

INTERNATIONAL EDUCATIONAL TECHNOLOGY CONFERENCE  
IETC2012

## The Ignored Concept on Development of Educational Information Technology

Fongling Fu<sup>a\*</sup>, Sheng-Chin Yu<sup>b</sup>, Chai-Jen Ting<sup>a</sup>

<sup>a</sup>National Chengchi, University, NO.64, Sec.2, ZhiNan Rd., Taipei 11605, Taiwan

<sup>b</sup>Tung-Nan University, Taipei 22202, Taiwan

---

### Abstract

On the surface, educational information technology (EIT) is progress with more and fantastic functions. But what factors motivate students to use EIT more was not clear enough. The research utilized technology acceptance model, easy to use as the hygiene factor of use and perceived usefulness and perceived enjoyment as the motivators of retain, to test the influencing variables of acceptance of EIT. The results indicated that pedagogic design and community were two motivators while functionality and interface design were two hygiene factors in EIT acceptance. The authors suggested that the development of EIT better considered the possibility of value added to pedagogic and community by functionality and interface design.

---

© 2012 Published by Elsevier Ltd. Selection and/or peer-review under responsibility of The Association Science Education and Technology

*Keyword: Technology acceptance model; Two-factors theory; Perceived usefulness; Perceived enjoyment*

### 1. Introduction

eLearning is acclaimed as enabling education that is more accessible, effective and efficient (Mark Nichols, 2004). They employ new pedagogic strategies and different students' assessment of the learning (Swan, 2004). Websites are capable of providing a richer degree of knowledge and multimedia content, which is particularly in self-learning through fluent Web material and collaborative learning with a virtual community. With potentials, what is the focus of the future development of educational information technology (EIT) will be? Previous researches indicated that the attitudes and perceptions which students

---

\* Fongling Fu. Tel.: 886-2-29387390; fax: 886-2-29393754.  
E-mail address: [flfu@nccu.edu.tw](mailto:flfu@nccu.edu.tw).

hold toward their learning experiences become increasingly important hints in the growth of eLearning system (Chao, Saj, Tessier, 2006).

For understanding user attitudes and perceptions of eLearning usage, two popular theories in information technology acceptance may be useful. One is the Technology Acceptance Model (TAM) which explored the intentional usage of new information technology by beliefs of easy to use and perceived usefulness (Davis, Bagozzi, Warshaw, 2002). The factor of perceived enjoyment played a key role in the Extended TAM due to the importance of leisureliness in online usage and students' ability to cultivate their learning experience (Heijden, 2003).

The other is Herzberg's motivation-hygiene theory. It suggested that motivation factors and hygiene factors are two different sets of factors that influence web usage. Without satisfying of hygiene factor, users would not try to use a web site while with the more satisfying on motivation factors, users would stay the longer in a web site. (Wu, Chuang, and Chen, 2008).

To apply the above two theory in eLearning, What factors would influence students' attitude and belief still in investigation. The comprehensive measurements – Website Quality, which has long progressed from SERQUAL (Parasuraman, Zeitham, and Berry, 1988), and information system quality measurement – may be suitable for external variables of the Extended TAM. Therefore, in this study we validate the relationships among students' perceptions, beliefs, attitude, and usage toward eLearning. We try to figure out, particularly from students' point of view, what are the hygiene factors and motivation factors for e-learning system acceptance.

## 2. Literature Review

### 2.1. *The Students' Attitude Toward the E-Learning System Acceptance*

In order to predict and explain user acceptance of information technology, the TAM was a very simple but effective model. It suggested that external variables would influence one's beliefs, attitudes and intentions regarding an information system. In the model, two beliefs – “perceived usefulness” and “perceived ease to use” – were found to be positively related to the usage. Perceived usefulness was defined as “the degree of one's job performance that would be improved by a specific system.” Perceived ease to use was defined as “the degree of lack of difficulty in using a specific system” (Davis, Bagozzi & Warshaw, 2002). Besides extrinsic motivation, such as perceived usefulness, the intrinsic motivation of perceived enjoyment is defined as “all enjoyment generated from participating in the computer-based activity itself, independent of any other predictable result of the activity” (Prensky, 2001; Kiili, 2005). Since browsing behavior on Websites was being controlled more by the self-directed intentions of users, “user enjoyment” was placed in the spotlight in current empirical studies (Johnson & Hignite, 2000).

### 2.2. *External variables: Web-Site Quality for On-Line Course*

External variables in TAM played important roles in the process of understanding the relationship between internal beliefs, attitudes and intentions (Davis, Bagozzi & Warshaw, 2002). To evaluate the effectiveness of or students' satisfaction with information technology products in particular learning contexts, researchers suggested that three other factors – the student's background, pedagogic, and content presentation – should be considered together (Chao, Saj & Tessier, 2006). In online learning, the system functions that enhance flexibility and interaction as well as learning materials, indeed also influence perceived usefulness (Parasuraman, Zeitham & Berry, 1988). “Perceived visual attractiveness” is positively related to perceived usefulness, perceived ease to use and perceived enjoyment (Heijden, 2003).

Ample research states that Website quality influences users' perception of effectiveness (Kim, Shaw & Schneider, 2003). The factors that determine the quality of e-commerce Websites include information content, content reliability, Website attractiveness, navigation, speed, security, and customer service (Kim, Shaw & Schneider, 2003). Another body of research on Website quality did not originate from studies on the quality of information systems, but from PZB measurement (SERQUAL). SERQUAL contains five dimensions: physic, service reliability, responsiveness, assurance, and sympathy (Parasuraman, Zeitham & Berry, 1988).

### *2.3. Herzberg's Two-factors theory*

Herzberg's two-factor theory (1959), also known as Hygiene-Motivation theory, has been a long standing component in motivation-related research and has been used to explain such motivation-related problems as why consumers who do not dislike an item are not necessarily motivated to purchase that item, and in regards to web site design is suitable for understanding why users who do not dislike a web site may not be inclined to revisit. At its heart, Herzberg's two-factor theory proposes that Hygiene factors are those things we "expect" to be in place. When they are there, we almost take them for granted. When they are not present, they become demotivational. Motivational factors are those things that will encourage us to work harder, longer, smarter etc (Herzberg, 1987).

The validation and verification of this dual structured model of motivation has not been easy - some subsequent studies support it (e.g. Schwab & Cummings, 1970) while others have failed to replicate Herzberg's et al., findings (e.g. French, Metersky, Thaler & Trexler, 1973). Yet despite the criticism of Herzberg's et al. methodology, the two-factor theory has been widely used across different industries in areas such as, mapping work environment motivations or understanding product and service satisfaction factors (e.g. Tuten & August, 1998; Hendriks, 1999). In recent years, the two factor theory has also been applied to website design for understanding how to retain visitors and customers. Zhang and von Dran (2000) applied Herzberg's theory to study perceptions of users who were introduced to a site for the first time, and found there existed corresponding likes and dislikes similar to the hygiene and motivation classification of the Hygiene-Motivation theory. The research results of another group, Liang and Lai (2002), showed that external hygiene factors are basic requirements which determine whether consumers enter the e-market in the first place and that internal motivation factors play a key role in consumers' decision on electronic store choice. Wu, Chang and Chen (2008) validated that hygiene (external context-related) factors of search engines were more influential towards attracting new users to a first try, while the motivation (internal content-related) factors played a more important role in long-term user retention.

Herzberg's theory is of interest to eLearning because it provides important clues for practice (Nichols, 2004). The conceptual model presented in Herzberg's motivation-hygiene theory that distinguishes hygienic and motivational factors that affect job attitudes is applicable to analyzing learners' attitudes toward online training programs (Chyung, 2007). In our study, motivator factors included both intrinsic and extrinsic factors. The factors are based on a learner's ability to achieve and maintain a positive attitude towards e-learning system acceptance. The second set of factors were labeled hygiene factors. Hygiene factors may influence an individual's satisfaction level in their current e-learning systems but do not affect their motivation to learn.

## **3. Research Methodology**

### *3.1. Framework and Hypotheses of Interaction Activated TAM on E-Learning*



### 3.2. Design of Questionnaire

Table 1. Reliability and validity of the questionnaire

Construction	Content of Item	Factor Loading	Extraction of	
System functionality	The Website is reliable	0.82	0.69	0.87
	Satisfied with the waiting time to connect	0.74		
	Links on the Website are working and correct	0.77		
Interface Design	The appearance of the Website is attractive	0.87	0.77	0.91
	The method of use is consistent	0.84		
	The interface design of the Website is consistent	0.90		
Pedagogic and content	The content is rich in quantity and quality	0.94	0.72	0.88
	The content is neither too easy nor too difficult	0.94		
	The content is clear and easy to read	0.85		
Community	Easy to get support from staff and classmate	0.88	0.67	0.86
	The facilities support peer interaction	0.87		
	The Website served as a learning community to me	0.88		
Perceived Ease to Use	It is easy to browse the Website	0.82	0.62	0.82
	It is easy to access to the Website	0.74		
	It is easy to search the materials in the Website	0.77		
Perceived Usefulness	The Website is useful	0.87	0.76	0.90
	The Website helps me learn more effectively	0.84		
	Using the Website improved my performance	0.90		
Perceived Enjoyment	Using the Website is an enjoyable experience	0.91	0.87	0.95
	Using the Website is a happy experience	0.96		
	Using the Website is an interesting experience	0.93		
Attitude	I like to use the Website	0.94	0.83	0.94
	I feel comfortable to learn with the Website	0.94		
	I have positive attitude toward using the Website	0.85		

The operation definition of the extended TAM was an adjusted version of the models of Lin & Lu (2000) and Davis (2003). The external variables of TAM in the study that measured Website quality were based on Swan's [19] suggestions and included system functionality (Barnes & Vidgen, 2003; Lin & Lu, 2000; Swan, 2004), interface design (Cox & Dale, 2002; Swan, 2004), pedagogic and content design (Swan, 2004), and community (Barnes & Vidgen, 2003). All items were measured using a seven-point Likert scale.

The reliability and validity of the measurement were tested through confirmation factor analyses using the Structural Equation Model. The confirmatory factor analyses were used for validity tests. According to the LAMBCA value calculated by the software LISREL, all items reported factor loadings greater than 0.7, indicating high validity (Table 1). The values of total extraction of variance were greater than 0.6 for

each dimension (Table 1) – higher than the acceptable of level 0.5. This also indicated that the measurement was valid. Coefficients of internal consistency (Cronbach  $\alpha$ ) were greater than 0.8 (Table 1) for each of the dimensions, further indicating that these measurements are reliable.

## 4. Data Analyses

### 4.1. Sample Analyses

An online survey was conducted in a Taiwanese university. The subjects taking the survey were volunteer students who had taken at least one online course. The total valid sample was 451, 39% of which majored in business and 23.9% of which majored in social science. The majority were not new Internet users, as 72.5% reported having more than 3 years of online surfing experience.

### 4.2. Evaluation of the Model

Results from all three fit indexes of the Structural Equation Model were good, indicating that the extended TAM model is applicable to e-learning. The indexes are listed as follows:

- 1 Absolute Fit Measures: Absolute fitness could be measured through coefficient of RMSEA. The acceptable value is said to be either smaller than 0.06 (Hu & Bentler, 1999) or smaller than 0.08 (McDonald & Ho, 2002). The value of RMSEA in the study was 0.06. The absolute fitness could also be indicated by the value of SRMR, which should be smaller than 0.08 (Hu & Bentler, 1999). The value of RMSR in this study was 0.058.
- 2 Incremental Fit Measures: The common measurement is the value of CFI, which should be equal to or greater than 0.95 (Bentler, 1995). Other indicators are NFI or NNFI. Their values are always between 0 and 1. At the same time, the model cannot be considered as meeting the standards unless the value of NFI or NNFI is greater than 0.9 (Hu & Bentler, 1999). In this study, the value of CFI was 0.98, greater 0.95. Both the value of NNFI and NFI were 0.98, greater than 0.9.
- 3 Parsimonious Fit Measures: The number of estimates that fulfill a specific level of appropriateness for the model. The model was considered good if the value of PGFI was greater than 0.5 (Mulaik, et. al., 1989). The value of PGFI in this study was 0.7.

### 4.3. Results of the Model

In Fig. 2, coefficients of the paths are demonstrated by the arrows, with t-values listed between the brackets. All t-values in Fig. 2 were greater than the value 1.96 at the significant level of 0.05, indicating that all null hypotheses were rejected. For example, for the Hypothesis 1, the coefficient of path =0.16 while t-value=2.51, implying that students who consider the e-learning system as more quickly accessible and more reliable will perceive the system as easier to use. The other hypotheses can also be proven according to their coefficients of path and t-values.

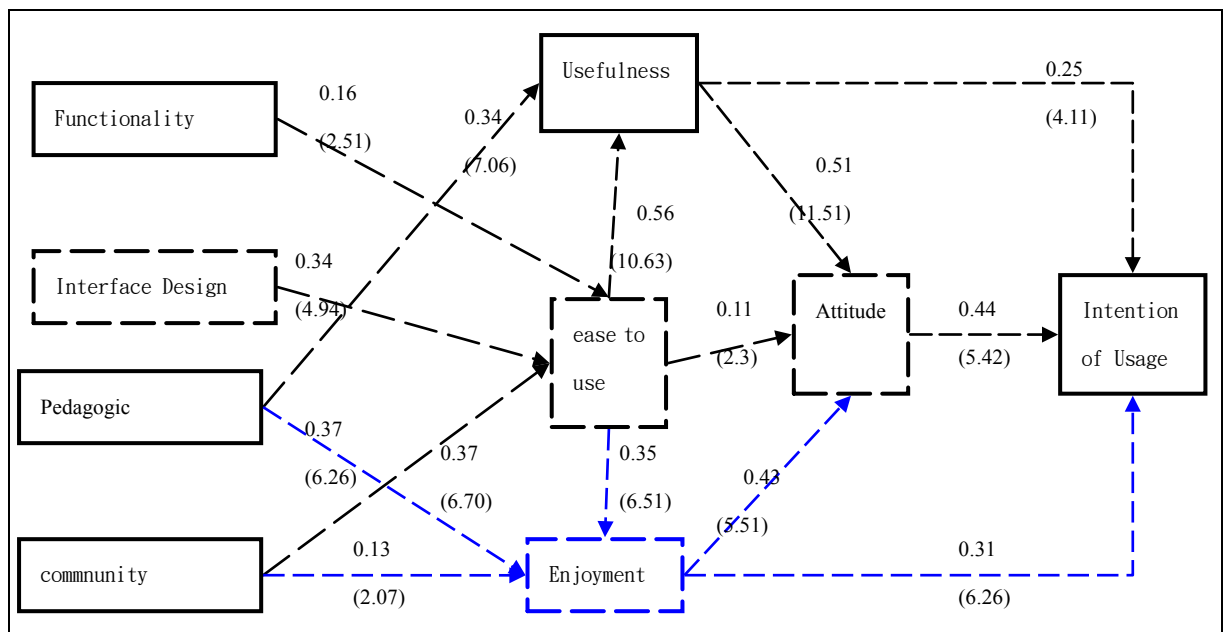


Fig. 2. Path Analyses

## 5. Discussions and Conclusions

The development of educational information technology (EIT) to date, from the technology standpoint, the function has been enough. But for teacher, they often not have enough knowledge to apply the functions properly to pedagogic design to get the synergy effect. The direction of EIT development should to create models of integrating functions and applications to help teachers feel that the EIT is easy to use and effective.

The research is an exploration of relationships between EIT and its application. The hypotheses and concept framework were established basing on the relationships between perceptions, motivations (beliefs), attitude and usage of extended TAM. And then the authors added the two(hygiene/motivation)-factored theory to classify the beliefs of TAM. Easy to use was considered as hygiene factor, students wouldn't use the eLearning system if they didn't believe they could know how to use it. Only the motivation factors: perceived usefulness and perceived enjoyment would motive students to stay relatively longer in the eLearning system.

According to the data analyses, we summarized the findings as follows:

(1) Because the values of model fitness testing were good, the researchers inferred that the conceptual framework (Fig. 1) could effectively explain that relationships between perception factors, motivation, attitude and usage.

(2) All three beliefs: easy to use, perceived usefulness, and perceived enjoyment showed significantly impact on students' willingness to use at .05 level (t value > 1.96), but only the last two beliefs still significant at more strict .01 level (t value > 2.54) (Fig. 2). The  $\beta$  values of three motivations (beliefs): easy to use, perceived usefulness, and perceived enjoyment, being 0.11, 0.51, and 0.43, also showed their degree of impact on students' attitude of willing to use. The researchers thus inferred belief on easy to use

is the hygiene factor and beliefs on perceived usefulness and perceived enjoyment were two motivation factors of EIT usage.

(3) There were three factors of perception: functionality, interface design, and community, had significant impact on the belief of easy to use (Fig. 2). According to their  $\beta$  values of above three factors, the researchers concluded that interface design of the eLearning system ( $\beta = .34$ ) and community (whether get enough support from staffs and classmates,  $\beta = .37$ ) were more impact on students' belief of easy to use than functionality was ( $\beta = .16$ ).

(4) Pedagogic design was the major factor to influence of two motivation factors: perceived usefulness and perceived enjoyment by t value greater than 254 at .01 significant level ( $t = 7.06$  and  $6.70$  in Fig. 2). The researchers suggested that it is necessary to promote co-operate between the EIT and education personnel to create the effective models of applying EIT in pedagogic design.

(5) Community only impact of perceived enjoyment at .05 level ( $t$  value  $= 2.07$ ) not at .01 level. The target platform was a very popular e learning system in higher educational institution in Taiwan. It though owned good functionality and even owned too many functions to most of teachers. But the fact was it still was difficult to create the belief of perceived enjoyment. With the popularity of using learning community in Facebook, the authors suggested that the development of EIT can consider more responsive to the habit of Facebook usage, to make data exchange more easily between the E learning system and Facebook, to publish of announcements simultaneously in Facebook or to create learning community automatically in facebook.

## References

- Bagozzi, R.P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of Academy of Marketing Science*, 16(1), 74-94.
- Barnes, S. J., & Vidgen, R.T.(2003). Measuring Web Site Quality Improvements: A case study of the forum on strategic management knowledge exchange. *Industrial Management & Data Systems*, 297-309.
- Bentler, P. M. (1995). *EQS structural equations program manual*. Encino, CA: Multivariate Software.
- Chao, T., Saj, T., & Tessier, F. (2006). Establishing a quality review for online courses. *EDUCAUSE Quarterly*, 3, 32-39.
- Chyung, S. Y. (2007). Invisible motivation of online adult learners during contract learning. *The Journal of Educators Online*, 4(1).
- Cox, J., & Dale, B.G. (2002). Key quality factors in web site design and use: An examination. *International Journal of Quality & Reliability Management*, 19, 862-888.
- Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-339.
- Davis, F.D., Bagozzi, R.P., & Warshaw, P.R. (2002). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982-1003.
- French, E.B., Metersky, M.L., Thaler, D.S., & Trexler, J.T. (1973). Herzberg's two factor theory: Consistency versus method dependency. *Personnel Psychology*, 26(3), 369-375.
- Heijden, H. (2003). Factors influencing the usage of websites: the case of a generic portal in the netherlands. *Information & Management*, 40, 541-549.



- Hendriks, P. (1999). Why share knowledge? The influence of ICT on the motivation for knowledge sharing. *Knowledge and Process Management*, 6(2), 91-100.
- Herzberg, F. (1987). One more time: how do you motivate employees?. *Harvard Business Review*, 65(5), 109-120.
- Herzberg, F., Bernard, M., & Snyderman, B. (1959). *The motivation to work*. NY: Wiley.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structural equation modeling, 6(1), 1-55.
- Jiang, J. J., Klein, G. C., & Christopher L. (2002). Measuring information system service quality: SERVQUAL from the other side, *MIS Quarterly*, 26(2), 145-166.
- Johnson, R.A., & Hignite, M.A. (2003). Applying the technology acceptance model to the WWW. *Academy of Information and Management Sciences Journal*, 3(2), 130-142.
- Kiili, K. (2005). Digital games-based learning: Towards an experiential gaming model. *The Internet and Higher Education*, 8(3), 13-24.
- Kim, Sung-Eon, Shaw, T., & Schneider, H. (2003). Web site design benchmarking within industry groups. *Internet Research*, 13(1), 17-26.
- Liang, T. P., & Lai, H. J. (2002). Effect of store design on consumer purchases: An empirical study of on-line bookstores. *Information & Management*, 39, 431-444.
- Lin, & Lu, H. (2000). Towards an understanding of the behavioural intention to use a web site. *International Journal of Information Management*, 20, 197-208.
- McDonald, R.P., & Ho, M.R. (2002). Principles and practice in reporting structural equation analysis. *Psychological Methods*, 7, 64-82.
- Moon, Ji-Won, Kim, Young-Gul (2001). Extending the tam for a world-wide-web context. *Information & Management*, 38, 217-230.
- Mulaik, S.A., James, L.R., Van Alstine, J., Bennett, N., Lind, S., & Stilwell, C.D. (1989). Evaluation of goodness-of-fit indices for structural equation models. *Psychological Bulletin*, 105, 430-445.
- Nichols, M. (2004). Motivation and Hygiene as a framework for eLearning practice. *Educational Technology & Society*, 7(3), 1-4.
- Parasuraman, A., Zeitham, V.A., & Berry, L.L. (1988). Service quality: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, 64(1), 12-40.
- Prensky, M. (2001). *Digital game-based learning*, USA7 McGraw-Hill.
- Schwab, D.P., & Cummings, L. L. (1970). Theories of performance and satisfaction: A review. *Industrial Relations*, 9, 408-430.
- Swan, K. (2004). Relationships between interactions and learning in online environments. Available: <http://old.sloanconsortium.org/publications/books/pdf/interactions.pdf>.
- Tuten, T. L., & August, R. A. (1998). Understanding consumer satisfaction in services settings: A bidimensional model of service strategies. *Journal of Social Behavior and Personality*, 13(3), 553-564.

Wu, L., Chuang, Y., & Chen, P. (2008). Motivation for using search engines: A two-factor model. *Journal of the American Society for Information Science and Technology*, 59(11), 1829-1840.

Zhang, P., & von Dran, G. M. (2000). Satisfiers and dissatisfiers: A two-factor model for web site design and evaluation. *Journal of the American Society for Information Science*, 51(14), 1253-1268.