International Journal for the Scholarship of Teaching and Learning

Volume 1 | Number 1 Article 11

1-2007

Effects of Information Distributions Strategies on Student Performance and Satisfaction in a Web-Based Course Management System

Margaret C. Lohman
Penn State University – Harrisburg, mlohman@psu.edu

Effects of Information Distributions Strategies on Student Performance and Satisfaction in a Web-Based Course Management System

Abstract

The effects of three information distribution strategies in a course management system (CMS) on student performance and satisfaction were investigated. Analysis of the data found that the distribution of instructional materials in class resulted in significantly higher student performance on an end-of-the-semester technical knowledge test than when instructional materials were available to students via a CMS either at the beginning of the semester or one week before each of the class sessions in which the materials were to be covered. However, no significant differences were found among the three information distribution strategies on total points earned in the course or on student reactions toward the instructional experience. Possible explanations for these findings and implications of the findings for theory and practice as related to utilizing a CMS in instructional programs in higher education are provided.

Keywords

Information distribution strategies, Course management system, Web-based course management system

Effects of Information Distributions Strategies on Student Performance and Satisfaction in a Web-Based Course Management System

Margaret C. Lohman
Penn State University – Harrisburg
Harrisburg, Pennsylvania, USA
mlohman@psu.edu

Abstract

The effects of three information distribution strategies in a course management system (CMS) on student performance and satisfaction were investigated. Analysis of the data found that the distribution of instructional materials in class resulted in significantly higher student performance on an end-of-the-semester technical knowledge test than when instructional materials were available to students via a CMS either at the beginning of the semester or one week before each of the class sessions in which the materials were to be covered. However, no significant differences were found among the three information distribution strategies on total points earned in the course or on student reactions toward the instructional experience. Possible explanations for these findings and implications of the findings for theory and practice as related to utilizing a CMS in instructional programs in higher education are provided.

Introduction

In recent years colleges and universities have made substantial investments in tools to facilitate the integration of technology into instruction. One of the tools being widely embraced by institutions of higher learning is web-based course management systems (CMSs). A 2003 report indicated that more than 80 percent of U.S. colleges and universities were utilizing CMSs (Harrington, Gordon, & Schibik, 2004). The cost of CMSs is significant, with many institutions spending millions of dollars on CMS development, licensing, faculty training, and student support services (Sausner, 2005). The University of Michigan, for example, recently estimated that it will spend approximately $6.8 million dollars over a three-year period on the development of a customized CMS.

Surely, that level of expenditure is expected to reap rewards in terms of improving the quality of student learning and performance. Indeed, Sausner (2005) quotes the Vice President and CIO of the University of Cincinnati, Fred Siff, as stating that "the money [spent on CMSs] is inconsequential compared to the value and the importance because you're finally affecting the classroom." This statement sounds impressive, but makes one wonder how these web-based course management systems are affecting the classroom and whether those effects have a positive impact on student performance and satisfaction.

Course management systems typically have the capacity to assist in a wide range of instructional tasks, including delivering course content, facilitating interaction among instructors and students, and evaluating learner performance (Bonk, Cummings, Hara, Fischler, & Lee, 1999). While CMSs have such capabilities, it has been widely reported that the most frequently used component of a CMS is its content presentation tools (Morgan,

https://doi.org/10.20429/ijsotl.2007.010111

2003; Nicoll & Laudato, 1999). Instructors typically use content presentation tools to distribute syllabi, class notes, participant handouts, and grades to students via the web.

However, the practice of distributing such course information on-line may conflict with several principles of effective instruction. One of those principles is that for optimal levels of learning to occur, regardless of the type of learning outcome desired, new information should be arranged and presented in such a way that instruction starts with familiar material and builds new knowledge through a step by step progression of facts and connections to arrive at the desired new understandings (Gagne & Medsker, 1996; Knowles, 1986). A concern about honoring this instructional principle in today's classrooms deals with the distribution of course materials via the web. For example, PowerPoint presentations are increasingly used in instruction, especially in post-secondary classrooms. When PowerPoints are made available on-line before a class session, students typically bring printouts of the PowerPoints to class as a guide for following the instructional process. The result is that it becomes more difficult for instructors to make appropriate adjustments to lessons without confusing and possibly irritating some students.

A second, related principle of effective instruction that appears to conflict with the distribution of course materials via a CMS is that the timely presentation of new information during instruction helps learners focus on the learning tasks at hand and promotes their motivation to engage in planned learning activities (Joyce & Weil, 1996). This principle calls for instructors to continually check on student learning as a lesson progresses and, based on this on-going assessment, introduce new material at optimal moments in the lesson and make appropriate adjustments to the rate and way in which the new material is presented. However, some control over this critical instructional task is lost when course materials are made available on-line to learners anywhere from a day to a semester before the class sessions in which the materials are presented. Such advanced access to instructional content may result in student confusion and/or boredom and, as a consequence, may be counterproductive to student performance and satisfaction.

Most empirical studies of CMSs have used survey research designs and provide little assistance in resolving these possible conflicts between instructional theory and practice. Specifically, most of the survey studies have found while students like the convenience of having course materials on-line (Bonk et al., 1999; Morgan, 2003), they do not believe that on-line access to course materials impacts their learning or performance (Young, 2004). Few studies, if any, have used experimental methods to examine the impact of distributing course materials via CMSs on academic performance and satisfaction.

Further investigation of this topic is of great significance to undergraduate and graduate education in colleges and universities. Decisions regarding the delivery of instruction must be based not only on the technological capabilities of CMSs, but also on the impact that they have on student performance and satisfaction. Empirical studies that provide such information will provide greater insights that can be used to evaluate and possibly reconsider the ways that instructors use CMS tools in their courses.

Theoretical Framework: Disconnects between Instructional Theory and CMS Practices

For over 40 years, Gagne's nine events of instruction have served as a framework for designing effective instructional programs (Kemp, Morrison, & Ross, 1998; Smith & Ragan, 1999). The nine external events of instruction and the internal learning processes they promote (noted in parentheses) are: (1) Gaining attention (reception), (2) Informing learners of the objective (expectancy), (3) Stimulating recall of prior learning (retrieval to working memory), (4) Presenting the content (selective perception), (5) Providing learning guidance (semantic encoding), (6) Eliciting performance (responding), (7) Providing feedback (reinforcement), (8) Assessing performance (retrieval and reinforcement), and (9) Enhancing retention and transfer (retrieval and generalization). While instructional methods, such as expository and inquiry methods, sequence these instructional events in different orders, it is widely accepted that effective instruction does involve the use of all nine events.

An important instructional principle underlying the effective design of these instructional events concerns the sequencing and organization of new information (Gagne & Medsker, 1996; Smith & Ragan, 1999). Specifically, this instructional principle dictates the arrangement and presentation of new information in such a way so that instruction starts with familiar material and builds new knowledge through a step by step progression of facts and connections to ultimately arrive at new understandings. This instructional principle infers that the amount and complexity of instructional content should be continuously adjusted as a lesson progresses in response to the pace and degree of learning that is occurring in the classroom. This type of information presentation strategy is likely to promote high levels of motivation and achievement of learning outcomes. Likewise, too complex or too much information presented too soon may inhibit a learner's ability and/or desire to connect new information to current knowledge and, ultimately, diminish his/her ability to make meaning out of the learning experience.

A second principle of effective instruction is that the timely presentation of new information is critical to the achievement of a program's learning objective (Smith & Ragan, 1999). This principle is anchored in the notion that the instructor or another instructional medium, such as a computer simulation, should decide when new information is presented and this decision should be made in concert with the instructional plan that has been designed to lead learners through the nine events of instruction (Knowles, 1986). As a consequence, many instructional theorists assert that when the instructor or instructional medium controls the time at which new information and materials are presented during a lesson, it enhances the focus of learners on the task at hand and promotes their motivation to engage in the planned learning activities (Joyce & Weil, 1996). Support for this instructional principle can be found in previous instructional design studies that found that providing highly structured and clearly ordered course materials in advance tends to foster superficial, memory-level encoding, but impede the far transfer of material to new learning tasks (Wilson & Cole, 1992). A similar issue may arise when learners access course materials via CMSs. It is possible that such advanced access to course materials may provide so much organization and structure to new information that it actually impedes active processing of that new information and, thereby, leads to more superficial levels of student learning and lower levels of motivation.

These two conflicts between instructional theory and practice drive the need to look more closely at the capabilities of CMSs and how they are commonly used to promote student learning, performance, and satisfaction in post-secondary education. Bonk et al. (1999) created a ten-level continuum for integrating the web into instruction in higher education in an attempt to clarify the pedagogical choices that instructors should consider when using CMSs. Levels 1 through 4 of the continuum focus on tools for information–distribution: Level 1–Marketing the course and the course syllabus, Level 2–Student exploration of web resources, Level 3–Student-generated resources posted on the web, and Level 4–Course resources on the web. These first four levels provide students with alternative sources for course information rather than provide features of the course that cannot be acquired elsewhere. Levels 5–10 of the continuum are distinguished from the first four levels in that the learning activities and tasks embedded in these higher levels contain requirements of the course that are not provided elsewhere. These levels include: Level 5–Repurpose web resources, Level 6–Substantive and graded web activities, Level 7–Course activities extending beyond class, Level 8–web as an alternative delivery system for resident students, Level 9–Entire course on the web for students located anywhere, and Level 10–Course fits within larger programmatic web initiative.

Most CMSs possess the capabilities to provide instructional experiences at all ten levels of Bonk's continuum. However, the most commonly used component of a CMS is its content-presentation features, that is, Levels 1 though 4 of the web-integration continuum. For example, recent surveys at the University of Wisconsin (Morgan, 2003) and the University of Pittsburgh (Nicoll & Laudato, 1999) found that faculty used the content-presentation features (e.g. lecture notes, PowerPoint presentations, quizzes, and course announcements) much more frequently than the interactive features of CMSs (e.g. on-line bulletin boards and chat rooms). And, a recent nationwide survey of 4,373 students at 13 U.S. colleges echoes the findings from these two university surveys (Young, 2004). In spite of the technological capabilities of CMSs, these studies indicate that the instructional practice of conducting class discussions and activities in live classroom settings and limiting the use of CMSs to the presentation of course materials and information remains the norm.

In large part, the rapid and widespread adoption of content-presentation features of CMSs in higher education results from two prevailing beliefs, one held by students and the other by educational administrators. From the students' perspective, a key benefit of on-line access to course materials is convenience (Nicoll & Laudato, 1999). Students report that on-line access allows them to download course materials if and when they choose to do so and this level of control enhances their ability to prepare for course sessions and organize course materials.

Educational administrators have also embraced the use of content-presentation features in CMSs. In large part, institutional support for this feature of CMSs is predicated on the notion that on-line access to course materials promotes student learning and satisfaction (Nicoll & Laudato, 1999). A chief assumption underlying this notion appears to be that on-line access to course materials helps students prepare for and engage in class lectures and activities (Morgan, 2003).

Interestingly, while survey research studies have found that faculty and students both believe that students like the convenience of having course materials on-line (Bonk et al., 1999; Morgan, 2003), both groups also report that they do not believe that on-line access to course materials positively impacts student learning or performance (Harrington et al., 2004; Young, 2004). Few studies, if any, have used experimental research designs to study the effects of CMSs on academic performance and satisfaction.

As a consequence, the question of whether the distribution of course materials on-line enhances academic performance is presently unknown. Therefore, the purpose of this study was to examine the effects of information distribution strategies in a CMS on student performance and satisfaction in a university course. Three information distribution strategies were investigated: (a) on-line access to participant materials via a CMS at the beginning of the semester in which the materials were presented, (b) on-line access to participant materials via a CMS one week prior to each class session in which the materials were presented, and (c) no on-line access to participant materials—all materials distributed in class. Two research hypotheses were investigated: (1) In-class distribution of participant materials will result in higher levels of student performance than either type of CMS information distribution strategy, and (2) In-class distribution of participant materials will result in greater student satisfaction with the instructional experience than either type of CMS information distribution strategy.

Methods

The population and sample, research design, outcome measures, and data analysis procedures are described in this section.

Population and Sample

The target population for this study was students using CMSs in higher education. Graduate students at a large mid-Atlantic university were the experimentally accessible population. The participating university had implemented a CMS in 2001.

The sample was comprised of 52 students enrolled in 3 sections of a graduate-level research design course. This 14-week course met one evening per week and is a required course in three graduate programs: teaching and curriculum, health education, and training and development. Of the 52 students, 13 were enrolled in the Fall 2002 section, 20 were enrolled in the Spring 2003 section, and 19 were enrolled in the Fall 2003 section.

As shown in Table 1, data were collected on 10 attribute variables: (a) age, (b) gender, (c) educational level, (d) past academic coursework in research design, (e) graduate program in which currently enrolled, (f) Internet usage rate, (g) relevant prior knowledge of concepts and principles in research design, (h) learning style, (i) cognitive style, and (j) self-directedness. The last three variables (learning style, cognitive style, and self-directedness) were included in the study because they have been found to influence a person's decision about the sources and methods that they use to learn something new.

Table 1. Student attributes in courses where materials were distributed in class versus a CMS.

Attribute Variables	Materials Distributed in Class		Materials Distributed via CMS: At Beginning of Semester		Materials Distributed via CMS: 1 Week Prior to Each Class		
	n	%	n	%	n	%	F
Cognitive style							.576
Field dependent	4	30.8	10	50.0	8	42.1	
Field independent	9	69.2	10	50.0	11	57.9	
Educational level							.332
Bachelors	13	100	19	95.0	18	94.7	
Masters	0	0	1	5.0	1	5.3	
Gender							.889
Male	3	23.1	5	25.0	8	42.1	
Female	10	76.9	15	75.0	11	57.9	
Graduate program							2.968
Health Education	2	15.4	5	25.0	0	0	
Teaching & Curriculum	4	30.8	3	15.0	4	21.1	
Training & Development	6	46.2	12	60.0	15	78.9	
None listed	1	7.7	0	0.0	0	0	
Learning style							.284
Accommodator	4	30.8	9	45.0	6	31.6	
Diverger	1	7.7	3	15.0	5	26.3	
Assimilator	6	46.2	4	20.0	4	21.1	
Converger	2	15.4	4	20.0	4	21.1	
Past research design courses							2.229
Yes	5	38.5	2	10.0	3	15.8	
No	8	61.5	18	90.0	16	84.2	
	M	SD	M	SD	M	SD	
Age	35.6	8.60	35.4	8.57	35.5	8.74	0.003
Internet usage rate [a]	3.6	1.06	4.2	0.95	4.3	0.87	1.405
Prior research design knowledge [b]	8.3	1.80	7.8	1.88	8.1	2.22	0.259
Self-directedness [c]	238.9	26.94	226.3	19.28	227.5	27.02	1.214

Notes
No significant differences among the 3 treatment groups were found on any of the 10 attribute variables at $p < .05$.
a Scale for Internet usage rate: 1 (Never) to 5 (More than 5 times per week)
b Total possible points for the research design knowledge pretest = 15.
c Total possible points for the self-directedness assessment = 290.

Several instruments were used to collect these data. Six items were included at the end of a research design knowledge test to collect data on students' age, educational level, gender, past academic coursework in research design, graduate program in which currently enrolled, and Internet usage rate.

Kolb's Learning Style Inventory was used to assess students' learning styles. This inventory is a statistically reliable and valid 12-item assessment tool that identifies four learning styles: converger (prefers to learn by solving problems and doing concrete tasks), accommodator (prefers hands-on, people-oriented learning activities), diverger (prefers to learn by observing, brainstorming, and gathering information) and assimilator (prefers to learn by putting information into concise logical order) (Kolb, 1999). These four learning styles provide insights about one's preferences for solving problems, working in teams, and managing personal and professional relationships.

The Group Embedded Figures Test (GEFT) was used to assess a cognitive style called field dependence/independence (*Group embedded figures test*, 1971). The validity and reliability of the GEFT have been extensively documented. The assessment activity involves the identification of 18 simple geometric shapes that are embedded in complex figures; more field independent individuals tend to be more successful at identifying the shapes embedded within the complex figures. Previous studies have found that field-independent learners are more autonomous, better problem solvers, and more likely to succeed academically than field-dependent learners (Pithers, 2002).

The Self-Directed Learning Readiness Scale was used to assess self-directedness. This is a 58-item self-report instrument, designed to measure the complex of attitudes, abilities, and characteristics which comprise readiness to engage in self-directed learning (Guglielmino, 1995). This instrument has been widely used to examine the self-directedness of adults in professional areas such as medicine and business. Its validity and reliability have been extensively documented (Guglielmino, 1996). Total possible scores on the SDLRS range from 0 to 290.

Research Design

A non-equivalent control group design was used to examine the effects of three information distribution strategies in a CMS on student performance and satisfaction (McMillan, 2004). With this design, pretests on research design knowledge, cognitive style, learning style, and self-directedness were administered in the first class of the semester for each of the three treatment groups. In the ensuing 13 weeks of the semester, class notes and handouts were distributed to students using three different strategies. The first information distribution strategy involved providing students with all instructional materials in class and was implemented in the Fall 2002 semester. Only two features of the CMS were used with this class, the syllabus was posted on-line and the e-mail function was used to facilitate communication between the instructor and students. Because in-class distribution of course materials has been considered the traditional way of sharing course information, this treatment group was considered the control group. The second information distribution strategy involved posting class notes and handouts for all 13 class sessions on the CMS at the beginning of the semester. This strategy was implemented in the Spring 2003 semester. The third information distribution strategy, implemented in Fall 2003, was similar to the second strategy in that class notes and handouts were posted on the CMS. However, in this treatment group the materials were posted on the CMS only one week prior to the class session in which they were presented. At the end of the semester, posttests on research design knowledge and reactions toward the instructional experience were administered and the total number of points that each student earned in the course was computed.

Participation in the study was voluntary. None of the research study assessments factored into the grade students earned in the course. All 52 students enrolled in the three sections of the course agreed to participate in the study.

https://doi.org/10.20429/ijsotl.2007.010111

The instructional objectives, content, and activities were kept constant for all three treatment groups. The same instructor taught all three courses and kept a journal to record any questions, events, or issues that occurred in the three classes that may have related to the research study.

Outcome Measures

Two dependent variables were examined in this study: student performance and satisfaction with the instructional experience.

Student performance. Two assessments were used to evaluate student performance. First, a 15-item multiple-choice test was used to assess student knowledge of research design concepts and principles. The test items were selected from the instructor's manual of the research textbook that was used in the course (McMillan, 2004). Total possible scores on the test ranged from 0 to 15. A coefficient of stability was established through a test-retest procedure. In this procedure, 28 graduate students in 2 graduate classes during Summer 2002 took the test two times, two weeks apart. This procedure yielded a Pearson product-moment correlation coefficient of .73. The internal consistency of the test was also calculated, with a split-half correlation analysis producing a reliability coefficient of .71.

The second form of assessment was the total number of points earned in the course. Grades were based on the total number of points students earned during the semester on two research article critiques (110 points) and two multiple-choice exams (125 points), with the total possible points equaling 235.

Student satisfaction. Satisfaction with the instructional experience was assessed with a written survey. The survey asked students to indicate the degree to which they agreed with 16 statements concerning the content, design, instructor, and perceived impact of the course. In addition, one item asked students to indicate the degree to which the use of technology supported their learning in the course. The survey used 5-point Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree). The validity and reliability of this survey instrument have been established in previous studies that also assessed student satisfaction with an instructional experience (Lohman & Finkelstein, 2000, 2002).

Data Analysis Procedures

A criticism of many empirical studies of on-line versus face-to-face instruction is that the research designs used did not investigate and control for pre-existing differences among the intact groups studied. As a result, the findings from many of these studies may have been due simply to pre-existing differences, rather than to the different instructional conditions being investigated (Joy & Garcia, 2000).

In the current study, the nonequivalent control group design was used to overcome this limitation (McMillan, 2004). With this design, data were collected at the beginning of the semester on 10 attribute variables (age, gender, educational level, past research design coursework, knowledge of relevant research design concepts and principles, graduate program in which enrolled, Internet usage rate, learning style, cognitive style, and level of self-directedness). These data were statistically analyzed to determine whether the three treatment groups differed significantly on any of these 10 attribute variables. If significant differences were found among the groups on any of these attribute variables, that variable would be included in the statistical analysis as a covariate and a multiple analysis of covariance would be used to test for differences among the three treatment groups on student performance and satisfaction. If no significant differences were found on any of the attribute variables, then a multiple analysis of variance (MANOVA), using posttest scores on

student performance and satisfaction, would be used to test for significant differences among the three groups.

Results

The statistical tests of the attribute variables and of the two main research hypotheses are presented in this section. An alpha level of .05 was established a priori for these statistical tests.

Analysis of the Attribute Variables

Statistical tests were conducted to examine whether there were significant differences among the three treatment groups on any of the 10 attribute variables. As shown in Table 1, no significant differences were found among the three treatment groups on any of these variables. Therefore, it was concluded that none of the attribute variables had influenced the results of the study and none was included as a covariate in the tests of the research hypotheses.

Tests of the Research Hypotheses

MANOVA was used to test the effects of three information distribution strategies in a CMS on student performance and satisfaction.

H1: Student performance. As shown in Table 2, the average score on the research knowledge posttest for students receiving course materials in class was 12.7 (SD = 0.63), as compared to an average of 11.1 (SD = 2.20) for students receiving course materials via the CMS at the beginning of the semester, and 11.3 (SD = 2.05) for those receiving course materials via the CMS one week prior to each class session. A MANOVA revealed a statistically significant difference among the treatment groups on the research design posttest scores, F (2, 49) = 3.218, p = .048, with the students who received course materials in class scoring significantly higher than either group of students who received course materials via the CMS.

Table 2. Student performance in courses where materials were distributed in class versus a CMS.

Student Performance	Materials Distributed in Class		Materials Distributed via CMS: At Beginning of Semester		Materials Distributed via CMS: 1 Week Prior to Each Class		
	M	SD	M	SD	M	SD	F
Knowledge Posttest	12.7	0.63	11.0	2.20	11.3	2.05	* 3.218
Course Points	211.5	16.42	213.9	18.03	208.6	18.91	0.892

* p < .05

In addition, the average number of total points earned by students in the course was 211.5 (SD = 16.42) for those receiving course materials in class, 213.9 points (SD = 18.03) for those receiving course materials via the CMS at the beginning of the semester, and 208.6

International Journal for the
Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 1, No. 1 (January 2007)
ISSN 1931-4744 © Georgia Southern University

points (SD = 18.91) for those receiving course materials via the CMS one week prior to each class session. A MANOVA revealed no significant difference among the three treatment groups on this variable, $F(2, 49) = 0.892$, $p > .05$.

H2: Student reactions. As shown in Table 3, an analysis of the reaction survey data showed that students in all three treatment groups had positive reactions toward the instructional experience. On a scale of 1 to 5, mean scores on the 16 survey items ranged from a low of 3.7 for students who received instructional materials via CMS at the beginning of the semester on their expectations for using what they learned in the course in future professional responsibilities (Item #15) to a high of 4.9 for both the students who received instructional materials in class and those who received materials via CMS at the beginning of the semester on their satisfaction with the clarity of the instructor's answers to their questions (Item #10) and overall satisfaction with the instructor (Item #11). A rating of 4.9 was also found for the in-class materials-distribution group on their perception of the organization of the course content (Item #3). A MANOVA found no significant differences among the three treatment groups on any of the 16 survey items.

Table 3. Student reactions in courses where materials were distributed in class versus CMS.

	Materials Distributed in Class		Materials Distributed via CMS: At Beginning of Semester		Materials Distributed via CMS: 1 Week Prior to Each Class		
Reaction Survey Items	M	SD	M	SD	M	SD	F
1. The objectives of this course were clear.	4.8	0.44	4.5	0.51	4.7	0.45	0.999
2. The content covered in the semester was consistent with the course objectives.	4.8	0.44	4.7	0.48	4.6	0.50	0.331
3. The course content was logically organized.	4.9	0.38	4.8	0.41	4.6	0.50	1.382
4. Large group activities and discussions were a constructive part of the learning experience in this class.	4.6	0.87	4.5	0.76	4.4	0.50	0.472
5. Small group activities and discussions were a constructive part of the learning experience in this class.	4.5	0.66	4.5	0.61	4.3	0.82	0.521
6. The course materials were useful to my learning.	4.6	0.51	4.5	0.69	4.2	0.83	2.084
7. The course materials were readily available.	4.6	0.77	4.8	0.41	4.6	0.50	1.424
8. Technology was used in a manner that supported my learning.	4.2	0.9	4.7	0.59	4.3	0.75	2.563
9. The instructor presented the course content in a clear and interesting way.	4.8	0.44	4.8	0.41	4.6	0.50	0.574
10. The instructor provided clear answers to student questions.	4.9	0.38	4.9	0.37	4.6	0.60	1.122
11. Overall, I was satisfied with this instructor.	4.9	0.28	4.9	0.31	4.8	0.38	0.238
12. In general, I found this class to be extremely challenging.	4.6	0.77	4.4	0.88	4.3	1.10	0.615
13. My knowledge and/or skills in research design increased as a result of this course.	4.7	0.48	4.6	0.5	4.4	0.61	1.102

International Journal for the
Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 1, No. 1 (January 2007)
ISSN 1931-4744 © Georgia Southern University

14. I expect to use what I learned in this class in future academic endeavors.	4.5	0.88	4.1	0.85	4.0	0.75	1.297
15. I expect to use what I learned in this course in future professional responsibilities.	4.2	1.17	3.7	0.93	4.1	0.78	0.906
16. Overall, I was satisfied with this course.	4.7	0.63	4.6	0.6	4.3	0.65	2.219

Note: Scores represent mean scores on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

International Journal for the
Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 1, No. 1 (January 2007)
ISSN 1931-4744 © Georgia Southern University

Discussion

The effects of three information distribution strategies on student performance and satisfaction were investigated. Analysis of the data found that the distribution of course materials in class resulted in significantly higher student performance on an end-of-the-semester objective test of research design knowledge than was found when the materials were distributed via a course management system. However, no significant differences were found among the three information distribution strategies on total points earned in the course or on student reactions toward the instructional experience. Possible explanations for these findings and implications of the findings for theory and practice as related to utilizing a CMS in instructional programs are provided in this section.

A possible explanation for the higher scores on the knowledge test for those that received course materials in class as compared to via a CMS relates to the principle of instruction dictating that new information should be presented in logical chunks during instruction to enhance learners' motivation to engage in planned learning activities and to help them focus on the learning tasks at hand (Joyce & Weil, 1996; Smith & Ragan, 1999). In the current study, when course materials were available via the CMS, students had the opportunity to preview new course information at any time they desired. The vast majority of students downloaded the PowerPoint presentations and supplemental handouts from the CMS in preparation for class. Many had read the new material prior to class and some had prepared questions about the material for class discussion. In contrast, when course materials were distributed in class, the instructor gradually introduced new material, adjusting the pace of information distribution in accordance with the rate and degree of learning that was occurring. Additionally, as new material was distributed in class the instructor explained its relevance to the learning task at hand. The continuous adjustment of the pace at which new material was introduced and the just-in-time explanation of the relevance of the material to the learning task may have enhanced students' levels of motivation and ability to focus on key aspects of the lessons and, ultimately, resulted in greater acquisition of research design knowledge than was the case for students who acquired course materials via the CMS prior to class.

Yet, no significant differences were found among the three treatment groups on the second measure of student performance, total course points. A plausible explanation for this finding was that the evaluative activities for which course points were earned required higher levels of thinking than the research design knowledge test did (Kemp et al., 1998). Students earned course points for their performance on two multiple-choice exams and two research article critiques. The second exam and both research article critiques required students to make critical judgments about the research designs and procedures that had been used in published research studies. These higher-level cognitive activities may have enabled students, regardless of which treatment group they were in, with a better opportunity to demonstrate their learning than was the case with the knowledge test.

A puzzling finding in the current study was that there were no significant differences among the treatment groups on student satisfaction with the instructional experience. It has been widely reported that the vast majority of students believe that accessing course materials on-line is convenient and helps them organize and prepare for class. However, students who accessed course materials via the CMS in the current study did not perceive that the use of technology or the availability of course materials was substantially better than students who received materials in class. Interestingly, several students in the in-class treatment group

International Journal for the
Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 1, No. 1 (January 2007)
ISSN 1931-4744 © Georgia Southern University

indicated at the beginning of the semester that they wanted course materials (e.g. class notes and PowerPoint presentations) to be posted on-line. When the instructor explained

that the CMS would not be used for that purpose, students seemed mildly disappointed. However, that disappointment dissipated within a few weeks and at the end of the semester the ratings of the in-class treatment group on the quality of the instructional experience, including the utilization of technology in instruction, were similar to both CMS groups.

When considering the implications of this study's findings, several of its limitations should be noted. The treatment was administered in three sections of the same course over a three-semester period. This design enabled the use of one instructor for all three treatment groups, thereby minimizing the likelihood that different teaching styles or teaching ability levels influenced the results of the study. However, two inherent limitations of the research design required actions to be taken by the researcher to enhance the confidence that the results were due to the treatment and not to something else. The first limitation was that three intact student groups participated in the study. To examine whether this limitation impacted the study's results, a statistical analysis of 10 attribute variables was conducted. No significant differences among the three groups were found on any of the 10 variables. A second limitation was that the three student groups experienced the treatment at different points in time. As a consequence, it was possible that events may have occurred in one of the semesters that influenced the performance and/or satisfaction of students in that group. A journal was kept by the instructor to record any such events in class sessions, on campus, or in the news that related to the integration of technology in the instructional process. Only one event was observed during the administration of the treatment that pertained to the use of CMS. Because inclement weather caused the last class session of the in-class treatment group to be cancelled, a research article that was to be used for the final exam was distributed to students via the CMS rather than in class. Despite these limitations, the findings of this study have important implications for theory, practice, and the future research of CMSs in relation to promoting student performance and satisfaction in higher education courses.

Theoretical Implications for Integrating CMSs into Instruction
The current study's findings provide empirical evidence to extend understandings of Bonk's ten-level web-integration continuum (Bonk et al., 1999). Specifically, this study's findings suggest that higher levels of student performance and satisfaction are not likely to occur if instructors utilize CMS tools that pertain only to the first four levels of the continuum; that is, those tools that enable learners to use the web as an alternative source for acquiring course-related materials and information. This finding is particularly concerning because most instructors in post-secondary education have NOT extended their use of CMSs beyond the first four levels of the web-integration continuum (Bonk et al., 1999; Young, 2004).

As a consequence, it is reasonable to suggest that the upper six levels of the web-integration continuum is where the most promise and opportunity resides for utilizing a CMS to enhance student performance and satisfaction (Bonk et al., 1999). Levels 5–10 of the continuum are distinguished from the first four levels in that the learning activities and tasks in the upper levels of the continuum contain requirements of a course that are not provided elsewhere. These levels range from Level 5, where group discussions and problem-solving activities are facilitated, to Level 10, where the course fits within larger programmatic web initiatives. Clearly, this study's findings show that the conventional practice of using a CMS as an alternative source for course materials and information provided in class does not lead to superior learning or affective outcomes. Yet, the question

International Journal for the
Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 1, No. 1 (January 2007)
ISSN 1931-4744 © Georgia Southern University

remains as to the potential benefits to be derived from using a CMS to accomplish learning tasks and activities that go beyond those conducted in face-to-face classroom settings.

International Journal for the
Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 1, No. 1 (January 2007)
ISSN 1931-4744 © Georgia Southern University

Implications for Integrating CMSs into Instruction
This study's findings give rise to two important implications for integrating CMSs into instruction. First, the study's findings provide little evidence to warrant continuing the conventional practice of using a CMS as a alternative way of presenting course materials and information. CMSs cost millions of dollars to purchase and maintain. Instructors must spend countless hours learning how to use the technology, preparing materials for CMSs, and monitoring student use of course websites. And, for what benefit? No evidence was found in this study to indicate that on-line access to course materials yields any positive dividend in terms of student learning or satisfaction.

A second implication of the study's findings is that current instructional practice is underutilizing the technological and pedagogical capabilities of CMSs. As such, instructional practice must move beyond using CMSs to replicate learning activities and materials that are already provided in class. Instead, CMSs should be used to conduct learning activities, such as facilitated group discussions and problem-based learning experiences, that supplement in-class activities as well as to provide additional learning resources that are not available in class. In other words, pedagogical practice must move into the upper six levels of the web-based continuum for integrating technology into instruction (Bonk et al., 1999).

However, instructors cannot be expected to move higher in the technology-integration continuum without additional time, training, and technical assistance. Instructors' teaching loads would need to be temporarily reduced to provide time to enhance their pedagogical skills in designing, implementing, and evaluating technology-mediated learning activities, such as electronic conferencing and journaling, on-line group debates, and web-based team projects. Instructors would also need additional time to develop the technical skills required to use the more advanced and complex features of CMSs. In addition, support staff with expertise in designing instruction for web-based environments would be needed to assist instructors with the pedagogical and technical concerns that are certain to arise as instructors work toward integrating more web-based learning events and activities into their instructional programs.

Implications for Future Research of CMSs
Further research in two areas would help clarify the potential value of CMSs in higher education. First, because the current study was conducted with graduate students, replications of the study with undergraduate students would provide a greater understanding of its generalizability to student populations in higher education settings. Second, future research studies must investigate the effects of integrating CMSs at the higher levels of the web-integration continuum on student performance and satisfaction. This is a crucial area of research because, at the present time, there is little empirical justification to advocate continuing the conventional use of course management systems as an alternative means of presenting course information and materials.

References

Bonk, C. J., Cummings, J. A., Hara, N., Fischler, R. B., & Lee, S. M. (1999, April). *A ten level web integration continuum for higher education: New resources, partners, courses, and markets.* Paper presented at the American Educational Research Association, Montreal, Quebec.

International Journal for the
Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 1, No. 1 (January 2007)
ISSN 1931-4744 © Georgia Southern University

Gagne, R. M., & Medsker, K. L. (1996). *The conditions of learning: Training applications.* Fort Worth, TX: Harcourt Brace.

Group embedded figures test. (1971). Palo Alto, CA: Consulting Psychologists Press.

Guglielmino, L. (1996, March 7, 1996). *Reliability and validity of the self-directed learning readiness scale and the learning preference assessment.* Paper presented at the Tenth International Symposium on Self-Directed Learning. West Palm Beach, FL.

Guglielmino, L. M. (1995). *Self-directed learning readiness scale*. Boca Raton, FL.

Harrington, C. F., Gordon, S. A., & Schibik, T. J. (2004). Course management system utilization and implications for practice: A national survey of department chairpersons. *Online Journal of Distance Learning Administration, 7*(4).

Joy, E. H., & Garcia, F. E. (2000). Measuring learning effectiveness: A new look at no-significant difference findings. *JALN, 4*(1), 33-39.

Joyce, B., & Weil, M. (1996). *Models of teaching* (5th ed.). Englewood Cliffs, NH: Prentice Hall.

Kemp, J. E., Morrison, G. R., & Ross, S. M. (1998). *Designing effective instruction* (2nd ed.). Upper Saddle River, NJ: Merrill.

Knowles, M. (1986). *The adult learner: A neglected species*. Houston: Gulf Publishing.

Kolb, D. A. (1999). *The Kolb learning style inventory*. Experience Based Learning Systems, Inc.

Lohman, M. C., & Finkelstein, M. (2000). Designing groups in problem-based learning to promote problem-solving skill and self-directedness. *Instructional Science, 28*(4), 291-307.

Lohman, M. C., & Finkelstein, M. (2002). Designing cases in problem-based learning to foster problem-solving skill. *European Journal of Dental Education, 6*, 121-127.

McMillan, J. H. (2004). *Educational Research* (4th ed.). Boston: Pearson.

Morgan, G. (2003). *Faculty use of course management systems*. Educause Center for Applied Research, 1-6.

Nicoll, J. M., & Laudato, N. C. (1999, October). *Assessing the impact on students of online materials in university courses.* Paper presented at the EDUCAUSE '99 Conference, Long Beach, CA.

Phipps, R., & Merisotis, J. (1999). *What's the difference: A review of contemporary research on the effectiveness of distance learning in higher education*. Institute for Higher Education Policy.

Pithers, R. T. (2002). Cognitive learning style: a review of the field dependent-independent approach. *Journal of Vocational Education and Training, 54*(1), 117-132.

International Journal for the
Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 1, No. 1 (January 2007)
ISSN 1931-4744 © Georgia Southern University

Sausner, R. (2005, July). Course management: Ready for prime time. *University Business*.

Smith, P. L., & Ragan, T. J. (1999). *Instructional design* (2nd ed.). Upper Saddle River, NJ: Merrill.

Wilson, B., & Cole, P. (1992). A critical review of elaboration theory. *Educational Technology Research and Development, 40*(3), 63-79.

Young, J. R. (2004, August 13). Students say technology has little impact on teaching. *Chronicle of Higher Education, 50,* A28.