USING FLEXIBLE AND BLENDED LEARNING ENVIRONMENTS FOR A LARGE PRODUCTION OPERATIONS MANAGEMENT CLASS

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ABSTRACT

Due to economic and logistical constraints, many business colleges are attempting to deliver core courses to large audiences. One such course examined in this study is Production and Operations Management class where large is defined as 80 or more students in the lecture hall. This approach is effective in rationing resources and reducing the human resource costs of providing a core course. In addition, it can lead to standardization in teaching and assessments particularly when the large section is the only section offered. Despite the positive gains there are some challenges. Large class size, the complexity of operations management concepts and the variety of student backgrounds can lead to difficulties in achieving learning outcomes. To address these issues, blended and flexible learning environments/methodologies have been shown to be potentially effective in addressing such challenges. This paper describes the use of online tutorials developed with Adobe Captivate™ to support student learning of operations management techniques in large classes as well as discussing the integration of the Captivate™ exercises into the learning flow. The results from this study indicate that online tools can play role in the teacher-student relationship--resource delivery, mentorship and assessment and as such help assist colleges meet the challenges of economic and logistical restraints while still delivering the same level of rigorous knowledge.

Keywords: Learning outcomes, blended learning methodologies, online tutorials, course assessment

INTRODUCTION

Production and Operations Management is a survey course required in many business schools as part of the business core curriculum. Students learn how to apply the basic analytical models to operation decisions involving topics such as scheduling, production technology, inventory management, quality assurance, just-in-time, and production. Faculty teaching operations management tend to find students uninterested in the course content because it appears to be irrelevant to their intended careers, and burdens them with sometimes difficult mathematical and statistical concepts. Due the combination of lack of interest in the course and quantitative nature, students tend to perform poorly.

To address these issues, faculty teaching operations management often seek ways to make the material more accessible and understandable to students, especially as large class size limits opportunities for one on one interactions in the classroom. Typically when the class size increases faculty find themselves spending increasingly more time in office hours, or the school supplies student tutors. Either way, this increase in class size often results in an increase in human resources costs. Some specific examples

would be a direct cost of hiring more student assistants as well as the loss of faculty research and service productivity due to an increased focus on answering student questions.

Flexible learning is a learning environment where students can access learning resources, on- or off-campus, at times and in contexts that are best suited to the student rather than the teaching staff. Blended learning is defined as a learning environment that combines face-to-face and online learning [4].

This new paradigm of online education has spawned a rich literature on the effectiveness and efficiency of various forms of electronic teaching tools, from full online courses to web-assisted, lecture-based courses [2] [8] [3] [6] [1]. Recent studies suggests that flexible and blended learning environments provide an improvement in learning efficiency for the school but students with access to online resources are not necessarily more likely to achieve learning outcomes [5] [7] [2]. In fact, the number of flexible and blended learning courses has increased since the introduction of e-learning technologies. In 1996, the National Center for Education Statistics reported that 34% of higher education institutions offered distance learning programs. In 2006, 66% - almost twice that of those in 1996 - offered some form of distance education, with more than 90% of the courses offered online El-Zein [2] demonstrated that, when integrated well, blended and flexible learning environments especially using e-tools can be effective when teaching computational skills to students.

This paper discusses the design, development and implementation of Captivate™ tutorials into the Production and Operations Management class and describes a learning environment that integrates the tutorials with e-learning and face-to-face interaction. The aim of this integration is to increase the number of students who achieve the required learning outcomes and reduce the percentage of students who fail. While other methods for improving learning outcomes have been suggested in the literature, e-learning remains more attractive because of its potential cost-effectiveness in terms of student time and financial expenditure [2].

CURRICULAR CONTEXT

The Production and Operations Management course introduces students to basic definitions and concepts in operations. Topics such as decision making, project management, forecasting, total quality management, control chart techniques, queuing theory, inventory theory and supply chains are typically covered. Typical learning outcomes for the course include:

1. Understanding the strategic role of operations within business.
2. Applying quality concepts such as statistical process control.
3. Forecasting using regression models and time series methods.
4. Understanding and using tools related to project management.
5. Understanding the strategic importance of supply chain management.
6. Understanding and using basic concepts and models related to the planning and control of inventory and operations processes.

The course is usually aimed at junior year business college students as such a large component of the class aims to improve students' skills at analyzing quantitative information to solve operational problems and improve operational and tactical level decision making.

In this study, students were given a one hour lecture each week, after which they use the online Captivate™ tutorials to reinforce and practice simulations of the current lecture and when warranted material from previous lectures to show the interrelationships of concepts. They are asked to solve a particular problem, with help and guidance from the Captivate™ simulations. The use of the Captivate™ material is voluntary. Following typical course design, students are given weekly review quizzes on the week's topic and then four major projects that integrate various concepts. Typically forecasting and cost management are always a component of the major projects.

The topical quizzes are given online and include a combination of multiple choice, multiple select, and fill-in-the-blank questions. If students have problems with the quizzes they have the choice of posting the question on the discussion board, emailing the professor, attending office hours, or discussing the problem at the beginning of class. Questions on the discussion board, as well as emailed communications helped the teaching staff keep track of the kind of difficulties arising in the class, which may then be specifically addressed by instructors during lectures.

Three of the exams were given in class for the purpose of assurance of learning. The last exam was given online to give students the flexibility of completing it before exam period. Only those exams given in class are used to evaluate student performance since the last exam cannot assure that the student completing the assignment is the student enrolled in the class. It was also weighted such that the student's overall grade could not significantly improve (e.g., move from a B to an A) but the student could potentially go down a letter grade if not completed at all.

EVALUATION OF CAPTIVATE™ MATERIAL

Captivate™ is a commercially available product from Adobe Inc. Adobe® Captivate 3 software enables anyone to rapidly create powerful and engaging simulations, scenario-based training, and robust quizzes without programming knowledge or multimedia skills." (http://www.adobe.com/products/captivate) It has been used by the european history e-learning project to help set up presentation for the history classroom (http://www.e-help.eu/course/notes/e-help_captivate_delegate.pdf) as well as by the University of Massachusetts also has Captivate™ tutorial sessions available for faculty to help with creating blended/flexible environments (http://www.lib.umd.edu/UES/captivate.html).

Two direct and two indirect forms of evaluation were used to assess the impact of the Captivate™ material. The direct evaluations included questions were placed on the regular semester instructor evaluation and a feedback survey students were asked to complete mid-semester. Indirect evaluations included student performance on the quizzes and in-class exams and student queries and complaints about the Captivate™ material itself. The end-of-semester scores for the course reflected the degree of overall student satisfaction. Student performance in quizzes and exams was considered a measure of the extent to which learning outcomes were being achieved. Finally, a qualitative assessment of the impact of Captivat™e material on student satisfaction was made by qualitatively monitoring the change in students' complaints and queries about the material itself.

The control semesters for this course were Fall 2007 and Spring 2008. During these two semesters, students did not have access to the Captivate™ material. Instead student tutors were used to provide assistance to the students on quizzes. The Captivate™ material was introduced in Fall 2008 and was used Fall 2008 and Spring 2009. The feedback survey was given to students in week 8 which is mid-semester for the college. Students were asked to fill in an anonymous questionnaire about the course, which included the following question about the Captivate™ material:

How useful did you find the Captivate™ material in helping you to learn operations management concepts:

1. Very useful
2. Fairly useful
3. Not so useful
4. Not useful at all
5. Have not used the Captivate™ material

63 and 70 students responded to the questionnaire in Fall 2008 and Spring 2009, respectively. Each section of the class from Fall 2007, Fall 2008, and Spring 2009 had 88 students enrolled in the class. Survey statistics for the Captivate™ question is shown in Table 1 for Fall 2008 and Spring 2009.

	Fall 2008	Spring 2009
N	63	70
Mean	2.11	2.14
Median	2	2
Mode	2	1
Std. Deviation	1.05	1.01
Variance	1.10	1.02
Range	4	3
Minimum	1	1
Maximum	5	4

Table 1. Statistics for Fall 2008 and Spring 2009 for the Captivate Survey Question

The use of the Captivate™ material was tracked through the e-learning platform Desire2Learn. All of the students accessed at least one of the tutorials at some point during the semester. But since fewer than 100% completed the mid-semester feedback survey, possible selection bias must be kept in mind, with more involved students more likely to complete the questionnaire and answer the Captivate™ question. However, the consistency of the response for the two semesters increases confidence in the findings.

	Fall 2007	Fall 2008	Spring 2009
1. The course as a whole	4.10	4.32	4.28
2. Instructor's contribution to the course	4.12	4.18	4.32
3. Use of class time	0.00	4.22	4.39
4. Instructors interest in whether the student learned	4.24	4.28	4.32
5. Amount you learned in this course	4.24	4.30	4.35
6. Quality of online materials	4.17	4.25	4.29
7. Quality of in class handouts	N/A	4.33	4.36
8. Quality of course assessments as related to course material	4.07	4.30	4.33
9. Level of difficulty compared to other courses taken	4.27	4.45	4.29
10. Level of difficulty compared to other courses taken in the business college	4.20	4.28	4.33
11. Level of difficulty compared to courses taken this semester	4.20	4.32	4.37
12. Evaluative techniques	4.20	4.33	4.35
13. Clarity of student responsibilities and requirements	4.22	4.29	4.25
14. Course organization	4.20	4.22	4.29
15. Sequential presentation of topics	4.24	4.21	4.48
16. Instructor's use of examples and illustrations	4.05	4.29	4.48
17. Clarity of instructor's voice	N/A	4.37	4.43
18. Student confidence in instructor's knowledge	4.27	4.17	4.40
19. Instructor's enthusiasm	4.12	4.25	4.33
20. Explanations by instructor	4.17	4.16	4.33
21. Answers to student questions	4.22	4.28	4.52
Overall	4.18	4.28	4.36

Table 2. Student Evaluation of Course in Fall 2007, Fall 2008 and Spring 2009.

Students evaluated the courses each semester using the questions listed in Table 2. The questions with N/A were not asked during in Fall 2007. Each question is rated using a Likert scale of 1 to 5 where 5 is the highest possible opinion. As the results indicate, there was no major shift in student appreciation for the course but there was no decline in appreciation when the course was moved from a 100% face-to-face model to a blended model. The online materials in the Fall 2007 were lecture notes and online quizzes. The online materials for Fall 2008 and Spring 2009 were the lecture notes, online quizzes and the Captivate™ tutorials. The opinions towards the quality improved but the majority of the students still tend to rate the material as a 4. This is an indicator that the overall course and learning experience was not harmed with the implementation of the Captivate™ tutorials.

OTHER RESULTS

Impact on Number of Questions from Students

In addition to evaluating the Captivate™ material, impact on professor productivity was also measured in terms of the number of questions the professor had to answer. The number of questions about quiz performance decreased after the Captivate™ material was introduced. The number of questions raised by students in Fall 2007 was 138, and 46 and 49 in Fall 2008 and Spring 2009 respectively. The questions were fairly evenly distributed across topics. When comparing the questions about the quizzes and student performance, more than 90% of the concerns came from students who had not accessed the Captivate™ material. The reduction in time spent responding to concerns about performance indicates a potential cost-effectiveness of the Captivate™ material especially since the Captivate™ material replaced a lecture as well as student tutors.

Cost Effectiveness

One of the objectives of the Captivate™ tutorials is to provide students with a quality learning resource in a cost-effective manner. It is clear that to benefit from Captivate™ requires high upfront investment in developing the tutorials. But the upfront costs are worthwhile in a course like Operations Management where the course material is consistent from year to year with at most minor changes, making the material usable in subsequent years. This type of investment may be useful in other courses that are highly quantitative and for which chairs are considering moving to larger sections.

CONCLUSION

University teaching is undergoing changes due to constrained resources due to budgetary concerns, new paradigms about student expectations, and the proliferation of technology to support e-learning. Despite the increase in class sizes, instructors are still expected to help students achieve learning outcomes. While lecturing remains the core of the learning process, the teacher no longer needs to be the sole source of material with most of the workday dedicated to answering student inquiries and concerns, a problem that is exacerbated as class size increases. The results shown in this paper suggest the role online tools can play in the teacher-student relationship--resource delivery, mentorship and assessment. The blended-learning approach, including a flexible online tool to help production and operations management students, has been successful in improving student satisfaction with the course, re-focus the curriculum on the ability to analyze operational problems, and reduce the rate of student failures. In addition, the online tool has led unambiguously to an improvement in the quality of the one-on-one support and a reduction of its cost in a class of over 90 students. However, it is difficult to characterize

with precision the impact of Captivate™ tutorials on course quality because of a number of poorly-controlled variables from year to year. Yet, a convergence of quantitative and qualitative measures gives a strong indication that such online tools can play a critically positive role, provided their specific function in achieving learning outcomes are elicited as part of a learning activity map for the course.

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