When Course Management Systems Fail: Student and Instructor 'On-the-Fly' Adaptation Behaviors

Jessica J. Andrews, Gary D. Bond and Lassiter F. Speller
Winston-Salem State

Course management systems (CMSs) have become popular in classrooms, yet system failures are common enough to deserve careful study. Instructor (N = 6) and student (N = 215) usage and perceptions of the Blackboard CMS in 10 technology-enhanced courses at a Historically Black College and University (HBCU) were documented in this research. Technology-enhanced courses were defined in this research as ancillary or integrated based on types of CMS features used. Pre-and post- surveys and e-Diary entries were collected over 9 weeks. Descriptions of adaptations were coded when the CMS was unavailable. Consistent with predictions, active adaptations (e-mailing or contacting the instructor) were higher in integrated courses, and passive adaptations (waiting, doing nothing) were higher in ancillary courses. Overall, instructors hold mixed feelings about CMSs in face-to-face classes, while students generally hold positive feelings about using CMSs to scaffold learning.

KEYWORDS: Course Management Systems, Adaptation, LIWC, Learning, Educational Psychology

The use of course management systems (CMSs) in higher education has become quite popular (Ansorge & Bendus, 2003), yet system failures are not uncommon. In current literature little is known about classroom effects (e.g., adaptation behaviors and emotional responses) when the system is experiencing technological errors. The current study seeks to investigate technology-enhanced face-to-face courses to determine whether these courses invite passive or active adaptation behaviors in students when the CMS is unavailable, depending upon whether they are ancillary or integrated course types; and whether course types invite positive or negative feelings from student and instructor perspectives. The current study also seeks to describe instructor behavioral adaptations when the CMS is down. Instructor and student users require relatively continuous access to course features and content; however, scheduled and unscheduled system downtimes negate uninterrupted usage.

Course management systems lend virtual architecture to courses, scaffolding or replacing many or all features of the traditional face-to-face classroom. Web-based distance learning and online courses are often structured using CMS features. CMS features are also used in face-to-face courses which incorporate some online interaction or learning activities, termed 'mixed mode' courses (Harasim, 2000) or 'hybrid' courses which vary in levels of virtual interaction (Swenson & Evans, 2003). In technology-enhanced traditional courses (Arabasz, Pirani, & Fawcett, 2003), the focus of this research, technology is integrated into traditional face-to-face courses. Instructors incorporate PowerPoint and/or multimedia, but CMSs allow instructors of these types of courses a wide range of options from posting media to online testing to more advanced features. Technology-enhanced courses stop short of being classified as 'hybrid' because students and instructors meet in traditional face-to-face classrooms on a regular schedule, and there are no virtual class meetings.

When CMSs are used as ancillary systems in technology-enhanced courses, the system is used as a minor assisting or supplementary tool to the course. For example, instructors may post syllabi, lecture slides, notes, and grades that can be accessed by students outside of class at their leisure. Integrated technology-enhanced courses require more active networked participation from students, such as asynchronous posting on discussion boards or blogs, and completing online assessments and assignments in addition to or outside of traditional face-to-face classroom activities. These classifications occur based on the features of online technologies used in the technology-enhanced courses. Figure 1 depicts course delivery typology and Table 1 shows CMS features associated with technology-enhanced face-to-face course delivery types as defined by the authors of this research.

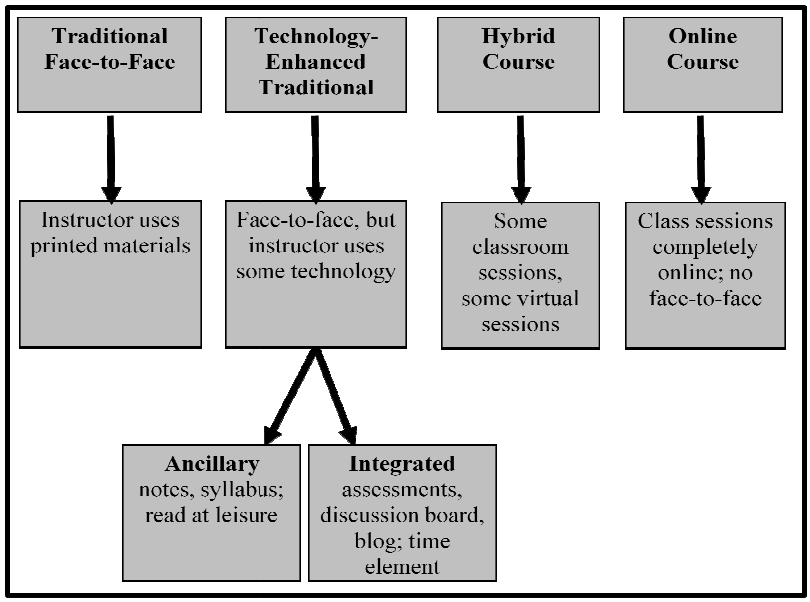

Figure 1. **Course delivery typology. NOTE: Ancillary and integrated course types are defined (in terms of the types of features used by instructors) and tested (in terms of the passivity or activity of 'on-the-fly' adaptation behaviors) in this research.**

Table 1. ***Features Associated with Technology-Enhanced Traditional Course Delivery Types***

Features[a]	Ancillary	Integrated
Syllabi	X	
Posted Lectures	X	
External Links	X	
Announcements	X	
Grades	X	
Course/Faculty Information	X	
Calendar	X	
Assignments	X	
Tests		X
Quizzes		X
Discussion Board		X
Blog		X
Digital Dropbox		X
e-Mail		X
Voice Board, e-Mail		X
Wimba Classroom, Podcaster		X
Collaboration		X

[a]features in Blackboard course management system.

Course Management Systems

Course management systems are programs designed to assist instructors in the management and implementation of course content (Simonson, 2007). Course management systems are also known as learning management systems (e.g., Samal & Gopal, 2003), or virtual learning environments (e.g., Piccoli, Ahmad, & Ives, 2001). In addition, there are several developers and distributors of CMSs; a few are Blackboard, WebCT, Moodle, and Sakai (Gibbons, 2005). Blackboard is the only CMS investigated in this study. There are numerous benefits and weaknesses in CMSs, described next.

Bradford and colleagues (2007) indicate that some benefits of the Blackboard Learning System include increased availability with students and instructors having access to course content anytime and anywhere, and quick feedback with instant grading and instant feedback for faculty. Furthermore, CMSs facilitate instructor and students' organization of course material (Simonson, 2007), and improve electronic information and communication reciprocity through the use of synchronous and asynchronous communications such as online chat and discussion board (Gibbons, 2005). Bradford and colleagues (2007) describe weaknesses in using Blackboard as well. These include cost concerns and restrictions to particular operating systems. For instructors, the system requires considerable time and effort to learn, and setting up and maintaining course materials and creating online assessment materials is time consuming (Arabasz et al., 2003). Traditional face-to-face courses require extensive preparation for lectures, assignments, assessments, and grading, but use of CMS features requires even more preparation time (Ansorge & Bendus, 2003). Instructors must upload and update materials, enter and update grades if grade functions are used, and instructors and students must adapt when a CMS does not function properly or is unavailable.

Existing Research Model to Investigate CMSs

Malikowski, Thompson, and Theis (2007) presented a research model accounting for five facets of CMSs. This model was proposed because of the limited research on CMSs and the limits to viewing aspects of student learning in the research. The model contains five categories that are proposed for research. They include transmitting course content, creating class discussions, evaluating students, evaluating courses and instructors, and creating computer-based instruction. Course information can be transmitted using several methods which include syllabi, assignments, announcements, and through a grade book. Within CMSs, class discussions can be asynchronous with the use of discussion board and e-mails or synchronous where students are able to interact simultaneously within a virtual classroom. Asynchronous discussions allow students the time to answer questions thoughtfully while synchronous discussions allow students social interaction and instant feedback. Student evaluation can be accomplished with the use of tests and quizzes in a variety of formats generated by the instructor, and the digital drop box can be used to submit work to instructors. The evaluation of courses and instructors can also be completed using generated quizzes and also with the use of a survey feature. Computer-based instruction is included in the model to hint at the fact that CMSs can be used for more than transmitting data and includes features such as quizzes using questions pools, tutorials, and correct and incorrect feedback (Malikowski et al., 2007).

Most research in CMSs has looked at the business and financial aspects of choosing a system (buy versus build), and the costs of CMSs (Morgan, 2003). Non-business CMS studies, reported primarily by scholars at the EDUCAUSE Center for Applied Research (e.g., Arabasz et al., 2003; Morgan, 2003), have surveyed opinions of faculty and instructional staff and features used, but few have gone beyond those levels to address student learning or other student-level variables (Malikowski et al., 2007). Only a handful of studies, including research on the WebCT CMS by Bongey, Cizadlo, and Kalnbach (2005), have looked at student-level variables. Bongey et al. (2005) reported benefits in using student 'self-tests' in an integrated course. Self-tests were incorporated into an anatomy and physiology course as an interactive quiz feature which provided feedback to students using WebCT. Bongey et al. (2005) indicated that student test scores increased after adoption of the self-testing feature. Caruso (2004) surveyed students' experiences and skill in using technology and found that students held mainly positive attitudes about using information technology (IT) in classes, and indicated that the greatest benefit in using IT was its convenience, but that one major barrier for students was that using IT "feels like extra work" (p. 6). Ansorge and Bendus (2003) surveyed students, instructors, and administrators concerning the use of CMSs and found that each group agreed that teaching and learning had been positively affected by the use of CMSs. Instructors perceived students' attitudes toward using a CMS in classes as very high (p. 179), and students held positive perceptions of CMSs, considered them user-friendly, and found them helpful in their learning experience (Ansorge & Bendus, 2003).

Focus on Technology-enhanced Courses

Of the few studies that have looked at student perceptions of using CMSs, few have gone beyond using traditional survey methods to gain information. Beard, Harper, and Riley (2004) gathered written student comments as data in an investigation of student perceptions and attitudes about face-to-face and online instruction with the Blackboard CMS. The investigators collected comments from students in two classes in two different semesters. The sample in the study by Beard et al. consisted of 42 participants who were tested during the first class and then 31 of the same participants enrolled in the follow-up course during the next term. Females comprised the majority of the sample (78%). In the first half of each semester the instructor used traditional face-to-face methods, but in the second half the instructor posted lecture notes and course materials on Blackboard, and attendance in class during the second half of the semester was optional. Students favored internet instruction because of its flexibility. Concerns that arose for students regarding online instruction were the lack of interaction with the instructor, and the instructor also became concerned with the lack of interaction during the "online" phase (Beard et al., 2004). The Beard et al. (2004) study suggests that some students and instructors prefer face-to-face instructional methods, but that online learning offers flexibility to students. Students reported that they learned as much during the online portion of the course as they did in the traditional phase.

More precisely, the Beard et al. (2004) research was a test of student perceptions of a hybrid course. No empirical investigation that we are aware of has explored instructor and student usage, perceptions, and adaptation behaviors (when the CMS is unavailable) in technology-enhanced courses using Blackboard CMS features. In the current literature, system-related strengths and weaknesses for instructors and students in technology-enhanced courses are largely unknown. This article documents instructor and student usage and perceptions of the Blackboard CMS over a 9 week period at a

Historically Black College and University (HBCU) in the southeastern United States.

Predictions

Technology-enhanced courses are defined in this research as ancillary or integrated based on the types of features listed in Table 1. Students and instructors will resort to 'on-the-fly' adaptation behaviors when CMSs fail. 'On-the-fly' (e.g., Cooke & Breedin, 1994) suggests problem solving or decision making in which a person adapts behavior before or during a task being completed in response to new changes that occur. Students' behavioral adaptations might include delaying the completion of assignments or bypassing the system with the use of e-mails or telephone calls to instructors. Students should adapt by seeking interpersonal contact, or by possibly misusing the unavailability of Blackboard to their advantage. For instructors, behavioral adaptations might include changing assignments, changing assignment due dates, giving paper and pencil tests, and using more traditional forms of face-to-face instruction.

Within technology-enhanced course subtypes, we predict that student on-the-fly adaptation behaviors will be mostly passive (waiting, delaying, doing nothing) in ancillary technology-enhanced courses, while adaptations will be more active (e-mailing, contacting behaviors) in integrated courses. Students are predicted to have more positive feelings about instructors' usage of CMSs in technology-enhanced courses, while instructors will have less-positive emotions about the system, because depending upon whether the system is unavailable from time to time, instructors will need to adapt quickly, especially in integrated courses, to serve student needs. Further, instructors will probably report that the workload involved in maintaining and up-dating CMS features is greater than the workload experienced in teaching a traditional face-to-face course (e.g., Ansorge & Bendus, 2003). The current study will include a pre- and post-semester survey, as well as weekly e-diary entries, in order to gain more accurate and timely insights into how students and instructors perceive, use, and experience the system, and how they adapt when the system is down.

METHOD

Participants

Students from a Historically Black College and University (HBCU) in the southeastern United States participated in the research. Students (N = 215) ranged in age from 18 to 37, M = 19.94, SD = 2.4. There were 92.4% African American participants; 2.5% persons listed themselves as other; 2.0% Hispanics; 2.0% Caucasians; 0.5% Asian Americans, and 0.5% Native Americans. There were 132 female and 83 male participants. All students in their classes who volunteered to participate (59.2% of students enrolled in the classes) were given the pre-survey, post-survey, and diary forms. Of the 215 students who completed the pre-survey and diaries, 152 completed the post-survey. Thus, 70.7% of the students participated for the full duration of the study. Incentive for participation was extra course credit.

Six instructors from the same university who taught psychology, sociology, English, computer science, and Spanish courses participated. Ten sections of courses taught by those six instructors were included in the study. Two instructor-participants used features which fit the ancillary definition of usage (transmitting information only; Malikowski et al., 2007), and taught 6 sections of students (190 of the student participants). Four instructors used features included in our definition of an integrated course system; including use of discussion board, provisions for test administration, and quizzes using the Blackboard system (refer to Table 1). There were 4 integrated sections with 177 student participants. Instructors ranged in age from 30 to 60, M = 46, SD = 13.3. Ethnicity was 66.7% Caucasian; 16.7% African American; and 16.7% Asian American. Instructors reported a median of 9.5 years teaching experience, a median of 6 years teaching at this university, and had been using Blackboard functions for an average of 4.17 years, SD = 2.8 (range 1 year to 8 years). Instructors received a summary of results from the study as compensation.

The Instructional Technologist in charge of Blackboard from the same university acted as a participant. Information about the Blackboard system, downtime reports, and an in-depth interview about the system were obtained from this participant.

Materials and Apparati

Linguistic Inquiry and Word Count (LIWC; Pennebaker, Francis, & Booth, 2001) software was used to code emotions expressed in language produced in open-ended answers from pre- and post-surveys and from e-diary entries. LIWC has been used in psychological research to investigate such diverse areas as evaluating gender differences in academic writing (Hartley, Pennebaker, & Fox, 2003), language used in truth and deception (Bond & Lee, 2005; Bond & Speller, 2009; Newman, Pennebaker, Berry, & Richards, 2003), and improvement in health through writing (Pennebaker & Francis, 1996), for examples.

Procedure

Pre-survey and post-survey. A survey at the beginning of the semester was administered to gather student and instructor usage, feelings, and experiences with Blackboard, and the same information was collected at the end of 9 weeks in a post-survey before students took final examinations. Survey questions included number of classes taken using Blackboard, functions used in Blackboard, participant experiences with Blackboard, feelings towards Blackboard, and student and instructor adaptations when Blackboard was unavailable. Samples of questions included, "describe some of your experiences using the Blackboard system" and "if your instructor uses the Blackboard system, and it is unavailable at the time of your quiz or test, describe some specific things that your instructor has done."

Electronic diary collection. Students and instructors were asked to log an electronic diary (e-diary) entry each time they accessed the Blackboard system, and they were asked to send their accumulated diary entries at the end of each week. Instructions provided to participants for diary entries included reminders to include the purpose of their use of the system, the ease with which they could access information, problems encountered while using the system, how problems were solved, and perceptions of their interactions with the system. Participants sent e-diary entries weekly via email to researchers, and if participants did not send an entry, reminders were sent. Diary entries were saved as .txt files.

Persistence Scale. Student participants were given a shortened version of the College Persistence Scale (Cabrera, Castaneda, Nora, & Hengstler, 1992) in the eighth week of the study. The scale was constructed by Cabrera and colleagues to measure 2 general factors, student attrition (Bean, 1980; 1983; 1985) and student integration (Tinto, 1975; 1982; 1987). In this study, 5 items from the scale were used to measure behavioral intentions to remain in college (or leave), taken from the 10 original student attrition items, and 6 items measuring social integration, commitment, and intent to persist were taken from the 8 original student integration items. The complete Cabrera et al. scale is available in the 1992 publication, and is described in detail there. Students answered scale items on a Likert-like scale from 1 (not important at all) to 5 (extremely important).

LIWC Coding. Questions about feelings and experiences with the Blackboard system were open-ended on pre- and post-surveys and e-diary entries. LIWC software was used to assess the affective features produced in transcribed responses. Specifically, positive and negative emotion words were used to assess student and instructor feelings and experiences with the system. The LIWC software coding system is described in detail in the LIWC Manual (Pennebaker, Francis, & Booth, 2001). Some examples of affect words are "warmth," "love," and "bother." Relative intensity of emotion is not coded by the software, but frequency of use of affect words, positive emotion words, and negative emotion words are coded.

Interview and contacts with instructional technologist. The first author conducted an interview with the university's Instructional Technologist prior to the beginning of the study. Questions regarding instructor training, use of the Blackboard CMS by instructors and students, and questions regarding the degree to which the system was available/unavailable were asked in the interview. E-mails were sent to the second author when the system was unavailable over the course of the semester, and system 'downtimes' were recorded (date, duration, reason for system unavailability).

RESULTS

Interview with Instructional Technologist

The Instructional Technologist in charge of the Blackboard system indicated that the CMS had experienced 5 downtimes in the past academic year. Over the course of this study the Blackboard system experienced downtimes from between 1 hr to 24 hr 12 times in 9 weeks. There were 5 scheduled downtimes over the course of the semester with at least 1 hr advance e-mail notice, and 7 unscheduled downtimes in which no advance notice was given. Eight of the 12 downtimes were longer than 4 hr, and of the 8 longer downtimes, 6 were longer than 8 hr. According to the Instructional Technologist, the current Blackboard version 6.3.1 would be upgraded to Blackboard version 8.0 at the end of the semester, and the upgrade would allow students to work in groups and communities allowing more extensive virtual contact with one another. Over 100 instructors use the Blackboard system at this HBCU, however, a majority are using the system to post course syllabi. The Instructional Technologist also mentioned having experience with other CMSs at other universities, which included WebCT and Moodle. The Technologist indicated that all of the CMSs with which she had experience showed distinct benefits and deficiencies, but that this university used Blackboard since it was part of a 16-member state university system that adopted that CMS.

Student Results Pre- and Post- Surveys

T-tests were conducted on student feelings and experiences in all course types from the pre- and post-

survey data. Results showed that positive emotions as coded by LIWC increased from pre- (M = 2.67, SD = 3.0) to post-descriptions of feelings and experiences (M = 6.86, SD = 7.3), $t(361) = 7.49$, $p = .0001$, $d = .75$. Similarly, students' negative emotion words increased from pre- (M = 0.53, SD = 1.3) to post-descriptions (M = 1.13, SD = 2.5), $t(361) = 3.04$, $p = .0001$, $d = .30$.

In order to determine if there were differences in feelings and experiences between students in the two different technology-enhanced traditional courses, a multivariate analysis of variance (MANOVA) was conducted with Course Type (ancillary, integrated) and Survey (pre, post) installed as factors and measured on positive and negative emotion words. There were main effects found for Course Type, $F(2) = 3.03$, $p = .05$; and for Survey $F(2) = 23.32$, $p = .0001$. No interaction was discovered between Course Type and Survey. Between-subjects, usage of negative emotion words were significantly different between ancillary and integrated course types, $F(1, 351) = 5.89$, $p = .02$, $\eta^2 = .02$. Ancillary students used an average of 0.37 negative emotion words (SE = 0.19), and integrated students used an average of 0.89 negative emotion words (SE = 0.12). Positive emotion words were significantly different pre- to post-survey, $F(1, 351) = 41.41$, $p = .0001$, $\eta^2 = .10$. Students' pre-survey language showed an average of 2.56 positive emotion words (SE = 0.39), and post-survey language showed an average of 6.74 positive emotion words (SE = 0.52).

College Persistence Scale

A shortened version of the College Persistence Scale (Cabrera et al., 1992) was administered to students in order to measure how invested students were in their education. Reliability of the shortened scale was acceptable at $\alpha = .74$. An analysis of variance determined that there were no differences in college persistence scale scores between ancillary and integrated course students [$F(1, 151) = 0.37$, *ns*]. Overall, shortened scale mean for students was 45.43, SD = 5.9, with 11 items included. Grand item mean was 4.13 (min = 2.65, max = 4.87), indicating that students showed above average investment in college persistence.

Student Adaptation Behaviors

Student adaptations when Blackboard was unavailable-survey. Proportions of active and passive adaptations were derived by coding participants' responses to the pre- and post-survey question of how he or she adapted when the system was unavailable. Categories were constructed by two researchers based on participants' responses, and coded by two research assistants. Inter-coder reliability was acceptable, $\alpha = .88$. An analysis of variance (ANOVA) was conducted with Course Type (ancillary, integrated) measured on proportions of active and passive adaptation behaviors. Consistent with expectations, the analysis revealed that active adaptation behaviors tended to be higher in the integrated group (M = .24, SD = .2) than in the ancillary group (M = .17, SD = .2), $F(1, 207) = 4.14$, $p = .04$, $\eta^2 = .02$. Also as predicted, passive adaptation behaviors were higher in the ancillary group (M = .21, SD = .2) than in the integrated group (M = .14, SD = .2), $F(1, 207) = 6.55$, $p = .01$, $\eta^2 = .03$. Refer to Table 2 for students' ancillary and integrated adaptations listed in the surveys.

Students' e-Diary adaptations. Adaptations in the e-diaries were coded similarly to the coding of the pre- and post-surveys. Categories were constructed by two researchers based on participant responses, and coded by two research assistants. Inter-coder reliability was $\alpha = .84$. An analysis of variance (ANOVA) was conducted with Course Type (ancillary, integrated) measured on proportions of active and passive adaptation behaviors reported in e-diaries. Although reported adaptation behaviors were few, consistent with expectations, the analysis revealed that active adaptation behaviors tended to be higher in the integrated group (M = .23, SD = .2) than in the ancillary group which reported no active adaptation behaviors at all, $F(1, 34) = 5.67$, $p = .02$, $\eta^2 = .13$. Also as predicted, passive adaptation behaviors were higher in the ancillary group (M = .34, SD = .1) than in the integrated group (M = .11, SD = .2), $F(1, 34) = 5.06$, $p = .03$, $\eta^2 = .14$.

Table 2. ***Adaptations Listed in Student Surveys***

Type of Adaptation	Ancillary MEAN (SD)	Integrated MEAN (SD)
Wait for System to Come Back Online [p]	51.4% (0.5)	32.9% (0.5)
Email Instructor [a]	15.3% (0.4)	34.7% (0.5)
Communicate Face-to-Face With Instructor [a]	19.4% (0.4)	13.8% (0.4)
Call Classmate [a]	2.8% (0.2)	3.0% (0.2)
Expect Email [p]	2.8% (0.2)	3.0% (0.2)
Call Help Desk [a]	4.1% (0.2)	4.2% (0.2)
Refer to Printed Materials [a]	4.2% (0.2)	8.4% (0.3)

[p] – passive adaptation behaviors
[a] – active adaptation behaviors

Most students delayed or waited to complete assignments (38.9%), resorted to face-to-face methods of learning (e.g., looking over written notes from class, using the book; 27.8%), emailed the instructor or classmate (22.2%), communicated face-to-face with the instructor or classmate (13.9%), and no students mentioned calling the Blackboard Help Desk or expecting an email from

the instructor. The last two categories were mentioned in the survey coding. None of the participants indicated that they 'misused' system unavailability to their benefit.

Predictors of student adaptations. A multiple regression analysis was conducted to determine predictors of adaptation behaviors for all students (ancillary and integrated class participants). Persistence in college scale scores, averaged positive and negative emotion words (pre- and post-survey language coded and averaged), self-reported grade point average, and past CMS usage were regressed on adaptation behaviors. The adaptation behaviors variable represented the difference between active and passive adaptation behaviors in a proportion, derived from pre- and post-survey data. The regression model with all predictor variables included revealed $F(5, 41) = 2.41$, $p = .045$, $R^2 = .23$. Standardized coefficients were: past CMS usage ($\beta = .45$) negative emotion words ($\beta = .20$), positive emotion words ($\beta = .15$), grade point average ($\beta = .07$) and college persistence scale scores ($\beta = .09$). Coefficients for past CMS usage and negative emotion words were significant in the model ($ps < .05$).

Instructor Results Pre- and Post- Surveys

Instructor feelings and experiences toward Blackboard. T-tests were conducted on instructor feelings and experiences as coded by LIWC from pre- to post-survey data. Results showed no significant difference in positive and negative emotions from the beginning of the study to the end. Averaged pre-survey positive emotions was $M = 9.03$ ($SD = 7.8$); post-survey was $M = 6.55$ ($SD = 7.5$); $t(5) = 0.44$, *ns*. Negative emotions on the pre-survey were $M = 0.99$ ($SD = 1.4$); post-survey, the average was 2.92 ($SD = 3.9$); $t(5) = -1.07$, *ns*.

To determine if there were differences in feelings and experiences between instructors in the two different technology-enhanced traditional course types, a multivariate analysis of variance (MANOVA) was conducted with Course Type (ancillary, integrated) and Survey (pre, post) installed as factors and measured on positive and negative emotion words. There were no main effects or interaction.

Instructor survey comments. Some comments expressed by instructors on their surveys are shown next.

Ancillary instructors:

- "[My experiences were] okay. There are ways that [Blackboard] can be improved."
- "It's been very helpful. I just need to make greater use of [Blackboard features]."

Integrated instructors:

- "It's been frustrating because of problems with stability- at one point I was ready to quit using [Blackboard]."
- "I use many of the features, but would use more (especially tests and quizzes) if I had faith in [Blackboard] working."
- "I'm becoming more and more jaded and while the idea behind Blackboard is great and it allows me to make lecture material available before class, the effort involved in almost every other feature is so large and time consuming that it is becoming too much of a time sink. I'm seriously considering scaling back my use of Blackboard in the future."

Instructor Adaptation Behaviors

Instructor adaptations when Blackboard was unavailable-survey. Table 3 depicts instructor adaptation behaviors listed on their surveys. If the system was down, instructors provided materials in class for students one quarter of the time. This included handing out paper and pencil tests and assignments. To a lesser extent, instructors also waited for the system to come back online, extended assignment deadlines for students, created duplicate websites as an alternative system, emailed students to inform of system downtime, called the Blackboard Help Desk to determine the length of and reason for downtime, and reset assessments if students informed them of difficulties.

Instructors' e-Diary adaptations. Instructors submitted e-diaries each week over a 9 week period. Adaptations were mentioned in weeks two, three, four, and five, and they were mostly active behaviors, such as extending the deadlines of assignments for students, and providing printed materials in class for students. Most instructors of integrated courses mentioned adaptations in their e-diaries. Most of the active adaptations were providing printed materials such as paper and pencil tests, and paper assignments for students.

Table 3. ***Adaptations Listed in Instructor Surveys***

Type of Adaptations	Mean	SD
Wait for System to Come Back Online	16.7%	0.5
Extend Assignment Deadline	16.7%	0.5
Create Duplicate Website	8.3%	0.4
Email Students	16.7%	0.5
Communicate Face- to-Face with Students	0.0%	0
Provide Materials in Class	25.0%	0.5
Call Help Desk	8.3%	0.4
Reset Assessments	8.3%	0.4

DISCUSSION

The purpose of this study was to investigate 'on-the-fly' adaptation behaviors shown by students and instructors in technology-enhanced face-to-face courses when the Blackboard CMS was unavailable. A second purpose was to create taxonomy of technology-enhanced courses based on features used in CMSs which were ancillary or integrated in nature. We also wanted to observe student and instructor feelings and experiences as they used the system over the course of a semester. The findings in this study revealed (a) that students were active in their on-the-fly adaptations in integrated courses, while students in ancillary courses were passive adaptors; (b) that students held mainly positive attitudes toward the CMS and that overall, emotions increased from the beginning to the end of the semester; and (c) that instructors showed no difference in positive or negative emotions felt in using the CMS over the course of the semester. Instructors in integrated courses expressed more negative feelings about using Blackboard features while instructor comments in ancillary courses were not as negative. Also, students indicated that they did not misuse system unavailability to their advantage, at least as expressed in the comments that they made in surveys and e-diaries.

With few exceptions, students felt mainly positive about using features of the CMS in their courses. Students in integrated courses did hold more negative feelings toward the CMS than did students in ancillary courses. For students, past CMS usage and negative emotion words significantly predicted adaptation behaviors. In short, the more negative emotions one feels, the greater active adaptation behaviors one shows. Also, the greater the number of courses taken in the past using Blackboard, the greater the active adaptation behaviors. Thus, students' positive attitudes about using features of the CMS in this study, especially those students participating in ancillary courses, follow the positive attitudes shown by students about information technology in Caruso's (2004) research and the positive perceptions of CMSs held by students in Ansorge and Bendus' (2003) research.

Instructors exhibited mixed feelings about their use of CMS features. Ancillary instructors indicated on their surveys that they would simply wait through or provide printed materials during periods of system unavailability. Integrated course instructors extended deadlines for assignments and quizzes and reset assessments if students reported system trouble. One integrated instructor actually created an alternative website in cases of system unavailability; that particular instructor indicated that she had experienced trouble with the system before and apparently decided that a redundant site was necessary.

To put student and instructor variables into context, students mainly in integrated courses with greater Blackboard experience are active adaptors but feel negative emotions in having to deal with system uncertainty. Students in ancillary courses are passive perhaps because they know they can wait and put off any assignments until the instructor adapts in the next class period. These reactions by students may be why instructors have mixed feelings about using the system. Instructors of integrated courses have students who are perhaps frustrated or unhappy about the system being down, and in the midst of that ambiguity, the students email, call, and make office visits to the instructor, increasing instructor workload. Alternatively, instructors of ancillary courses experience passive students who generally wait for the instructor to adapt for them. In either course type, a strain seems to be placed on instructors who must actively work to respond to student demands and to create alternative printed assignments, lectures, activities, or assessments.

There are a number of reasons why instructors might feel somewhat dissatisfied about using a CMS when teaching a course. Dissatisfaction may not only come from increased workload but also a feeling of loss of control over their course. An instructor must 'fit' course materials into the CMS format which constrains the way they teach their course. The instructor may also feel distress due to a loss of perceived credibility when the CMS fails. Students who hold high regard toward an instructor may feel less satisfied with the instructor's skills, abilities, and even the extent of their knowledge if a quiz or examination does not work, or if there are assignments which are interrupted by CMS downtimes. The instructor may ultimately worry how the failure of the CMS may affect their semester teaching evaluations as well. Globally, instructors might also feel overwhelmed adapting to the rapid change in teaching courses. There was a time not so long ago when instructors presented standard lectures using the standard chalkboard. Currently, the integration of e-learning in courses is used with increased frequency and administrators, budgeting for increased use of technologies, place emphasis on instructors' use of CMSs and other technological software and equipment.

Limitations

There were several limitations in the current study. The relatively high number of Blackboard system failures may have affected participants' perceptions in this study (especially instructors' perceptions) so we caution the reader not to make strong generalizations from this study to other situations in which a CMS has fewer periods of

interruption. The University was preparing for an upgrade to the Blackboard CMS from version 6.3.1 to version 8.0, and there were substantially more downtimes due to this scheduled upgrade. During the course of this 9-week study the CMS went down 12 times (ranging in duration from 1 hr to 24 hr). This was more than double the past semester's number of downtimes (5), and may have represented an atypical number of downtimes.

Further, as in most studies which incorporate a diary methodology, we cannot be certain that all participants were truthful when they wrote their e-diary entries. Researchers must take into account that students may only include information that is relatively positive, and they may decline to present negative information in their weekly written diaries.

Lastly, this study was conducted at an HBCU where instructors taught the courses and maintained and updated information using CMS features. In other words, instructors were doing 'double-duty'—teaching and maintaining all aspects of the CMS for the course. At other universities, teaching assistants or other designates maintain and update information for instructors, so there might be lower instructor dissatisfaction in those situations.

Future Directions

Further investigations should specifically examine how instructor workload is perceived in ancillary and integrated courses, and how this affects instructors' future use of Blackboard features. For example, instructors who perform 'double-duty' (maintaining and updating the CMS while teaching the course) could be compared to instructors who have only the single duty of teaching, while a teaching assistant maintains and updates information on the CMS. We would obviously predict that workload would be perceived as lower in the single duty case, but it would be interesting to assess perceptions of the teaching assistant (would they perceive their workload as being high, and would they hold relatively negative feelings toward maintaining and updating the CMS, like the 'double-duty' instructor?).

We also suggest that in future investigations, individual difference variables (e.g., locus of control, openness to new experience) may predict how negatively one reacts to a CMS failure. It is possible that even in ancillary courses a person with an external locus of control might feel more frustrated than a person who has a higher internal locus.

In the current study we found that active adaptors felt more negatively about system uncertainty. We could predict in a future study that people with an internal locus of control would be more likely to engage in adaptive behaviors (i.e., instructors may take control over their class or students may take charge of what may affect their grade).

CONCLUSIONS

Technology-enhanced courses are ill-defined in the e-learning literature. Scholars have largely investigated variables affecting student achievement and student feelings and experiences in online courses rather than in face-to-face courses. Because there are a larger number of traditional courses in operation than online courses, future research should begin to address technology-enhanced course variables and their effects on learning and behavior. We sought to provide a clearer definition of courses that use various features of a CMS in face-to-face courses. We differentiated ancillary from integrated course types based on the types of CMS features used by instructors. We found that students in ancillary course types were passive adaptors when the CMS was unavailable, and students in integrated course types were active adaptors during CMS downtime. Our distinction of ancillary and integrated course types based on features used was generally supported in this research. Students in integrated courses who were active adaptors felt more negative emotions when the system was unavailable, indicating that the necessary CMS integrated features, as part of the course curriculum, strongly impacted their learning process.

Integrated technology-enhanced courses seem to be more demanding for students and also for instructors. Integrated courses are more interactive, and studies suggest that engagement is greater when learning is interactive (Northrop, 2001). Engagement is also related to better student learning outcomes in more interactive learning settings. However, when interactivity is disrupted, such as when the system is down, situational ambiguity seems to lead to an increase in emotional stress. In this study we observed students in integrated courses taking a more active role than students in ancillary courses by minimizing ambiguity surrounding downtime situations. They called, e-mailed, or visited their instructors to assess their instructor's adaptation to the situation. Instructors were relied upon to adapt on-the-fly, and this added further demands to an already burdensome workload.

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AUTHOR NOTES

Jessica J. Andrews, Gary D. Bond, and Lassiter F. Speller, Department of Behavioral Sciences, Winston-Salem State University. Jessica J. Andrews is now at Learning Sciences, Northwestern University. Lassiter F. Speller is now at Department of Psychology, The Ohio State University.

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Correspondence concerning this article should be addressed to Jessica J. Andrews, Learning Sciences Program, Northwestern University, Evanston, Illinois 60208. EMAIL: andrews.jessicaj@gmail.com.