WILL MA AND ALLAN YUEN

11. E-LEARNING SYSTEM ACCEPTANCE AND USAGE PATTERN

ABSTRACT

In the form of e-learning systems, information and communication technology improves both access to and effectiveness of learning. However, recent studies have found that instructors and students are not always fully engaged in online activities. Other studies have found inconsistent results, with learner participation varying significantly across contexts. This study adopts the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) to investigate e-learning systems acceptance. An instrument was designed and administered to 128 undergraduate students who were using an e-learning system, named Interactive Learning Network, within a semester of study to examine the acceptance factors. Data were collected at the beginning of the semester (Phase A) as well as at the end of the semester (Phase B). Survey questionnaires were the same at both Phase A and Phase B, containing instruments of UTAUT, behavioural intention and satisfaction. The results showed that in both Phase A and Phase B, *Behavioral Intention* and *Satisfaction* were determined by *Effort Expectancy* and *Social Influence* ($p<0.001$), with R-sq at 0.519 (Phase A) and 0.615 (Phase B) for *Behavioral Intention*; and at 0.695 (Phase A) and 0.635 (Phase B) for *Satisfaction.** Moreover, usage data were extracted from the system, and their correlations with the acceptance factors were examined. Interestingly, in Phase A, a convergent factor effect was found: only usage on "*Tasks*" was significantly correlated to *Social Influence* ($p<0.001$). In Phase B, a divergent factor effect was found: usage on "*Course Module*" was significantly correlated to *Performance Expectancy* ($p<0.05$), while usage on "*Announcement*" ($p<0.01$), "*My Folder*" ($p<0.05$), and "*Resources*" ($p<0.001$) were significantly correlated with *Effort Expectancy*. Implications for e-learning systems implementation and for individual learning strategies are discussed in light of the findings.

INTRODUCTION

In contemporary society, the learning process is becoming a vital factor in business and socioeconomic growth. Information and communication technology (ICT) is having a growing and an innovative impact on learning processes (Kamel 2002). In the form of e-learning systems, ICT improves both access to and effectiveness of learning. E-learning plays a key role in the marketplace of organizational learning. However, the availability of ICT alone does not guarantee a high motivation to use it. There is always a need to understand better when an individual user will use ICT.

T. Teo (ed.), Technology Acceptance in Education: Research and Issues, 201–216.

On the other hand, the current literature suggests that knowledge sharing is one of the key steps in knowledge management methodologies (Liebowitz, 2000). Studies have found that informal sharing among employees particularly improves business knowledge (e.g. Armstrong & Sambamurthy, 1999). The acceptance of e-learning systems could be viewed in various aspects. E-learning systems improve learning effectiveness especially through the facilitation of collaborative or group learning in a peer-support and exchange environment. Learners may "work together" asynchronously; they can do joint projects or collaborate in other ways even though their schedules make it difficult to work at the same time. Therefore, e-learning systems maybe well accepted in one aspect but maybe far from acceptance in another. For example, many studies have found that asynchronous communication tools are rarely used (Peter, Lang & Lie, 2003; Schubert, Leimstoll & Wackernagel, 2003; Serrano, Resende, Reis & Mendes, 2003).

Therefore, the objectives of this study are: (1) To identify and empirically test major determinants of intention to use an e-learning system; and (2) To explore if major determinants of intention can predict system users' knowledge sharing behavior.

LITERATURE REVIEW

E-Learning Systems

E-learning is defined as a teaching and learning environment located within a computer-mediated communication system. It consists of a set of group communication and work "spaces" and facilities, which are constructed in software (Hiltz, 1994, p. 3). The formal goals of e-learning systems are to improve both access to and effectiveness of learning (Hiltz, 1994, p. 9). E-learning can improve access in a number of ways.

Time and Place Utility - Learners can access the system at any time and at any place as long as there is an Internet connection. There are no additional requirements regarding hardware peripherals or software applications.

Shared Work Space - The information and communication technology of the system makes it easy to exchange information that is difficult to share in a traditional classroom. For example, both draft and completed project tasks can be passed back and forth among peers and instructors for discussion of problems in order to comment, compare, or offer constructive criticism.

Participation Opportunity - On the other hand, by making use of both synchronous and asynchronous communication means of e-learning systems, all learners are able to have an equal opportunity to ask questions and make comments. That is the basis for knowledge sharing to take place.

This would not be possible in traditional classrooms due to the fixed time schedule and ritualized routines. Effectiveness of a course is defined in terms of the extent to which a course achieves a set of learning goals for the learner (Hiltz, 1994, p. 12). E-learning systems can improve effectiveness in a variety of ways by facilitating the learning process.

Facilitation of collaborative or group learning in a peer-support and exchange environment - Learners can work together and learn from each other through the synchronous and asynchronous communication tools and the common work space in the learning platform. That is also how knowledge sharing processes take place in e-learning systems.

Facilitation of self-pacing - Learning can take place at a rate adjusted by the learner instead of the instructor. Learners can review the learning material at their own pace. Learners can read discussions as many times as they wish, without the tight time constraints of the traditional classroom.

Use of other computer resources - Learners can access embedded application software in the system - Learners can also access other useful links to the web.

Provision of complete archive of reference material - Learners are able to access to all the learning material, which is stored in the system, at any time they wish.

Therefore, the acceptance of e-learning systems would be more meaningful if it refers to the acceptance of all these above mentioned tools to achieve effective learning goals.

Unified Theory of Acceptance and Use of Technology

User technology acceptance has been examined extensively in prior information system research. Most previous studies have been anchored in the analysis of behavioral intention, the rationale being that an individual is conscious of his or her decision to accept a particular technology.

Several intention-based theories have been developed to explain the phenomenon from different perspectives, including diffusion of innovations (e.g., Rogers 1995; Moore & Benbasat 1991); theory of planned behavior (e.g., Mathieson 1991; Taylor & Todd 1995); the technology acceptance model (e.g., Davis, Bagozzi & Warshaw 1989); and social cognitive theory (e.g., Compeau & Higgins 1995; Hill, Smith & Mann, 1987).

Recently, a unified model, called the Unified Theory of Acceptance and Use of Technology (UTAUT), has specifically been designed to consolidate all these previous different frameworks in order to explain individual technology acceptance decisions across a wide range of information technologies and user populations (Venkatesh, Morris, Davis & Davis 2003).

UTAUT was formulated with four core determinants of intention and usage: performance expectations, effort expectations, social influences, and facilitating conditions; and up to four moderators of key relationships: age, gender, computer experience and voluntariness. The model, with its high explained variance, is strong in predicting intention and use behavior. It is also rich in providing relevant factors to explain intention and use behavior.

Motivation and Research Questions

A review of the literature found that learning is becoming a critical factor in business and socioeconomic growth. With the emergent information and communication

technologies, e-learning systems improve both access to and effectiveness of learning. However, simply the availability of e-learning systems alone would not motivate employees to use them.

Therefore, the research aims of this study are: (1) To identify and examine empirically the major determinants of intention to use e-learning systems; (2) To determine if major determinants of intention can predict system usage, particularly different levels of knowledge-sharing activities.

MODEL AND HYPOTHESES DEVELOPMENT

Our modified model based on UTAUT (Venkatesh et al., 2003) for its theoretical basis is shown below (see Figure 1).

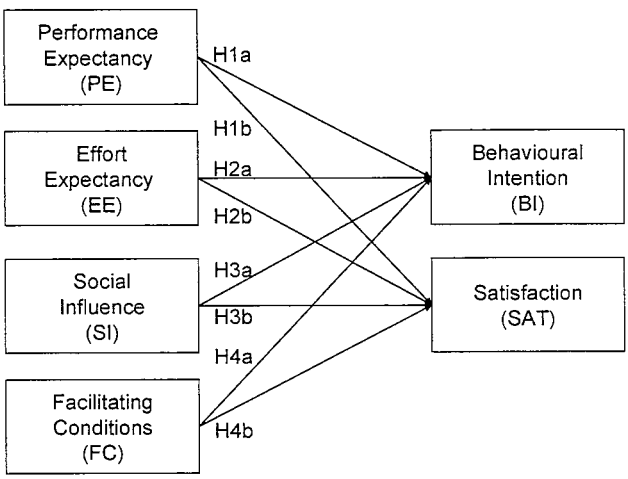

Figure 1. Model framework.

Specifically, performance expectancy was defined as the degree to which an individual learner believed that using the e-learning system would help him or her to attain gains in achieving learning goals. Therefore, we hypothesized that:

H1a: *Performance expectancy would influence behavioral intention to use the e-learning system. That is, the higher the level of performance expectancy of an individual user toward an e-learning system, the more likely the individual intended to use the system.*

Similarly, it was logical to expect that the higher the degree an individual learner believed that the e-learning system was helpful to his/her performance; the individual learner would be more satisfied with the e-learning system. Therefore, we hypothesized that:

H1b: *Performance expectancy would influence how an individual learner evaluates the e-learning system. That is, the higher the level of performance expectancy of an individual user toward an e-learning system, the more likely the individual felt satisfied with the use of the e-learning system.*

Effort expectancy was defined as the degree of ease associated with the use of the system. It was expected that ease of use of an e-learning system would influence users in their deciding whether or not to use the system. We posited that e-learning system acceptance was directly affected by effort expectancy. Therefore, we hypothesized that:

H2a: *Effort expectancy would influence behavioral intention to use the e-learning system. That is, the lower the level of effort expectancy of an individual user toward an e-learning system, the more likely the individual intended to use the system.*

Similarly, it was logical to expect that the higher the degree of ease an individual learner believed that the e-learning system was, the individual learner would be more satisfied with the e-learning system. Therefore, we hypothesized that:

H2b: *Effort expectancy would influence how an individual learner evaluated the use of the e-learning system. That is, the lower the level of effort expectancy of an individual user toward an e-learning system, the more likely the individual felt satisfied with the use of the e-learning system.*

Social influence was defined as the degree to which an individual perceived that important others believed he or she should use the new system. Within a social system, an individual's technology acceptance decision might be influenced by such opinions/suggestions to varying degrees.

By and large, learners appeared to have strong psychological attachments to the learning community and exhibited relatively close bonds with peer learners. Several factors might contribute to the described intimate attachments or bonds. For example, an individual learner would like to be a part of the learning community in order not to be isolated. He or she at least needed to use the same communication means to receive and disseminate information among the community.

Individual learners also recognized the fact that there might be a lot of problems in the learning process. It was important to develop a closed-loop community to share resources and to gain support from each other. Hence, it was hypothesized that:

H3a: *Social influence would be a direct determinant of behavioral intention to use an e-learning system. That is, if an individual perceived that someone important to him or her thought he should use the system, he or she would be more likely to use the system.*

Similarly, it was hypothesized that:

H3b: *Social influence would be a direct determinant of satisfaction to use of an e-learning system. That is, if an individual perceived that someone important to him or her thought he should use the e-learning system, he or she would be more likely to satisfy with the use of the e-learning system.*

Facilitating conditions were defined as the degree to which an individual believed that an organizational and technical infrastructure existed to support use of the system. There were all sorts of problems (both technical and psychological) involved in using an e-learning system because of hardware, software and support. Sometimes, it was not the actual functionality of a software application that caused the problem,

but the individual user's perception of where his or her stands were. Therefore, facilitating conditions were to measure the perception of an individual user's readiness toward the use of the system. According to UTAUT, although these facilitating conditions might have an effect on the technology acceptance decision-making process, they were not direct determinants of intention and use. Therefore, we hypothesized that:

> H4a: *Facilitating conditions would not influence the intention to use an e-learning system. That is, whether an individual perceived that an e-learning system provided all the necessary infrastructure and support for their use of the system would have no direct relationship with his or her intention to use the system.*

Similarly, it was not because of how an individual learner perceived facilitating conditions ready for his or her use of the e-learning system, he or she would evaluate the use of the e-learning system more positively. Therefore,

> H4b: *Facilitating conditions would not influence satisfaction to use of an e-learning system. That is, whether an individual perceived that an e-learning system provided all the necessary infrastructure and support for their use of the system would have no direct relationship with his or her satisfaction to the use of the e-learning system.*

Age, gender, experience and voluntariness were suggested as part of UTAUT (Venkatesh et al., 2003) and were included in the analysis. They were analyzed to find out how they influenced the acceptance factors, including performance expectancy, effort expectancy, social influence and facilitating conditions, towards intention, satisfaction and use.

METHOD

Background

An e-learning system, named Interactive Learning Network, was launched in a university in Hong Kong last year. The e-learning system provided a number of functionalities that facilitated access to resources and communication between instructors and among individual users to improve teaching and learning over the Internet. This e-learning system allowed for the creation of modules, personal profiles, and storage folder settings; possessed calendar and announcement capabilities; provided a synchronous communication tool (online chat room) and an asynchronous communication tool (discussion forum), learning material dissemination tools such as a resources folder, and assessment tools such as an assignment folder and online quiz. There were also other tools such as an online survey. This was the second year that the e-learning system was being used in the university.

Subjects

A total of 128 respondents completed the surveys in both Phase A and Phase B. The data from those respondents who only completed the survey in either Phase A or Phase B were discarded. There were 40 male and 88 female respondents. 22 of the respondents (17.2%) ranged from 19 to 20 years of age; 87 (68%) ranged from

21 to 22 years of age; and 19 (14.8%) ranged 23 to 24 years of age. They came from the three faculties at the university, including 11 from the Arts faculty; 51 from Commerce; and 66 from Social Science.

Measures

There were four constructs in the UTAUT model: performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC). Each of the constructs had 4-items. Altogether, there were 16-items. The dependent variables included behavioral intention (BI) and satisfaction (SAT), with 3-items for behavioral intention and 2-items for satisfaction. The survey included demographic items and the instrument for the UTAUT items, which are listed in the Appendix. Each statement was given a seven point Likert scale ranging from strongly disagree (1) to strongly agree (7).

In addition to the survey instrument, this study also collected system log data from the e-learning system. These system log data mainly included the usage record of the respondents. The personal system log of each respondent who completed the surveys could be extracted for analysis. However, to protect the privacy of the respondents, the student ID or login ID was discarded before analysis. The usage log included eight different applications, which are listed in the table below (see Table 1.)

Table 1. Online activities usage and e-learning system applications

Usage	*E-learning applications*
USG1	View Community Announcement
USG2	Enter Course Module
USG3	Enter/Upload Assignment
USG4	Modify My Profile/Enter My Folder
USG5	Enter Course Resources
USG6	Enter Discussion Forum
USG7	Scheduler/Calendar
USG	Total Login

Data Collection

At the beginning of the second semester (Phase A), a survey was put online, and the students were asked to participate in the study through the e-learning system. The usage log of every participant was captured for that month. At the end of the semester (Phase B), the same survey was introduced, but the items were rearranged randomly.

RESULTS

Summary of Variables

A summary of the descriptive statistics of the constructs of UTAUT, including performance expectancy (PE1-4); effort expectancy (EE1-4); social influence (SI1-4), facilitating conditions (FC1-4), and the two dependent variables, behavioral intention (BI1-3) and satisfaction (SAT1-2) was shown in Table 2 below. The internal

consistency was measured by reliability Cronbach's alpha coefficient for each of the constructs. All of them were over 0.7, except FC which was close to 0.7, attained the threshold value suggested by prior studies (Nunnally & Bernstein, 1974). The items for each of the construct were then added together to form a composite scale to the corresponding construct for further regression analysis.

Table 2. Descriptive statistics of instrument items

	Phase A			*Phase B*		
	Mean	*Std. Dev*	*Alpha*	*Mean*	*Std. Dev*	*Alpha*
PE1	5.11	1.138	0.7953	5.51	1.071	0.8597
PE2	5.15	1.130		5.36	1.084	
PE3	4.90	1.189		5.12	1.168	
PE4	4.00	1.386		4.33	1.289	
EE1	5.22	1.101	0.8589	5.54	.926	0.8499
EE2	4.98	1.133		5.48	1.018	
EE3	5.38	1.094		5.83	.705	
EE4	5.41	1.187		5.72	.891	
SI1	5.65	1.054	0.7325	5.81	.999	0.8121
SI2	5.02	1.298		5.12	1.161	
SI3	4.93	1.138		5.35	1.045	
SI4	5.46	1.216		5.62	.954	
FC1	5.45	1.254	0.6866	5.84	.991	0.6137
FC2	5.25	.939		5.63	.929	
FC3	4.87	1.089		5.21	1.127	
FC4	4.30	1.251		4.44	1.110	
BI1	5.74	.966	0.8963	5.80	.988	0.8878
BI2	5.91	.964		5.89	.914	
BI3	5.55	1.121		5.68	1.021	
SAT1	5.19	1.148	0.8304	5.71	.818	0.7593
SAT2	5.06	1.176		5.47	1.129	

The descriptive statistics for the usage log of each of the applications in the e-learning system were listed in Table 3 below. The means referred to the total number of logins per respondent.

Table 3. Descriptive statistics of online activities usage (N=128)

	Phase A				*Phase B*			
	Min	*Max*	*Mean*	*Std. Dev.*	*Min*	*Max*	*Mean*	*Std. Dev.*
USG1	27	420	98.51	64.93	39.00	634.00	148.68	93.81
USG2	67	705	275.13	140.85	68.00	1008.00	385.27	181.30
USG3	1	218	66.18	61.18	.00	319.00	91.88	84.19
USG4	30	694	133.33	103.68	43.00	1059.00	200.98	148.53
USG5	1	2948	312.86	428.81	12.00	4016.00	489.77	592.94
USG6	1	791	89.24	123.83	.00	3167.00	144.93	313.25
USG7	1	133	17.33	23.76	.00	134.00	19.44	26.03
USG	196	5082	994.30	728.90	322.00	7127.00	1499.96	1095.76

Regression analysis results for e-learning system acceptance

The data collected was analyzed using a two-step linear regression procedure with "enter" method. Firstly, BI and SAT were treated as dependent variables and were predicted by all the independent variables, AGE, GENDER, EXP, VOL, PE, EE, SI, FC. Secondly, USG1-7 and USG were treated as dependent variables and were predicted by all the independent variables including AGE, GENDER, EXP, VOL, PE, EE, SI, FC, BI, SAT (see Table 5a and Table 5b)

Analysis of UTAUT data collected in Phase A

Regression model testing found that performance expectancy, effort expectancy, and social influence were all directly and significantly related to intention to use the e-learning system in Phase A (see Table 4 below). The beta coefficients for the constructs were 0.298 ($p<0.001$); 0.331 ($p<0.001$); and 0.215 ($p<0.01$), respectively, supporting hypotheses H1, H2 and H3. Facilitating conditions were found not to be significantly related to intention to use the e-learning system, supporting hypothesis H4. On the other hand, all the four moderators: age; gender; computer experience; and voluntariness, were found not to be significantly related to intention to use the e-learning system. The variance explained by the model is comparable to most previous studies on information technology acceptance ($R^2 = 0.519$, $p<0.001$).

Satisfaction was found to be determined by age ($ß = 0.139$, $p<0.05$); effort expectancy ($ß = 0.352$, $p<0.001$); social influence ($ß = 0.412$, $p<0.001$); and behavioral intention ($ß = 0.201$, $p<0.01$). Satisfaction was found not to be significant in any of the usage patterns of the e-learning system. The variance explained by the model is comparably high ($R^2 = 0.695$, $p<0.001$).

Analysis of UTAUT data collected at Phase B

Regression model testing found that performance expectancy, effort expectancy, and social influence were all directly and significantly related to intention to use the e-learning system in Phase B (see Table 4 below). The beta coefficients for the

Table 4. Regression analysis on behavioral intention (BI) and satisfaction (SAT)

	Phase A		*Phase B*	
Variables	*BI*	*SAT*	*BI*	*SAT*
AGE	n-s	0.139*	n-s	n-s
GENDER	n-s	n-s	n-s	n-s
EXP	n-s	n-s	n-s	n-s
VOL	n-s	n-s	n-s	0.138*
PE	0.298***	n-s	0.461***	0.361***
EE	0.331***	0.352***	0.182*	0.255***
SI	0.215**	0.412***	0.239**	n-s
FC	n-s	n-s	n-s	n-s
BI	-	0.201**	-	0.192*
R-sq	0.519	0.695	0.615	0.635
Adjusted R-sq	0.507	0.683	0.604	0.622
Model Significance	***	***	***	***

*p<0.05; **p<0.01; ***p<0.001.

constructs were 0.461 ($p<0.001$); 0.182 ($p<0.05$); and 0.239 ($p<0.01$), respectively, again, supporting hypotheses H1, H2 and H3. Facilitating conditions were found not to be significantly related to intention to use the e-learning system, again, supporting hypothesis H4. On the other hand, all the four moderators, age; gender; computer experience; and voluntariness, were found not to be significantly related to intention to use the e-learning system. The variance explained by the model is comparable to most previous studies on information technology acceptance ($R^2 = 0.615$, $p<0.001$).

Satisfaction was found to be determined by voluntariness (ß = 0.138, $p<0.05$); performance expectancy (ß = 0.361, $p<0.001$); effort expectancy (ß = 0.255, $p<0.001$); and behavioral intention (ß = 0.192, $p<0.05$). Satisfaction was found not to be significant in any of the usage patterns of the e-learning system. The variance explained by the model is comparably high ($R^2 = 0.635$, $p<0.001$).

Regression Analysis Results for Usage of E-Learning Applications

Analysis of usage data collected at Phase A

Usage patterns of the e-learning system were examined with the determinants. Overall total usage of the system was found to be significantly determined solely by behavioral intention (ß = 0.323, $p<0.001$) (see Table 5 below). This result confirmed our measurement of technology acceptance using behavioral intention, and was congruent with most of the previous intention-based theories mentioned above. Further breakdown of the usage patterns provided additional information about individual reactions to e-learning system. USG1, USG2, and USG4 were found to be determined solely by behavioral intention. On the other hand, USG6 and USG7 were found not to be significantly related to any of the intention determinants in the model. Further investigation is required to explain the phenomenon. Both USG3 and USG5 have additional determinants in the regression model. USG3 was determined by age (ß = -0.296, $p<0.001$); computer experience (ß = -0.177, $p<0.05$); social influence (ß = 0.311, $p<0.001$) and behavioral intention (ß = -0.434, $p<0.001$). USG5 was determined by age (ß = 0.182, $p<0.05$); and behavioral intention (ß = 0.407, $p<0.001$). The overall variance explained was low and would be a potential limitation to this study ($R^2 = 0.104$, $p<0.001$).

Analysis of usage data collected in Phase B

Usage patterns of the e-learning system were examined with the determinants. Interestingly, overall total usage of the system was found not to be significantly related to behavioral intention (see Table 5a and 5b below). Instead, overall usage was jointly determined by computer experience (ß = 0.198, $p<0.05$) and performance expectancy (ß = 0.269, $p<0.01$). Further breakdown of the usage pattern provided additional information about individual reactions to the e-learning system. USG1 and USG5 were found to be determined solely by effort expectancy (ß = 0.272, $p<0.01$ and ß = 0.349, $p<0.001$) respectively). USG2 was found to be determined solely by performance expectancy (ß = 0.209, $p<0.05$). USG3 was found to be determined by both age (ß = -0.240, $p<0.01$) and computer experience (ß = -0.242, $p<0.01$). USG4 was found to be determined jointly by voluntariness (ß = 0.203,

p<0.05) and effort expectancy (ß = 0.209, p<0.05). Again, USG6 was found not to be significantly related to any of the intention determinants in the model. Further investigation is required to explain the phenomenon. USG7 was determined by age (ß = -0.214, p<0.005); and computer experience (ß = 0.195, p<0.05). USG8 was solely determined by age (ß = -0.198, p<0.05). The overall variance explained was low and would be a potential limitation of this study (R^2=0.131, p<0.001).

Table 5a. Regression analysis on online usage activities (Phase A)

	Phase A							
	USG1	*USG2*	*USG3*	*USG4*	*USG5*	*USG6*	*USG7*	*USG*
AGE	n-s	n-s	-0.296^{+}	n-s	0.182*	n-s	n-s	n-s
GENDER	n-s	n-s	n-s	n-s	n-s	n-s	n-s	n-s
EXP	n-s	n-s	-0.177*	n-s	n-s	n-s	n-s	n-s
VOL	n-s	n-s	n-s	n-s	n-s	n-s	n-s	n-s
PE	n-s	n-s	n-s	n-s	n-s	n-s	n-s	n-s
EE	n-s	n-s	n-s	n-s	n-s	n-s	n-s	n-s
SI	n-s	n-s	0.311^{+}	n-s	n-s	n-s	n-s	n-s
FC	n-s	n-s	n-s	n-s	n-s	n-s	n-s	n-s
BI	0.268	0.182*	-0.434^{+}	0.278$^{\#}$	0.407^{+}	n-s	n-s	0.323^{+}
SAT	n-s	n-s	n-s	n-s	n-s	n-s	n-s	n-s

$^{*}p<0.05$; $^{\#}p<0.01$; $^{+}p<0.001$.

Table 5b. Regression analysis on online usage activities (Phase B)

	Phase B							
	USG1	*USG2*	*USG3*	*USG4*	*USG5*	*USG6*	*USG7*	*USG*
AGE	n-s	n-s	-0.240 **	n-s	n-s	n-s	-0.214 *	n-s
GENDER	n-s	n-s	n-s	n-s	n-s	n-s	n-s	n-s
EXP	n-s	n-s	-0.242	n-s	n-s	n-s	0.195*	0.198*
VOL	n-s	n-s	n-s	0.203*	n-s	n-s	n-s	n-s
PE	n-s	0.209*	n-s	n-s	n-s	n-s	n-s	0.269
EE	0.272	n-s	n-s	0.209*	0.349	n-s	n-s	n-s
SI	n-s	n-s	n-s	n-s	n-s	n-s	n-s	n-s
FC	n-s	n-s	n-s	n-s	n-s	n-s	n-s	n-s
BI	n-s	n-s	n-s	n-s	n-s	n-s	n-s	n-s
SAT	n-s	n-s	n-s	n-s	n-s	n-s	n-s	n-s

$^{*}p<0.05$; $^{\#}p<0.01$; $^{+}p<0.001$.

DISCUSSION

Main findings

The main findings of this study showed that the technology acceptance model UTAUT worked. Performance expectancy, effort expectancy, and social influence were key intention determinants of the e-learning system. Congruent with UTAUT, facilitating conditions were found not to be significantly related to e-learning system acceptance. Behavioral intention, some of the UTAUT beliefs, and age together determined satisfaction with the e-learning system. Moreover, the findings

also revealed that behavioral intention was a strong determinant of usage across applications within an e-learning system but its effect diminished over time; while performance expectancy and effort expectancy became strong and significant to usage over time.

Performance expectancy

Performance expectancy is defined as the degree to which an individual learner believes that using the e-learning system will help him or her to attain gains in achieving learning goals. In Phase A, performance expectancy was found to be directly and significantly related to intention to use the e-learning system, with a beta coefficient of 0.298 ($p<0.001$). In Phase B, performance expectancy was also found to be directly and significantly related to intention to use the e-learning system; however, with a sharp increase in coefficient beta value to 0.461 ($p<0.001$). In Phase A, performance expectancy was not found to have any significant relationship with various application usages. However, in Phase B, performance expectancy was found to be directly significant in "Login to Course Module" (USG2). In Phase A, performance expectancy was found not to be significantly related to satisfaction. However, in Phase B, performance expectancy was found to be directly and significantly related to satisfaction, with a beta coefficient of 0.361 ($p<0.001$). The findings suggest that performance expectancy makes a unique and important contribution to the development of acceptance of e-learning system use. The significant relationship between performance expectancy and intention to use explains both current use and future use intentions, which is supported by the findings in Phase B. The significant relationship of performance expectancy to both intention and satisfaction in Phase B suggest that individual users have developed a positive perception of the e-learning system. This positive user perception motivates individual users to a better acceptance of the e-learning system and leads to greater use of the e-learning system. More usage leads to a more positive perception of the e-learning system, which helps students attain gains in achieving learning goals. These observations in the significant relationships between performance expectancy, intention to use, satisfaction, and usage help in drawing the conclusions for the findings.

Effort expectancy

Effort expectancy is defined as the degree of ease associated with the use of the e-learning system. In Phase A, it was found that effort expectancy was both directly related to intention to use ($\beta=0.331$, $p<0.001$) and satisfaction ($\beta=0.352$, $p<0.001$) of the e-learning system. In Phase B, although the significant relationships persist, both beta coefficients drop: $\beta=0.182$ ($p<0.05$) for intention to use, and $\beta=0.255$ ($p<0.001$) for satisfaction. Moreover, in Phase A, effort expectancy was not significantly related to any of the individual application usages. Effort expectancy was found to be significantly related to "Announcement" (USG1) ($\beta=0.272$, $p<0.01$); "My Folder" (USG4) ($\beta=0.209$, $p<0.05$); and "Resources" (USG5) ($\beta=0.349$, $p<0.001$). The consistent significant relationships in Phase A and in Phase B suggest that effort expectancy made a unique and important contribution to the development of acceptance of the e-learning system. In other words, individual users would first of all probably accept and adapt to using the e-learning system if they perceived the

e-learning system as easy to use. In Phase A, effort expectancy became a strong factor in affecting both current use and future use intentions. Throughout the semester, individual users had lots of chances to try the e-learning system. The significant findings between effort expectancy and several applications usage suggest that the individual users had developed a positive perception of the ease of use of the e-learning system. This became a motivation for more usage behavior. Hence, usage behavior reinforced the self-perception of positive intention and satisfaction in current and future e-learning system use.

Social influence

Social influence is defined as the degree to which an individual user perceived that important others believed he or she should use the e-learning system. In Phase A, social influence was found to be significantly related to both intention to use (β=0.215, $p<0.01$) and satisfaction (β=0.412, $p<0.001$). Social influence was also found to be significantly related to usage, "Upload Assignment" (USG3) (β=0.311, $p<0.001$). However, in Phase B, social influence was solely significantly related to intention to use (β=0.239, $p<0.01$). The findings suggest that social influence is another important factor influencing the development of acceptance of e-learning system use. Social influence not only affects current and future use of the e-learning system, but also affects how individual users evaluate (satisfaction) the e-learning system. However, the longitudinal findings also reveal that, as time passed and as more practical experience was gained, the effects of social influence diminished to only a limited scope with respect to current and future use intentions; irrespective of the evaluation (satisfaction) of the e-learning system, or of individual application usage. Although the scope of the effects of social influence diminished, their strength was comparably the same, similar in value of beta coefficients, in Phase A and Phase B.

Facilitating conditions

Facilitating conditions are defined as the degree to which an individual user believed that an organizational and technical infrastructure existed to support use of the e-learning system. Consistent with prior literature (Venkatesh et al., 2003), facilitating conditions were found not to be significantly related to intention, either in Phase A or in Phase B. In this study, facilitating conditions were found not to be significantly related to satisfaction, either.

Post hoc analysis - Extent of knowledge sharing

The acceptance of technology could mainly be measured by its use or its intention to use. However, e-learning systems are a collection of various tools aimed at achieving the common goals in effective teaching and learning purposes. Key areas of the use of e-learning systems are to facilitate shared work space, participation opportunity, collaboration and group learning. Only if a more in-depth analysis to the various applications and their use, should therefore the degree of acceptance be concluded. The findings in this study provide such clues for further discussion in this aspect.

For example, Announcement could be regarded as one-way communication through broadcasting technologies. Resources serve as a shared work space for

easy exchange of information. This application is regarded as a step further towards knowledge sharing as individual users are required to proactively check and acquire (download) the exchanged resources.

Synchronous (chatroom) and asynchronous communication (discussion forum) tools facilitate collaborative or group learning in a peer-support and exchange of ideas environment. These tools greatly enhance knowledge sharing through social interaction among individual users. From the findings of the study, it was found that individual users showed actual usage behavior in using "Discussion Forum" (USG6), and there was an increase in usage throughout the semester, with a mean of 89.24 in Phase A rising to a mean of 144.93 in Phase B. However, the usage pattern had no significant relationship with any of the acceptance factors discussed above, nor to intention or satisfaction. The findings suggest that a high level of knowledge sharing has no relationship to motivational factors in e-learning system use. In Phase A, only "Upload Assignment" (USG3) had significant relationships with social influence. Applications included announcement, login to course module, manage user folders, and resources are irrelevant to knowledge sharing as they are only intended to fulfill the requirements of the instructors to manage the course. However, in Phase B, various applications showed significant relationships between motivational factors and usage behavior. These applications, including announcement, login to course module, manage user folders, and resources, reflect a certain extent of knowledge sharing, from the purely one-way communication involved in receiving messages from instructors, to proactive participation to login course, and to proactive checking and acquiring exchange information.

With the data for each individual application, the present study facilitates a more in-depth analysis of the effects of usage. This provides an alternative perspective to prior studies, which only include composite usage patterns.

Limitations and Future Studies

There are several limitations in the study. First, the study was conducted in the second semester. There might be differences in the instructors and the available courses that affect the generalizability of the findings. However, the study was distributed to the university as a whole, and respondents came from various departments. Therefore, the findings were, to some extent, representative of the overall population, with respect to both the students and the instructors. Second, the study was based on a specific e-learning system adopted by the sample university. The findings may not be generalizable to other universities using different e-learning systems; for example, the interface design that affects the effort expectancy, or the collaborative support that affects the collaborative or group learning process. Further studies with different e-learning systems would increase the generalizability of the findings.

CONCLUSION

In conclusion, the present study applied the UTAUT model in exploring the acceptance of the e-learning system. The empirical data revealed significant relationships between the motivational factors, including performance expectancy; effort expectancy; and social influence; and intention and satisfaction. The study further

provides significant usage data in a longitudinal manner for various applications in e-learning systems. Interestingly, behavioral intention was a strong determinant of usage but its effect diminished over time; while performance expectancy and effort expectancy became strong and significant to usage only after a certain period of use. This provides a fuller picture of how motivational factors affect the extent of acceptance of individual users using an e-learning system.

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Alan Yuen
The University of Hong Kong
Hong Kong SAR

Will Ma
Hong Kong Shue Yan University
Hong Kong SAR

APPENDIX: INSTRUMENT ITEMS (ADAPTED FROM VENKATESH ET AL., 2003)

Items	
Performance Expectancy (PE)	
PE1:	I would find the system useful.
PE2:	Using e-learning system enables me to accomplish tasks more quickly.
PE3:	Using e-learning system increases my productivity.
PE4:	If I use the system, I will increase my chances of getting better performance.
Effort Expectancy (EE)	
EE1:	My interaction with the e-learning system would be clear and understandable.
EE2:	It would be easy for me to become skillful at using the e-learning system.
EE3:	I would find the e-learning system easy to use.
EE4:	Learning to operate the e-learning system is easy for me.
Social Influence (SI)	
SI1:	People who influence my behavior think that I should use the e-learning system.
SI2:	People who are important to me think that I should use the e-learning system.
SI3:	People who are important to me have been helpful in the use of the e-learning system.
SI4:	In general, my organization has supported the use of the e-learning system.
Facilitating Conditions (FC)	
FC1:	I have the resources necessary to use the e-learning system.
FC2:	I have the knowledge necessary to use the e-learning system.
FC3:	The e-learning system is compatible with other systems I use.
FC4:	A specific person or group is available for assistance with the e-learning system difficulties.
Behavioral Intention (BI)	
BI1:	I intend to use the e-learning system in the coming future.
BI2:	I predict I would use the e-learning system in the coming future.
BI3:	I plan to use the e-learning system in the coming future.
Satisfaction (SAT)	
SAT1:	As a whole, I am satisfied with using the e-learning system.
SAT2:	As a whole, e-learning system is successful.