

Effects of determinants for computer use among teachers in Malaysia

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This study seeks to identify effects of determinants for computers use among teachers in Malaysia. In Malaysia, there is widespread recognition that computer can play a powerful role in supplementing and complimenting the process of teacher's teaching and learning. Given current recognition of the value of computer integration, as well as the investment costs that technologies represent for schools, this study attempted to develop a model which demonstrates the variables that affect computer use among teachers and which also explain its interactions. The proposed research model is based on previous models of technology acceptance. Three variables (computer teaching efficacy, computer attitude and learning outcomes) were selected to build a model for this study. Methodologically, Structural Equation Modelling (SEM) was used as the main technique for data analysis. The findings support the notion that computer attitudes, computer teaching efficacy and learning outcomes have effects on computer use among teachers. However, among them, learning outcomes and computer teaching efficacy did not have direct effects towards computer use. Implications and practical guidelines for both educational technology developers and practitioners are subsequently presented.

Key words: Educational technology; in-service teachers; structural equation modelling (SEM)

Introduction

Technologies are widely used in a world of education today, both in higher education through to preschool education. Forms of technology resourcing in the classroom have been revolutionized since the use of personal computers. Malaysian schools have devoted considerable resource to technology. Malaysian schools and colleges have included computer technology as an integral part of students learning experiences and as a way to equip them with the skills and knowledge necessary to succeed in the 21st century. Many ministers have expressed strong desire to use technology in creating classroom-to-classroom connections via the internet as a way to build cultural awareness and foster studying habits. The Ministry of Education in Malaysia had emphasized that public education system, either primary or secondary schools must ensure all students have equal access to computer-based technology support for academic success, regardless of social or economic status. Moreover, the Malaysian government has established various institutions, such as the National Information Technology Council (NITC), the Malaysian Institute of Microelectronics Systems (MIMOS), the Communications and Multimedia Commission (CMC) and the Multimedia Development Corporation (MDC) (Tipton, 2002) to encourage

the use of computer related technologies in the Malaysian society. Hence, billions of Ringgits have been poured into the educational sector to acquire necessary equipment. Funding efforts over the past few years have dramatically increased the availability of computer technology for students use in schools across Malaysia. Given the vital role of technology in teaching and learning, and growing concern that many Malaysian teachers lack of interest in it, time has come to review and examine factors that influence computer use among these them. From the findings of this study, policymakers and teacher educators can have a better picture on the factors which have the most influential impacts on computer use and thus, design a curriculum that can boost the level of computer use among teachers.

Theoretical Basis of the Study

According to Bandura's social cognitive theory (Bandura, 1977), individual with high self-efficacy will have better ability to cope with roadblocks and endure stress related to change. Conversely, an individual with low self-efficacy will be less likely to attempt innovation or follow through as barriers arise. Many previous researchers, such as Gibson and Dembo (1984), Riggs and Enochs (1990), Marcinkiewicz (1994), Torkzadeh, Pfulghoeft and Hall (1999), Gibson (2001), Tracey *et al.* (2001), Bandura (2001), Cassidy and Eachus (2002) and Sugar (2002) have suggested that self-efficacy, by itself, will influence actual performance and practices. According to the Bandura's theory, there are two dimensions of expectancies of behavior; efficacy beliefs and outcome expectation. Efficacy belief is the feelings of confidence in performing certain task. Outcome expectation was defined as the belief about the consequences that action will produce. Given those two dimensions, CTE refers to teachers' judgement of their capabilities to teach with computer and their personal beliefs in using that technology as an effective teaching tool to improve student's performance.

Alongside, several models have explained the relationship between computer attitudes (CA) and intention or actual behavior. Among those notable models are Technology Acceptance Model (TAM) (Davis, 1989), Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980), Theory of Planned Behavior (TPB) (Ajzen, 1985) and Multi-Attribute Attitude Model (MAA) (Wilkie & Pessemier, 1973). TAM, TPB, TRA and MAA were based on the relationship of attitude-intention-behavior (actual) constructs. Based on those models and theories, attitudes construct has been the main focus. Ajzen and Fishben (1977) argued that by understanding an individual's attitude toward an object, one can predict his or her overall pattern of response to the object. An individual's attitude represents an individual's personal convictions and feelings towards a specific object or behavior. Generally, a person who believes that performing a given behavior will lead to positive outcomes will hold a favourable attitude toward performing the behavior. On the other hand, a person who believes that performing a given behavior will lead to negative outcomes will hold an unfavourable attitude toward performing the behavior.

Despite the accolades given to computer attitudes for its predictive ability for computer use (CU), this study also focuses on teachers' learning outcomes (LO). In this study, learning outcomes defined as how much the trainees have learnt and retained after undergoing training from the teacher educational training program. Based on previous training transfer models, higher level of training transfer could occur when there were positive learning outcomes (Goldstein & Ford, 2002; Phillips, 1997; Kirkpatrick, 1996; Rouiller & Goldstein, 1993; Baldwin & Ford, 1988; Noe, 1986). Those previous researchers also noted that there was a direct significant relationship between learning outcomes and the actual performance in activities or tasks. This means, learning outcomes can determine the

level of actual transfer. For transfer to occur the trainees must be able to generalize the material presented in their training session to their current surroundings and they must be able to maintain their knowledge base over a period of time.

Based on the above statements, the following hypotheses were formulated.

- H1. CA will have a significant influence on CU.
- H2. CTE will have a significant influence on CU.
- H3. CTE will have a significant influence on CA.
- H4. CTE will have a mediating effect in the effect of LO towards CA.
- H5. LO will have a significant influence on CA.
- H6. LO will have a significant influence on CTE.
- H7. LO will have a significant influence on CU.

Research Methodology

The purpose of this study is to model the determinants of teachers in the use of computer in teaching and learning. This study employs a structural equation modelling (SEM) approach to develop a model that represents the relationships among five variables in this study: computer attitudes, computer teaching efficacy, learning outcomes and computer use. Data were collected through using a survey questionnaire comprising questions on demographics and multiple items for each variable in the research model. Participants in this study were 269 teachers from teacher training colleges in Malaysia. Almost all the participants accessed a computer at home (94%) and their mean length of computer use was 6.78 years. Participation by the teachers was wholly voluntary and no course credits were given for their participation. All participating teachers were briefed on the purposes of the study and have been informed that they can withhold their participation during or after they had completed the questionnaire. Respondents were taken approximately 15 minutes to complete the questionnaire.

A structured questionnaire was developed as the mode of data collection. The survey question composed of 4 constructs. (computer use, learning outcomes, computer attitudes and computer teaching efficacy). Respondents were asked to indicate the items on a four-point Likert scale ranging from strongly disagree (1), slightly disagree (2), slightly agree, (3) and strongly agree (4). Each item was coded so that the more positive levels of the constructs yielded higher scores. These items were adapted from various published sources and were found to be reliable and valid. These items were adapted from various published sources (Davis, 1989; Compeau & Higgins, 1995; Thompson et al., 1991; Riggs & Enochs, 1990; Gibson & Dembo, 1984).

Model Building and Testing: Analysis and Results

In this study, two phase analyses have been carried out. The first phase revealed the preliminary analysis which examined the descriptive statistics of the measurement items, and assessed the reliability and validity of the measure used in this study. This was to ensure the data adequate for structural equation modelling testing. For second phase, assessments on the contributions and significance of the manifest exogenous and endogenous variables towards computer use among teachers have been done.

Preliminary analysis

A descriptive analysis was preliminarily carried out on variables involved. Computer attitudes, computer teaching efficacy, learning outcomes, and computer use have been identified for their mean and standard deviation (Table 1). All means scores are > 2.5 of the midpoint, ranging from 2.7 to 3.7. This indicates an overall positive response to the scales in the study. The standard deviation (SD) values have proven that a narrow spread around the mean. Multivariate normality can be assessed through the inspection of univariate distribution index values, with univariate skew indexes greater than 3.0 and kurtosis indexes greater than 10 indicative of unacceptable non-normality (Kline, 2005). Skew and kurtosis indices for all scales are under 1.5. Internal reliability was adequate for all measures. The data in this study is regarded as normal for the purposes of structural equation modelling.

Table 1. Descriptive statistics of the study constructs

Construct	Mean	Standard deviation	Skewness	Kurtosis
Learning outcomes	2.75	.88	-.08	-1.21
Computer attitudes	3.71	.58	-1.31	1.20
Computer teaching efficacy	2.72	.63	.02	-.67
Computer use	2.76	.77	-1.07	-1.04

To ensure the constructs have high reliability and validity, convergent-discrimination test has been carried out. Underlying convergent-discrimination analysis, item reliability, composited reliability (CR), average variance extracted (AVE) and discriminate validity of each construct have been examined. The item reliability of an item was assessed by its factor loading onto the underlying construct. Table 2 shows all the items in the measurement model ranged above .60. A factor loading of 0.50 and above was considered to be a well-defined structure (Hair, et al., 1992).

The composite reliability (CR) of each construct was assessed using Cronbach's alpha. The composite reliability for all the factors in the measurement model range from 0.73 to 0.89 (Table 2) and it exceeds the recommended threshold value (Sekaran, 2003). According to Sekaran (2003), if the value of Cronbach's alpha is coefficient less than .60, the reliability is low, between .60 and .80 is moderate and acceptable, and more than .08 is high.

Table 2. Results for the measurement model

Latent Variable	Item	Factor (>.60)*	Loading	Average Extracted (= or >.50)*	Variance (= or >.70)*	Composite Reliability (= or >.70)*
Computer Teaching Efficacy	CTE1	.80		.59		.71
	CTE2	.88				
	CTE3	.59				
Computer Attitudes	CA1	.83		.51		.77
	CA2	.75				
	CA3	.84				
Learning Outcomes	LO1	.90		.64		.81
	LO2	.90				
	LO3	.78				
Computer Use	CU1	.68		.65		.73
	CU2	.85				
	CU3	.86				

^a AVE: Average Variance Extracted = $(\sum\lambda^2) / (\sum\lambda^2) + (\sum(1 - \lambda^2))$.

^b Composite Reliability = $(\sum\lambda^2) / (\sum\lambda^2) + (\sum(1 - \lambda^2))$.

^c This value was fixed at 1.00 in the model for identification purposes.

*Indicates an acceptance level or validity.

** $p < .01$.

Test of the structural model

In this study, computer program software AMOS18 (Arbuckle, 2005) has been used to test the research model underlying structural equation model approach (SEM). The five absolute fit indices: χ^2 goodness-of-fit statistic, χ^2/df , Goodness of Fit (GFI), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Standardized Root Mean Square Error of Approximation (RMSEA) have been assessed. Absolute fit indices measure how well the proposed model reproduces the observed data. According to Hair, et al (2010), the value of GFI and CFI should more than 0.95 and RMSEA smaller than 0.05 to be considered good fit. For χ^2/df , the value below 3 is considered acceptable. TLI value should greater than 0.90 (Byrne, 2001). Based on the minimum thresholds for acceptable model's fit, modified model was built as depicted in Figure 1. Only significant structural paths were retained in this rival model. Estimation of this modified model showed much better fit statistics, which reached minimum thresholds for acceptable model's fit ($\chi^2 = 6.1$, $p < 0.01$; $\chi^2/df = 1.3$; GFI=.90; CFI=.93; TLI=.92 and RMSEA = 0.07).

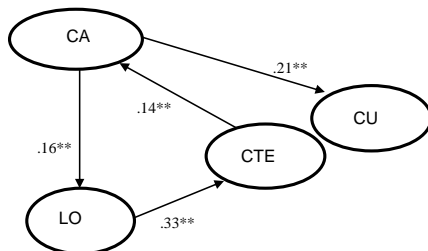


Figure 1. Path coefficients of the structural model

Hypothesis testing

Table 4 shows parameter estimates for the significant hypothesized paths. All hypotheses, except H2 and H7, were supported by the data. The exogenous variable, learning outcomes, did not significantly influence computer use but was a significant influence on computer attitudes ($\beta=.16$, $p<.01$) and computer teaching efficacy ($\beta=.33$, $p<.01$). Computer teaching efficacy was a significant influence on computer attitudes ($\beta=.14$, $p<.01$) and computer attitudes has a significant influence on computer use ($\beta=.21$, $p<.01$).

Table 4. Hypothesis testing results

Hypotheses	Path	Path coefficient	Results
H1	CA→CU	0.21**	Supported
H3	CTE→CA	0.14**	Supported
H4	LO→CTE→CA	0.08**	Supported
H5	LO→CA	0.16**	Supported
H6	LO→CTE	0.33**	Supported

* $p < .05$; ** $p < .01$.

Computer attitudes were found to be significantly determined by learning outcomes and computer teaching efficacy, resulting in an R^2 of 0.16. That is, learning outcomes and computer teaching efficacy explained 16% of the variance in computer attitudes. Computer teaching efficacy was significantly determined by learning outcomes and the percent of variance explained was 33%. That is, the combined effects of learning outcomes, computer attitudes, and computer teaching efficacy explained 39.7% of the variance of computer use.

Discussion and Implications

The findings of this research offer several important implications for the research and practice of computer integration among teachers. As anticipated, computer attitude has direct towards the levels of integration of computer among teachers and the model explains 39.7% of the variance in computer use. Overall, the findings have support existing theories and assumptions that those selected exogenous and endogenous variables affected the computer use among teachers. Using structural equation modelling, data also indicated that the resulting model is an adequate fit to the observed relationships among the factors that influenced teachers in computer use in teaching and learning.

With regard to learning outcomes, it was found that learning outcomes only had significant effects on computer attitudes and computer teaching efficacy. This result has highlighted the importance of leaning outcomes, and as such is a new contribution to the study of acceptance of computer among teachers. However, learning outcomes has no relationship with computer use. This finding gathered from this study contradicted previous findings (Kirkpatrick, 1996; Rouiller & Goldstein, 1993; Baldwin & Ford, 1988; Noe, 1986). The ineffectiveness in the implementation and irrelevant syllabi and level of complexity that were taught in the teacher educational program might be one of the reasons that led to the respective results. This early indication and realization will help policymakers and teacher educators to develop a better and more comprehensive approach toward educational technology, especially in designing the curriculum for teacher educational program.

From the results, it has been corroborated that computer attitudes have positively influenced the use of computer among teachers. Therefore, it goes to show that computer attitude has an important role to play in influencing teachers' use of computers. The finding is in line with previous findings in Western settings. Henceforth, in this regard, the Ministry of Education and the related government departments should do more in terms of encouraging positive computer attitudes among teachers. Since many findings from the previous researches and the results of this study have indicated that computer attitudes have significant impact on teachers' use of computer, schools should provide training, funding and support required for this process. By strengthening staff training in technologies, schools can help encourage more positive attitudes toward computers, especially to reduce teachers' anxiety towards computers in general. The school boards of management should ensure that in-service technology training program to be a part of their yearly activities. By meeting the needs related to technology integration and helping to instill more favourable computer attitudes will directly assist in the integration of computer into the teaching and learning activities.

It was also further revealed that computer teaching efficacy mediated the relationship between learning outcomes and computer attitudes. This finding could be a new contribution to the educational field. For this reason, there is potential for practical application in the development and management of computer use in schools. Practitioners and curriculum designers should make an effort to strengthen teachers' technology self-efficacy by paying extra attention to increasing teachers' belief and confidence in using computers, especially in designing the curriculum for teacher-education programs and in-service training for teachers. Regular updating of national educational technology standards in teacher-education programs is vital because technology continues to grow and develop rapidly. Moreover, this would help provide guidelines for updating courses for teachers so that they develop appropriate knowledge to enable them to make effective use of IWBs in teaching and learning.

Several limitations narrow the scope of the above conclusions. First, self-report items were employed to measure the variables for the present study. Thus, suggesting the possibility of bias in the findings due to the fact that participants might give socially desirable responses, especially when one of the researchers is the course coordinator. Secondly, given the importance of demographic factors such as gender, age and voluntariness of use (as theorized in the various models of technology acceptance), future research could replicate this enquiry by using a larger sample and by testing for the model invariance across those demographic and background factors. Finally, this study is the timeliness of the data and finding process. At the time of this writing, the data was collected more than a year old. Thus, during this period of time, there may have been some changes in syllabi and curricula in teacher educational training program. However, the main findings of this study will remain true regardless of the aforementioned changes.

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