A conceptual model of computer self-efficacy and intention to use computers

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Abstract

Although the realization that information technology is a key to the success and survival of companies in a highly competitive environment, the potential benefits of computers as aids to end user computing may not be fully realized due to poor acceptance by end users. In general, no matter how sophisticated and how capable the technology, its effective implementation depends upon users having a positive attitude towards it. The present study undertakes a thorough exploration of the relationships between three cluster variables: computer experience, computer self-efficacy, and intention to use computers. The results presented that users' computer experience was a major factor to affect user's computer self-efficacy. In addition, users' computer self-efficacy could be divided to two levels, basic and advanced computer self-efficacy by computer experiences. Moreover, users' computer self-efficacy could affect users' intention to use computers.

Keywords: Computer experience, Computer self-efficacy, Intention to use computers

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1. Introduction

    Since microcomputers became readily available from the early 1980's, more and more computing environments have equipped end users with computer tools that allow them to become more self-sufficient. Therefore, information system managers identified end-user computing (EUC) as one of their critical issues [18]. Essentially, EUC can be broadly defined as the direct use of computing resources by non-computer professionals to support their own personal business or job needs [22]; at the same time, EUC also can be narrowly defined as systems developed by end users to support their decision making [1]. Although the primary goal of EUC is to make the user more productive, most non-programming users only can use menu-based application packages [6]. In other words, end users cannot extract the maximum benefit from technology. Therefore, effective utilization of computers is the ultimate goal of implementation for EUC [26].

    Indeed, information technology with its capacity to process, store, transmit, and communicate information has a significant potential impact on organizational effectiveness and productivity. Despite the realization that information technology is a key to the success and survival of companies in a highly competitive environment, the potential benefits of computers as aids to EUC may not be fully realized due to poor acceptance by end users [12, 24]. End users are sometimes unwilling to accept and use available systems and express less enthusiastic response to new technology, even the system may increase their productivity [28]. The acceptance and use of computers by end users appear to be limited due to fear of computers, lack of confidence, and even resist accepting new technology [25]. Thus, greater attention needs to be paid to the factors that cause end users resistance to computer usage.

    In recent years, information systems researchers have realized that there is a need to build a multidisciplinary approach to research of individuals' perceptions regarding computers. In general, no matter how sophisticated and how capable the

technology, its effective implementation depends upon users having a positive attitude towards it [4]. Heilman and Hornstein [10] stated that the performances of organization were affected by human forces rather than technical capabilities. Historically, self-efficacy in performance is a component in achieving organizational success. Employee self-efficacy perceptions of technological advancements are reflected in the performance and proficiency realized by the organization [7]. A large body of study indicated that computer self-efficacy had been shown to be associated with an individual's performance in computer training and technology acceptance [7, 12, 5, 23].

The purpose of this exploratory study is to understand the relationship between end users' self-efficacy and their acceptance of advanced computer technology and training. The present study undertakes a through exploration of the relationships between three cluster variables: computer experience, computer self-efficacy, and intention to use computers. In this study, the meaning of intention to use computers is users' expectation for using more powerful computers and learning more advanced computer knowledge for assisting their job performance.

2. Literature review

2.1. Computer experience

There are several ways in which computer experience, or computer use, can be defined and conceptualized. In general, computer experience can be considered to be an act where users engage in applications that are often centered on computers, which become the end rather than the means to an end [17]. In addition, Computer experience also can be defined in two different ways as perceived use and variety use: "While perceived usage refers to the amount of time spent interacting with a microcomputer and frequency the use, variety of uses refers to the importance of use and the collection of software package use." [11, p.109]. Essentially, the computer would often be a tool for wider and more diverse use. Users are increasing using computers for information retrieval, data analysis, programming, word processing, creating graphics, and communication using electronic mail or online conferencing [27]. In this study, the computer

experience refers to the experience of software packages.

2.2. computer self-efficacy

Bandura [3, p. 391] defined self-efficacy as "generative capability in which cognitive, social, and behavioral subskills must organized into integrated courses of action to serve innumerable purpose". Essentially, if serious uncertainties regarding performance of necessary activities existed in efficacy expectations, the efficacy expectations would no longer impact behavior. Thus, the greater people perceive their self-efficacy to be, the more active and longer they persist in their efforts. Kinzie, Delcourt, and Powers [14] defined self-efficacy as an individual's confidence in her/his ability that may impact the performance of tasks. They noted that self-efficacy reflected an individual's confidence in her/his ability to perform the behavior required to produce specific outcomes and was thought to directly impact the choice to engage in a task, and the effort that would be expended and the persistence that would be exhibited. Murphy, Coover, and Owen [19] stated computer self-efficacy as individual's perception of their capabilities regarding specific computer knowledge and skills. Several studies found [14, 15, 29] that computer self-efficacy positively related to computer experience, intention to use computers.

2.3. Intention to use computers

Advanced computer technology, including hardware and software, was developed rapidly in recent years. Thus, end users may need to learn and use more advanced computer skills and technology for promoting their jobs' performance in time. Zhang and Espinoza [29] indicated that individuals' expectation for learning and using computers was a crucial factor to affect individuals' perceptions toward computers. In addition, Donitsa-Schmidt [15] also noted that individuals' advanced computer knowledge could affect positively individuals' computer attitudes. Therefore, end users' intention to use computers should include end users' expectation for using more advanced computers and for learning more relative computer knowledge to assist their job performance.

2.4. Hypotheses

A large body of study has investigated the effects of computer use or experience with computer self-efficacy [17, 15, 29, 14, 2, 21]. Indeed, those

studies presented that computer experience was a positive factor for computer self-efficacy. For example, Levine and Donitsa-Schmidt [15] indicated that computer experience had a positive effect on computer self-confidence, or self-efficacy. Moreover, Igbaria and Iivari [12] showed that computer experience was a predictor on computer self-efficacy. This leads to the following hypotheses:

Hypothesis 1. There exists a predictive relationship of computer experience on computer self-efficacy.

Zhang and Espinoza [29] noted that computer self-efficacy was a crucial factor in desirability of learning and using computers. In other words, when individuals have more computer self-efficacy, they have more expectation for using powerful computers and learning advanced computer skills. Based on these evidences, this study assumes that computer self-efficacy is a predictor of intention to use computers. Thus, the following hypotheses are postulated:

Hypothesis 2. There exists a predictive relationship of computer self-efficacy on intention to use computers.

In summary, this study predicts that computer experience would lead to computer self-efficacy. In addition, this study assumes that computer self-efficacy could predict intention to use computers. Figure 1 presents the theoretical model summarizing the hypothesized relationships between the research variables.
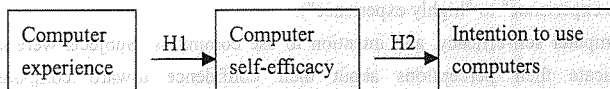

Figure 1. A Conceptual Model between Computer Experience, Computer Self-Efficacy, and Intention to Use Computers

3. Methodology

3.1. Subjects

The study was conducted in a medical college in central Taiwan with a sample of 402 faculty and staff. All subjects needed to answer a questionnaire survey that included demographic information and three different components

(computer experience, computer self-efficacy, intention to use computers). The questionnaire with a covering letter was distributed to subjects during working time from the researchers. All respondents were asked to respond in one week after received the survey and their responses were guaranteed confidentially. A total of 164 responses were returned, a response rate of 40.8%. Questionnaire with any missing responses were eliminated for statistical analyses to avoid confounding variables. A total of 164 responses, 62 were male and 102 were female employees. Concerning job status, 72 were staff and 92 were faculty.

3.2. Instruments

The data for this study was gathered by a questionnaire survey. The questionnaire survey included four major components: (a) demographic information, (b) computer experience, (c) computer self-efficacy, and (d) intention to use computers. The questionnaire was described as follow sand was presented in Appendix A.

Demographic information: The demographic component of the questionnaire covered gender and job status. The job status has two statuses (staff and faculty).

Computer experience: In this component, subjects were asked to indicate whether they had experiences of operating systems, word-processing packages, spreadsheet packages, database packages, and WWW (World Wide Web) programming languages. These questionnaires are all 7-point likert scales (from "no experience" to "highly experience").

Computer self-efficacy, and intention to use computers: Subjects were asked to indicate their perceptions about their confidence toward computers and expectation of using and learning advanced computers to assist their jobs. These questionnaires are all 7-point likert scales (from "strongly disagree" to "strongly agree").

4. Results

Descriptive statistics (means (M) and standard deviations (SD)) of computer use was reported in Table 1. The alpha reliability of computer self-efficacy and intention to use computers was to be highly accepted (α=0.89).

Table 1: Descriptive statistics of Computer Experience

Variables	M	S.D.
Experience using operating systems.	5.12	1.55
Experience with word processing packages.	5.30	1.54
Experience with spreadsheet packages	4.14	1.87
Experience with database packages.	2.56	1.69
Experience with WWW programming languages.	2.05	1.59

4.1. Factor analysis

A principal component analysis (PCA) was conducted for factorial structure. Generally, factor analysis requires two stages, factor extraction and factor rotation [13]. The primary purpose of the first stage is to make an initial decision about the number of factors underlying a set of measured variables or items. The goal of the second stage is to statistically manipulate the results to make the factors more interpretable and to make final decisions about the number of underlying factors.

Regarding factor extraction, the PCA yielded three components with eigenvalues greater than 1. In general, eigenvalue is the total amount of variance explained by a factor. In other words, eigenvalue is equal to the sum of the squares of each factor in a column [13]. Essentially, deciding how many factors should be retained for more detailed analysis is a crucial event for factor analysis and Eigenvalues, percentage of variance explained, and scree plots are useful assistant tools for this purpose [13]. When a component's eigenvalue was greater than 1 and the percentage of variance was greater than 9.1%, this component could be retained for factor extraction. Three eigenvalues were greater than 1 and three percentages of variance were larger than 9.1%. So the factor structure was three factors.

Varimax and Oblimin rotations were conducted to correct the artifact. After rotation analyses, the Varimax rotation was easier to interpret factor structure than Oblimin rotation did. Varimax (orthogonal) rotations were used for three-factor extraction. In general, varimax aims to maximize the sum of variances of squared loadings in the columns of the factor matrix [9]. The rotation converged in five iterations for varimax rotation. After varimax rotation, the rotated eigenvalues and percentages of variance was presented in Table 2.

Table 2: Total Variance Explained and Percentage of Variance by Varimax Rotation

Component	Eigenvalue	Percentage of Variance	Cumulative Percentage
1	4.38	39.78	39.78
2	2.88	26.21	65.99
3	1.96	17.81	83.80

Using a minimum factor structure coefficient criterion of .75, 6 items had unique high saliency with component one, 3 items with component two, and 2 items with component three. The three factors (as shown in Table 3) were titled: intention to use computers, self-efficacy for computer basic application, and self-efficacy for computer advanced application.

Table 3: Factor Structure

Items	M	S.D.	Item-total correlation	Factor Coefficient
Factor: Intention to use computers				
It is necessary for me to promote the Internet speed.	6.39	1.10	0.80	0.76
It is necessary for me to upgrade my hardware.	6.27	1.09	0.81	0.84
It is necessary for me to upgrade my operating system.	6.09	1.16	0.77	0.91
It is necessary for me to upgrade my application software.	6.14	1.09	0.80	0.89
It is necessary for me to learn more computer knowledge.	6.03	1.29	0.36	0.75
I believe computers can enhance my job performance.	6.20	1.16	0.71	0.84
Factor: Self-efficacy for computer basic application				
I feel confident using a personal computer.	5.71	1.40	0.72	0.90
I feel confident using e-mail.	5.69	1.39	0.69	0.92
I feel confident using the Internet to find information.	5.67	1.44	0.78	0.88
Factor: Self-efficacy for computer advanced application				
I feel confident to solve hardware problems.	2.81	1.55	0.42	0.93
I feel confident to solve software problems.	3.02	1.71	0.43	0.92

4.2. Regression analysis

The Pearson correlation coefficients among the variables were presented in

Table 4. The bi-variate relationships indicated that most of variables were significant correlated with each other and the correlation were all less than 0.80.

Table 4: Correlation Analysis

Variables	OS[a]	WD[a]	SP[a]	DB[a]	WP[a]	CP[a]	SE[a]
OS[a]	0.79*						
WD[a]	0.62*	0.69*					
SP[a]	0.41*	0.45*	0.48*				
DB[a]	0.35*	0.32*	0.44*	0.42*			
WP[a]	0.37*	0.42*	0.25*	0.25*	0.07		
CP[a]	0.74*	0.79*	0.55*	0.35*	0.24*	0.52*	
SE[a]	0.55*	0.53*	0.56*	0.46*	0.47*	0.17*	0.45*

[a]. "OS" means experience using operating systems, "WD" means experience with word processing packages, "SP" means experience with spreadsheet packages, "DB" means experience with database packages, "WP" means experience with WWW programming languages, "CP" means intention to use computers, and "SE" means self-efficacy for computer application.

*. p<0.01.

Regarding analytic strategy for assessing the predictive model, path analysis is an appropriate multivariate analytical methodology for empirically examining sets of relationships in the form of linear causal models. In general, the value of the path coefficient associated with each path represents the strength of each linear influence. Although the path coefficient can be estimated in many ways, multiple regression analysis has been used by most empirical applications of this methodology [16].

The stepwise multiple regression results for the path associated with the variables were presented in Table 5. The first regression analysis was performed to check the effect of predict variables on the intention to use computers. The predictor variables were self-efficacy for computer basic application and Self-efficacy for computer advanced application. The results showed the biggest and only predictor was self-efficacy for computer basic application (F=52.68, p=0.000, R²=0.26). The second regression analysis was conducted to examine the

effect of computer experience on the self-efficacy for computer basic application. The predictor variables were computer experience that included experience using operating systems, experience with word processing packages, experience with spreadsheet packages, experience with database packages, and experience with WWW programming languages. The result presented the biggest predictor variable was experience with word processing packages and another predictor was experience using operating systems (F=109.7, p=0.000, R^2=0.65). The third regression analysis was performed to examine the effect of computer experience on the self-efficacy for computer advanced application. The results indicated the biggest predictor variable was experience with spreadsheet packages and other two predictors were experience with WWW programming languages and experience with database packages (F=32.08, p=0.000, R^2=0.45).

Table 5: Regression Results for Predicted Path Relationships

Dependent variable	Independent variables	B	β	R^2 Change	P
Intention to use computers	Self-efficacy for computer application	0.36	0.51	0.26	0.00
Self-efficacy for computer basic application	Experience with word processing packages	0.62	0.65	0.63	0.00
	Experience using operating systems	0.17	0.20	0.02	0.02
Self-efficacy for computer advanced application	Experience with spreadsheet packages	0.30	0.36	0.34	0.00
	Experience with WWW programming languages	0.28	0.30	0.09	0.00
	Experience with database packages	0.16	0.18	0.02	0.03

Figure 2 represented the final model with the non-significant paths removed. Essentially, multicollinearity can be controlled by two ways: (1) correlation between independent variables should all less than 0.8 [8]; (2) variance inflation factors (VIF) should less than 10 [20]. In this study, multicollinearity was ruled

out because the correlation between independent variables, as Table 4 shown, were all less than .8 and the VIFs were all less than 3. Based on multiple regression analysis, the scatter plots of the standardized residuals by the standardized predicted scores were also examined to verify the assumption of linearity.
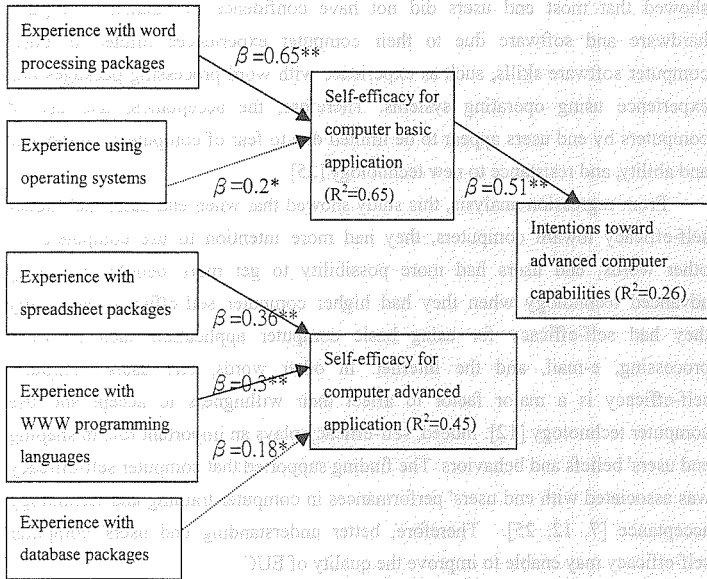

Figure 2: A Conceptual Model between Computer Experience, Self-Efficacy for Computer Basic Application, Self-Efficacy for Computer Advanced Application, and Intention to Use Computers

*. p<0.05

**. p<0.01

5. Discussion

Table 1 presented that most end users had higher computer skills in word

processing packages and operating systems than their computer skills in database packages or WWW programming languages. This finding supported that most non-programming users only can use menu-based packages [6]. From factor analysis, computer self-efficacy could be divided to two levels: self-efficacy for computer basic application (basic computer self-efficacy) and self-efficacy for computer advanced application (advanced computer self-efficacy). Table 3 showed that most end users did not have confidence to maintain computer hardware and software due to their computer experiences limited in basic computer software skills, such as experience with word processing packages and experience using operating systems. Therefore, the acceptances and use of computers by end users appear to be limited due to fear of computers, confidence and ability, and resistance to new technology [25].

From regression analysis, this study showed that when end users had higher self-efficacy toward computers, they had more intention to use computers. In other words, end users had more possibility to get more benefits by using advanced technology when they had higher computer self-efficacy; especially they had self-efficacy for using basic computer application such as word processing, e-mail, and the Internet. In other words, end users' computer self-efficacy is a major factor to affect their willingness to accept and use computer technology [12]. Indeed, self-efficacy plays an important role in shaping end users' beliefs and behaviors. The finding supported that computer self-efficacy was associated with end users' performances in computer training and technology acceptance [7, 12, 25]. Therefore, better understanding end users' computer self-efficacy may enable to improve the quality of EUC.

In terms of goodness-of-fit indicators, the models accounted for 26% of the variance in intentions toward computer capabilities by basic computer self-efficacy. In addition, experience with word processing packages and operating systems accounted for 65% of the variance in basic computer self-efficacy. Moreover, experience with spreadsheet packages, WWW programming languages, and database packages accounted for 45% of the variance in advanced computer self-efficacy.

6. Conclusions

There were three significant implications in this study. First, this study revealed that end users' computer experience was a major factor to affect end user's computer self-efficacy. In other words, when end users have more computer experience, then they have higher confidence to use and operate computers. Second, end users' computer self-efficacy could be divided to two levels (basic and advanced computer self-efficacy) by computer experiences. Although self-efficacy reflected end users' confidence in their ability to perform the behavior required to produce specific outcomes, computer self-efficacy can be divided to different levels by various computer experiences. This new finding is quite different to previous studies [14, 15, 29]. And third, end users' computer self-efficacy could influence end users' intention to use computers. Based on these evidences, end users' computer experience may change their computer self-efficacy and subsequently affect their intentions to use and learn advanced computer skills for improving their job performance. Therefore, the potential benefits of computers as aids to EUC might be realized when end users had more computer experience and self-efficacy.

Acknowledgement

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Appendix A: The Survey Questionnaire

General and Demographic Information

Gender: Female Male

Job status: Staff Faculty

Computer Experience: (1=no experience 7= highly experienced)

1. Experience using operating systems.

2. Experience with any word processing packages (e.g. Microsoft-Word, WordPad).

3. Experience with any spreadsheet packages (e.g. Microsoft-Excel).

4. Experience with any database packages (e.g. Oracle, Microsoft-Access).

5. Experience with any World Wide Web programming languages (e.g. HTML).

Computer Self-Efficacy and intention to use computers: (1=strongly disagree, 7=strongly agree)

1. I feel confident using a personal computer.

2. I feel confident using e-mail.

3. I feel confident using the Internet to find information.

4. I feel confident to solve hardware problems.

5. I feel confident to solve software problems.

6. It is necessary for me to promote the Internet speed.

7. It is necessary for me to upgrade my hardware.

8. It is necessary for me to upgrade my operating system.

9. It is necessary for me to upgrade my application software.

10. It is necessary for me to learn more computer knowledge.

11. I believe computers can enhance my job performance.

電腦自信心與電腦使用意願之模組探討

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摘　要:

在資訊科技發達之今日，雖然說資訊科技是一個組織成功與生存的關鍵之一，很多資訊科技的使用者並沒有真正體會到資訊科技所帶給他們真正的益處。其原因有可能是這些使用者對資訊科技的接受度較差。一般而言，無論多麼複雜之資訊科技或多麼有效能之電腦設備，有效的使用資訊科技或電腦設備端賴使用者對這些設備有無正面的態度。而本研究是在找尋所謂的正面因子，是在探討三個變數之關連性。這三個變數分別為電腦經驗、電腦自信心、電腦使用意願。經過統計及分析後之結果發現，使用者之電腦經驗是影響使用者電腦自信心之因子。除此之外，使用者之電腦自信心可分成兩大類型：一為基本應用電腦自信心，另一為進階應用電腦自信心。而造成此電腦自信心分成兩大類型之原因則為電腦經驗的類型。從本研究之結果亦發現使用者之電腦自信心是影響使用者電腦使用意願之因子。因此增加使用者電腦經驗的訓練以及電腦自信心是增加使用者對電腦持正面態度的方法。

關鍵字：電腦經驗、電腦自信心、電腦使用意願。