The Effectiveness of An On-Line Graduate Engineering Management Course: A Preliminary Study

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Abstract

In the summer of 1997, the University of Missouri-Rolla's (UMR) Engineering Management Department began offering its first completely Web-based course. This graduate level course, Advanced Production Management, was designed to utilize a combination of Web-based tools to create a conducive, yet non-traditional, learning environment for its students. The students in the course did not physically have to attend any lectures and only met for an initial and final class period. The remainder of the course was conducted exclusively via Web-based tools. Accordingly, the Engineering Management Department commenced a research effort to determine the effectiveness of this new learning environment. This paper will discuss the initial results of this study, based on the first of three consecutive offerings of this course. Specifically, this paper addresses student subjective expectations and corresponding experiences as to the time required and learning effectiveness in comparison to a traditional, in-class, course. In addition, the expectations and learning experiences as related to specific Web-based tools are examined.

Introduction

Khan noted that the Internet is increasingly becoming an influential medium for delivering "dynamic and global education" while concurrently enabling students and instructors to interact regardless of time or place.[1] In the past several years, the use of Internet technology, enabling the connection between individual computer networks, has exploded in the United States and around the world. From electronic commerce to education, the Internet has become a vital resource to companies, government, and academia. In the academic community, there is much fanfare and excitement concerning its revolutionary implications for educational improvements. However, there exists little overwhelming evidence that this technology actually increases the learning effectiveness in comparison to traditional, classroom, teaching tools.

Many definitions of an Internet-based, or web-based, course exist in the literature. Depending on which subset of Web tools is chosen, Internet-based courses can range from those totally Internet dependent to those which just supplement traditional lectures with complementary Internet-based material. In the former case, a course is taught entirely across the Internet and does not require any physical interaction between students and teachers, as all communications are performed electronically. In the latter case, a professor might complement his or her campus course with an Internet site or "Web page" containing such information as the class syllabus, assignments, and announcements.

UMR's Advanced Production Management Course and the Internet

The Engineering Management Department's Advanced Production graduate level course used in this research provides an overview of a production manager's responsibilities. Topics covered in this course include decision theory, forecasting, total quality management, statistical process control, acceptance sampling, product design, process selection, facilities layout, location planning, aggregate planning, material requirements planning, scheduling, and project management.

The Advanced Production Management is currently taught both in the traditional classroom setting and the Internet-based environments. The Internet-based course utilizes an Internet site where its "homepage" resides. The material "on-line" was designed and created at UMR using Microsoft's FrontPage software. This homepage includes links to the class syllabus, assignment lists with instruction, grading policies, the class ChatRoom, class lectures and quizzes.

The lecture and quiz modules created by Lotus ScreenCam software are available via the Internet. These modules are in a compressed data format and therefore require the student to have decompression or "unzip" software on his or her computer. The modules, which contain both video and audio information, resemble a Microsoft PowerPoint presentation with associated audio instruction. In addition, both audio and visual components of each presentation are synchronized with prerecorded cursor movements. Students are able to stop the lecture or quiz at any time and repeat if necessary. There is an option for students to purchase the lecture and quiz material on CD-ROM. This option is for students who choose to avoid possible delays in downloading compressed or "zip" formatted modules. Notably, all students in this study chose to use the CD-ROM version, thus limiting any potential Internet access problems.

The students in this Internet-based course are required to purchase a textbook, supplementary case-book, and prepared class notes. The prepared class notes, created by the instructor, contain all visual lecture material in addition to homework answers. On the first day of class, the instructor meets with the students at an on-campus site to provide an introduction to the course format and the Internet-based tools used for this course. There is no further meeting of the Internet-based class until the last day of the semester on which the final examination is administered. Interactions between students and instructor and among students are encouraged to be done electronically via the ChatRoom or Email. The Chatroom was created using Allaire "Forums" software. As an option for students less familiar with the technology, the course instructor is available via phone and fax or, if necessary, at assigned office hours. During the semester, there are two group assignments for which students have the option to communicate with each other either electronically or face-to-face.

Overview of Research

UMR is conducting an ongoing research effort to determine the effectiveness of Internet-based technology for "improved learning" in engineering education. Over one hundred students will be involved in this study. Due to the complexity of defining "effectiveness", there are many facets which need to be addressed including class performance, fulfillment of student expectations, and potential effects from student backgrounds. To assist in evaluating learning effectiveness, the following four areas were investigated: a) the time required for the course, b) overall learning experience, c) the effectiveness for aiding course material comprehension using specific instructional tools including video lectures, Email, and ChatRoom, and d) level of satisfaction related to a specific tool utilized by the instructor including video lectures, Email, and ChatRoom.

Preliminary Results

This paper will only discuss the preliminary results regarding the expectations and experiences of the first class of Advanced Production Management students taught via Internet-based technologies. This first Internet-based class contained 22 students pursuing M.S. degrees in Engineering Management.

Several surveys were created and subsequently administered to the Internet-based class students. For this paper, we'll discuss just two; the "Student Expectations" survey administered on the first day and the "Student Final Experiences" survey administered on the last day of class. To capture student expectations, the following questions in Table 1 were asked. In determining the fulfillment of student expectations, student experiences were recorded by rephrasing the expectations questions as shown in Table 2. To allow for future statistical comparisons, all questions were accompanied by a set of answers from which the students could chose from. In addition, student explanations regarding the reasoning behind their answers were recorded.

Table 1: Student Expectations

Questions
Q1. In comparison to traditional in class lecture courses, what <u>are</u> your expectations as to the time required for this Internet-based course?
Q2. In comparison to traditional in-class lecture courses, what <u>are</u> your expectations as to your overall learning effectiveness for an Internet-based course?
Q3. For each tool noted (Digitized Lectures, Email and ChatRoom), <u>I expect</u> the tool to be effective for aiding my comprehension of the material in this Internet-based course.
Q4. For each tool noted (Digitized Lectures, Email and ChatRoom), <u>I expect</u> the tool to have a high level of satisfaction for this Internet-based course.

Table 2: Student Experiences

Questions
Q1. In comparison to traditional in class lecture courses, what was your experience as to the time required for this Internet-based course?
Q2. In comparison to traditional in-class lecture courses, what was your experience as to the learning effectiveness of this Internet-based course?
Q3. For each tool noted (Digitized Lectures, Email and ChatRoom), the tool was effective for aiding my comprehension of the material in this Internet-based course.
Q4. For each tool noted (Digitized Lectures, Email and ChatRoom), the tool had a high level of satisfaction for this Internet-based course.

Due to uncontrollable factors, only 19 of the original 22 students responded to the "Student Final Experiences" survey. A summary of student expectations and experiences are found in Table 3 and Table 4, respectively.

Table 3: Student Expectations

Questions	Expectations of 22 Students			
In comparison to traditional in class lecture courses, what are your expectations as to the time required for this Internet-based course?	**The course would require:** 1 (4.5%) significantly less time 6 (27.3%) less time 3 (13.6%) same amount of time 7 (31.8%) more time 4 (18.2%) significantly more time 1 (4.5%) Not sure or No Opinion			
In comparison to traditional in-class lecture courses, what are your expectations as to your overall learning experience for an Internet-based course?	**I expect this course would be:** 0 (0.0%) a significantly less effective experience 7 (31.8%) a less effective experience 4 (18.2%) same experience 8 (36.4%) a more effective experience 1 (4.5%) a significantly more effective experience 2 (9.1%) Not sure or No Opinion			
For each tool noted (Digitized Lectures, Email and ChatRoom), I expect the tool to be effective for aiding my comprehension of the material in this Internet-based course.	**Response**	**Digitized Lectures**	**Email**	**ChatRoom**
	Strongly Disagree	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Disagree	2 (9.1%)	2 (9.1%)	2 (9.1%)
	No Opinion	5 (22.7%)	4 (18.2%)	11 (50.0%)
	Agree	13 (59.1%)	14 (63.6%)	6 (27.3%)
	Strongly Agree	2 (9.1%)	2 (9.1%)	3 (13.6%)
For each tool noted (Digitized Lectures, Email and ChatRoom), I expect the tool to have a high level of satisfaction for this Internet-based course.	**Response**	**Digitized Lectures**	**Email**	**ChatRoom**
	Strongly Disagree	1 (4.5%)	1 (4.5%)	1 (4.5%)
	Disagree	1 (4.5%)	1 (4.5%)	2 (9.1%)
	No Opinion	8 (36.4%)	4 (18.2%)	8 (36.4%)
	Agree	11 (50.0%)	12 (54.6%)	8 (36.4%)
	Strongly Agree	1 (4.5%)	4 (18.2%)	3 (13.6%)

(Percentages may not equal 100% due to rounding error of +/- 0.1%)

Table 4: Student Experiences

Questions	Experiences of 19 Students			
In comparison to traditional in class lecture courses, what were your expectations as to the time required for this Internet-based course?	**The course would require:** 1 (5.3%) significantly less time 9 (47.4%) less time 6 (31.6%) same amount of time 2 (10.5%) more time 1 (5.3%) significantly more time 0 (0.0%) Not sure or No Opinion			
In comparison to traditional in-class lecture courses, what were your expectations as to your overall learning experience for an Internet-based course?	**This course was:** 0 (0.0%) a significantly less effective experience 2 (10.5%) a less effective experience 6 (31.6%) same experience 10 (52.6%) a more effective experience 1 (5.3%) a significantly more effective experience 0 (0.0%) Not sure or No Opinion			
For each tool noted (Digitized Lectures, Email and ChatRoom), the tool was effective for aiding my comprehension of the material in this Internet-based course.	**Response**	**Digitized Lectures**	**Email**	**ChatRoom**
	Strongly Disagree	0 (0.0%)	1 (5.3%)	1 (5.3%)
	Disagree	0 (0.0%)	1 (5.3%)	5 (26.3%)
	No Opinion	0 (0.0%)	7 (36.7%)	8 (42.1%)
	Agree	9 (47.4%)	9 (47.4%)	5 (26.3%)
	Strongly Agree	10 (52.6%)	1 (5.3%)	0 (0.0%)
For each tool noted (Digitized Lectures, Email and ChatRoom), the tool had a high level of satisfaction for this Internet-based course.	**Response**	**Digitized Lectures**	**Email**	**ChatRoom**
	Strongly Disagree	0 (0.0%)	1 (5.3%)	1 (5.3%)
	Disagree	0 (0.0%)	0 (0.0%)	4 (21.1%)
	No Opinion	0 (0.0%)	5 (26.3%)	10 (52.6%)
	Agree	10 (52.6%)	11 (57.9%)	3 (15.8%)
	Strongly Agree	9 (47.4%)	2 (10.5%)	1 (5.3%)

(Percentages may not equal 100% due to rounding error of +/- 0.1%)

Summary

From the data collected, one can conclude that more than 50% of the class expected that the course would require more or significantly more time. However, upon the completion of the course, only about 16% of the students felt this way. In relation to overall effectiveness, nearly a third of the student expected the course to be less effective while nearly another third expected the course to be more effective . Upon completion, only 11% believed the class was a less effective learning experience while nearly 58% believed the class was a more or significantly more effective learning experience. Regarding the effectiveness for aiding course material comprehension and level of satisfaction using specific instructional tools student, the responses suggest that the majority of students believed that the digitized lectures were effective. In addition, from the data collected, the students preferred Email over the ChatRoom environment.

Currently, there exist many possibilities for instructors who wish to design an Internet-based course. Among the benefits of Internet-based instruction is the ability to access students who otherwise could not be reached. Unfortunately, little documentation as to the effectiveness of these technologies is available. Once completed, this study should provide a greater degree of insight as gained through the examination of a specific Internet-based course. The current and future results should provide instructors, regardless of discipline, with statistical evidence as to the effectiveness of a variety of Internet-based technologies.

References

1. Khan, B. H. (1997). (Ed.) *Web-Based Instruction*. Englewood Cliffs, New Jersey: Educational Technology Publications, Incorporated.

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