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The Computer Use Intention (CUI) scale in education: Development, validity and reliability studies

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The main aim of this research was to develop an instrument to examine the intention of computer use among student teachers and provide an initial psychometric evaluation of the *Computer Use Intention* (CUI) scale among student teachers. The process of item generation for the CUI scale was carried out through the sequential mixed method approach. A total of 177 student teachers from a teacher education participated in this study. Based on the exploratory factor analysis (EFA) results, it yielded a four-factorial with 12 items in the CUI scale. The researchers then carried out a confirmatory factor analysis (CFA) to assess its factorial validity and reliability. Based on the findings, the CUI scale reached the minimum thresholds for acceptable scale. Convergent validity and discriminant validity of the CUI scale shows satisfactory validity and good internal consistency for all 12-item of CUI scale.

Key words : Educational technology; student teachers; psychometric evaluation; scale development.

Introduction

Technology instructional has been widely used in a world of education today, either in higher education or preschool education and it has now taken a place in the agenda of international meetings, along with trade and economics (Wong, Russo, & McDowall, 2013). Since the introduction of computer in education in the mid 1970's, computers in the classrooms have been thought as the solution to a myriad of social, economic and educational problems. From that moment onwards, research into its use in the educational world began. Many studies explored various aspects of the use of computers in teaching and learning for instructional or non-instructional (planning, assessment and communication) purpose. Many related journals began to add teachers in the use of computers. For example, the International Society for Technology in Education was formed and began publishing the Journal of Research on Computer in Education. This action is coherent with the recent surge in published technology acceptance studies, with most studies highlighted the importance of technology in teaching and learning. (Hixon & So, 2009; Teo, Lee & Chai, 2008; Wong, Goh, Hafizul & Rosma, 2010). Based on the literature reviews, there are many benefits of computer in education; these include individualizing instruction, nurturing

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quality thinking, building higher processing skills, allowing students to become global learners and creating opportunities for students to enhance worldwide knowledge and skills through the internet. In addition, it also prepares students for the future as in today's working environment, more and more occupations require some interaction with computers and a majority of the new jobs require computer and technical skills.

The push to incorporate and integrate technology in classroom teaching from all levels became much stronger and vital in Malaysian education system after the introduction of Smart School. The Smart School is one of the seven flagships applications underlying Multimedia Super Corridor (MSC) which began its operations in 1997. The objectives of the Smart School are to develop technology savvy individuals and eradicate computer illiteracy. Such strategies began with RM150 million allocated for 1340 schools to develop their multimedia facilities and computer laboratories, thus paving the way for a revised school curriculum. However, at the same time, there is also an overwhelming sentiment that the government has yet to create the kind of training and practice that teachers could enable teachers to teachers to effectively integrate the computer in teaching and learning. This has been proven whereas some teachers have had problems to adapt with computer advances. This situation has also occurred in developed countries. Kumar and Kurma (2003) noted that California Teacher Educational program generally failed to improve teachers experience with technology where most trainee teachers were able to use simple computer applications, such as word processor, email, internet but not even 10% were be able to use advanced instructional software such as multimedia, problem-solving and electronic network collaboration capabilities.

Given the affordances of computer teaching and learning and its obstacles in the process of implementation of computer in schools, having a valid and reliable scale to measure intention of computer use among student teachers is vital and are worthwhile issues of enquiry and fruitful to explore.

Furthermore, from the findings of this study, the policymakers and teacher educators can clearly identify factors that are related to the use of computer and with this in mind, it is hoped that they will be able to design a curricula and syllabi which can help enhance the use of computer in teaching and learning in future teaching practices. It is vital to design the appropriate curricula and syllabi that able to cater the needs of student teachers' intention to use of computer for teaching and learning. With all these, the government would not have to spend much money on the in-service educational technology training programs which indirectly affect the teaching and learning process and students' performance as a whole.

The study

With more studies verifying the importance of educational technology in making teaching and learning more effective, productive and creative, numerous technology acceptance measurements have been created and modified to understand technology acceptance and its use in different levels or groups. 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. According to Ajzen and Fishbein (1980), to understand the foundation for tracing the relationship of attitudes-intention-behavior, researchers need to understand the Theory of Reasoned Action (TRA). TRA is a widely studied model from social psychology which is concerned with the determinants of consciously intended behaviours. According to TRA, a person's performance of specified behaviours is determined by his or her behavioral intention to perform certain tasks. Behavioral intention is jointly determined by the person's attitudes. Besides TRA, Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991) also noted that attitudes and behavior have strong significance. TPB was an expansion of the TRA model. TPB is also widely used in predicting behavioral intention. For example, in consumer behavior studies, Shim, Mary, Sherry and Warrington (2001) developed a model to predict consumers' intention to purchase via the internet. The findings revealed that all three variables, attitude, subjective norms and perceived behavioral control, significantly influenced the intention to use the internet for information search (Ramayah & Muhamad Jantan, 2004).

Thereafter, rooted in the work of Ajzen and Fishbein, the TAM provided a theoretical context in using attitudes to predict the behavioral intention to use and actual system use. In the year 1990, TAM has grown to become one of the most influential models widely used in the studies of the determinant of information system and information technology acceptance. Many previous studies have adopted and expanded this model which was empirically proven to have high validity (Davis, 1989; Mathieson, 1991; Adams, Nelson & Todd, 1992; Segars & Grover, 1993; Igbaria, 1990; Igbaria *et al.*, 1995, 1997; Venkatesh *et al.*, 2000; Ji-Won Moon & Young-Gul Kim, 2002).

Besides that, student teacher's attitude represents an individual's personal convictions and feelings towards a specific object or behavior. According to Rotter (1966), a generalized belief regarding one's personal efficacy was characterized as internal and external being related to a belief that an event is beyond one's own control can be regarded as external. In the 1980s and 1990s, the concept of teacher efficacy became firmly rooted in Bandura's social cognitive theory (Bandura, 1977). Teacher efficacy beliefs can influence a teacher's behavior regarding choices made, effort expended and perseverance under adverse conditions. Numerous positive outcomes have been associated with student teachers' high sense of self-efficacy. Among these were student achievement (Ashton & Webb, 1986), the ability to implement classroom management strategies successfully (Hoy & Woolfolk, 1993), ability to work longer with students who are struggling (Ashton & Webb, 1986; Gibson & Dembo, 1984) and computer usage (Eyadat, 2006). Student teachers with low efficacy feel that they only have minimal influence on student achievement. These teachers give up more easily when confronted with difficult situations and they are less resourceful and oftentimes feel that students cannot learn because of the extenuating circumstance (Ashton & Webb, 1986; Bandura, 1997). Teaching efficacy exists in two levels: personal teaching efficacy and general teaching efficacy. Personal teaching efficacy is an individual student teachers' belief in his or her own effectiveness, a perception that may be situation specific (Ashton & Webb, 1986; Bandura, 1977). Bandura refers to this as "efficacy belief". He noted that one's personal teaching efficacy governs one's motivation, thought processes, emotions and willingness to expend energy. General teaching efficacy refers to teachers' perceptions that teaching can influence students' learning. Bandura's theory of self-efficacy advocated this as "outcome expectancy". In this construct, teachers with positive general teaching efficacy believed that they could help students to learn and be motivated as well as influence their level of academic progress. In addition, a positive sense of general teaching efficacy suggests that the students can learn regardless of their capabilities or home and peer influences. On the other hand, the teacher who believed that students could or would not learn regardless of the influences exerted by teachers was categorized as low sense of general teaching efficacy.

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. Based the above statement, the following hypothesis was formulated. (Davis, 1989; Davis, Bagozzi & Warshaw, 1989; Ajzen & Fishbein, 1980; Ajzen, 1985; Ajzen, 1991; Venkatesh & Davis, 2000; Venkatesh, Morris, Davis & Davis, 2003).

Despite the accolades give to computer attitudes for its predictive ability for computer use, this study also focusing on social influences. Social influence' is defined as, "The degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003, p. 451). It integrates the aspects of subjective norm (TRA, TAM2, TPB/DTPB and C-TAM-TPB), social factors (MPCU), and image (IDT) (Venkatesh et al., 2003). Social influence also affects behavioural intention more noticeably in the early stages of technology adoption (Venkatesh & Davis, 2000). In this study, social influence refers to the social factors which influence the use of computer among student teachers, and it includes support and encouragement from educators and the university.

Despite the credit and adulations given to the above models for its predictive ability and efficient mode to explain users' acceptance to use technology among student teachers or practising teachers, there are some primary limitations leads itself to conduct the current study. To date, there is a paucity of study that trying to develop and provide related instrument to understand and explore the intention use of computer among for student teachers from teacher institution in Malaysia context.

Furthermore, undoubtedly, recently there were some studies aimed to empirically develop a valid and reliable instrument that use for evaluating intention use of computer; however those instruments main focused on school perspectives which mostly highlighted the intention use of computer among practicing teachers. Researchers believed that student teachers have different backgrounds, mind-sets and attitude toward computer use if compare to practising teachers in schools. Alongside, type of technologies is being chosen for teaching and learning practises by student teachers are mainly based on the topic and its learning outcomes and objectivities of the entire lessons. In addition, student teachers tend to have autonomy over the teaching tools best suited to their planned activates (Teo, Wong & Chai, 2008).

In response to the aforesaid gap in the literature, as well as the investment costs by teacher educational institutions throughout nation, it seems having a specific measurement or scale to evaluate the intention use of computer among student teachers is a worthwhile issue of enquiry and focus in.

Research methodology

Item generation

The process of item generation for the CUI scale was carried out through the sequential mixed method, a powerful method for developing and validating a new instrument. It has been used in previous studies for developing and validating measurement in educational settings. In the qualitative phase, a review of the literature of a similar field was carried out, especially the items employed in the empirical studies (Venkatesh et al., 2003). Apart from reviewing the literature related to this area which provided a practical framework for constructing the CUI scale for student teachers, six teachers, ten student teachers and two language experts were taking part in this study in order to assist and develop in the process of gathering the items pool for CUI scale.

In the first draft, 19 items were developed to examine the intention use of computer among student teachers. Alongside, verification of the content and face validity was conducted to ensure the developed CUI scale have high in validity and reach the values that consider appropriate and acceptable. The appropriate and acceptable figures were based on Hair, Black, Babin and Anderson (2010).

Meanwhile, another three independent content expert panels were consulted on the first draft of CUI item on its nomological validity. The aim was to identify whether the items would provide the desired data and whether any problems had been overlooked. Furthermore, the items were checked by two language professionals to ensure that they were designed for ease of response. After all the detail and focus process, the first CUI scale was modified and rewrite according the ease of understand that able to cater all levels of student teachers. Based on the first draft of CUI scale, 12 items were remained for the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

The 12 items of CUI scale was measured using a four-point Likert scale with responses ranging from "strongly disagree" (1) to "strongly agree" (5). Respondents were asked to indicate the items on a five-point Likert scale ranging from strongly disagree (1), slightly disagree (2), not sure (3), slightly agree (4) and strongly agree (5). 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).

For the quantitative phase, an examination of the psychometric quality of the CUI scale was carried out to ensure the validity and reliability of the items used. For these purposes, an exploratory factor analysis (EFA) and a confirmatory factor analysis (CFA) were performed. An EFA was performed on the dataset to test whether the data reflected the suggested factor structure, and the CFA was conducted to confirm the stability of the factor structure of the new developed CUI scale from this study.

Participants and data collection methods

Data were collected through using a survey questionnaire comprising questions on demographics and multiple items for each construct based on CUS scale. Participants in this study were 117 student teachers from teacher training colleges in Malaysia. Almost all the participants accessed a computer at home (89%) and their mean length of computer use was 8.1 years. Participation by the student 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.

Alongside, participants (student teachers) would receive detailed Consent Information Sheet about the research by means of verbal explanation and a consent letter. This was to ensure participants understand the objectives and structures of this study. Furthermore, the Consent Information Sheet that outlining the research title, researchers' information, objectives and structures of study were given to participants. Participants (student teacher) were requested to sign consent form. Respondents were taken approximately 15 minutes to complete the questionnaire.

Results of analysis

Psychometric quality of the instrument and preliminary analyses

In order to develop a valid and reliable CUI instrument, an examination of the factor structure and psychometric properties of the items was conducted extensively. Prior to perform the EFA and CFA, preliminary analyses were performed.

A descriptive analysis was preliminarily carried out on variables involved. Computer attitudes, computer teaching efficacy, social influence, and computer use have been identified for their mean and standard deviation (Table 1). All means scores are > 3.0 of the midpoint, ranging from 3.12 to 3.46. 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. On this basis, the internal reliability of CUI scale was adequate for all measures.

From the findings, the skewness (social influence =.07; computer attitudes=1.1; computer teaching efficacy=.02; computer use=-1.02) and the kurtosis (social influence=1.11; computer attitudes=1.0; computer teaching efficacy=-.63; computer use=-1.01) noted that all constructs were acceptable. Based on the results, the data in this study was regarded as normal.

Table 1. Descriptive statistics of the study constructs

Construct	Mean	Standard deviation	Skewness	Kurtosis
Social Influence	3.25	.81	.07	1.11
Computer attitudes	3.31	.61	1.1	1.0
Computer teaching efficacy	3.12	.60	.02	-.63
Computer use	3.46	.74	-1.02	-1.01

Exploratory factor analysis (EFA)

In examining the Exploratory factor analysis (EFA), Varimax with Kaiser Normalisation was performed on the 12 items of the CUI scale. An eigenvalue greater than 1 should be achieved to determine the number of components in the scale. Based on Kaiser's assumption, the suggested CUI item scale had four constructs with eigenvalues exceeding 1. The results show that the theoretical four-factor structure in the CUS item scale explained 59.77% of the total variance, where the first factor had an eigenvalue of 3.01 and explained 21.75% of the total variance while the second factor had an eigenvalue of 2.17 and explained 16.65% of the total variance. The third factor had an eigenvalue of 1.21 and explained 11.93% of the total variance. The last factors contributed 9.44% towards total variance of the CUI scale. Furthermore, the results indicated that all the factor loadings of the individual items were above .50 and ranged from .61 to .90 (refer to Table 2). None of the items reflected high factor loadings on a second or additional other factor. This means that at least half the variances in all the indicators were explained by their respective latent constructs. Hair, Black, Babin and Anderson (2010) suggested that an item is significant if its factor loading is greater than .50.

To ensure the constructs have the 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.

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 0.63 to 0.91 (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. The final CUI corresponding instrument was presented in the Table 3.

Table 2. Results for the measurement model

Latent Variable	Item	Factor Loading (>.60)*	Average Variance Extracted (= or >.50)*	Composite Reliability (= or >.70)*
Computer Teaching Efficacy	CTE1	0.88	0.72	0.91
	CTE2	0.88		
	CTE3	0.79		
Computer Attitudes	CA1	0.63	0.59	0.79
	CA2	0.90		
	CA3	0.77		
Social Influence	SI1	0.67	0.56	0.83
	SI2	0.83		
	SI3	0.75		
Computer Use	CU1	0.61	0.53	0.63
	CU2	0.66		
	CU3	0.89		

[a] AVE: Average Variance Extracted = (∑λ2) / (∑λ2) + (∑(1 – λ2)).
[b] Composite Reliability = (∑λ2) / (∑λ2) + (∑ (1 – λ2)).
[c] This value was fixed at 1.00 in the model for identification purposes.
Extraction method: Principal Component Analysis (PCA)
Rotation method: Varimax with Kaiser Normalization
*Indicates an acceptance level or validity.
**$p < .01$.

Table 3. The Computer Use Item (CUI) corresponding instrument

Construct	Item	
Computer Teaching Efficacy (CTE)	CTE 1	I would find using computers useful for teaching.
	CTE 2	Teaching with computers is a very powerful influence on student's achievement when all factors are considered.
	CTE 3	If I use computers for teaching, I will increase my employment opportunities.

Computer Attitude (CA)	CA1	I would like working with computers.
	CA2	Learning about computers is a waste of time.
	CA3	Learning to use the computer for teaching would be easy for me.
Social Influence (SI)	SI1	Educators who influence my behaviour would expect me to use computers for teaching science.
	SI2	People who are important to me will think that I should use computers for teaching and learning.
	SI3	This university has been helpful with learning to use computers in my future career.
Computer Use (CU)	CU1	Whenever possible, I intend to use computer for teaching and learning.
	CU2	I think most of my teaching lesson will be conducted via computers related technologies.
	CU3	I plan to use the computer for teaching during my teaching practicum.

Test of the Confirmatory factor analysis (CFA)

As mentioned above, the main aim of this research is to develop an instrument to examining the intention of computer use and provide an initial psychometric evaluation of the Computer Use Intention (CUI) scale among teachers. It is normal practices to assess the factorial validity for the four-factor structure of the 12-item CUI scale through confirmatory factor analysis (CFA). In this study, computer program software AMOS18 (Arbuckle, 2005) has been used to test the factorial validity of the designed item scale underlying structural equation model approach (SEM). The five absolute fit indices: χ^2 goodness-of-fit statistic, χ^2/df, Goodnees 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.

Table 4 shows the fit indices for the proposed research model and its acceptable fit. All values are above the recommended thresholds for acceptable model fit. These results indicate that the measurement constructs underlying CUI instrument achieved a good fit.

Table 4. Good-of-fit indices for the measurement model

Fit indices	**Values**	**Criteria**
$\square^2/df$	1.430	<3
RMSEA	.051	<.08
GFI	.953	≥.90
CFI	.907	≥.90
TLI	.944	≥.90

*p < .05.

Conclusion and recommendations

The aim of this research was to develop and furnish an initial psychometric property evaluation of a scale to explore and understanding the intention of computer use among student teachers from teacher educational institution in Malaysia. Having a valid and reliable scale is vital for policy makers and related ministry such as Ministry of Education (MOE) to explore and understanding the factors influencing the use of computer among student teachers. In line with the growing popularity of the use of computer in schools, either primary or secondary schools, having valid and reliable instrument to assess the use of computer could provide a better platform for researchers to carry out research regards to the use of computer among student teachers. Based on the results from CFA, the CUI scale which highlighting four aspects of student teachers' perspective (computer attitude, computer teaching efficacy, and social influence) was highly recommended instrument to understand and examine the intention of computer use among them. In the initial draft, a total of 19 items was developed. After the expert panels have reviewed the 19-item for its content and face validity concerning computer use for student teachers, only 12 items were reminded for further testing and analyses.

From the results of the exploratory factor analysis on CUI scale, it has proven that the items in the CUI scale consist of four-factor structure (computer teaching efficacy (CTE); computer attitudes (CA); social influence (SI); computer use (CU). The results show that the theoretical four-factor structure in the CUI scale explained 59.77% of the total variance. In addition to the normality test, the results of the Kaiser-Meyer-Olkin (KMO) test (.857) and Bartlett's test of sphericity (BTS) (χ^2 = 676.018; *df* = 86; *p*<.001) indicated the dataset was adequate and all construct were acceptable for model testing.

Consequent to examine the psychometric properties of the CUI scale, researchers also demonstrated the use of confirmatory factor analysis to provide a more parsimonious list of items to measure computer use among student teachers. A series of confirmatory factor analysis was performed to allow comparisons of different conceptualisation of the factor structure and get the best model fit. Based on the result from the confirmatory factor analysis, it has proven that the final 12-item CUI scale has good standardised loadings and all the absolute-fit indices are above the recommended thresholds for acceptable model fit. In addition, results from convergent validity and discriminant validity of the CUI scale, showing satisfactory reliability and validity of the all four-factor constructs. On this basis, it was confirmed that the suggested 12-item of CUI scale which underlying the four-factor structure scale was reliable and valid as a scale to measure the use of computer among student teachers.

Despite the subsequent results indicate that the CUI scale is reliable and valid, there are 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, the population of this study was only student teachers. Therefore, the findings derived from the analyses might not adequately reflect the perceptions of the whole population of student teachers graduated from teacher educational institutions as a whole. Third, the CUI scale may not be able to measure all aspects for the variables concerned. This is due to the fact that the result of the four-factor structure in the CUI scale has shown that the 12-item scale only able to explain 59.77% of the total variance, it is suggested that future research include other constructs that are possible to be determines of computer use to account for the unexplained variance. Future research could replicate this enquiry by using a larger sample and by testing for the scale 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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