An Enhanced Technology Acceptance Model for Web-Based Learning

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ABSTRACT

Although information technology (IT) has played an increasingly important role in contemporary education, resistance to IT remains significant in the education sector. This study attempts to identify additional key determinants of the IT acceptance in the education sector based on a study in which. 280 full-time teachers who were part-time students of a bachelor degree program participated. The current technology acceptance model (TAM) and the social cognitive theory (SCT) are combined to provide a new framework for this analysis. Results of the study are consistent with the TAM factors for explaining behavioral intention. The study also indicates that the computer self-efficacy (CSE) has substantial influence on the teachers' technology acceptance. Implications of the resulting factors are discussed within the context of education.

Key Words: User Technology Acceptance, Computer Self-Efficacy, Information Technology, Web-Based Learning System

1. INTRODUCTION

Information technology (IT) plays an important role in modern education. The Hong Kong Special Administrative Region (HKSAR) has made a huge investment to promote the application of the IT in the education sector (Alshare et al., 2003; Hu et al., 2003). In Hing Kong, of the total public expenditure of US$36.82 billion in the 2002-2003 fiscal year, one-fourth of it was for education (HKSAR, 2003; Tung, 2004). Moreover, additional funding was provided through the formal establishment of the Quality Education Fund (QEF) in 1998 with an allocation of US$641 million (HKSAR, 2002). Information technology, being one of the five major categories that sought for funding from the QEF, received US$157.66 million (QEF, 2004). To further improve the effectiveness of teaching and learning, the Chief Executive announced, in his 2004 Policy Address, a plan to equip all teachers with necessary IT skills (Tung, 2004). This initiative is undoubtedly a serious commitment since it was made at a time when the government is taking tight budget control due to its financial deficit. Nonetheless, resistance to IT remains significant in both the public and in the education sector and it is not unique to Hong Kong alone (Leidner and Jarvenpaa, 1995; Gilbert, 1996, Christensen, 2002; Hu et al., 2003). Since teachers play a major role in education, their IT acceptance and use has been an important issue for the government in assessing the success of its efforts in facilitating the application of the IT in education (Alshare et al., 2003).

As a group, teachers may subtly differ from end users in ordinary business settings. For instance, teachers are relatively independent and have considerable autonomy over their teaching activities, including technology choice and use. Public schools are institutions whose objectives fundamentally differ from those of business organizations: teachers usually have less peer competition for resources or promotion. From a research perspective, such characteristics can affect teachers' technology acceptance, which, as a result, may differ from that of business workers examined in most previous research.

In this paper, we establish an enhanced technology acceptance model, which includes another determinant from the social cognitive theory. We test this model on a group of full-time teachers, who were part-time students on a degree program using a web-based system to assist in their learning. We then apply the enhanced model to predict the specified subjects' intention for using IT. Finally, the implications of this research are discussed.

2. LITERATURE REVIEW

In response to the growing importance of information technology, user technology acceptance has been studied intensively. These research efforts have examined different aspects of technology acceptance using a variety of theoretical perspectives (Compeau et al., 1999; Karahanna and Straub, 1999; Straub et al., 1997; Igbaria and Tan, 1997; Sheppard et al., 1988). Several intention-based theories have been used to explain different user technology acceptance scenarios, including the theory of reasoned action (TRA) (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980), the theory of planned behavior (TPB) (Ajzen, 1991), the technology acceptance model (TAM) (Davis, 1986), and the social cognitive theory (SCT) (Compeau and Higgins 1995; Hill et al., 1986, 1987). While TRA and TPB (which are general theories developed in social psychology) attempt to explain and predict individual behavior across a wide variety of domains, TAM has been proposed as an adaptation of TRA to specifically explain computer/IT usage behavior (Davis, 1986).

2. 1. Technology Acceptance Model (TAM)

As illustrated in Figure 1, the TAM posits that two particular beliefs, namely perceived usefulness and perceived ease of use, are of primary relevance to computer/IT acceptance behaviors. Perceived usefulness is defined as the prospective user's subjective probability that using a specific application system would increase his or her job performance within an organizational context. Perceived ease of use refers to the degree to which the prospective user expects the target system to be free of effort. At the same time, the TAM postulates that computer usage is determined by behavioral intentions, which are viewed as being jointly determined by the person's attitude toward using the system and perceived usefulness. However, Davis (1989) found that the two determinants, namely perceived usefulness and perceived ease of use, were not equal in strength. The link between the perceived usefulness and the intention to use was significantly stronger than the link between the perceived ease of use and the intention to use (Davis, 1989). The regression analyses examining the joint effect of the two variables on intention to use showed that this difference was even more pronounced: the perceived usefulness - intention to use relationship remained large, while the perceived ease of use - intention to use relationship was diminished substantially. Additionally, he concluded that the prominence of perceived usefulness makes sense conceptually: users were driven to adopt an application primarily because of the functions it performed for them, and secondarily for how easy or hard it was to get the system to perform those functions. For instance, users were often willing to cope with some difficulty of use in a system that provided critically needed functionality. Significant results were found for these two determinants to predict behavioral intentions or self-reported usage in a number of studies (Mathieson, 1991; Venkatesh and Davis, 1996; Hu et al., 1999; Chau and Hu, 2001).

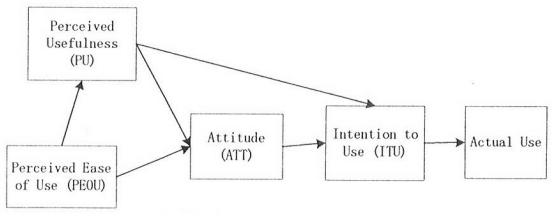

Figure 1. Technology Acceptance Model

Although the TAM is generic to user technology acceptance decision-making by design and supported considerably by empirical studies, it has been criticized for its parsimony (Venkatesh, 2000; Venkatesh and Davis, 2000; Hu et al., 2003). To address this issue, several model extension efforts have been attempted (Taylor and Todd, 1995; Venkatesh, 2000; Riemenschneider et al., 2003). Typical is that, in addition to perceived usefulness and perceived ease of use, some other constructs from related theories, i.e., psychology, behavior, marketing, economic etc., were included into the TAM. Among these constructs, self-efficacy is studied frequently with respect to the social cognitive theory (Taylor and Todd, 1995; Chin and Todd, 1995; Venkatesh, 2000).

2.2. Social Cognitive Theory (SCT) and Self-Efficacy

While TAM perspective focuses almost exclusively on beliefs about the technology and the outcomes of using it, SCT includes other beliefs that might influence behavior, independent of perceived outcomes. Self-efficacy, the belief that one has the capability to perform a particular behavior, is an important concept in SCT. Self-efficacy perceptions have been found to influence decisions about what behavior to undertake: the effort exerted and persistence in attempting those behaviors; the emotional responses (including stress and anxiety) of the individual performing the behaviors, and the actual performance attainments of the individual with respect to the behavior (Bandura, 1977, 1982, 1986). Bandura (1986) defines self-efficacy as:

> *People's judgments of their capabilities to organize and execute courses of action required attaining designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses* (p.391).

Self-efficacy has been shown to be an important construct in a wide variety of behaviors, for example, attendance, career choice and development, research productivity and sales performance. The first paper related self-efficacy to computer use appeared in 1995 (Compeau and Higgins,

1995). This paper described in a program of research aimed at understanding the impact of self-efficacy on individual reactions to computing technology. The study involved the development of a measure for computer self-efficacy and a test of its reliability and validity. A number of studies appeared to adopt the measure and validate its applications to technology acceptance researches (Compeau et al., 1999; Venkatesh and Davis, 1996) although the objectives of the studies varied. Computer self-efficacy referred to a judgment of one's capability to use a computer (Compeau and Higgins, 1995). Computer self-efficacy was found to exert a significant influence on individuals' expectations of the outcomes of using computers, their emotional reaction to computers (affect and anxiety), as well as their actual computer use. An individual's self-efficacy and outcome expectations were found positively influenced by the encouragement of others in their work group, as well as others' use of computers. Thus, self-efficacy represented an important individual trait, which moderated organizational influences on an individual's decision to use computers. Understanding self-efficacy was important to the successful implementation of systems in organizations, since it has been viewed in the SCT as an important antecedent to technology use or acceptance (Bandura, 1986; Compeau and Higgins, 1995; Compeau et al., 1999). On the other hand, when Davis (1989) first developed the Technology Acceptance Model (TAM), he asserted that self-efficacy research only provided one of several theoretical perspectives suggesting that perceived ease of use and perceived usefulness function as basic determinants of user behavior. That is, in their model, self-efficacy was not an important construct and would not be a determinant of such technology acceptance framework. Although Venkatesh and Davis (1996) further studied the self-efficacy construct by adopting the measure taken by Compeau and Higgins, self-efficacy was only considered as an antecedent of perceived ease of use, in the study of technology acceptance: "*An individual's perception of a particular system's ease of use is anchored to her or his general computer self-efficacy at all times.*"

3. RESEARCH MODEL AND HYPOTHESES

Since previous research cannot reach the unanimity on what was the role that the computer self-efficacy played in determining the users' technology acceptance or intention to use, it is worth exploring this problem within some particular research context. With respect to teachers' technology acceptance in the education sector, we established a research model as shown in Figure 2. The particular target technology was a kind of web-based learning system, which will be depicted in detail in the next section.

This research model uses the current TAM as a basis and extends it by adding computer self-efficacy as a direct antecedence of perceived ease of use and intention to use (Venkatesh and Davis, 1996; Compeau et al., 1999).

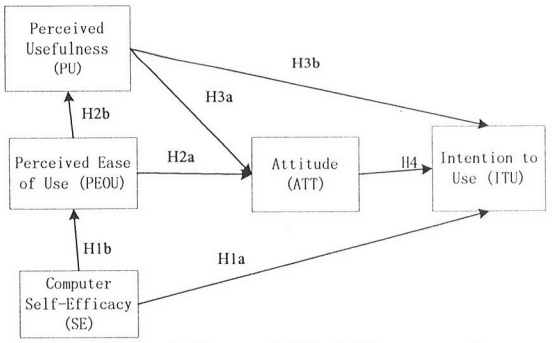

Figure 2. Research Model Framework

Computer self-efficacy denotes one's judgment of his or her capability to use a computer. This efficacy may influence an individual's perception of a technology's ease of use and acceptance decision. This efficacy reflects the resistance of self-efficacy to apparently disconfirming information. Individuals with a weak sense of computer self-efficacy will be frustrated more easily by obstacles to their performance and will respond by lowering their perceptions of their capability of using computer or IT. By contrast, individuals with a strong sense of computer self-efficacy will not be deterred easily by difficult problems, and will persist with their efforts, with the result that they are more likely to overcome whatever obstacle was present (Compeau and Higgins, 1995).

Thus, it is hypothesized that an individual with a weak sense of computer self-efficacy will have a low perception of his or her capability of using a computer in general. This low perception of capability of using a computer will in turn project a high obstacle for an individual to use a new technology or a new system. The individual will feel that he or she may meet a lot of problems in using a new system in the future but he or she is not able to tackle those obstacles. The individual is not willing to persist to tackle these problems once he or she meets such barriers. As a result, the individual will have a low future intention to use such new technology or new system. On the basis of above hypothesis with regard to the acceptance of the web-based learning system, we propose:

H1a: *A teacher's computer self-efficacy has a positive effect on his or her intention to accept web-based learning system.*

Moreover, computer self-efficacy is the perception of one's capability of using a computer. Before the individual has any hands-on experience of the new technology or the new system, general perception of computer self-efficacy becomes the anchor of an individual's perception of how a technology or a system is easy to use. Thus,

H1b: *A teacher's computer self-efficacy has a positive effect on his or her perception of ease of use about web-based learning system.*

The Technology Acceptance Model (TAM) specifies the causal relationships between perceived usefulness, perceived ease of use, attitude toward the technology, and behavioral intention to use the technology. The TAM is based on principles adopted from Fishbein and Ajzen's (1975) attitude paradigm from psychology, which (1) specifies how to measure the behavior-relevant components of attitudes, (2) distinguishes between beliefs and attitudes and (3) specifies how external stimuli, such as the objective features of an attitudinal object, are causally linked to beliefs, attitudes and behavior. In other words, once an individual views an attitudinal object, he (she) will form a perception of beliefs. He (she) then likes or dislikes the object. He (she) probably forms a belief of behavioral intention to do it or use it in the future. That is, if he (she) dislikes it, he (she) will not do it or use it in the future. However, what actually helps form these attitudinal beliefs about an attitudinal object? Davis (1989) suggested two specific beliefs, perceived ease of use and perceived usefulness that were the fundamental determinants, operative in the context of computer user behavior. Perceived ease of use was hypothesized to have a significant direct effect on perceived usefulness. Between two systems that performed the identical set of functions, a user should find the one that was easier to use more useful. Perceived usefulness was not hypothesized to have an impact on perceived ease of use. Perceived usefulness concerned the expected overall impact of system use on job performance (process and outcome), whereas ease of use pertained only to those performance impacts related to the process of using the system per se (Davis, 1993).

In summary, attitude theory from psychology provided a rationale for the flow of causality through perceptions to attitude and behavioral intention while the TAM identified specifically the two specific beliefs that contributed to such perceptions. Applying these principles into the research environment herein, we propose

H2a: *A teacher's perception on ease of use has a positive effect on attitude toward accepting web-based learning system.*

H2b: *A teacher's perception on ease of use has a positive effect on his or her perception on usefulness on the web-based learning system.*

H3a: *A teacher's perception on usefulness has a positive effect on attitude toward accepting web-based learning system.*

H3b: *A teacher's perception on usefulness has a positive direct effect on behavioral intention to accept web-based learning system.*

H4: *A teacher's attitude has a positive effect on behavioral intention to accept web-based learning system.*

4. RESEARCH DESIGN AND DATA ANALYSIS

4.1. Research Design

In this study, the enhanced model was analyzed with empirical survey data in order to test its predictive power towards the teachers' technology acceptance of a web-based learning system called Interactive Learning Network (ILN), a community-oriented learning management system that was developed by the Centre of Information Technology in School and Teacher Education (CITE), University of Hong Kong. It was an online environment aimed at equipping instructors with the tools to provide scaffoldings for participants to engage in collaborative and cooperative learning activities. It allowed users to interact with each other simultaneously through synchronous communication, or to interact with each other at any time at their own convenience through asynchronous communication. Built-in features included announcement, calendar, course management, file sharing, course evaluation, Web-based quiz, discussion forum and chatting room. The instructor could customize features on his/her community as well. Forum was one of the features in the ILN and was a place for open discussion. All participants could post and read messages. In the design of the training program, there was a web-based discussion forum session and participants were required to participate. The ILN was specifically designed to assist the learning and teaching of all the courses conducted by the CITE. Courses included Master of Science in Information Technology Education and Bachelor of Education in Information Technology and Library Information Science. Course instructors were required to make the ILN as the only official source for students to get all the information and course material. Therefore, the acceptance of the ILN would probably affect the teaching and learning process.

4.2. Pilot Study and Data Collection

The study targeted full-time teachers who all held certificate in education and were currently joining the three-year part-time Bachelor in Education degree program (BED). It was believed that a study of these subjects would provide a good understanding of practicing teachers' actual use of the IT in the real educational sector. According to the structure of the research model, a questionnaire was designed to measure computer self-efficacy (CSE), perceived ease of use (PEOU), perceived usefulness (PU), attitude (ATT), and intention to use (ITU). All items were measured in a 7-point Likert's scale, with 1 as strongly disagree and 7 as strongly agree, except the CSE, which was measured in a 10-point scale (Compeau and Higgins, 1995). Compeau and Higgins (1995) used 10-point scale rather than commonly used 7 or 5-point scale to measure the construct of the CSE because it could pinpoint user's perception of the CSE better as it was a relatively newly formed construct in IS research. Here, therefore, we adopted this measurement scale too. After establishing the questionnaire, we conducted a pilot study with 20 full-time teachers who didn't participate in the real survey later. The final version of the questionnaire was written after we solved those problems brought out in the pilot study, such

as avoiding ambiguous questions, improving the conceptual validity of the constructs' measure items, and guaranteeing the proper time length to complete the questionnaire, etc. At last, total 31 questions would be included to address all these five constructs. For details of the questions please refer to the appendix-A.

Data were collected using a user-reported self-assessment approach. At the beginning of the second month of the 2002-2003 spring semester, a total of 280 questionnaires were distributed to these full-time teachers in the BED via individual group representatives. Subjects were asked to return the completed questionnaires to their group representatives within a week. At the same time, subjects were also asked to state demographic data in the first part of the questionnaire, including sex, age range, major teaching areas (including Language, Nature Science, Liberal Arts and others), access to web-based teaching-learning system outside lecture and if there was any previous formal computer training experience, etc. At the end of that week, group representatives collected the questionnaires and sealed in an envelope and returned to the researcher, with 152 of the total number of distributed surveys eventually returned. The response rate is 54.3 %, which was considered reasonable because the survey was unsolicited and some teachers had some difficulty in returning the questionnaires in time because they were part time participants living off-campus.

4.3. Analysis of Respondents

Among the 152 questionnaires collected, some obviously abnormal records were found. For example, in some observations the answers to all or almost all questions were the same extreme numbers, either the smallest or the largest. Some had too many unfilled blanks. After the deletion of these records, there were totally 146 observations left and were used for subsequent data analysis. Table 1 summarizes some characteristics of our respondents. Data analysis indicated that there was no significant difference in these characteristics between those teachers that responded and those that failed to respond, which meant no responding bias existed.

Table 1. Summary of Respondents' Demography

Gender	Male		Female
	62 (40.8%)		90 (59.2%)
Age			
Below 25	25-29	30-35	Over 35
5 (3.4%)	56 (38.1%)	40 (27.2%)	46 (31.3%)
Years of full-time teaching			
Blow 2	2-5	5-10	Over 10
1 (0.7%)	32 (21.2%)	61 (40.4%)	57 (37.7%)
Main Teaching subject (Can have many choices)			
Languages	Science	Liberal arts	Others
55 (36.2%)	48 (31.6%)	22 (14.5%)	75 (49.3%)
Access to Web-based teaching network after lecture			
Yes		No	
143 (96.6%)		5 (3.4%)	
Prior computer-related training (online service)			
Basic 0-10 hours	Average 10-18 hours	Above average 18-36 H	Advanced > 36 hours
13 (8.8%)	73 (49.3%)	55 (37.2%)	7 (4.7%)

4.4. Data Analyses and Results

4.4.1 Reliability and Validity Analysis

The Partial Least Squares (PLS) analysis, instead of the LISREL, was used to analyze the survey data, because the PLS follows a components-based strategy and does not depend on having multivariate normal distribution, interval scales, or a large sample size (Fornell and Bookstein, 1982; Chin and Frye, 1995; Teo et al., 2003; Enns et al., 2003). The PLS is more prediction-oriented and seeks to maximize the variance explained in constructs (Barclay et al., 1995). Given the prediction-oriented nature of this research and the relatively small sample size compared with the number of variables, the PLS is more suitable for testing the structural model in this study.

Reliability analysis was conducted to test the items' internal consistency reliabilities (ICR) and factor loadings (Barclay et al., 1995). Of the original 31 items, eleven did not contribute to adequate levels for reliability, exhibiting factor loading less than 0.7 (See the Appendix for the original items). Six of them came from the newly adopted construct, the CSE. This was common when new or standard scales were initially adopted in causal modeling (Barclay et al, 1995). After discarding these items, the internal consistency reliabilities (ICR) of all scales subsequently exceeded .70, the level deemed acceptable for exploratory research (Fornell and Larcker, 1981) (see Table 2).

Table 2. Reliabilities of the Scales

Construct	Original Number of Items	Items Remained (Loadings)	ICR	AVE
PU	6	PU1 (.82) PU2 (.80) PU3 (.76) PU4 (.79) PU5 (.72) PU6 (.83)	.907	.619
PEOU	6	PEOU1(.84) PEOU4(.76) PEOU6(.78)	.839	.634
CSE	10	CSE3 (.74) CSE4 (.88) CSE9 (.77) CSE10(.83)	.879	.646
ATT	3	ATT1 (.81) ATT2 (.74) ATT3 (.72)	.800	.618
ITU	6	ITU1 (.70) ITU3 (.77) ITU4 (.80) ITU6 (.85)	.863	.613

4.4.2. Convergent and Discriminant Validity

Table 2 indicates the constructs' strong convergent validity, since they each had an Average Variance Extracted (AVE) of more than .5, which is the suggested threshold (Fornell and Larcker 1981). Convergent validity also was demonstrated because the items loaded highly (loading > .70) on their associated factors in Table 2. For satisfactory discriminant validity, the AVE from the construct should be greater than the variance shared between the construct and other constructs in the model (Chin 1998). Table 3 listed the correlation matrix, with the inter-construct correlations off the diagonal and the square root of AVE on the diagonal. Sound discriminant validity was shown because all the diagonal elements were greater than corresponding off-diagonal elements

Table3. Correlations of Construct

	PU	PEOU	CSE	ATT	ITU
PU	.786				
PEOU	.454	.796			
CSE	.305	.166	.804		
ATT	.633	.600	.287	.786	
ITU	.768	.677	.504	.405	.783

Note: Diagonal elements were the square root of Average Variance Extracted. These values should exceed the inter-construct correlations for adequate discriminant validity.

4.5. Test of the Structural Model and Hypotheses

The test of the structural model included estimating the path coefficients, which indicated the positive or negative relationships between the dependent and independent constructs and the strength of these relationships, and the R-square (R^2) value, which represented the amount of variance of the dependent constructs explained by the independent constructs. Together, the path coefficients (arbitrary value and statistical significance) and R^2 indicated how well the model was performing. R^2 indicated the predictive power of the model, and the path coefficients should be significant and directionally consistent with the hypotheses.

Overall, the whole model was able to account for 56% of variance in the construct of intention to use (ITU), as indicated by Figure 3. Besides, attitudes, perceived usefulness and computer self-efficacy contributed significantly to the observed explanatory power of intention to use. At the same time, the combination of perceived usefulness and perceived ease of use accounted for 40.7% of the variances observed in attitudes, while perceived ease of use contributed to attitudes slightly more than perceived usefulness, with the path coefficients of .376 and .370 respectively. According to significant path coefficients shown in Figure 3, all proposed hypotheses were supported. Perceived usefulness had significant direct positive effect, and indirect positive effect through its positive effect on attitude, on the intention to use. Perceived ease of use had a significant direct positive effect on perceived usefulness. Importantly, individual's computer self-efficacy had significant direct positive effect both on perceived ease of use and on intention to use.

Among the determinant factors, perceived usefulness had the strongest direct effect on intention to use, with a path coefficient of .414, followed by attitude with a path of .291. See Table 4 for a summary of the hypotheses testing results.

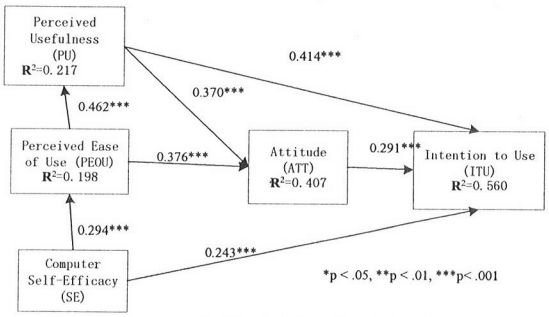

Figure 3. Model Testing Result

Table 4. Hypothesis Testing Results

H1a	*A teacher's computer self-efficacy has a positive effect on his or her intention to accept web-based learning system.*	*Supported*
H1b	*A teacher's computer self-efficacy has a positive effect on his or her perception of ease of use about web-based learning system.*	*Supported*
H2a	*A teacher's perception on ease of use has a positive effect on attitude toward accepting web-based learning system*	*Supported*
H2b	*A teacher's perception on ease of use has a positive effect on his or her perception on usefulness on the web-based learning system.*	*Supported*
H3a	*A teacher's perception on usefulness has a positive effect on attitude toward accepting web-based learning system.*	*Supported*
H3b	*A teacher's perception on usefulness has a positive direct effect on behavioral intention to accept web-based learning system*	*Supported*
H4	*A teacher's attitude has a positive effect on behavioral intention to accept web-based learning system*	*Supported*

5. DISCUSSIONS AND IMPLICATION

In this study we examined the enhanced model of technology acceptance model using social cognitive theory within the context of education. Based on data collected from 146 full-time teachers, the utility of the postulated enhanced model for explaining teachers' acceptance of web-based learning system was evaluated. The results fairly supported the proposed enhanced model.

Perceived usefulness had both a direct and indirect effect on intention to use, but the direct effect was dominant. It accounted for higher strength of the effect on intention to use (.414) than on attitude (.370). Attitude belief is formed partly anchored on the perception of the system's usefulness. The direct effect of perceived usefulness on intention to use (ITU) was significant ($p < .001$), so we could not eliminate the direct effect of perceived usefulness on intention to use and would not treat attitude as the full mediator for perceived usefulness on intention to use. The results agreed with what the TAM postulated.

The perceived ease of use (PEOU) was found to have a significant effect on teachers' attitudes and perceived usefulness simultaneously. This result was quite different from the current TAM, in which the effect of perceived ease of use on attitude belief was not significant. In our study, we attributed this phenomenon as a result of the combination of the subjects, technology and the organizational context. In our sample, the respondents had a month of experience on the web-based learning system before we conducted the survey. They had a better idea on the benefits they might get from using the learning system. Experience might change the determinants in their decision making process. Moreover, as they needed to use it everyday, they might have a higher concern on using the system *free of effort*. The easier and more convenient the system was and the less the time the respondent needed to search and acquire material from the system, the more positive the manner of the respondents would be towards the system. Therefore, perception of ease of use became a crucial concern determining the respondents' attitude, as well as perceived usefulness.

It was worth to notice that computer self-efficacy showed strong direct effect on both perceived ease of use and intention to use. Judged by the respective path coefficients, it had stronger influence on perceived ease of use than on the final dependent variable, namely intention to use. This was logically understandable. Since computer self-efficacy was a kind of individual confidence towards computer technology, the confidence would have a direct and strong impact on the ease of use intuitively.

These findings had significant implications to systems implementation in the real world. It indicated that in order to facilitate teachers' IT acceptance, it is critical to increase their perceived usefulness and perceived ease of use simultaneously. At the same time, improvement in teachers' computer self-efficacy can enhance their system acceptance. When a new information system is introduced to an educational institution or school, in order to motivate teachers' proactive acceptance of the system, it is necessary to provide a variety of features to prompt users' perceived usefulness; it is also necessary to provide a user-friendly system-human interactive interface to increase perceived ease of use. Additionally, and more importantly, measures should be taken to improve potential users' computer self-efficacy, e.g., providing some training program. It may not be extravagant to claim that the primary goal of the training program was to increase users' computer self-efficacy. The training program should be carefully planned. A comprehensive plan should include selecting an experienced trainer, dividing the training task into very tiny steps, ensuring users to finish one task before proceeding to the next, showing users plentiful evidences that they could handle the system by themselves, and preparing a checklist or outline for users. In addition to these suggestions, there should be many other ways to improve users' self-efficacy.

6. LIMITATIONS AND CONCLUSION

This empirical investigation of the proposed enhanced model has several limitations. Firstly, there are numerous factors affecting the acceptance of new systems, but in our study we just focused on four factors as seen in our model. We intend to study the effects of other potential determinants in future research. Secondly all the subjects in this study were from the education sector only. Additional studies need to be done in order to generalize our findings using subjects from other sectors and domains. Thirdly, as the survey was conducted using a self-report method, it is hard to know how accurately can self-reports reflect actual behavior. It may also, to some extent, cause common method variance (CMV) (Kline, et al., 2000). The Multi-Trait Multi-Method should be adopted in the future research in order to avoid this kind of CMV (Bagozzi and Yi, 1990). Fourthly, this study adopted the PLS to analyze the model since the PLS is suitable when a model is used for predictive application, even though it is not suitable for a rigorous model-fit assessment. If the research priority were to test the new established model, other covariance-based approaches, such as the LISREL would be preferred. However, some larger sample size would be necessary for the LISREL analysis (Fornell and Bookstein, 1982).

Overall, this study provides a better understanding of the individual user's acceptance decision making for a new technology, namely the Web-based learning network technology, in the education sector. The findings are achieved on the basis of an enhanced technology acceptance model (TAM) using an additional determinant from the social cognitive theory (SCT). The results show that computer self-efficacy has both a strong direct and indirect effect on intention to use, and it can enhance users' perceived ease of use significantly. The results of this study emphasize the need to consider self-efficacy of the learners in promoting the application of IT in the education sector.

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8. REFERENCES

Ajzen, I. and M. Fishbein (1980). Understanding attitudes and predicting social behaviors. Prentice-Hall, Englewood Cliffs, NJ.

Ajzen, I. (1991). "The theory of planned behavior." Organizational Behavior and Human Decision Processes 50: 179–211.

Alshare, K., M. A. Dwairi, et al. (2003). "Student-instructor perception of computer technologies in developing countries: The case of Jordan." The Journal of Computer Information Systems 43(4): 115-123.

Bandura, A. (1977). "Self-efficacy: toward a unifying theory of behavioral change." Psychological Review 84: 191–215.

Bandura, A. (1982). "Self-efficacy mechanism in human agency." American Psychologies 37: 122–147.

Bandura, A. (1986). Social foundations of thought and action. Englewood Cliffs, NJ, Prentice Hall.

Bagozzi, R. and Y. Yi (1990). "Assessing method variance in Multi-Trait-Multi-Method matrices: The case of self-reported affect and perceptions at work." Journal of Applied Psychology 75: 547-560.

Barclay, D., C. C. Higgins, et al. (1995). "The Partial Least Squares (PLS) Approach to Causal Modeling: Personal Computer Adoption and Use as an Illustration." Technology Studies, Research Methodology 2(2): 285-309.

Chau, Y. K. Patrick and J. H. Hu (2002). "Investigating healthcare professionals' decisions to accept telemedicine technology: an empirical test of competing theories." Information and Management 39(4): 297-311.

Chin, W. W. (1998). "The partial least squares approach for structural equation modeling." In George A. Marcoulides (Ed.), Modern Methods for Business Research, Lawrence Erlbaum Associates, 295-336.

Chin, W. W. and P. A. Todd (1995). "The use, usefulness, and ease of structural equation modeling in IS research: A note caution." MIS Quarterly 19(2): 237-246.

Chin, W. W. and T. A. Frye (1995). PLS-Graph, Version 2.9.1.02.08. University of Calgary.

Christensen, R. (2002). "Effects of technology integration education on the attitudes of teachers and students." Journal of Research on Technology in Education 34(4): 411-434.

Compeau, D. R. and C. A. Higgins (1995). "Computer self-efficacy: development of a measure and initial test." MIS Quarterly 19(2): 189–211.

Compeau, D. R., C. A. Higgins, et al. (1999). "Social cognitive theory and individual reactions to computing technology: a longitudinal study." Management Information Systems Quarterly 23(2): 145–158.

Davis F. D. (1986). "A technology acceptance model for empirically testing new end-user information systems: theory and results." Doctoral dissertation, MIT Sloan School of Management, Cambridge, MA.

Davis, F. D. (1989). "Perceived usefulness, perceived ease of use, and user acceptance of information technology." MIS Quarterly 13(3): 319-340.

Davis, F. D. (1993). "User acceptance of information technology: system characteristics, user perceptions and behavioral impacts." International Journal of Man-Machine Studies 38(3): 475-487.

Enns, H. G., S. L. Huff, et al. (2003). "CIO lateral influence behaviors: Gaining peers' commitment to strategic information systems." MIS Quarterly 27(1): 155-175.

Fishbein, M. and I. Ajzen (1975). Belief, Attitude, Intention and Behavior: An Introduction to theory and Research. Addison-Wesley, Reading, MA.

Fornell, C., and D. F. Larcker (1981). "Evaluating structural equation models with unobserved variables and measurement error." Journal of Marketing Research 18: 39-50.

Fornell, C. and F. L. Bookstein (1982). "Two structural equation models: LISREL and PLS applied to consumer exit-vice theory." Journal of Marketing Research 19: 440-452.

Gilbert, S. W. (1996). "Making the most of a slow revolution." Change 28(2): 46-52.

Hill, T., N. D. Smith, et al. (1986). "Communicating innovations: convincing computer phobics to adopt innovative technologies." Advances in Consumer Research 13. Association for consumer research, Provo, UT, 419-422.

Hill, T., N. D. Smith, et al. (1987). "Role of efficacy expectations in predicting the decision to use advanced technologies: the case of computers." Journal of Applied Psychology 72(2): 307-313.

HKSAR (2002). Topical Information: Provision of Education. Accessed at http://www.info.gov.hk/info/education.htm

HKSAR (2003). The Economy. Accessed at http://www.info.gov.hk/info/sar5/eecon2.htm

Hu, J. H., H. K. Clark, et al. (2003). "Examining technology acceptance by school teachers: a longitudinal study." Information and Management 41: 227–241.

Hu, J. H., Y. K. Chau, et al. (1999). "Examining Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology." Journal of Management Information Systems 16(2): 91-112.

Igbaria, M. and M. Tan (1997). "The consequences of information technology acceptance on subsequent individual performance." Information and Management 32(3): 113–121.

Karahanna, E. and D. W. Straub (1999). "The psychological origins of perceived usefulness and ease-of-use." Information and Management 35(4): 237–250.

Kline, J. B., L. M. Sulsky, et al. (2000). "Common method variance and specification errors: A practical approach to detection." The Journal of Psychology 134(4): 401-421.

Leidner, D. E. and S. L. Jarvenpaa (1995). " The use of information technology to enhance management school education: A theoretical view." MIS Quarterly 19(3): 265-292.

Mathieson, K. (1991). "Predicting User Intentions: Comparing the Technology Acceptance Model with the

Theory of Planned Behavior." Information Systems Research 2(3): 173-191.

QEF (2004). Quality Education Funding's Project Statistics. http://www.info.gov.hk/qef/stat/index.htm

Riemenschneider, C., D. A. Harrison, et al. (2003). "Understanding IT adoption decisions in small business: integrating current theories." Information and Management 40(4): 269–285.

Sheppard, B. H., J. Harwick, et al. (1988). "The theory of reasoned action: a meta-analysis of past research with recommendation for modifications and future research." Journal of Consumer Research 15: 325–343.

Straub, D. W., M. Keil, et al. (1997). "Testing the technology acceptance model across cultures: a three country study." Information and Management 33 (1): 1–11.

Taylor, S. and P. A. Todd (1995). "Understanding information technology usage: a test of competing models." Information Systems Research 6(1): 144–176.

Teo, H. H., K. K. Wei, et al. (2003). "Predicting intention to adopt interorganizational linkages: An institutional perspective." MIS Quarterly 27(1): 19-50.

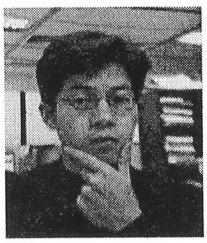
Tung, C. H. (2004). The Chief Executive's policy address 2004 of the HKSAR Government. http://www.policyaddress.gov.hk/pa04/eng/index.htm

Venkatesh, V. (2000). "Determinants of perceived Ease of Use: Integrating Control, Intrinsic Motivation, and Emotion into the Technology Acceptance Model." Information Systems Research 11(4): 342-365.

Venkatesh, V. and F. D. Davis (1996). "A Model of the Antecedents of Perceived Ease of Use: Development and Test." Decision Sciences 27(3): 451-481.

Venkatesh, V. and F. D. Davis (2000). "A theoretical extension of the technology acceptance model: four longitudinal studies." Management Science 46(2): 186–204.

AUTHOR BIOGRAPHIES



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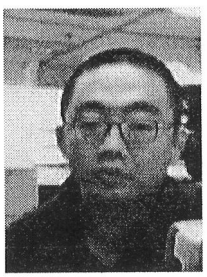

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APPENDIX-A:. MEASUREMENT ITEMS

Computer Self-efficacy (CSE) (Compeau and Higgins, 1995)	
CSE1	I could use ILN if there was no one around to tell me what to do as I go.
CSE2	I could use ILN if I had never used a technology like it before.
CSE3	I could use ILN if I had only the software manuals for reference.
CSE4*	I could use ILN if I had seen someone else using it before trying it myself.
CSE5*	I could use ILN if I could call someone for help if I got stuck.
CSE6	I could use ILN if I had a lot of time to complete the job for which ILN was provided
CSE7	I could use ILN if I had jus the built-in help facility for assistance.
CSE8*	I could use ILN if someone showed me how to do it first.
CSE9*	I could use ILN if I had used similar package before this one.
CSE10*	I could use ILN if I had used similar package before this one to do the some job.
Perceived Usefulness (PU) (Davis, 1989)	
PU1	Using ILN would improve my performance in the study of the BED course.
PU2	ILN would enable me to accomplish my study of the BED course's tasks more quickly.
PU3	Using ILN would enhance my effectiveness on the study of the BED course.
PU4	Using ILN would increase my productivity in the study of the BED course.
PU5	Using ILN would make it easier to learn my BED course.
PU6	I would find ILN useful in my study of the BED course.
Perceived Ease of Use (PEOU) (Davis, 1989)	
PEOU1	Learning to use ILN would be easy for me.
PEOU2	I would find it easy to get ILN to do what I want it to do.
PEOU3	My interaction with ILN would be clear and understandable.
PEOU4	I would find ILN to be flexible to interact with.
PEOU5	It is easy for me to become skillful in using ILN.
PEOU6	I find ILN easy to use.
Attitude (ATT) (Hu, et al., 1999)	
ATT1	I think it would be very wise to use ILN in my study of the BED course.
ATT2	In my opinion it would be very desirable to use ILN in my study of the BED course.
ATT3	I think it would be worthful to use ILN in my study of the BED course.
Intention to Use (ITU) (Hu, et al., 1999)	
ITU1	I intend to use ILN in my course when it becomes available.
ITU2	I intend to use ILN to improve my study performance as often as needed.
ITU3	I intend to use ILN routinely.
ITU4	To the extent possible, I intend to use every function provided in ILN
ITU5	Whenever possible, I intend to use ILN in my study.
ITU6	To the extent possible, I would use ILN in my study frequently.

Note: All the above items were randomly arranged in the questionnaire. The CSE items with the symbol of '*' were reversed in wording.