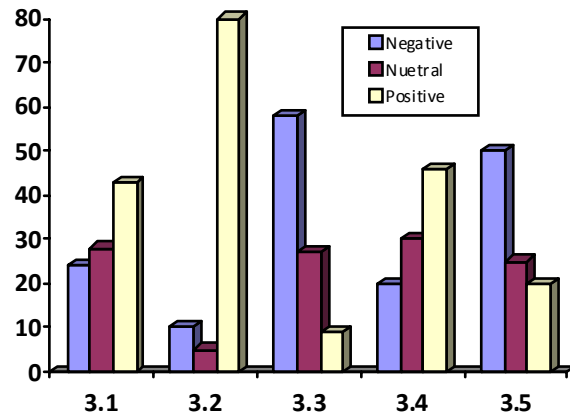
1. Students use their laptops actively during the lecture sessions
2. Students use their laptops actively during the tutorial / lab sessions
3. Students are required to use the Internet during class (<u>NOT</u> Blackboard)
4. Students use course specific/specialized software (e.g. modeling, simulation, etc.) during class
5. I use course specific software during class to demonstrate the concepts being taught
6. I use traditional teaching techniques during class along with the laptop (e.g. whiteboard)
7. I use Blackboard for posting PowerPoint presentations and lecture documents
8. I use Blackboard for posting and receiving assignments
9. I use Blackboard for conducting online tests
10. I use Blackboard for sending emails to students registered on my class
11. I use Blackboard for conducting surveys
12. I use Blackboard for creating discussions and discussion groups among students

Figure 7 illustrates survey's results related to "Laptop and online usage", responses related to using software packages in teaching, simulation software, use of presentation software, use of Blackboard, and use of traditional teaching method (whiteboard), received 60%-100% positive responses in terms of frequent usage. While as questions related to the use of internet during class session and use of Blackboard for online testing, conducting surveys, and creating discussion groups the responses were 50-75% in the negative side.

Infrastructure and IT Services
This section is made of 10 questions related to the instructors' preparation on using Blackboard system and active learning, and casts instructors' satisfaction with infrastructure and IT services available at the college.
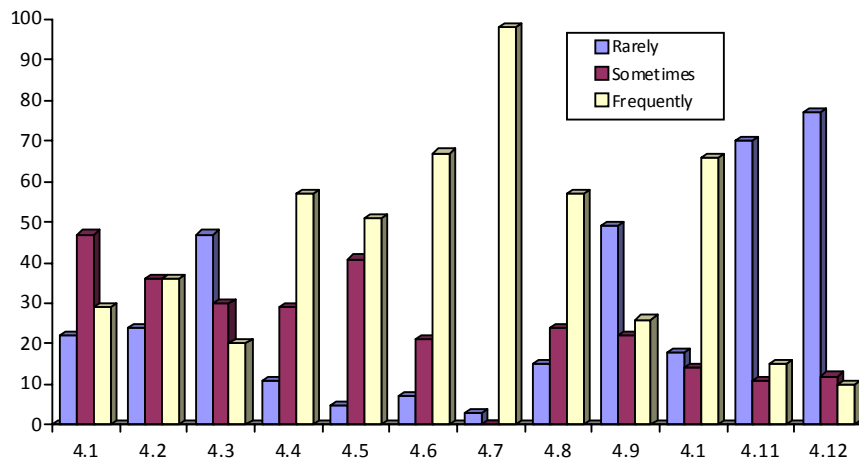
Figure 7. Faculty survey results on laptop and online usage

1. Faculty members may need training for using the Blackboard system
2. Faculty members may need training on interactive teaching methods
3. Laptop-based classes usually start smoothly without much need for debugging problems (e.g. missing cable, defective lamp, data projector problems)
4. The Blackboard system is efficient and easy to access at all times
5. Faculty members receive adequate support for the required software packages
6. Faculty members receive adequate support for laptop problems
7. I am able to use all software packages I need on my laptop (e.g licenses, cpu speed, RAM etc.)
8. The facilities at the College (e.g., data show projectors, screens, classrooms … etc) are adequate for the full implementation of the interactive teaching using the laptop project
9. The College's technical infrastructure (e.g. network / wireless connections) is adequate for the full implementation of the use of wireless laptops
10. The College's infrastructure and IT support services are excellent overall
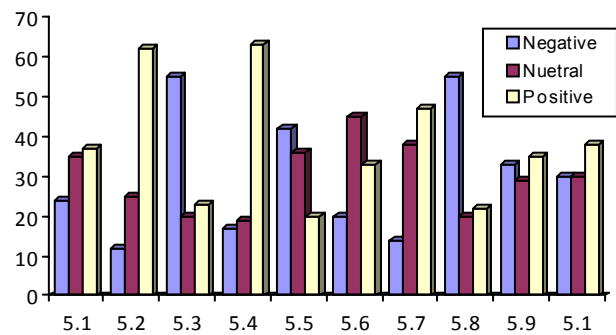
As for the "Infrastructure and IT services", close to 40% of the faculty members support the idea of conducting training sessions for faculty members on the use of Blackboard system, and more the 60% are in favor of attending training sessions on Interactive teaching methods, Figure 8. Close to 55% of the faculty are having problems with laptop classrooms, either data cable is not available, defected projectors lambs, or data projector start up problems. Faculties' response for software packages support (College/University) was more that 40% negative.

Figure 8. Faculty survey results on infrastructure and IT services

Interview Survey by Faculty

The interview survey is introduced to give faculty members freedom to express their opinion and provide their feedback about the weaknesses and threats, strengths, and possible enhancements that laptop teaching might have on the education process. Most faculty showed concern that laptop courses, in general, may distract the student from exploring primary sources of learning (i.e., textbook or reference books) and others feel that laptop project sacrifices the students ability to conduct experiments and calculations by hand (and shortcut methods), and they fear that this will severely affect the quality of graduates.

Others showed concern about the development time assigned by the administration to faculty developing laptop courses. They feel that the time assigned, typically two weeks, for developing a laptop course is not sufficient to prepare a complete and adequate course. Also it was found that the short service durations and the high turnover of faculty members lead to the discontinuity of laptop course development.

Some faculty members showed concern regarding IT infrastructure, software support and classroom furniture and fixtures. Due to many laptop courses running at the same time and sharing the same network bandwidth, online exams would be difficult in terms of connection delay, and network congestion. Unavailability of sufficient software licenses for in class and out class use have a major effect on efficient implementation of developed laptop courses. Lack of infrastructure needed for comfortable use of computers in class (e.g., improper classroom lighting, deficient projector lamps, and unsuitable furniture) surely affect the delivery method.

However, most of the faculty members believe that the laptop is a valuable tool in the education process and the laptop project can be successful once the above stated difficulties are resolved. Nonetheless, it was highly recommended by faculty member to have training sessions for "Interactive learning", and "Blackboard".

3. CONCLUSIONS AND RECOMMENDATIONS

The laptop project at the college of engineering has been in implementation for over 4 years. It was designed to provide an innovative, high technology learning environment in the classroom and access to technology outside of the classroom. Results from faculty and students' surveys identified that IT-based learning and laptops are valuable tools in the education process and are convinced that they contributed significantly to the improvement of the learning process. However, the effective implementation of learning technologies in general and laptops in particular, requires a preliminary framework of infrastructure and faculty development for blended learning.

To enhance teaching with laptops and to improve student outcomes, it is indispensable to take a close look at existing course curricula and pedagogical strategies to create a meaningful teaching and learning environment. The authors believe that the use of laptop in the classroom is discipline and course specific.

Faculty need to find ways to implement different technologies (not necessarily laptop) to assist students to better understand difficult concepts more easily, to expand classroom discussion, and to better integrate classroom theory with laboratory experimentation.

Nonetheless, the authors believe that for a continuous success of the laptop project, the college and university administration should seriously consider some of the barriers that might hinder the success of the project. University administration should find more rewarding incentives for instructors developing laptop courses, taking into consideration the high teaching load of instructors. Administration should look seriously at the high faculty turnover, since faculty employment continuity and stability is a crucial factor in the successful and effective implementation of the project, training sessions and workshops on the use of Blackboard and Interactive learning are a must. Support of computing resources and lecture rooms infrastructure, such as furniture, internet connectivity, power outlets and data-show equipment and cables, should continue.

ACKNOWLEDGMENT

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