Analysis of a Student-Centered, Self-Paced Pedagogy Style for Teaching Information Systems Courses

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ABSTRACT

The entry-level skills for students enrolling in a college-level information systems course can vary widely. This paper analyzes the impact of a "student-centered" pedagogy model, in which students use a self-paced approach for learning the material in an introductory information systems course, with pre-assigned dates for lectures and for assignment/exam deadlines. This new paradigm was implemented in several sections of an introductory information systems course over a two-semester time span. Under the new model, tutorial-style textbooks were used to help students master the material, all other materials were available online, and all exams were given using a hands-on, task-oriented online testing package, which included a multiple-choice/true-false component to test student understanding of the conceptual portion of the course. An anonymous student survey was used to gain student perceptions of the level of learning that took place under the new paradigm, as well as to measure student satisfaction with the course design, and a pre-/post-test was used to provide a measure of student learning.

Keywords: Pedagogy, Teaching Style, Self-paced, Flexibly-structured, Student-centered, Assessment.

INTRODUCTION

Students entering college can bring with them a wide range of "information systems" knowledge and skills. Many students have been using the Internet, e-mail, spreadsheet, and word processing software throughout elementary and high school. Other students enter college with little or no computer experience. As a result, the entry-level skills for students enrolling in a college-level information systems course can vary widely. When teaching a course with such a wide range of skill levels, both in terms of breadth and depth, the traditional method of maintaining the same schedule for all students essentially targets students in the middle range, which can result in boredom for the more advanced students and frustration for the less knowledgeable students. This dilemma led to the development of a "student-centered" model in which students use a self-paced approach, with pre-assigned dates for lectures and for assignment/exam deadlines.

This new paradigm was implemented in several sections of an introductory information systems course over a two-semester time span. Under the new paradigm, tutorial-style textbooks that students could work through at their own pace were utilized to help students develop the knowledge and skills they were expected to attain throughout the semester. All material was available online through WebCT [3], a web-based educational environment tool, and all exams were given using SAM [2], a hands-on, task-oriented online testing package which includes a multiple-choice/true-false component to test student understanding of the conceptual portion of the course. Both a student survey [1] and a pre-/post-test requirement were used to assess student learning and student satisfaction with the student-centered model.

DATA COLLECTION

At the beginning of the semester, students were required to complete the pre-test. This same exam was given as a post-test, after all other requirements in the course had been completed, to provide a measure of student learning. After completion of the post-test, each student was asked to complete an on-line, anonymous survey, which was used to gain student perceptions of the level of learning that took place, as well as student satisfaction with the course design.

Pre-/Post-test

As indicated above, a pre-test was given to the students at the beginning of the semester and was again given as a post-test at the end of the semester. The material on this particular test is not directly related to material taught in the class, but is rather a test of technological knowledge that students are expected to pick up through the general education component of the curriculum. However, some of the questions on the pre-post test relate to concepts that MIS faculty hope students pick up while taking the introductory information systems course, so it is expected that their overall score would increase. The test was given in order to determine if there was a significant increase in student learning in these areas as a result of having taken the course. After all, if student satisfaction is increased, but little student learning has taken place, the new paradigm is flawed.

Student Survey

A five-point Likert scale was used to rate student-perceived skill levels, both prior to taking the course and after completing the course, with a five being the highest skill level. Students were asked to rate their overall computer technology skills, as well as their skills in each of the following areas, both prior to and after completing the course: word processing, webpage design, spreadsheets, database development and management,

and presentation software (e.g. PowerPoint). They were also asked to rate their knowledge of computer concepts, both prior to and after completing the course. In addition, they were asked to indicate their preference of the flexibly-structured paradigm versus the traditional model of teaching the course. Again, a five-point Likert scale was used, with a three indicating no preference of one over the other. Similarly, they were asked to rate whether they felt that they learned more or less in the flexibly-structured paradigm versus if they had taken the same course taught using the more traditional lecture-style model, with a three indicating that they learned about the same, a five indicating that they learned much more, and a one indicating that they learned much less. Additionally, students were asked to rate such things as accessibility of the instructor, accessibility of computers and applicable software, instructor effectiveness in answering questions, instructor availability for consultations outside of class, instructor knowledge about the subject matter, the quality of the course, etc.

Open-ended questions were also included in the survey, including a place for students to indicate what they *liked* about the flexibly-structured nature of the course and a spot for them to indicate what they *disliked* about the flexibly-structured nature of the course. Other open-ended questions referenced aspects of the course that they found particularly good, helpful, or enjoyable, as well as comments on how the course could be improved. Similarly, they were asked to indicate what would help them learn more easily in a class of this nature, and they were asked to comment on materials that were available online, homework assignments, the tutorials, and the testing package.

Moreover, a "personal" component was included in the survey. In this section of the instrument, students were asked to indicate such things as their age, gender, student classification (e.g. freshman, sophomore, etc.), major program of study, marital status, number of children, number of hours worked per week (if applicable), completion date for the course, anticipated grade, composite ACT score (if known), number of credit hours in which they were enrolled, etc. The purpose of this section was to help assess whether any of these factors had a significant impact on student preference for the flexibility-structured paradigm, student satisfaction with the model, or student perceptions of the level of learning attained in the course.

ANALYSIS OF SELF-PACED PARADIGM

Both student perception and student performance in the student-centered model were statistically tested. Forty-nine students completed both the pre- and post-test in the spring semester and forty students completed both in the fall.

TABLE 1
Two-Sample Test of Means

	Spring 2004		*Fall 2004*	
	Post	***Pre***	***Post***	***Pre***
Mean Test Score	0.8384	0.7816	0.8350	0.7720
Variance	0.0057	0.0070	0.0074	0.0112
Observations = n	49	49	40	40
t Stat (calculated t)	3.52		2.92	

A t-test was used to test for the difference between means at a level of significance of 0.25 or 2.5%. For the spring data, the critical t for a one-tail test is 1.985 and for a two-tailed test is 2.277. For the fall data, the critical t for a one-tail test is 1.991 and for a two-tailed test is 2.285. As shown in Table 1, the results indicate a statistically significant difference (increase) in the scores of the post-test when compared with the pre-test. These results add credence to the conclusion that learning did in fact take place for students taking the course under the student-centered pedagogy model. Additional tests were run to determine whether statistical differences exist between the spring and fall pre-/post-test results. No statistical differences were found between the pre-test results, nor between the post-tests results, when comparing the spring and fall test scores.

As indicated above, a five-point Likert scale was used to rate student-perceived skill levels, both prior to taking the course and after completing the course. Although numerous questions relating to access to software, availability of instructor outside of class, etc. were included in the survey, only those questions directly related to the impact of the student-centered model on student learning and student satisfaction with the model are addressed in the table below.

TABLE 2
Means and Variance of Select Student Survey Questions

	Spring 2004		*Fall 2004*	
Question	***Mean***	***Sample Variance***	***Mean***	***Sample Variance***
Q 5 Prior Overall	3.05	1.02	3.12	0.71
Q 6 Post Overall	3.77	0.51	3.90	0.29
Q 7 Prior Word	3.68	0.78	3.54	0.85
Q 8 Post Word	4.09	0.46	4.10	0.34
Q 9 Prior Webpage	2.41	1.18	2.37	0.99
Q10 Post Webpage	3.57	0.48	3.34	0.53
Q11 Prior Excel	2.77	1.34	2.71	0.81
Q12 Post Excel	3.64	0.66	3.56	0.60
Q13 Prior Access	1.84	0.88	1.71	1.01
Q14 Post Access	3.07	0.58	2.90	0.74
Q15 Prior PowerPoint	3.14	1.33	3.29	1.21
Q16 Post PowerPoint	3.98	0.39	3.98	0.47
Q17 Prior Concepts	2.30	1.10	2.51	1.26
Q18 Post Concepts	3.11	0.66	3.27	0.50
Q19 Flexible vs Trad.	4.32	0.69	4.17	0.85
Q24 Learning	3.52	0.49	3.66	0.48

The first item in Table 2, Q5 (Prior Overall), provides the mean score, and the sample variance, of the skill level students perceived themselves as having prior to starting the course, in terms of overall computer technology skills. Q6 (Post Overall) provides the mean score, and the sample variance, of the skill level students perceived themselves as having after having completed the course, in terms of overall computer technology skills. Questions 7 through 18 provide the same type of data, but with a focus on individual components of the course, such as the Word component, followed by Webpage Design, all the way through to the Computer Concepts component (Q17-18). As shown in Table 2, the mean skill level for each component of the course received a higher rating following the completion of the course when compared to the perceived skill level of students entering the course. Table 3, below, provides the results of a t-test used to determine whether there is a significant difference in the perceived skill levels prior to taking the course

and perceived skill levels after having completed the course.

Question 19 in Table 2, above, provides a rating for student preference between the flexibly-structured model utilized in the class and a traditional format of daily lectures and pre-assigned exam dates. A four represents a preference for the flexibly-structured model and a five represents a strong preference for the flexibly-structured model. As the data indicates, students showed a fairly strong preference for the flexibly-structured model. Question 24 provides a rating for the level of learning that took place in the student-centered model when compared to a more traditional format, where a score of three indicates no difference and a score of 4 indicates more learning took place as a result of the student-centered model. The data suggests that students felt slightly more learning took place under the new model when compared to a more traditional setting.

TABLE 3
Tests of Differences between Means

	Spring 2004 n=44 level of significance = .025 or 2.5% critical one-tail t = +1.988 critical two-tail t = ±2.281		***Fall 2004*** n=41 level of significance = .025 or 2.5% critical one-tail t = +1.990 critical two-tail t = ±2.281	
	Prior Overall	***Post Overall***	***Prior Overall***	***Post Overall***
Mean	3.04545	3.77273	3.12195	3.90244
Variance	1.02114	0.50529	0.70976	0.29024
t Stat	3.90468		4.99756	
	Prior Word	***Post Word***	***Prior Word***	***Post Word***
Mean	3.68182	4.09091	3.53659	4.09756
Variance	0.78013	0.45666	0.85488	0.34024
t Stat	2.44005		3.28571	
	Prior Webpage	***Post Webpage***	***Prior Webpage***	***Post Webpage***
Mean	2.40909	3.56818	2.36585	3.34146
Variance	1.17759	0.48362	0.98780	0.53049
t Stat	5.96530		5.06979	
	Prior Excel	***Post Excel***	***Prior Excel***	***Post Excel***
Mean	2.77273	3.63636	2.70732	3.56098
Variance	1.34249	0.65539	0.81220	0.60244
t Stat	4.05296		4.59573	
	Prior Access	***Post Access***	***Prior Access***	***Post Access***
Mean	1.84091	3.06818	1.70732	2.90244
Variance	0.88108	0.57664	1.01220	0.74024
t Stat	6.74265		5.78073	
	Prior P-Point	***Post P-Point***	***Prior P-Point***	***Post P-Point***
Mean	3.13636	3.97727	3.29268	3.97561
Variance	1.32981	0.39482	1.21220	0.47439
t Stat	4.24744		3.36715	
	Prior Concepts	***Post Concepts***	***Prior Concepts***	***Post Concepts***
Mean	2.29545	3.11364	2.51220	3.26829
Variance	1.09672	0.66121	1.25610	0.50122
t Stat	4.09332		3.65212	

As shown in Table 3, in each test of statistical difference, the null hypothesis that the means are equal is rejected in favor of the conclusion that there is a statistical difference in means. In other words, there was a statistically significant increase in the student skill level in each area taught in the course, as perceived by students, as a result of having taken the course.

Additional tests were run for both sets of data to determine if there was a significant difference in student responses based on age, gender, major program of study, marital status, etc., but none were found. Similar tests were run to determine if there was a significant difference in student responses for those who worked compared to those who did not work, but no differences were found. A comparison of underclassmen (freshmen/ sophomores) to upperclassmen (juniors/seniors) could not be conducted, due to the small number of upperclassmen (two juniors and one senior in the spring class and one lone senior in the fall class). Moreover, no statistical differences were found between the pre-test results, nor between the post-tests results, when comparing the spring and fall 2004 test scores.

The open-ended questions were also analyzed. Of the 40 participants in the spring who responded to the open-ended question, "What did you LIKE about the flexibly-structured nature of this course?" 37 respondents (84% of the 44 students who completed the survey) indicated that they liked the ability to work at their own pace, to work ahead if they so desired, etc. Similarly, of the 36 participants who responded to this question in the fall, 34 respondents (83% of the 41 students who completed the survey) indicated that they liked the flexibility of the course, the ability to work ahead, the ability to work at their own pace, etc.

Students were also asked, "What did you DISLIKE about the flexibly-structured nature of this course?" In response to this question, one student in the spring indicated that he/she was often tempted to skip class because he/she was ahead and would not be missing anything, another indicated that he/she didn't like the fact that "not everyone was on the same page," a third respondent indicated some concern over that fact that we "didn't go over a lot of things as a class," a fourth indicated "I found myself slacking a lot of the time – I think I just need a little bit more structure – homework due almost every day kind of thing," three other students also indicated a tendency to procrastinate, and one student commented that it must be "harder for the teacher to know what to cover in class." Similarly, in the fall, three students indicated that the flexibility of the course led to procrastination, resulting in late assignment submissions, and four students indicated that the work load was too much for them to handle effectively. In other words, a few students seemed to indicate a preference for traditional, lecture-style courses and a few seemed to find it easier to procrastinate in a class of this nature.

When students were asked to comment on which aspects of the course they found to be particularly good, helpful, or enjoyable, the answer repeated the most often, both fall and spring, was the flexibility of the course and the ability to work at one's own pace. In the fall, a few students also commented on the accessibility of the instructor when they had questions, which they found helpful. When students were asked how the course could be improved, a couple students in the spring class indicated that the instructor should spend a little more time lecturing and, conversely, a couple students indicated that the instructor should spend a little less time lecturing. In the fall,

only one student indicated a preference for more lectures whereas three students indicated frustration when the instructor took control of student computers to demonstrate concepts that they felt could be picked up on their own.

CONCLUSION

The statistical analyses and results provide an indication that students think the alternative teaching paradigm, in which students work at their own pace and may complete the course early, if they so desire, was successful, at least in terms of student learning and student satisfaction. As the data show, there was not a significant difference between the two semesters in attitude and/or performance. It should be noted, however, that the instructor using the student-centered model did not teach any sections of the course using the more traditional "lecture-centered" paradigm in the spring and fall, so data are not available to provide a direct comparison between the two models.

The student-centered paradigm outlined above is especially beneficial in a course in which students bring a wide range of knowledge and skills to the class. Most students seem to prefer the flexibility that the paradigm provides, allowing them to work ahead on select subjects, as dictated by their individual schedules. Conversely, a few students commented that the flexible structure of the new paradigm can also result in the tendency to procrastinate, and a couple of students indicated a preference for the structure of a traditional class, to keep them on task.

One advantage of a class of this nature is the ability of the instructor to work more closely with individual students during class-time. At the same time, a disadvantage is that on any particular day, students may be working on a wide range of different topic areas, depending on where they are in the class. Therefore, the instructor has to be flexible and knowledgeable in the subject matter and application packages, in order to be ready to answer the variety of questions that can arise during any class period.

RECOMMENDATION

It might be interesting to try to utilize a "learning-style" pre-test, to ascertain which students would be most apt to benefit from a course of this nature, before placing students into the sections taught under the flexibly-structured paradigm. For those students who prefer more structure and feel they would benefit from a more traditional lecture-style class, the alternative model is probably not a good option. Moreover, since the implementation of a pre-/post-test format in all MIS courses would be valuable for assessment purposes, adding such a requirement to all MIS sections, regardless of the instructor, would allow statistical comparisons both between and within the courses taught under the different styles. At the same time, it is important to keep in mind that other factors will have an impact on the results, such as the ability of individual instructors to relate to students and answer questions effectively, the time of day that the course is taught, the particular skills of the students entering the course, etc. so the researchers must be careful not to jump to unsubstantiated conclusions beyond those justified by the general statistical analysis on the pre/post test scores.

REFERENCES

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