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Perceptions of Instructional Technology: Factors of Influence and Anticipated Consequences

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ABSTRACT

The use of instructional technologies such as PowerPoint ™ and WebCT ™ are nearly ubiquitous in contemporary college classrooms. The literature is rich with ideas about the transformative powers of technology. What is less understood is how users perceive technology and its effects on classroom dynamics such as student attendance and participation as well as student learning. The literature offers neither an empirical nor rhetorical consensus about the efficacy of classroom technology. This study explores perceptions about the effects of two commonly used technologies through surveys of faculty (n= 485) and students (n= 3145) at a large, public university. Results indicate that individual factors such as gender, grade point average, class/faculty rank, and length of tenure influence orientation toward technology. Results indicate student and faculty differ in their perceptions of the impact of technology on student attendance, class discussion, and connections between students. We explore potential reasons for these differences and how they provide clues for improving the usefulness of technology in meeting learning objectives for all students.

Keywords

Instructional technology, PowerPoint, WebCT, Student perceptions, Classroom dynamics

Introduction

Instructional technology use has long been a standard in college classrooms. Contemporary choices to use whiteboards instead of chalkboards, PowerPoint instead of overhead transparencies, and electronic communication in lieu of office hours have implications for teaching and learning. In addition to these replacement mediums, contemporary instructors frequently employ course management software such as WebCT ™ or Blackboard ™ to facilitate communication between class members and faculty and as a means to electronically distribute information. According to a recent study conducted by the Educause Center for Applied Research ([ECAR], n= 28,274 from 93 schools), nearly three quarters of undergraduate students reported using course management systems in their classes (Katz, 2006).

The availability of more advanced technologies is giving rise to more advanced research questions than whether PowerPoint is an effective teaching and learning tool. Researchers are, and should be, examining how technology can support learning across a variety of instructional contexts (e.g. problem-based learning in engineering, Mandal, Wong, & Love, 2000; collaborative processes in the humanities, Fisher, 2006). However, questions about commonly distributed tools such as PowerPoint persist in part because there is neither an empirical nor rhetorical consensus in the literature about their effectiveness. For example, Cassidy (1998) found students preferred PowerPoint supported lectures over those using transparencies. If the two media perform comparable functions, providing visual support to presentations, then the differences in perceptions are counterintuitive.

In 1996, Ayersman and Reed argued that there were foundational issues related to technology, student characteristics, and learning that are overlooked as excitement over new technologies grows. We concur and argue that basic gaps in our understanding have yet to be filled. For instance, user expectations and perceived outcomes of technology are not well understood. We view instructional technologies from an instrumental perspective. According to Moore (2006), "instrumentalism is the idea that anything that is used to accomplish work can be considered a tool, technology, or instrument." We see classroom technologies as instrumental outcomes of the instructional design process. Therefore, the purpose of this study is to explore faculty and student perceptions about two common instructional technologies: PowerPoint and the course management system WebCT.

The literature is rich in the identification of issues related to classroom technology use. Issues related to unequal access to computer technologies, effects of gender on computer use, and the automation of the learning process are just a few examples (read about the digital divide by race/ethnicity in Korgen, Odell, & Schumacher, 2001; increased use of the Internet by males in Hoskins & van Hoof, 2005; more frequent access of WebCT in females in Heffner & Cohen, 2005; and the degradation of learning through PowerPoint in Leidner & Jarvenpaa, 1995). Student, faculty, and organizational characteristics all likely play a role in how and why classroom technologies are used. This study will explore the role demographics play in perceptions about the effects and consequences of classroom technologies for learning.

In an article written for The Chronicle of Higher Education, Young (2004) argues that technology use can result in poor teaching when it's improperly applied. He proposes that today faculty use technology primarily because students expect it, and they don't always use it well. He attributes this to a lack of training and motivation brought on by tenure and promotion processes that privilege research over teaching. According to a 2006 national survey carried out by the campus computing project, the most significant IT issue is network and data security. This is a change from 2000-2003 when the concern was reportedly assisting faculty with instructional integration of technology. What we don't know is whether the new focus is due to increased concerns about viruses and identity theft or to a feeling of "mission accomplished," since technology appears to have reached critical mass. For example, in the present study 82.1 percent of faculty reported using classroom technologies, slightly higher than the national average of three-quarters reported by Katz (2006).

Given the time, effort, and resources needed to incorporate technology in the classroom, faculty and administrators should expect a positive return on their investments. The literature provides little evidence of an effectual return. Craig and Amernic (2006) report finding fewer than 20 studies reporting positive outcomes related to PowerPoint. Web-based technologies such as course management systems are more positively presented in the literature, yet few studies offer evidence that student learning is enhanced. Most indicate no significant differences in student performance, so at least they do no harm (e.g. Atjonen, 2005; Finlay, Desmet, & Evans, 2004). In 2002, Warburton, Chen, and Bradburn suggested there was little descriptive information to inform basic questions about technology use and teaching in post-secondary education. We believe the information gap still exists, prompting us to undertake the present study. We explore student and faculty perceptions about PowerPoint and WebCT through focus groups and survey research of both students and faculty at a large public university. In this report, we describe and compare student and faculty attitudes about classroom technology and identify individual characteristics that may yield influence on user perceptions. Descriptions of the methodology and findings follow a review of the relevant literature.

Competing Perspectives on Classroom Technology Use

There appears to be a bifurcation in views surrounding the use of classroom technology. One view sees technology as providing enhanced opportunities for student interaction with both content and class colleagues enriching possibilities for knowledge construction. This view falls neatly in line with constructivist approaches to learning. Another view sees technology as largely dictating the content of lectures and controlling ways instructors and students think about said content. This view stems largely from a view that using classroom technologies such as PowerPoint has become a default way of teaching; hence it is applied with little or no reflexivity on the part of students or faculty. Concerns about access and the digital divide are associated with constructivist views of technology. Concerns about technological determinism are associated with the alternate view. We explore the arguments associated with these perspectives below beginning with those associated with concerns about technological determinism.

One argument in the literature alleges that instructors are employing technology without considering the pedagogical implications. This is a McLuhan-style charge that *the medium is the message* (see McLuhan, 1964; McLuhan & Fiore, 1967; Tufte, 2003a). In other words, classroom technology is driving choices related to course content rather than the content driving choices about instructional technology. Instructors, under pressure to make use of expensive course management systems or student pressures to provide PowerPoint slides, employ technologies without reflecting upon how they can help them in the meeting of learning objectives.

It's been suggested that instructors may drop portions of content because technology is inadequate to handle the task. Adams (2006) paints a dismal picture of instructors limiting course content to that which can be "PowerPoint-ed." She cites examples such as the instructor who admitted to dropping a major set of readings because they didn't lend themselves to bulleted lines of text. One provocative line of research goes so far as to suggest that the Columbia disaster was caused, in part, by NASA's overdependence upon slide presentation technology that renders significant information insignificant and vice versa (Tufte, 2003b). In other words, we assume the most important information is on the screen and the narrative that accompanies it to be filler. DuFrene and Lehman (2004) argue that PowerPoint is viewed as the message and that the audience attention remains focused primarily on the visual content potentially missing critical verbal details.

The bleakness of these arguments is contrasted by those suggesting technology enabled enhancements to student and faculty relations result in deeper level learning. For instance, Weigel (2002) suggests technology increases learning by facilitating student collaboration. He sets out a specific model that structures student interaction around particular types of collaborative explorations such as research or skill building. There is some empirical support for Weigel's developing theory. In a comparative study of students enrolled in an MBA class (n=127, one-third in the control group condition), those who used technology enhanced decision making strategies (through Group Decision Support Software [GDSS]) perceived they had enhanced skills, higher collaborative learning effectiveness, and more interest in the class than those in the traditional, face to face condition (Alavi, 1994).

In another comparative study of technology enhanced instruction (in what's called asynchronous learning networks [ALN]), students in ALN groups were found to cover a greater number of issues, produce longer reports, and perceive higher discussion quality than their face to face peers (Benbunan-Fich & Hiltz, 1999). Parker and Gemino (2001) compared undergraduate students enrolled in a gateway course (n = 235, approximately half in each condition) and found the ALN format of the course facilitated more opportunities for student participation and communication.

There is a strong case in the literature for increased student engagement and satisfaction in technology-enhanced contexts. What has yet to be established are differences in outcomes such as course grades or final exam scores. In all three of the studies cited, no significant differences were found on learning outcome measures. This appears to hold true in the literature (see Lou, Bernard, & Abrami, 2006 for a meta analysis). This is not to say there is no difference in the learning. The real contribution of technology may be its ability to facilitate collegial relationships rather than deliver superior content. It may also facilitate new approaches to teaching. For example, ALN are better suited to problem based learning than lecture. These changes have both direct and indirect implications for learning. Technology, when reflexively applied, may enhance pedagogy, and affect learning outcomes. What's more, increased contact enhances student satisfaction, which encourages student persistence (Shin, 2003).

What is not present in the literature is a line of research that casts the use of technology as a neutral choice. For better or worse, technology appears to alter the landscape of the college classroom in all formats: face-to-face, on-line, or blended. Also missing is a consensus about what draws faculty and students to use technology and what perceptions inform their choices. Better understanding of who uses technology and why can assist in professional development efforts to make technology choices more mindful. In the present study we explore both student and faculty perceptions of learning using the common classroom technologies of PowerPoint and WebCT.

Research Questions

Factors of influence on student perceptions and use of technology are not well established. Findings in early studies, many with small samples and only published as part of conference proceedings, found students to be more positive about technologies such as PowerPoint than more recent studies (for examples see Harknett & Cobane, 1997; Jackson, 1997; and Frey & Birmbaum, 2002). More recent, large sample studies indicate that students are dissatisfied with the way technology is being employed (for examples see Young, 2004; Craig & Amernic, 2006, James, Burke, & Hutchins, 2006). It's difficult to reconcile these results. One explanation is that differences are brought about by the research strategy. Small sample, action research may generate a kind of Hawthorne Effect surrounding technology. Another explanation is, as the novelty of technology wears off, students become more discerning in their assessments of its efficacy. The need to understand the factors affecting student perceptions about technology lead to the following research question:

> RQ1: How do student factors such as gender, academic major, class rank, computer skill and cumulative grade point average predict perceptions of learning using PowerPoint and WebCT?

Factors of influence on faculty perceptions about the outcomes of technology, and hence their choices to use said technology, are also not well understood. A small scale qualitative study carried out by Spotts (1999), found technology use to be dictated more by faculty attitude than by learning content. A large scale, mixed methodology study conducted across 15 campuses of the University of Wisconsin system explored why faculty members use course management software. Faculty and instructional staff interviews and surveys (n = 140 and n = 740 respectively) indicated that class management functions such as posting course documents and student grades, plus expedited communication with students, were the largest draw (Morgan, 2003). One additional study found that faculty reportedly chose technology to extend class time outside the confines of scheduled class meetings (Alavi, Yoo, & Vogel, 1997).

In seeking to better understand factors that influence faculty technology use, knowing why faculty members choose to use technology is only half of the equation. It is equally important to understand why faculty members choose not to use technology. It is necessary to identify unintended consequences that concern faculty about technology use. In a recent study comparing student (n = 240) and faculty (n = 49) perceptions about classroom technology, faculty members expressed a strong belief that using PowerPoint and posting the slides on the web would negatively affect student attendance; students disagreed (James et al., 2006). Reports that classroom technology is making instruction more efficient ("automating" it) implies a passivity on the part of learners that also concerns instructors (Leidner & Jarvenpaa, 1995). Adams (2006) charges that PowerPoint facilitates a kind of linear/hierarchical thinking that impedes critical thinking. There is also concern about PowerPoint reducing communication immediacy behaviors and hindering deeper classroom discussion (Craig & Amernic, 2006; Cyphert, 2004). The need to better understand faculty perceptions of technology led to the following questions:

> RQ2a: What are the perceived consequences that influence faculty perceptions of instructional technology?
> RQ2b: How do individual factors such as gender, rank, academic discipline, and length of employment predict perceived consequences of PowerPoint and WebCT?

To further enhance our understanding of the consequences of using instructional technology we think it is important to make comparisons between student and faculty perceptions, so we ask the following question:

> RQ 3: Do student and faculty members share perceptions about learning through PowerPoint and WebCT?

Method

Overview of Samples and Procedures

To answer our research questions, we used a mixed method, multiple sample sequential design. We began with a qualitative exploration of student and faculty perceptions of PowerPoint and WebCT due to a lack of consensus in the literature about their effectiveness. This first phase of the study served to develop and expand our understanding so that inferences could be made that lead to phase 2 research questions (Green, Caracelli, & Graham, 1989). Qualitative data was analyzed and used in the design of measures for a large sample survey to allow for generalization (Creswell, 2003; Tashakkori & Teddlie, 1998).

Qualitative data collection consisted of 7 focus group interviews with a convenience sample drawn from undergraduate students enrolled in a multi-section public speaking course utilizing both PowerPoint and WebCT at a large public university. Detailed notes were taken by a dedicated note taker then coded by the interviewer and note taker independently and reconciled through interaction. Potential consequences such as attendance, participation, preferences for chalkboard use, and perceptions of enhanced learning were identified through focus groups.

We then conducted 2 focus group interviews with a convenience sample drawn from faculty members attending an on-campus professional development workshop. These focus groups were used as a means to check the issues identified through student interviews and identify faculty-specific concerns. Interest in determining perceived effects of technology on student-faculty relations came out of faculty interviews.

Participant views were elaborated on using a survey constructed to measure perceptions that emerged through analyzing the focus group data. The remainder of this section is dedicated to describing the samples and procedures for a large scale survey of students and faculty informed by past research and the focus group interviews.

Samples

The population for the first sample was the undergraduate students from a large, public university with approximately 27,300 undergraduates attending during the Spring 2006 semester including the students from both the main and satellite campuses. This population was sampled using a Web-based survey administered by an on-campus survey research laboratory associated with the Department of Sociology. In blocks of 5,000 students, all undergraduates were e-mailed website links to the student survey; follow-up e-mails were sent two times after the initial notification. The number of respondents was 3,145 for a response rate of approximately 11.5%. However, note that sample sizes for the regression analyses may be smaller than this number, due to exclusion of missing cases.

Dillman (2000) asserts that the acceptable response rate for Web-based surveys should be approximately 80%; he also acknowledges that this rate is extremely high and very difficult to obtain. He urges researchers using this design to use a protocol to encourage higher response rates. We indeed employed such a protocol – we notified each of the students three times by e-mail.

In lieu of very high response rates, Dillman (2000) suggests that samples be rectified with demographic data (e.g. age, sex, race, class year), so that they closely match the demographic data of the population that the samples are intended to represent. Table 1 presents the percentages and means of student characteristics for the sample as compared to the known population parameters provided by administrators at the university. Note that the sample is not only large enough to generalize statistical results derived from the data, but also closely representative of the student population on important demographics. One exception is the percentage of satellite campus students in the population as compared to the study sample. Clearly, the study sample has an over-sample of these students; fifteen percent of students attended the satellite campuses, but the sample consists of 33.6% of these types of respondents. The measures presented in Table 1 serve as independent variables for multivariate regression analyses concerning the students.

The population for the second sample was classroom instructors, be they professors on or off the tenure track, graduate students, part-time, or emeriti, from the same university. Approximately 2,000 of such faculty were teaching courses during December 2005. A saturation sample of this population was attempted, much like with the students, as all classroom instructors were sent website links to a unique faculty survey with two follow-up notifications. Four hundred and eighty-five instructors answered the survey for a response rate of approximately 24.2%. When generalizing with this sample, we urge caution, as we could not rectify demographic data with population parameters, which were not available to us.

Table 1: Percentages and Means of Student Characteristics

	Sample %	N	Population %[d]	N
Male	32.7	2,792	38.9	27,302
Non-European American	7.6	2,697	12.8	27,302
Part-Time Student	21.5	2,792	26.7	27,302
First Year Student	21.1	3,212	30.2	27,302
Sophomore	19.8	3,212	22.9	27,302
Junior	18.7	3,212	19.0	27,302

Social Science Major	16.0	3,212	14.5	27,302
Humanities Major	13.4	3,212	13.5	27,302
Business Major	14.6	3,212	13.3	27,302
Education Major	7.5	3,212	7.5	27,302
Other Major	12.0	3,212	10.1	27,302
Regional Campus Student	33.6	2,779	15.0	27,302

Means and Standard Deviations	Mean	SD	N in Sample
Basic Computer Skills[a]	2.87	(.356)	3,120
Advanced Computer Skills[b]	1.97	(.991)	3,120
Cumulative GPA, Spring 2006[c]	3.08	(.631)	2,785

Source: Spring 2006 Web-Based Survey of University Undergraduates

Notes: [a] The Basic Computer Skills measure is composed of adding "yes" responses to ever using the university's Intranet, instant messaging and e-mailing.

[b] The Advanced Computer Skills measure is composed of adding "yes" Reponses to taking a computer programming class, knowing how to write a computer program, using a word processing program and knowing how to construct a Web page.

[c] Cumulative GPA averages are not collected by the administration, with the exception of one satellite campus that reports a 2.9.

[d] Source of population statistics is the Spring 2006 15-day count produced by Research, Planning, and Institutional Effectiveness. Ethnicity data taken from Factbook 2006-2007, produced by Research, Planning and Institutional Research.

Table 2 presents the percentages of faculty characteristics for the faculty sample. Also, these demographics serve as independent variables for multivariate regression analyses concerning faculty members. Again, note that this sample size may be smaller for statistical analyses due to exclusion of missing cases.

Table 2: Percentages of Faculty Characteristics

	Sample %	N
Male	40.4	450
Non-European American	10.9	449
Part-Time Faculty	26.0	450
Non-Tenure Track	40.4	448
Instructor Rank	29.9	485
Assistant Professor Rank	30.5	485
Social Science	20.6	485
Humanities	25.8	485
Business	4.5	485
Education	11.1	485
Other	2.9	485
Regional Campus	27.4	445

Means and Standard Deviations	Mean	SD	N in Sample
Years at Kent State University	9.12	(8.53)	441

Source: Spring 2006 Web-Based Survey of University Classroom Instructors

Surveys

The students' survey consisted of 78 questions regarding PowerPoint, WebCT, and other technologies. Only 4.6% of these respondents reported that they had never had PowerPoint nor WebCT used in any class. For PowerPoint, 85.2% of the students reported having had it used in a class; for WebCT, 69.1% of students reported use of this technology.

The professors' survey consisted of 75 questions regarding the aforementioned technologies. For professors, 72.4% report that they have used PowerPoint and 45.8% report using WebCT. Only 17.9% reported never using either of these technologies.

Dependent Variables for Students' Perceptions of Learning Using PowerPoint and WebCT

The dependent variables capturing students' perceptions of learning using PowerPoint and WebCT were constructed using responses to 8 and 7 questionnaire items, respectively. Table 3 reports these questionnaire items. The dependent variables used in analyses of favorable perceptions of PowerPoint and WebCT for learning were constructed by first examining internal consistency, then performing principal component factor analyses. Finally, factor scores of maximum likelihood, confirmatory factor analyses were saved as the final latent constructs for the measures.

Table 3: Dependent Variables for Students' Perceptions of Learning

	PC 1[a] Factor	ML 1[b] Factor	PC 2[c] Factor	ML 2[d] Factor
WebCT Learner (Cronbach's Alpha .888)[e]				
I feel like I learned the material covered in the class much better because the professor used WebCT.[f]	.747	.702	.628	.587
Because this professor used WebCT, I feel he or she cared more about my learning than if he or she had not used WebCT.	.728	.677	.650	.601
Because the professor used WebCT, I feel my grades were better in this class than my grades would have been had the professor NOT used WebCT.	.758	.716	.675	.639
I am the type of person who likes to see concepts as I learn them, so WebCT helped me learn these concepts because it's a visual tool.	.746	.700	.674	.670
I am the type of person who likes to read concepts as I learn them, so WebCT helped me learn these concepts because it's a reading tool.	.737	.690	.674	.669
Because the professor used WebCT, I came to class more than I usually do.	.704	.656	.628	.619
Because the professor used WebCT, I participated in class discussions more than I usually do.	.755	.714	.688	.686
Because the professor used WebCT, I remember the concepts for this class longer than I usually do.	.822	.803	.745	.727
Power Point Learner (Cronbach's Alpha .892)[e]				
I feel my grade was higher in this class because the professor used PowerPoint.	.793	.767	.677	.654
I feel I learned the class material much better because the professor used PowerPoint.	.841	.826	.688	.673
I am the type of person who likes to see concepts as I learn them, so PowerPoint lectures helped me learn these concepts because it's a visual tool.	.804	.767	.657	.646
I am the type of person who likes to read concepts as I learn them, so PowerPoint lectures helped me learn these concepts because it's a reading tool.	.756	.704	.642	.627
Because the professor used PowerPoint lectures, I participated in class discussions more than I usually do.	.707	.640	.665	.632
Because the professor used PowerPoint lectures, I remember the concepts from this class longer than I usually do.	.834	.797	.738	.718
Because this professor used PowerPoint lectures, I feel he or she cared more about my learning than if he or she had not used PowerPoint lectures.	.719	.653	.651	.608
Valid N	1920	2088	1629	1629

Source: Spring 2006 Web-Based Survey of Undergraduates

NOTES: [a] PC 1 stands for Principle Component factor loadings for WebCT Learner and PowerPoint Learner, respectively.

[b] ML 1 stands for Maximum Likelihood factor loadings for WebCT Learner and PowerPoint Learner, respectively. Average variance for WebCT Learner factor is 56.3. Average variance for PowerPoint Learner factor is 60.9

[c] PC 2 stands for Principle Component factor loadings for overall Technology Learner. Cronbach's Alpha for this factor is .913.

[d] ML 2 stands for Maximum Likelihood factor loadings for overall Technology Learner. Average variance for overall Technology Learner is 45.3.

[e] WebCT Learner factor and Power Point Learner factor are correlated at r=.532***.

[f] Response set for these questions is: strongly disagree (=1), disagree (=2), neither agree nor disagree (=3), agree (=4), strongly agree (=5).

Internal consistency for both favorable perceptions of PowerPoint and WebCT for learning was extremely high, with Cronbach's alphas higher than .8. The principal component factor loadings for these constructs were also very high – .719 and higher – and are considered excellent indicators of construct validity (Comrey & Lee, 1992) and excellent levels of common variance that represent one construct (Tabachnick & Fidell, 1996). Using maximum likelihood confirmatory factor analysis allows the scores to be created with the assumption that the distribution of each item is normal, a representation of the items' distribution in the population that enhances reliability (Pett, Lackey & Sullivan, 2003). We performed these operations for both of these measures, then repeated them with all 15 of the questionnaire items to determine if one overall construct for favorable perceptions of technology for learning was evident. As internal consistency for this overall measure was very, very high (Cronbach's alpha = .913), and the factor loadings were over .6, considered "very good" indications of common variance, we created this overall latent construct as well. These analyses are summarized in Table 3 (dependent variables for students' perceptions of learning).

Dependent Variables for Instructors' Perceptions of Learning Using PowerPoint and WebCT

Table 4 summarizes the data analyses performed for instructors' dependent variables. Note that the same scheme used to construct the students' dependent variables was used for the instructors'. Three questionnaire items were used to create the dependent variable capturing favorable perceptions of WebCT use. While internal consistency is high for this measure (Cronbach's alpha = .719), the maximum likelihood loadings do fall slightly below .6. While this renders the measure "good" and not "excellent" (Tabachnick & Fidell, 1996) for internal variance, we proceed. Note that the sample size to create this variable is now 212 because only instructors who used WebCT responded to these items.

The dependent variable capturing favorable perceptions of PowerPoint use was constructed with 4 questionnaire items. Again, the internal consistency was high (Cronbach's alpha = .788), but maximum likelihood factor loadings dip slightly below .6. Note that the items for the two dependent variables did not load on a single technology factor as did the students' two dependent variables.

Table 4: Dependent Variables for Instructors Perceptions of Learning

	PC 1[a] Factor	ML 1[b] Factor
WebCT User (Cronbach's Alpha .719)		
Because I used WebCT (Vista) for this class, I feel that the class's overall average grade was better than the average grade would have been had I NOT used WebCT.[c]	.762	.588
Because I used WebCT (Vista) for this class, the students came to class more than they usually do.	.846	.808
Because I used WebCT (Vista) for this class, the students participated in class discussions more than they usually do.	.806	.673
Valid N	212	212
Power Point User (Cronbach's Alpha .788)		
I feel that using Power Point in the classroom enhances student learning.	.703	.566
I think that students prefer it when the professor uses the chalkboard during lecture rather than PowerPoint (reverse coded).	.728	.591
I feel that [those] students will not participate in class discussion as much as they would if the professor used other teaching devices (reverse coded).	.837	.791
I feel that [those] students will not remember concepts as much as they would if the professor used other teaching devices (reverse coded).	.857	.839
Valid N	477	477

Source: Spring 2006 Web-Based Survey of Classroom Instructors

NOTES: [a] PC 1 stands for Principle Component factor loadings for WebCT User and PowerPoint User, respectively.
[b] ML 1 stands for Maximum Likelihood factor loadings for WebCT User and PowerPoint User, respectively. Average variance for WebCT User factor is 64.8. Average variance for PowerPoint User is 61.4 .
[c] Response set for these questions is: strongly disagree (=1), disagree (=2), neither agree nor disagree (=3), agree (=4), strongly agree (=5).

Results

Table 5 presents results of the cross-sectional regression of dependent variables (favorable student perceptions of PowerPoint, WebCT, and overall technology for learning) on student demographics. Model 1, *WebCT Learner,* reveals that students higher in class rank are less likely to have favorable perceptions of WebCT for learning. In other words, the tendency to have favorable perceptions of WebCT for learning diminishes over time. The predictor for being a first year student as compared to being a senior (b=.090, p<.001) is higher than the predictor for being a sophomore (b=.00079, p<.01) or junior (b=.054, p<.05) as compared to being a senior. This trend partially holds for Model 3, *Technology Learner,* with significance dropping off by junior year (first year student rank: b=.092, p<.001; sophomore: b=.092, p<.01).

TABLE 5: Favorable Student Perceptions of Technology for Learning on Independent Variables

	Model 1: WebCT Learner		Model 2: PowerPoint Learner		Model 3: Technology Learner	
Male	-.043		-.076	***	-.083	**
	(.051)		(.049)		(.056)	
Non-European American	.000		-.027		-.006	
	(.085)		(.084)		(.096)	
Part-Time Student	.020		.007		.007	
	(.065)		(.057)		(.071)	
.First Year Student	.090	***	.037		.092	***
	(.066)		(.061)		(.073)	
Sophomore	.079	**	.042		.076	**
	(.062)		(.060)		(.068)	
Junior	.054	*	.015		.041	
	(.060)		(.058)		(.065)	
Social Science Major	.010		.066	*	.042	
	(.067)		(.064)		(.072)	
Humanities Major	-.025		-.012		-.020	
	(.072)		(.070)		(.079)	
Business Major	.054	*	.046		.060	*
	(.070)		(.066)		(.076)	
Education Major	-.022		-.019		-.031	
	(.085)		(.083)		(.093)	
Other Major	.036		.014		.048	**
	(.084)		(.075)		(.092)	
Regional Campus Student	.064	*	.010		.061	*
	(.058)		(.050)		(.063)	
Basic Computer Skills	.021		.020		.040	
	(.027)		(.022)		(.030)	
Advanced Computer Skills	.047		-.003		.023	
	(.024)		(.022)		(.026)	
Cumulative GPA	-.123	***	-.083	***	-.111	***
	(.039)		(.036)		(.043)	
N	1743		1968		1538	
Constant	.461	***	.367	**	.449	**
R-Squared	.044		.023		.045	

Source: Spring 2006 Web-Based Survey of Undergraduates (Standard Errors in Parentheses).
* p <.05, ** p < .01, *** p < .001, two-tailed tests

Both Model 2, *PowerPoint Learner,* and Model 3, *Technology Learner,* reveal gender differences with males significantly less likely to be oriented toward technology when holding all else constant (PowerPoint: b=.076, p<.001; technology: b=.083, p<.01). Majoring in Business (as compared to majoring in the natural sciences) or attending a satellite campus (as compared to attending the main campus) predicted students would be more favorable to both WebCT and technology in general for learning.

The most interesting result regarding individual student factors is the negative relationship between student grade point average and orientation toward technology. Holding all else constant, cumulative GPA was a negative predictor of favorable perceptions of WebCT for learning (b=-.123, p<.001), favorable perceptions of PowerPoint for learning (b=-.083, p<.001) and favorable perceptions of technology in general for learning (b= -.111, p<.001).

In answer to research question 1, student factors that influence their perceptions regarding the use of technology are in descending order of strength: grade point average, gender, class rank, campus location, and major. Implications of these findings are explored in the Discussion Section.

TABLE 6: Favorable Faculty Perceptions of Technology for Learning

	Model 1: Enhanced Learning	Model 2: Attended Class	Model 3: Participated in Discussion	Model 4: WebCT Works
Male	.034	.023	.005	.024
	(.131)	(.112)	(.145)	(.130)
Non-Euro-American	-.040	-.100	-.075	-.098
	(.191)	(.164)	(.212)	(.190)
Part-Time Faculty	-.264 **	-.215 *	.050	-.182
	(.211)	(.181)	(.234)	(.210)
Non-Tenure Track	.109	-.020	-.019	.007
	(.238)	(.205)	(.265)	(.238)
Instructor	.003	.171	.030	.118
	(.293)	(.252)	(.327)	(.293)
Assistant Professor	-.070	.029	.054	.020
	(.184)	(.158)	(.204)	(.183)
Social Science	.172 *	.150	-.006	.134
	(.188)	(.161)	(.209)	(.187)
Humanities	.015	.005	-.025	-.002
	(.171)	(.146)	(.190)	(.171)
Business	.094	.105	.001	.089
	(.257)	(.221)	(.286)	(.256)
Education	.082	.043	-.039	.034
	(.218)	(.188)	(.243)	(.218)
Other	-.053	.033	-.027	-.001
	(.391)	(.336)	(.435)	(.390)
Regional Campus	-.005	-.021	-.076	-.040
	(.155)	(.133)	(.173)	(.155)
Years at KSU	.053	.055	.110	.085
	(.009)	(.008)	(.010)	(.009)
N	205	206	206	205
Constant	2.990 ***	3.294 ***	3.043 ***	-.148
R-Squared	.087	.062	.023	.060

Source: Spring 2006 Web-Based Survey of Class Instructors (Standard Errors in Parentheses).
* p <.05, ** p < .01, *** p < .001, two-tailed tests

The focus group interviews framed the consequences to be explored in the second research question. Table 6 presents the results of the cross-sectional regression of favorable perceptions of WebCT use measures by faculty on independent variables. Model 1, *Enhanced Learning,* suggests that instructors in the social sciences, as compared to the natural sciences, believe that technology in general enhances learning (b=.172, p<.05). Part-time faculty, as compared to full-time faculty, perceive an inverse relationship between WebCT use and learning (b=-.264, p<.01).

Model 2, *Attended Class,* explores concerns about the use of technology affecting attendance. Only part-time faculty (as compared to full-time faculty) held a significant concern about an inverse relationship between WebCT use and attendance (b=-.215, p<.05). Model 3, *Participated in Discussion,* yields no significant predictor variables, indicating no differences among faculty members for effects on class discussions if using WebCT. Model 4, *WebCT Works,* reflects the results of the predictor variables collectively (see Table 4: favorable perceptions of WebCT use) and indicates no significant differences among faculty in general about favorably perceiving WebCT use for the classroom. In other words, significant differences of opinions about WebCT are evinced only with respect to specific items about WebCT, but not about using WebCT in general.

Tables 7a and b similarly present the results of the cross-sectional regression of favorable perceptions of PowerPoint use measures by faculty on independent variables. There were some interesting results reflected in the models. First, only faculty members in the humanities saw PowerPoint as a means to enhance learning as portrayed in Model 1 (b=.156, p<.01) as compared to natural scientists.

Model 2, *Preferred Chalkboard,* presents faculty perceptions of students' preference for use of the chalkboard over PowerPoint. Professors in the social sciences (b=-.202, p<.001), business (b= -.138, p<.01), education (b=-.111, p<.05), and other instructors (b=-.128, p<.01), as compared to natural scientists, believe students prefer PowerPoint over chalkboards. The longer one is at the university, the more instructors believe that students prefer PowerPoint (b=-.128, p<.05). Conversely, male instructors (b=.106, p<.05; b=.128) believe students prefer them to use the chalkboard over PowerPoint. Model 3, *More Class Discussion,* reflects a belief among assistant professors and instructors, as compared to associate and full professors, that PowerPoint use stimulates class discussion (b=.134, p<.05). This belief is shared by those who have had more years at the university (b=.196, p<.001).

In Model 4, *Better Concept Memory,* we see that social scientists (b=-.120, p<.05) and instructors from education (b=-.113. p<.05), as compared to natural scientists, feel that PowerPoint in the classroom does not help with remembering concepts; however, the longer instructors are at the university, the more favorably instructors feel about students remembering concepts transmitted through this technology (b=.008, p<.05).

Finally, Model 5, *PowerPoint Works,* (see Table 7b) reflects overall patterns for perceptions of PowerPoint use in the classroom. Social scientists (b=-.127, p<.05) and instructors from education (b=-.106, p<.05), as compared to natural scientists, do not prefer PowerPoint in the classroom. However, the longer at the university, the more instructors perceive PowerPoint favorably (b=.168, p<.01).

In answer to research questions 2a and 2b, we once again see gender effects this time gender is related to faculty perceptions that students would prefer they not use PowerPoint over chalkboards. Most instructors felt that students preferred PowerPoint presentations over chalkboard lectures. Many believed that PowerPoint actually stimulates class discussion. However, social scientists and education instructors are concerned that students will not remember the concepts discussed, lively or not. In fact, in general, these same instructors (at least compared to natural scientists) do not really prefer PowerPoint, although the longer one is an instructor at the university, the more favorable one tends to be.

TABLE 7a: Regression of Perceptions of PowerPoint Measures by Faculty

	Model 1: Enhanced Learning	Model 2: Preferred Chalkboard	Model 3: More Class Discussion	Model 4: Better Concept *Memory*
Male	.048	.106 *	.011	.003
	(.097)	(.085)	(.098)	(.097)
Non-Euro-American	-.085	.042	-.021	-.035
	(.147)	(.130)	(.148)	(.148)

Part-Time Faculty	-.049	.009	.009	-.001
	(.153)	(.135)	(.154)	(.154)
Non-Tenure Track	-.076	-.011	-.061	.003
	(.170)	(.150)	(.171)	(.171)
Instructor	.019	.052	.123	-.046
	(.210)	(.185)	(.212)	(.212)
Assistant Professor	-.007	.025	.134 *	.007
	(.137)	(.121)	(.138)	(.138)
Social Science	.052	-.202 ***	-.104	-.120 *
	(.133)	(.117)	(.134)	(.134)
Humanities	.156 **	-.061	.083	.039
	(.126)	(.111)	(.127)	(.126)
Business	-.032	-.138 **	-.055	-.047
	(.232)	(.204)	(.234)	(.234)
Education	.014	-.111 *	-.082	-.113 *
	(.165)	(.145)	(.166)	(.166)
Other	-.041	-.128 **	-.073	-.020
	(.275)	(.242)	(.277)	(.277)
Regional Campus	-.064	.070	.011	.029
	(.106)	(.094)	(.107)	(.107)
Years at KSU	.082	.128 *	.196 ***	.118 *
	(.006)	(.006)	(.006)	(.006)
N	437	437	437	437
Constant	2.320 ***	2.630 ***	2.304 ***	2.386 ***
R-Squared	.065	.092	.072	.050

Source: Spring 2006 Web-Based Survey of Class Instructors (Standard Errors in Parentheses).
* p <.05, ** p < .01, *** p < .001, two-tailed tests

TABLE 7b: Standardized Coefficients for the Cross-Sectional Regression of PowerPoint Measures by Faculty

	Model 5: PowerPoint Works
Male	.030
	(.090)
Non-Euro-American	-.032
	(.137)
Part-Time Faculty	-.003
	(.142)
Non-Tenure Track	-.035
	(.158)
Instructor	.034
	(.195)
Assistant Professor	.057
	(.127)
Social Science	-.127 *
	(.123)
Humanities	.065

	(.117)
Business	-.072
	(.215)
Education	-.106 *
	(.153)
Other	-.065
	(.255)
Regional Campus	.021
	(.099)
Years at KSU	.168 **
	(.006)
N	437
Constant	-.125
R-Squared	.073

Source: Spring 2006 Web-Based Survey of Class Instructors
(Standard Errors in Parentheses)
* p <.05, ** p < .01, *** p < .001, two-tailed tests

Tables 8a and 8b present the results of t-tests comparing student and faculty mean scores related to perceptions of consequences of technology use such as stronger student connections with their peers and professor plus increased rates of attendance and class participation. We found significant differences in perceptions for all three consequences. Equal variance for student and faculty variables was not assumed and all results are for two-tailed tests. In answering questions about WebCT (see Table 8a, *Perceptions and Means of Perceptions of WebCT*), faculty agreed slightly that using WebCT in a class increases connections between students (t=6.108, p<.000). To a lesser extent, faculty also saw more connection between themselves and their students than students did (t=2.335, p<.02). Students and faculty differed in their perceptions of WebCT's influence on class attendance with students believing they came to class more because of its use (t=-18.921, p<.000). Students were more likely to perceive that they participated more in class discussion when the instructor used WebCT (t=2.696, p<.007).

To check these results using a more conservative statistical test of group mean differences, the Kolmogorov-Smirnov Test, reveals that means for questions sets One and Three of Table 8a are statistically different (Kolmogorov-Smirnov Z=2.43, p<.001 and Kolmogorov-Smirnov Z=4.61, p<.001, respectively), but means for question sets Two and Four (Kolmogorov-Smirnov Z=1.06, p=2.14 and Kolmogorov-Smirnov Z=.923, p=.362, respectively) were not. Note that in any case, the mean differences between faculty and students or questions Two and Four do not differ very much, and therefore were not the strongest findings.

TABLE 8a I: Percentages and Means of Students' and Professors' Perceptions of WebCT

	Strongly Agree (=1)	Agree (=2)	Neither Agree Nor Disagree (=3)	Disagree (=4)	Strongly Disagree (=5)
Question Set One: Student Question (Valid N = 2,016) Using WebCT (Vista), I experienced a greater sense of connection with the others taking the class than I feel when classes that do not use WebCT (Vista):	2.7	12.2	44.6	28.0	12.5
Professor Question (Valid N = 214) Using WebCT (Vista), I believe my students experienced a greater sense of connection with the others taking the class than during classes when I did not use WebCT (Vista):	7.0	25.2	40.2	22.9	4.7

Independent Samples t-test[a]: (t=6.108, p<.000) Student Mean = 3.36 (SD=.941) Professor Mean = 2.93 (SD=.974)					
<u>Question Set Two: Student Question (Valid N = 2,016)</u> Using WebCT (Vista), I sensed a greater connection between the students and professor than I have when classes do not use WebCT (Vista):	3.4	17.0	44.3	24.5	11.9
<u>Professor Question (Valid N = 214)</u> Using WebCT (Vista), I sensed a greater connection between the students and me than I have during classes when I did not use WebCT (Vista):	6.5	21.5	35.5	30.8	5.6
Independent Samples t-test[a]: (t=2.335, p<.02) Student Mean = 3.24 (SD=.983) Professor Mean = 3.07 (SD=1.007)					

Source: Spring 2006 Web-Based Survey of Undergraduates

Notes: [a] Independent Samples t-tests do not assume equal variances with faculty and student variables.

TABLE 8a II: Percentages and Means of Students' and Professors' Perceptions of WebCT

	Strongly Agree (=1)	Agree (=2)	Neither Agree Nor Disagree (=3)	Disagree (=4)	Strongly Disagree (=5)
<u>*Question Set Three: Student Question (Valid N = 1,950*)</u> Because the professor used WebCT (Vista), I came to class more than I usually do:	3.3	7.5	47.5	25.5	16.2
<u>*Professor Question (Valid N = 214)*</u> Because I used WebCT (Vista) for this class, the students came to class more than they usually do:	.9	6.5	48.6	37.4	6.5
Independent Samples *t*-test[a]: (*t*=-18.921, p<.000) Student Mean = 2.69 (SD=.941) Professor Mean = 3.62 (SD=.971)					
<u>*Question Set Four: Student Question (Valid N = 1,950)*</u> Because the professor used WebCT (Vista) for this class, I participated in class discussions more than I usually do:	3.3	11.9	47.1	25.0	12.7
<u>*Professor Question (Valid N = 214)*</u> Because I used WebCT (Vista) for this class, the students participated in class discussions more than they usually do:	6.1	14.5	45.3	28.0	6.1
Independent Samples *t*-test[a]: (*t*=2.696, p<.007) Student Mean = 3.32 (SD=.952)					

Professor Mean = 3.14 (SD=.947)

Source: Spring 2006 Web-Based Survey of Undergraduates
Notes: [a] Independent Samples *t*-tests do not assume equal variances with faculty and student variables.

In answering questions about PowerPoint (see Table 8b, *Percentages and Means of Perceptions of PowerPoint Use*), students were more likely to indicate a preference for PowerPoint over the chalkboard than were faculty members (t=9.189, p<.000). Faculty were more likely to perceive lower rates of participation in discussions when using PowerPoint than were students (t=-6.745, p<.000). Students were much more likely to perceive PowerPoint as an aid in remembering concepts than were faculty members (t=-18.921, p<.000).

In answering research question 3, faculty and student perceptions about the influence of technology on learning vary. Students are much more positive about its effect on their class performance such as increased attendance, discussion participation, and memory of important concepts, than were faculty members. They were less positive about its influence in facilitating student to student and student to faculty connections than were faculty members, however.

TABLE 8bI: Percentages and Means of Students' and Professors' Perceptions of PowerPoint

	Strongly Agree (=1)	Agree (=2)	Neither Agree Nor Disagree (=3)	Disagree (=4)	Strongly Disagree (=5)
Question Set One: Student Question (Valid N = 2,226)					
To be honest, I prefer it when the professor used the chalkboard during lecture rather than PowerPoint:	5.1	7.3	25.9	35.8	25.9
Professor Question (Valid N = 477)					
I think that students prefer it when the professor uses the chalkboard during lecture rather than PowerPoint:	3.4	11.9	45.7	32.1	6.8
Independent Samples t-test[a]: (t=9.189, p<.000)					
Student Mean = 3.70 (SD=1.087)					
Professor Mean = 3.27 (SD=.882)					
Question Set Two: Student Question (Valid N = 2,128)					
Because the professor used PowerPoint lectures, I participated in class discussions more than I usually do:	5.1	15.7	51.1	22.6	5.4
Professor Question (Valid N = 477): Reverse Coded					
If a professor uses a PowerPoint presentation during a lecture, I feel that those students will (NOT) participate in class discussion as much as they would if the professor used other teaching devices, such as overhead transparencies and blackboards:	3.1	16.1	29.4	39.4	11.9
Independent Samples t-test[a]: (t=-6.745, p<.000)					
Student Mean = 3.07 (SD=.894)					
Professor Mean = 3.41 (SD=.997)					
Question Set Three: Student Question (Valid N = 2,128)					
Because the professor used PowerPoint lectures, I remember the concepts from this class longer than I usually do:	9.4	32.7	40.3	14.3	3.3

Professor Question (Valid N = 477): Reverse Coded					
If a professor uses a PowerPoint presentation to teach concepts, I feel that his or her students will (NOT) remember concepts as well as they would using other teaching resources, such as overhead transparencies or blackboards:	17.4	42.6	26.8	10.9	2.3
Independent Samples t-test[a]: (t=-18.921, p<.000)					
Student Mean = 2.69 (SD=.941)					
Professor Mean = 3.62 (SD=.971)					

Source: Spring 2006 Web-Based Survey of Undergraduates
Notes: [a] Independent Samples t-tests do not assume equal variances with faculty and student variables.

Using the more conservative Kolmogorov-Smirnov Test did not reveal differences from the t-test results for PowerPoint questions: all K-S Tst results revealed significant differences between student and faculty means.

Note that the size of the sample vary between questionnaire items. This is because of the structure of the survey – the professors who actually used WebCT and PowerPoint answered questions about these computer technologies; professors who did not use these technologies were directed around these questions. The same is true for students. If we executed a list-wise deletion on missing cases, the sample may be the same size with the same respondents, but we would lose many of the actual users of these technologies – and it is precisely those responses in which we are interested. Finally, minor variation between sample sizes exists for the student questionnaire items. Excluding the 50 to 100 cases that are directed around some items does not change the results of the statistical analyses.

Discussion

Factors Influencing Orientation toward Technology

Individual factors such as gender and organizational tenure influence student and faculty member perceptions of instructional technology. Female students viewed technology more favorably than their male colleagues. At first glance this finding may appear surprising. Past research establishes an inverse relationship between computer anxiety, experience, and gender. Females typically have more anxiety and less experience with technology than males (Ayersman & Reed, 1995). Males typically have lower computer anxiety and higher computer interest than females (Schumacher & Morahon, 2001). The difference we see in perceptions of instructional technology may relate more to learning style than either computer anxiety or interest. Using the Kolb's (1984) learning inventory, Severiens & ten Dam (1994) found women preferred a concrete learning style. They found men to be more likely to use an abstract conceptualization style. A concrete style, characterized by Vermunt (2005) as "reproduction-oriented," lends itself better to the hierarchical, linear progression of PowerPoint and the organization of materials in WebCT.

Preference for technology does not necessitate enhanced learning, however. According to Leidner and Jarvenpaa (1995), students perceive classes using technology such as PowerPoint as more organized, but not necessarily more effective. Gender effects may be more reflective of female's preference for how the technology is employed at the university under study than for the technology itself. For instance, in 2003, Colley studied preferences for in-school computer use by middle and high school students (n=211 girls; n=245 boys). Girls reported technology as a support for work more than boys did and were more likely to experience it as supporting learning than boys were. Conversely, boys reported games and the Internet as major advantages significantly more often than girls did. Gender effects in approaches to technology, with girls having a task and work orientation and boys a "play and tinker" approach, were previously found by van Schie and Wiegman (1997). This idea that orientation toward technology relates to how the technology is used, rather than technology itself, also has explanatory power for our finding that GPA is inversely related to technology orientation in the sample under study.

Turning again to past research, relationships between student performance (e.g. GPA) and learning style are apparent. Lonka, Olkinuora, and Makinen (2004) found the concrete learning style to be negatively associated with performance. Boyle, Duffy, and Dunleavy (2003) found meaning centered learning, which involves relating and structuring information and thinking critically, to be positively related to performance. PowerPoint is criticized in the literature as overly structured and reductionist in its delivery of content (Craig & Amernic, 2006; Parker, 2001; Tufte, 2003b); however, these qualities may be what appeals to students who struggle more with learning. For instance, in the present study freshmen and students with lower GPA were more oriented toward technology (PowerPoint and WebCT) than seniors and students with higher GPA. Organizing and streamlining content supports a concrete learning style. This may be the learning style most appropriate to freshmen level coursework when students need information upon which to build in later, more advanced courses.

Once again, the results of this study may be more reflective of students' orientation toward the way the technology is typically employed, as an organizing tool, than an overall orientation toward technology. During focus group interviews, there were few examples of technology applications beyond information distribution activities. Typical uses for PowerPoint were reported by students and faculty as a visual complement to lecture and as a note taking tool. Typical uses for WebCT were reported as a repository for course materials (syllabus, handouts, PowerPoint slides) and a way to track class performance (grade book; student tracking features). Using technology as an organizing tool is unlikely to increase learning for students preferring an abstract conceptualization learning style that lends itself to problem-based learning activities. Understanding factors related to faculty perceptions of technology may provide additional clues about classroom technology use.

Perceptual Comparisons

Factors related to faculty differences in perceptions of technology related to rank, organizational tenure, and academic discipline. Part-time faculty members were more likely to relate technology use with negative outcomes such as reduced attendance and reduced learning. This is in contrast to student reports that they were more likely to attend class and participate in discussions when their instructor used technology. They specifically saw PowerPoint as a way to remember concepts. This was a perception shared only by long-term faculty members.

Faculty in the natural sciences saw PowerPoint as an aid to students remembering concepts as compared to those in the social sciences. Past research indicates that there are disciplinary ties to learning styles. In other words, some cognitive styles are more suitable for learning natural science principles (Hansen, 1997). Findings in the present study appear to bear this out. Faculty in the natural sciences perceived PowerPoint more positively than their social science peers. The organizing properties of PowerPoint may be particularly well suited to the linear presentation of information required by the natural sciences.

Social science faculty members were more likely to see WebCT as supporting learning than their natural science peers. WebCT was reportedly seen as a means to connect students with each other and, to a lesser extent, themselves. This is a promising application for those convinced that learning happens through interaction (e.g. Atjonen, 2005). This notion is aligned with constructivist views of education that knowledge is something that is created rather than disseminated (Leidner & Jarvenpaa, 1995). Results indicate that students do not see WebCT as a means to increase their connections with others, however. Students do not seem to perceive WebCT as a vehicle for social networking. It may be the technology itself or, once again, it may be the way it is employed by students and faculty.

Contemporary students take advantage of social networking sites such as Facebook™ and My Space™, but don't see WebCT as serving a similar purpose. One explanation is that social networking sites can be individualized, giving students ownership and building enthusiasm and interest through self expression. The arrangement of materials and choice of functionality in WebCT is instructor driven. Instructors frequently dictate how students are to use the site. For instance, faculty may grade students on participation, requiring them to post to the discussion board a set number of times each week and then evaluating said postings. The fact that communication tools are available (e.g. email, chat room, discussion board) is not sufficient to ensure they are used. If faculty members are using WebCT in the hopes of building a learning community, their efforts may not be having the desired effect. Future research should focus on exploring why.

Limitations and Future Directions

Drawing data from a single university limits the generalizability to institutions of like size and mission. For instance, the mission of the university under study is to serve first-generation college students. School performance and exposure to technology may be specific to this population. Studying only two technologies, particularly when both were used primarily to organize course content, fills foundational gaps in the literature but generates more questions than it answers. Future studies should further explore the relationship between technology and student performance, relationships between technology and gender, and relationships between technology and academic discipline. It should also examine the effects of how student and faculty actually use technology on these relationships.

Conclusion

The present study helps us see that contemporary students and members of faculty share the expectation that instruction will involve technology. Use of technology alone should not be used as a measure of effective use, informed application or added instructional value. Both faculty and students need help in making good technology choices. Using technology as a means to deliver information may appeal to younger and lower performing students, but it does little to assist students in thinking critically about course concepts. When used as a means to organize course content, technology may make the information delivery process more efficient by supporting larger class sizes and reaching younger, more at-risk students. When technology is used in transformative ways, for example as a means to facilitate problem-based, collaborative learning or as a means to simulate field experience, it can help students achieve ends not possible through traditional classroom mediums. The choice to use technology, and how it is implemented, should be part of the formal instructional design process. Making deliberate choices is one way to exploit technology to meet student learning objectives. To achieve this end, faculty members must be reflexive in their choice of applications, students must engage technology enabled processes, and universities must be diligent in providing development and support for all users.

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