University Instructors' Acceptance of Electronic Courseware: An Application of the Technology Acceptance Model

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*This study examines the factors that influence instructors' adoption and use of an Internet-based course management system and tests the applicability of the Technology Acceptance Model (TAM), introduced by Davis (1986), in the context of e-learning practices in higher education. Using data from an online survey of a university's instructors (*N = *191), a path analysis revealed that* perceived ease of use *of the system had a significant impact on perceived usefulness as the TAM suggested. In addition, a direct effect of* perceived usefulness *on behavioral intention to use and an indirect effect of the variable on actual system use, both of which were proposed in the TAM, were also found. Further, motivation to use the system played a significant role in affecting perceived ease of use, perceived usefulness, evaluation of functions, current system use, and behavioral intention to keep using the system. This study suggests that integration of the TAM and the uses and gratification approach can be fruitful for future research on the diffusion of Internet-based technological systems.*

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Introduction

The rapid diffusion of the Internet has not only generated a renewed interest in the role of new information and communication technologies (ICTs) in higher education and learning (Dutton & Loader, 2002), but it has also affected the ways people teach and learn (DeLacey & Leonard, 2002; Radcliffe, 2002). At the same time, there

has been growing concern over the possible decline of traditional practices and institutions, as e-learning, virtual universities, and distance education become feasible alternative platforms for higher education. Students, teachers, and administrators have continued to employ the Internet and Web for their practices, and e-learning has remained a key item on educational agendas.

Among the various new e-learning systems, electronic course management software has been one of the most widely disseminated technologies in U.S. colleges and universities (Green, 2001). For instance, private virtual learning systems such as Blackboard (http://www.blackboard.com) and WebCT (http://www.webct.com) have been adopted by numerous academic institutions.[1] These Internet-based course management systems are designed to enable instructors to simulate most aspects of managing a course electronically, including: distribution of course documents such as readings, lecture notes, assignments, and quizzes; discussion of issues; administration of exams; and posting grades (Fredrickson, 1999).

The adoption of these systems in campus settings has many implications for ICT innovations in education. By establishing an institution-wide standard, adoption of electronic courseware creates incentives to invest in electronic content, and to link the course management system with other ICT applications within an academic institution. In addition, electronic courseware reshapes access to information by permitting interactive multimedia visualization, simulation of information, and the creation of educational networks beyond classroom walls (Dutton, Cheong, & Park, 2004a). Along with these implications, some studies (e.g., Dutton et al., 2004a, 2004b) highlight organizational and technological constraints on the diffusion of electronic courseware systems from the perspective of the social shaping of technology (Fulk, 1993; Fulk, Schmitz, & Steinfield, 1990; Kling, 2000; Williams & Edge, 1996). These studies emphasize that the evolutionary path of the systems is not predetermined by the systems' technological inner logic or economic imperative, but is rather affected by social, organizational, economic, and cultural factors that surround the systems.

Despite the popularity of electronic courseware systems in the U.S. and other countries, research on the individual-level factors that influence users' acceptance of electronic courseware systems in particular, and e-learning systems in general, has rarely been conducted. In addition, most studies of the adoption of Internet-based technologies in education have largely focused on students' use rather than instructors' use, even though instructors also play a critical role in the diffusion dynamics of e-learning systems. For example, individual instructors' perceptions of e-learning systems and prior teaching experience may promote (or discourage) willingness to adopt and may facilitate (or inhibit) use and diffusion of such systems.

Furthermore, few empirical studies have attempted to build a theoretical model that explains individual users' cognitive and affective factors that affect technology adoption and use. Given that a considerable amount of diffusion research in new technologies has accumulated, it is surprising that few theoretical models have gone beyond profiling users' characteristics with regard to the adoption of new

technologies. Thus, the goals of this study are: 1) to understand the factors that affect instructors' adoption and usage of a campus-wide electronic courseware system and 2) to suggest a model that explains the dynamics of users' acceptance of the system. An investigation of instructors' perception toward an electronic courseware system will help provide a rich set of antecedents to build a theory of e-learning system acceptance and further illuminate the process of technology adoption and use in the context of higher education.

The Technology Acceptance Model as a Theoretical Framework

Understanding why people accept or reject new information or communication technology has been one of the most challenging issues in the study of new technologies (Swanson, 1988). Among the various efforts to understand the process of user acceptance of information systems, the Technology Acceptance Model (TAM) introduced by Davis (1986) is one of the most cited theoretical frameworks. The model aims not only to explain key factors of user acceptance of information systems, but also to predict the relative importance of the factors in the diffusion of technological systems (Davis, Bagozzi, & Warshaw, 1989). According to Davis et al. (1989), the model is an attempt to derive "the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time trying to be parsimonious and theoretically justified" (p. 985).

The TAM is rooted in the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which has been applied to predicting and explaining user behaviors across a wide variety of domains. According to the theory of reasoned action (TRA), a person's performance of a specified behavior is determined by his or her behavioral intention to perform the behavior, and behavioral intention is jointly determined by the person's attitude and subjective norms concerning the behavior in question (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). Following the logic of the TRA, the TAM explores the factors that affect behavioral intention to use information or computer systems and suggests a causal linkage between two key variables—*perceived usefulness* and *perceived ease of use*—and users' attitude, behavioral intention, and actual system adoption and use (Davis, 1986).

Perceived usefulness is defined as "the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context," while perceived ease of use refers to "the degree to which the prospective user expects the target system to be free of effort" (Davis et al., 1989, p. 985). As Figure 1 illustrates, the TAM is a path model that identifies the impact of external factors such as system design characteristics, user characteristics, task characteristics, nature of the development or implementation process, political influences, organizational structure, and so on (Ajzen & Fishbein, 1980). The TAM suggests that information system usage is determined by behavioral

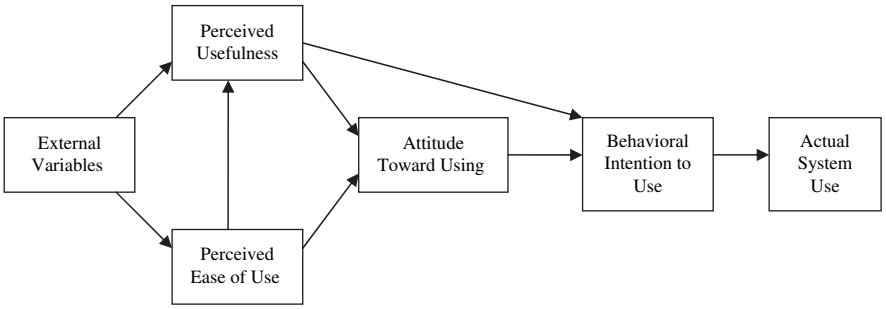

Figure 1 Technology Acceptance Model (TAM)

intention, which is viewed as being jointly determined by the user's attitude toward using the system and the perceived usefulness of the system (Davis et al., 1989).

Since Davis' (1986) introduction of the model, many studies have been conducted using it in a variety of information technology usage settings, testing its appropriateness and modifying it in different contexts. Past research on the TAM has largely focused on personal computer usage or relatively simple software applications such as email, word processing programs, spreadsheet software, and the Windows operating system (e.g., Chau, 1996; Davis, 1993; Davis et al., 1989; Doll, Hendrickson, & Deng, 1998; Mathieson, 1991). Recently, in line with the development of the Internet and Internet-based technologies, applications of the TAM have been made in the areas of organizational contexts (e.g., Hu, Chau, Sheng, & Tam, 1999; Igbaria, Zinatelli, Cragg, & Cavaye, 1997; Venkatsh & Davis, 1996), e-commerce (e.g., Jiang, Hsu, & Klein, 2000), telemedicine (e.g., Chau & Hu, 2002; Karahanna, Straub, & Chervany, 1999), and digital library systems (e.g., Davies, 1997; Hong, Thong, Wong, & Tam, 2002; Thong, Hong, & Tam, 2002).

Uses and Gratifications Approach

Although the TAM is a well-documented model for explaining technology acceptance by users, the model has been unable to account comprehensively for the factors that affect users' acceptance of technology systems, due to the original model's intended generality and parsimony. That is, one of the TAM's weaknesses is its lack of explicit inclusion of antecedent variables that influence perceived ease of use and perceived usefulness (Dishaw & Strong, 1999). Davis (1989), who originally introduced the model, also claimed that research should explore other variables that could affect perceived ease of use, perceived usefulness, and actual use. Thus, it is necessary to search for other constructs in order to enrich the explanation of users' acceptance of technology systems depending on specific technology adoption contexts.

One compelling complementary theoretical framework that may fill this gap is the uses and gratifications approach (Katz, Blumler, & Gurevitch, 1974; Palmgreen,

1984; Palmgreen, Wenner, & Rosengren, 1985; Rosengren, 1974; Rubin 1986, 1993, 1994; Windahl, 1981), which has been widely researched in the area of media effects. Although the approach focuses primarily on why and how people use media, its emphasis on individual media users' activities and choices makes it possible to be extended to consider the adoption and use of other technologies. Specifically, the following principal assumptions of the approach (Rubin, 2002) illustrate its aim to explain the reasons why people use mass media, including the Internet: 1) People's selection and use of media is goal-directed, purposive, and motivated; 2) People select and use media to satisfy their felt needs or desires, suggesting that they are active communicators; 3) Social and psychological factors guide, filter, or mediate people's communication behavior; and 4) People's own initiative mediates the patterns and consequences of media use.

These assumptions emphasize the role of people's initiative and activity, and consequently, focus on motivation—which can be defined as a general disposition that influences the actions people take to fulfill a need or want (Rubin, 1993)—as a factor that accounts for their selective choice and subjective interpretation of media messages. Because people are said to be actively aware of their choices of media and technology, they are assumed to exhibit motivations to use particular media or technology (Infante, Rancer, & Womack, 1993). In other words, strongly motivated media or technology users engage in more activities and experience greater satisfaction when using media or technology as compared to weakly motivated users (Lin, 1993). In sum, the approach views motivation as driven by felt needs and individual differences (Rosengren, 1974) and as playing a critical role in increasing people's behavioral intention and actual use of media.

Research based on the uses and gratifications approach has been extensively applied for more than 40 years for a variety of new media and new communication technologies, including the VCR (Cohen, Levy, & Golden, 1988; Rubin & Bantz, 1987), cable television (Bantz, 1982), online bulletin board systems (James, Wotring, & Forrest, 1995; Rafaeli, 1986), the World Wide Web (Ferguson & Perse, 2000), online services (Lin, 1999), and the Internet in general (Miller, 1996; Papacharissi & Rubin, 2000). Especially in the case of Internet use, many researchers have claimed that the uses and gratifications approach could be a productive means for better understanding the relationship between individual users and technology in the era of the Internet (e.g., Newhagen & Rafaeli, 1996). Moreover, past research has shown how users' various motivations for information, communication, surveillance, and entertainment have influenced their online activities and Internet use.

In addition to this perspective's applicability in the fields of mass media and the Internet, it has been claimed that the approach needs to be adopted to examine a variety of other new communication technologies (e.g., Rubin, 2002; Ruggiero, 2000; Williams, Strover, & Grant, 1994). In the area of instructional settings, Kuehn (1994) argued that by charting categories of motivations, the uses and gratifications approach could shed light on: 1) quantity and/or quality of interaction in class or in a course managed by computer-mediated communication (CMC) systems, 2) the

development of relationships between instructors and students in institutional settings, and 3) effectiveness of instruction.

In the case of electronic courseware, it is reasonable to assume that users have specific motivations—which could correspond to individual differences and external factors in the TAM—that drive them to participate in the adoption and use of the system. In addition, the aforementioned assumptions of the uses and gratifications approach can easily be modified and utilized to explain the adoption and use of electronic courseware. Instructors who adopt and use electronic courseware are also goal oriented in their teaching, motivated by various purposes to enhance their performance, and at the same time, constrained by social and institutional factors in the educational setting. Thus, it is expected that the uses and gratifications approach will not only provide a meaningful theoretical explanation to facilitate a clear understanding of the relationship between individual instructors and the use of electronic courseware, but also help address the weaknesses of the TAM.

Hypotheses

Drawing from the theoretical propositions of the TAM and the uses and gratifications approach, this study proposes several hypotheses with regard to the use of electronic courseware.

Perceived Ease of Use

A considerable amount of research over the past decades supported the significant effect of perceived ease of use on behavioral intention, either directly or indirectly through its effect on perceived usefulness (e.g., Davis et al., 1989; Hu et al., 1999; Jackson, Chow, & Leitch, 1997; Venkatesh, 1999). Thus, this study hypothesized that perceived ease of use of electronic courseware would have a positive effect on both perceived usefulness and behavioral intention to keep using electronic courseware.

H1a: Perceived ease of use will have a positive effect on the perceived usefulness of electronic courseware.

H1b: Perceived ease of use will have a positive effect on behavioral intention to keep using electronic courseware.

Perceived Usefulness:

Users' behavioral intention to use an information system is fueled, to a large extent, by their perceived usefulness of the system (Davis et al., 1989). There is also extensive empirical evidence that supports the significant effect of perceived usefulness on behavioral intention (e.g., Davis et al., 1989; Hu et al., 1999; Jackson et al., 1997; Venkatesh, 1999). As a logical corollary, it is likely that perceived usefulness will lead to positive evaluation of functions of electronic courseware. Thus, the following hypotheses were set forth:

H2a: Perceived usefulness will have a positive effect on the evaluation of functions of electronic courseware.

H2b: Perceived usefulness will have a positive effect on behavioral intention to keep using electronic courseware.

Motivation

In addition to perceived ease of use and perceived usefulness, individual differences in motivation to use technology systems were found to be one of the most relevant variables in the successful diffusion of information systems (Hong et al., 2002). Based on the uses and gratifications approach, past studies that have investigated the role of motivation in Internet use also confirm that motivation has a positive impact on new technology adoption and use (e.g., Lin, 1998; Stafford & Stern, 2002). In addition, instrumental use of media and technology with greater motivation has been found to produce stronger attitudinal and behavioral effects on the use of media and technology (Rubin, 2002; Windahl, 1981). Therefore, the following hypotheses were proposed:

H3a: Motivation will have a positive effect on the perceived ease of use of electronic courseware.

H3b: Motivation will have a positive effect on the perceived usefulness of electronic courseware.

H3c: Motivation will have a positive effect on the evaluation of functions of electronic courseware.

Compliance with School Policy

Both the TAM and the uses and gratifications approach identify the impacts of contextual societal factors such as political influences, organizational structure, and social interactions and relationships (e.g., Ajzen & Fishbein, 1980; Davis et al., 1989; Rubin, 1993, 1994). With regard to electronic courseware, one unique and important aspect of higher education settings is that top university management in many institutions asks instructors to use an institution-wide system regardless of the rank and file's desire and motivation to adopt the system. Institutional requirements from above may either promote instructors' adoption and use of the system or induce resistance from actual users. As Dutton et al. (2004a, 2004b) claim, however, it is hard for the adoption of a new innovation to be imposed in a top-down fashion, given that instructors are the primary end-users and most critical decision makers about the adoption and use of electronic courseware in classes. Therefore, whether instructors decide to use the system from their own will or due to school/departmental policy could be an important factor in the diffusion of the technology in the institutional context, even if school policy may lead to the use of the system in the short term. From this understanding, the following hypotheses were set forth:

H4a: School policy will have a negative effect on the evaluation of functions of electronic courseware.

H4b: School policy will have a positive effect on the current use of electronic courseware.

H4c: School policy will have a negative effect on behavioral intention to keep using electronic courseware.

Instructional Technology Clusters

The uses and gratifications approach claims that each communication medium and technology competes with other forms of communication or functional alternatives as a supplement, complement, or substitute (Rosengren & Windahl, 1972; Rubin, 2002). For instance, the Internet is a functional alternative to face-to-face communication for those who are anxious about interpersonal interaction (Papacharissi & Rubin, 2000). However, when it comes to the adoption and use of media or technologies, technological systems are rarely adopted in isolation, and "all technology clusters consist of one or more distinguishable elements of technology that are perceived as being closely interrelated" (Rogers, 1995, p. 15).

Consequently, adoption of a technology is likely to be stimulated by the use of functionally similar technologies (Atkin & LaRose, 1994; LaRose & Atkin, 1992). Reagan (1987), for instance, found that the adoption of communication technologies was powerfully related to the adoption of other technologies such as videotext, personal computers, compact discs, and cable. Lin (1998) also noted that computer adoption was related to Internet adoption intentions as well as a technology adoption index (comprised of 14 communication technologies). Neuendorf, Atkin and Jeffres (1998) applied Rogers' notion of technology clusters to the adoption of audiotext information services and found that the use of audiotext was related to functionally similar technologies such as videotext, ATMs, and 800 numbers. This concept of "technology clusters" led to hypotheses in which a positive relationship is expected not only between the use of other instructional technologies and perception of electronic courseware, but also between instructional technology clusters and evaluation of the functions of electronic courseware.

H5a: Instructional technology clusters will have a positive effect on the perceived ease of use of electronic courseware.

H5b: Instructional technology clusters will have a positive effect on the perceived usefulness of electronic courseware.

H5c: Instructional technology clusters will have a positive effect on the evaluation of functions of electronic courseware.

Evaluation of Functions

As the assumptions of the uses and gratifications approach illustrate, users of media and technologies are goal-oriented and purposive. In addition, users' active initiative can play an important intervening role in fueling the use of the media or technology in question (Rubin, 2002). In the context of electronic courseware adoption, it is expected that instructors are selective in using specific functions of the system in order to fulfill their needs and wants. At the same time, instructors

are likely to actively evaluate the functions as a way to assess their value for improving teaching performance. Therefore, it is hypothesized that users who favorably evaluate functions of electronic courseware have a higher likelihood of use and a stronger behavioral intention to keep using the technology than those who do not.

H6a: The evaluation of functions will have a positive effect on the current use of electronic courseware.

H6b: The evaluation of functions will have a positive effect on behavioral intention to keep using electronic courseware.

Current System Use

Many studies that empirically tested the TAM did not examine actual system use, which had been identified as a construct in the original TAM's path model (e.g., Chau & Hu, 2002; Hong et al., 2002; Thong et al., 2002). Given that numerous academic institutions are currently employing electronic courseware to support teaching and instruction in higher education, an examination of the relationship between the current usage of electronic courseware and behavioral intention to use the system in the future would shed light on the future adoption patterns of electronic courseware. Thus, the following hypothesis was set forth:

H7: Current system use will have a positive effect on behavioral intention to keep using electronic courseware.

The proposed research model in this study integrates the literature and hypotheses described above (Figure 2).

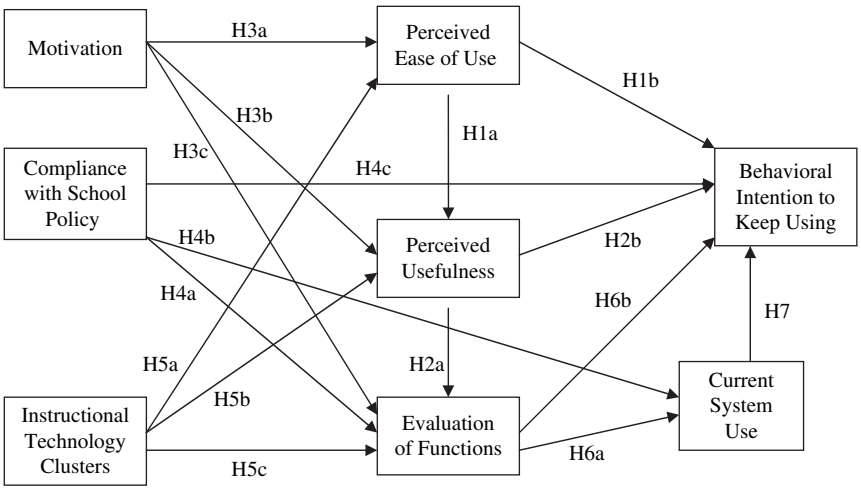

Figure 2 Research model

Method

In order to test the proposed model empirically, a private research university in the western United States was selected because it had adopted a commercial electronic courseware (called "eClass" hereafter), which appeared to diffuse rapidly within the university. The main institutional actor at the university was a center that was responsible for the use of ICTs in teaching and research. The center introduced a trial version of eClass at the university in the spring 1999 semester. Workshops and training sessions for faculty and instructors, together with general word-of-mouth recommendations, led to rapid spread over the next two years, from six adoptions at the beginning to over 1,000 by spring 2001.

Despite continuing growth in demand, by spring 2001, registration of new courses was stopped because eClass had reached the limit of the pilot version's capacity. The center therefore upgraded the system to a newer version in summer 2001, which could support many more courses. However, when the center began migrating older courses to the new system, implementation problems arose, such as unstable transition or loss of files stored in the pilot version, which caused many instructors to abandon their use of eClass. Faced with these problems, the center upgraded the courseware system again so that instructors could use the system effectively. In the spring of 2002, 6,814 courses were offered at the university, and 752 (about 11%) registered for eClass. Of these, 700 courses actually used eClass.

Procedures

A survey was conducted through an online questionnaire from January 2002 to March 2002. An email message was sent to all instructors registered on eClass, both current and former users, asking them to click on the link to the online questionnaire. The questionnaire took about 15 minutes to complete. Respondents were assured that their individual responses would be kept confidential. Following the first invitation to participate in the survey sent in January 2002, two follow-up reminders were sent in February to instructors who had not yet responded. Survey responses from 225 instructors were gathered, representing a response rate of approximately 50% based on the estimate of the number of actual users. Of these, 191 were completed fully; the rest were mostly from instructors who registered for the courseware but did not actually use it and, consequently, left many questions blank.

Measurement

Perceived ease of use measured the level of the participants' agreement with the following statements: 1) "eClass is easy for me to use;" 2) "eClass is easy for students to use;" and 3) "eClass is convenient for students to access." Items were followed by a 5-point Likert-type response scale: strongly disagree (1); disagree (2); neither agree nor disagree (3); agree (4); strongly agree (5) (Cronbach's $a = .80$).

Perceived usefulness measured the level of the participants' agreement with the following items: 1) "I am teaching in new ways since using eClass;" 2) "Students' performance is enhanced when using eClass;" 3) "I interact more with students when

using eClass;" 4) "Some students participate on eClass who do not participate in class discussion;" 5) "Students like to use eClass;" 6) "I save time by using eClass;" and 7) "eClass is a central component of my classes." Items were followed by a 5-point Likert-type response scale ranging from "strongly disagree" (1) to "strongly agree" (5) (Cronbach's $\alpha = .84$).

Motivation was measured by six items that asked instructors about the importance of the following motivations for using eClass: 1) "Keep up with technical change;" 2) "Increase communication among students;" 3) "Save time;" 4) "Respond to student requests or interest;" 5) "Learn more about online course development;" and 6) "Help students learn to use online resources." Respondents could provide answers along a 4-point scale: not important (1); somewhat important (2); important (3); and very important (4) (Cronbach's $a = .79$).

Compliance with school policy was measured by the following question: "How important to you was compliance with school or departmental policy in using eClass?" The item was anchored by a 4-point scale answer, ranging from "not important" (1) to "very important" (4).

Instructional technology clusters was measured by the instructors' use of 11 other instructional technologies and their frequency of use: 1) computer presentation software (e.g., PowerPoint); 2) overhead projectors; 3) simulation or gaming; 4) audio conferencing; 5) video conferencing; 6) email; 7) videotapes; 8) 35 mm slides; 9) groupware or collaborative software; 10) the Internet or the Web; and 11) flip charts. Again, a 4-point response scale was used: never (1); seldom (2); often (3); and regularly (4) (Cronbach's $\alpha = .77$).

Evaluation of functions was measured by the users' rating of the 17 functions of eClass: 1) posting announcements; 2) using the course calendar; 3) posting course documents; 4) posting student information; 5) posting assignments; 6) communication via email; 7) communication via the discussion board; 8) creating and facilitating groups; 9) posting external links; 10) using the eClass resource center; 11) using the address book; 12) surveying students; 13) administrating exams/quizzes; 14) using the gradebook; 15) tracking document downloads; 16) viewing usage statistics; and 17) communication via the chat/virtual classroom. Participants responded using 5-point scales: never used (1); not helpful (2); somewhat helpful (3); helpful (4); and very helpful (5) (Cronbach's $\alpha = .85$).

Current system use was measured by the following question: "In your most recent courses that use eClass, for how many hours per week did you personally use eClass?" The participants were asked to fill in with a numeric value for the question.

Behavioral intention to keep using was measured by the following question: "Do you plan to use eClass continuously in the future?" with responses on a 4-point scale: no, definitely not (1); no, probably not (2); yes, maybe (3); yes, definitely (4).

Data Analysis

This study used a path analysis with a series of multiple regression analyses to test the hypothesized relationships among the variables and the theoretical model presented

in Figure 2. The regression analyses were conducted with a hierarchical method based on the theoretical components of the current study: The variables from the TAM (perceived ease of use and perceived usefulness) were entered first in the regression equations; the variable of motivation was entered second; finally other variables were included. In order to screen potential multicollinearity problems with the variables, Pearson's correlation coefficients were computed for all variables.

The correlation matrix of all variables used to test the model is shown in Table 1, along with their respective means and standard deviations. All pairwise associations are positively correlated with one another except for the relationship between compliance with school policy and behavioral intention to keep using. The correlation coefficients among these variables are less than .6, except for the correlation between perceived ease of use and perceived usefulness, indicating that they have discriminant validity (Campbell, 1960). Perceived ease of use and perceived usefulness have a moderate relationship ($r = .66$, $p < .01$), suggesting that the two variables are related to each other.

Results

Descriptive Statistics

The survey results indicate that participants in the study have taught in colleges or universities for more than 12 years on average ($M = 12.59$, $SD = 10.60$), while they have used computers for teaching and research purposes for nearly 14 years ($M = 13.88$, $SD = 8.43$). Regarding eClass, they had used the system in the university for more than two semesters on average before the survey was conducted ($M = 2.32$, $SD = 1.48$), and only four participants used the system for the first time during the semester of the survey. In addition, participants in the survey have employed eClass in almost three courses for their teaching ($M = 2.97$, $SD = 3.10$). More than 10% of the participants have used the system in more than six courses.

Table 1 Means, standard deviations, and zero-order correlations (N = 191)

Variable	1	2	3	4	5	6	7	8	*M*	*SD*
1. Motivation	–	.21**	.21**	.20**	.28**	.44**	.25**	.07	2.56	.67
2. Instructional technology clusters		–	-.01	.11	.13	.30**	.24**	.08	2.01	.46
3. Compliance with school policy			–	.05	.02	.22**	.05	-.09	1.51	.92
4. Perceived ease of use				–	.66**	.36**	.12	.50**	3.49	1.02
5. Perceived usefulness					–	.50**	.23*	.58**	3.05	.81
6. Evaluation of functions						–	.39**	.26**	2.62	.71
7. Current system use							–	.14*	2.71	2.65
8. Behavioral intention to keep using								–	3.54	.82

Note: *$p < .05$, **$p < .01$ (2-tailed).

Tests of Hypotheses

Figure 3 presents the results for the path analysis of the combined hypotheses. The results of the analysis, including the standardized coefficients and *t*-statistic for each independent variable, and total variance explained and *F*-statistic for each dependent variable, are reported in Table 2.

The first two hypotheses proposed that perceived ease of use would predict the perceived usefulness of the electronic courseware (H1a) and behavioral intention to keep using the system (H1b), both with positive signs. Both of these proposed paths were significant in the hypothesized direction ($\beta = .63$, $t = 11.35$ for H1a; $\beta = .25$, $t = 3.41$ for H1b); thus, both hypotheses 1a and 1b were supported.

The second two hypotheses proposed that perceived usefulness would be a positive predictor of the evaluation of functions of the electronic courseware (H2a) and behavioral intention to keep using the system (H2b). These proposed paths were significant in the hypothesized direction ($\beta = .41$, $t = 6.48$ for H2a; $\beta = .48$, $t = 6.07$ for H2b), and thus, hypotheses 2a and 2b were also supported.

The third set of hypotheses proposed that motivation would be a positive predictor on the perceived ease of the electronic courseware (H3a), the perceived usefulness of the system (H3b), and the evaluation of functions of the system (H3c). These proposed paths were all significant ($\beta = .19$, $t = 2.60$ for H3a; $\beta = .15$, $t = 2.63$ for H3b; $\beta = .23$, $t = 3.56$ for H3c). Therefore, hypotheses 3a, 3b, and 3c were all supported.

The fourth set of hypotheses suggested that compliance with school policy would be a negative predictor of the evaluation of functions (H4a) and behavioral intention to use the system (H4c), while being a positive predictor of current system use (H4b). H4a was significant ($\beta = .13$, $t = 2.20$), while H4c was marginally significant

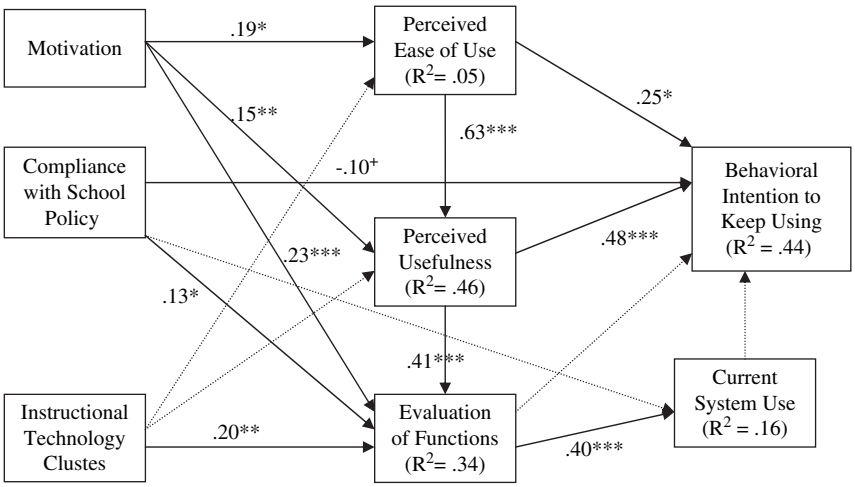

Figure 3 Multiple regression results for the final model
Note: Dotted lines indicate non-significant paths.
$^{+}p < .10$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Table 2 Results of multiple regression analyses

Dependent variables	R^2	ΔR^2	F	Independent variables	β	t
Perceived ease of use	.041			Motivation	.19	2.60*
	.045	.004	4.47*	Instructional technology cluster	.06	.88
Perceived usefulness	.434			Perceived ease of use	.63	11.35***
	.457	.023		Motivation	.15	2.63**
	.459	.001	52.79***	Instructional technology cluster	.04	.66
Evaluation of functions	.215			Perceived usefulness	.41	6.48***
	.281	.066		Motivation	.23	3.56***
	.318	.037		Instructional technology cluster	.20	3.31**
	.336	.018	22.92***	Compliance with school policy	.13	2.20*
Current system use	.151			Evaluation of functions	.40	5.78***
	.155	.004	16.77***	Compliance with school policy	−.07	−.97
Behavioral intention to use	.294			Perceived ease of use	.25	3.41**
	.421	.127		Perceived usefulness	.48	6.07***
	.434	.013		Compliance with school policy	−.10	−1.83$^+$
	.437	.003		Evaluation of functions	−.07	−1.05
	.437	.000	27.97***	Current system use	.03	.40

Note: $^+p < .10$, $^*p < .05$, $^{**}p < .01$, $^{***}p < .001$.

(β = −.10, $t = -1.83$, $p = .07$). Yet, the impact of compliance with school policy on current system use was not significant. In the case of H4a, however, a significant positive relationship was found, contrary to expectation.

The fifth set of hypotheses proposed that instructional technology cluster would predict the perceived ease of use of the electronic courseware (H5a), the perceived usefulness of the system (H5b), and the evaluation of functions of the system (H5c), all with positive signs. However, only the impact on the evaluation of functions of the system was supported (β = .20, $t = 3.31$ for H5c).

Hypothesis 6a, which predicted the impact of the evaluation of functions on current use of the electronic courseware, was supported (β = .40, $t = 5.78$), whereas H6b, which suggested the impact of the evaluation of functions on behavioral intention to keep using the system, was not supported. It indicates that the evaluation of functions is a positive predictor for current use of the system.

Quite surprisingly, hypothesis 7, which predicted the impact of current system use on behavioral intention to keep using the electronic courseware, was not supported (β = .03, $t = .40$), suggesting that current system use was not necessarily channeled into instructors' intention to continue to use the system in the future.

Direct and Indirect Effects

The examination of total effects of the variables is shown in Table 3. It was found that motivation had effects on all dependent variables either directly or indirectly. The variable had direct effects on perceived ease of use (.19), perceived usefulness (.15), and the evaluation of functions (.23). In addition, motivation had substantial indirect effects on perceived usefulness (.12), which accounted for nearly half of its total effect on that variable (.27), and on the evaluation of functions (.11). Motivation accounted for all total effects, both on current system use (.13) and on behavioral intention to keep using (.18) through indirect paths.

Compliance with school policy had substantial direct effects on the evaluation of functions (.13) and behavioral intention to keep using the system (−.10). The variable, however, had only an indirect effect on current system use (.05). Instructional technology cluster also exhibited a direct effect on the evaluation of functions (.20). The variable also had an indirect effect on current system use (.08).

Perceived ease of use also played a significant role in the model. The variable had direct effects on perceived usefulness (.63) and on behavioral intention to keep using (.25). In addition, perceived ease of use had a substantial indirect effect on behavioral intention to keep using (.30), and it accounted for more than half of the total effect (.55). Although the variable did not have direct effects on the evaluation of functions nor on current system use, it accounted for all total effects on those variables indirectly (.26 and .10, respectively).

As the TAM suggested, perceived usefulness was an important variable in this study as well. The variable accounted for the total effects, both on the evaluation of functions (.41) and on behavioral intention to keep using (.48) directly, while explaining the total effect on current system use indirectly (.16). Evaluation of functions was another variable that accounted for actual system use (.40) with a direct path.

Discussion and Conclusion

This study investigated the factors that influence behavioral intention toward and actual use of an electronic courseware system, using the framework of the Technology Acceptance Model developed by Davis (1986). The findings generally supported hypotheses derived from the model and from earlier empirical studies. However, the study also found that there were other variables that played an important role in accounting for actual system use, as well as in behavioral intention to keep using the system.

First of all, this study confirmed that perceived ease of use had a significant impact on perceived usefulness, as the TAM suggested. However, although the model suggested only an indirect effect of perceived ease of use on behavioral intention (see Figure 1), the current study found that perceived ease of use had a substantial direct effect on behavioral intention as well. It was also found that perceived ease of use was channeled into actual system use through perceived usefulness and the evaluation of functions of the system. In addition, the direct effect of perceived usefulness on

Table 3 Direct and indirect effects

Variable	Effects on[a]														
	Perceivedease of use			Perceived usefulness			Evaluation of functions			Current system use			Behavioral intentionto keep using		
	D	I	T	D	I	T	D	I	T	D	I	T	D	I	T
Motivation	.19	–	.19	.15	.12 (.05)	.27	.23	.11 (.03)	.34	–	.13 (.03)	.13	–	.18 (.05)	.18
Compliance with school policy							.13	–	.13	–	.05 (.02)	.05	−.10[b]	–	−.10[b]
Instructional technology clusters							.20	–	.20	–	.08 (.02)	.08			
Perceived ease of use				.63	–	.63	–	.26 (.04)	.26	–	.10 (.02)	.10	.25	.30 (.05)	.55
Perceived usefulness							.41	–	.41	–	.16 (.03)	.16	.48	–	.48
Evaluation of functions										.40	–	.40			

Note: D: Direct effect, I: Indirect effect, T: Total effect[a]. All $p < .05$,[b]. $p < .10$. Standard errors in parentheses.

behavioral intention and the indirect effect of the variable on actual system use, both of which were suggested in the original TAM model, were supported.

As mentioned earlier, since the TAM is a general and parsimonious model, the key variables (i.e., perceived ease of use and perceived usefulness) may function differently depending on other variables included in specific research settings. The current study employed four other variables: motivation, compliance with school policy, instructional technology cluster, and evaluation of functions. An important finding in this study is that motivation functioned as an external variable, which had an either direct or indirect effect on all dependent variables. Results suggest that for users to actively adopt electronic courseware, they should possess a strong desire to use that technology, as claimed by the uses and gratifications approach. Interestingly enough, findings from the path analysis also indicate that users' strong motivation leads to even higher perceived ease of use, which in turn facilitates behavioral intention to keep using the system in the end. As compared with those who have a weak motivation, users with a strong motivation to use electronic courseware are more likely to perceive the ease of use and usefulness of the system and to exhibit high evaluations, as long as the system seems supportive of their teaching. These findings are in parallel with the TAM's original proposition that emphasizes the effects of individual differences on perceived ease of use and perceived usefulness.

In order to explain the unique context of higher education, compliance with school policy was employed as an institutional variable that would affect instructors' adoption of the system. That is, while motivation is instructors' internal desire to adopt and use the system, compliance with school policy is an outside pressure that enforces use. An interesting finding from the analysis is the variable's direct effect on the evaluation of functions in a positive direction. In other words, the more instructors believe that school/departmental policy is an important reason to adopt electronic courseware, the more likely they are to highly evaluate the functions of the system. This means that electronic courseware could be considered a valuable system insofar as it is beneficial for instructors to manage classes and perform their teaching, regardless of whether the adoption of the technology is driven by their own desire or pressure from administration. This finding was also confirmed in part by the indirect effect of compliance with school policy on current use. Nevertheless, it was also found that, as expected, the variable had a negative effect on behavioral intention to keep using the system. This suggests that notwithstanding high evaluation of the system and its impact on the current use, it is hard for the use of electronic courseware to be sustained where its adoption and use are enforced in a top-down fashion. This finding empirically supports the claim from Dutton et al. (2004a, 2004b) that school-wide systems cannot be successfully imposed by top management's decisions without taking into account individual instructors' teaching styles and approaches to instructional technologies.

The instructional technology cluster was found to have a direct effect on the evaluation of functions and an indirect effect on current system use. This means that more use of other instructional technologies helped participants regard the system as

another valuable technology for their teaching. As prior studies on technology adoption have found, the variable affected actual system use, even if its effect was indirect, but its impact was quite small compared to that of other variables examined in this study. It is probable that participants in this study were fairly satisfied with other instructional technologies they had used and might not feel a strong need to use the new instructional technology. In addition, the evaluation of functions is a newly-found significant intervening variable in the use of the electronic courseware in this study. This means that, as the uses and gratifications approach suggests, instructors were selective in the evaluation of the functions provided by the system, and in turn, the evaluation facilitated current system use. The evaluation of functions had a significant direct effect on current system use, which suggests that participants' assessment of the system may be the most important drive to induce actual use.

Finally, contrary to expectations, the present study found that the impact of current system use was not carried over as a behavioral intention to continue to use the system in the future. There are two possible explanations for this. First, as a methodological problem, both the current system use and behavioral intention variables were assessed by one question each, which means that the measurement of the two variables may not represent the concepts appropriately. The second explanation is theoretical. As Dutton et al. (2004a, 2004b) argue, despite the instructors' readiness and intention to use the system, institutional factors such as copyright protection[2] or technical glitches may hinder their continuous use of the system. It is somewhat ironic that technical glitches may have impeded the implementation of electronic courseware. However, technical problems are not unique to electronic courseware; other previous technologies have had technical problems as well. Thus, people who experienced technical problems with other technologies might find a new opportunity in electronic courseware for their teaching.

The fact that participants in this study have regularly used email (66%), computer presentation software (e.g., PowerPoint; 50%), and the Internet (33%) as means of teaching indicates that electronic courseware and other technologies can supplement one other (see also Morgan, 2003). However, given that technical glitches in electronic courseware require more adjustment time and effort from users and may also result in unexpected outcomes such as low teaching evaluations from students (Dutton et al., 2004a, 2004b), it is plausible that technical glitches are a substantial barrier to widespread use of the system. Thus, instructors might abandon continued use of the new system.

Several limitations of this study should be noted. First, as already addressed, the single item measurement of three variables in the study design made validity of those variables, especially convergent validity, hard to achieve. More specifically, the measure of behavioral intention to keep using the system may have inadequately captured the effect of current system use of electronic courseware on that variable. Future research should incorporate more precise measures of behavioral intention. In addition, motivation to use the system was measured by an additive construct measuring level of motivation in the context of instructors' teaching. Future research

should further examine the types of motivation involved in the use of electronic course management systems and develop a more robust operationalization of the construct to increase the explanatory power of the model. Another limitation is that this study was conducted in a single university, which can call external validity into question. Future studies are encouraged to employ multiple institutions in order to prove the validity of the model.

The results of this study offer important theoretical insights and implications. First, as the current study uncovered, the TAM is a useful framework to explain the factors that affect users' intended and actual use of electronic courseware systems in higher education. The current study suggests, however, that other possible factors should be employed to make the theory building process of technology use more fruitful, as previous research recommends. In addition to the constructs that were found in this study, efforts to search for other relevant constructs are encouraged.

Second, the current study proposed an integration of the TAM and the uses and gratifications approach by incorporating motivation as a critical construct that facilitates perceived ease of use and perceived usefulness. Thus far, the TAM has been widely used in studies of information systems, while the uses and gratifications approach has been heavily utilized in media effects research. Given that there have been few efforts to connect the two approaches, despite the fact that both are trying to explain the underlying personal factors that influence people's use of information and communication technologies, this study contributes to an exploration of how the TAM and the uses and gratifications approach can be integrated. It is necessary to further elaborate on the integration of the two approaches in future studies.

Finally, an interesting extension of this study would be to determine how the research model can be adapted to include the perceptions of non-users. Some non-adopters of the electronic courseware may not be averse to the use of the technology in class. In fact, some non-adopters might have been early adopters of other technologies such as the Internet, listservs, or instant messaging to support their teaching and have already developed mechanisms for delivering them to students. Thus, they simply might not wish to take the time to replace their working systems with a new and unproven system, considering it safer not to experiment with it. Moreover, as mentioned earlier, lowered teaching evaluations due to technical problems made some instructors who were willing to adopt the electronic courseware cease use of the system (Dutton et al., 2004a, 2004b). Therefore, a comparison of users' and non-users' perceptions of electronic courseware would provide greater insight into the application and validation of the research model suggested in the current study.

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Notes

1 By 2002, more than 8,800 colleges, universities, and kindergarten through twelfth grade (K-12) schools in the U.S. were using Blackboard, an Internet-based educational product developed at Cornell University. In addition, over 2,600 colleges and universities in over 80 countries worldwide were using WebCT's products and services.

2 In the beginning stages of eClass use, many instructors used the system without considering copyright issues when they incorporated materials from the Internet, but the practice was cautioned against later by the university.

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