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Investigating the Technology Acceptance among Student Teachers in Malaysia: An Application of the Technology Acceptance Model (TAM)

Wong Su Luan
Faculty of Educational Studies, Universiti Putra Malaysia, Malaysia
wsuluan@gmail.com

Timothy Teo
National Institute of Education, Nanyang Technological University, Singapore
timothy.teo@nie.edu.sg

This study investigated 245 Malaysian student teachers' self-reported intentions to use (ITU) computers. Using the Technology Acceptance Model (TAM) as a research framework, this study found perceived usefulness (PU) of computer technology, perceived ease of use (PEU), and attitude towards computer use (ATCU) to be significant determinants of ITU. Results obtained using structural equation modelling revealed that (1) PEU significantly influenced PU; (2) both PU and PEU significantly influenced ATCU, and (3) both PU and ATCU significantly influenced ITU. In essence, the results of this study present some evidence that TAM serves as a valid model to predict technology acceptance among student teachers in Malaysia.

Keywords: Technology acceptance, student teachers, Malaysia

The Malaysian government, in 1996, identified Information Technology and Communication (ICT) as one of the important foundations for its planned transition from a production-based economy to a knowledge-based one by the year 2020 (Multimedia Development Corporation, 2005). Arising from this plan, the Smart School Pilot Project was initiated in 1999 where 87 schools were transformed into smart schools. The Malaysian smart school was defined "as a learning institution that has been systematically reinvented in terms of teaching and learning as well as the improvement of the school management processes in order to help students cope and leverage on the Information Age" (Multimedia Development Corporation, 2005, p.10). The Smart School Pilot Project emphasised a technology-supported education system and was introduced to help Malaysia fulfil the need for an ICT literate population (Wong, Kamariah & Tang, 2006). The national curriculum will still be used in Smart schools like in any other schools. However, students in

smart schools will reap the benefits of self-paced learning and learning away from school with the intervention of the latest ICT tools (Multimedia Development Corporation, 2005).

In 2002, the Malaysian Ministry of Education (MMOE) commissioned a study to assess the impact of the Smart School Pilot Project on teaching and learning. The results were encouraging and it was clear that students and teachers had benefited from the technology-supported project. According to the study, approximately 90% of the students were found to be competent to use the ICT facilities in classrooms and computer laboratories for meaningful learning. (Multimedia Development Corporation, 2006). Students were also able to work as a team and engage in peer learning within an ICT-enriched learning environment. The study also reported that teachers were confident enough to integrate ICT into their teaching-learning process with nearly 83% of the teachers found to possess a high level of ICT competency (Multimedia Development Corporation, 2006).

Encouraged by the success of the Smart School Pilot Project, the MMOE launched a National Education Blueprint in 2006 to work towards all schools in the nation becoming smart schools by the year 2010 (Ministry of Education, 2006). As a consequence, all teachers in Malaysian schools must be prepared to teach in the Smart Schools.

Teachers' use of computer technology in Malaysia

Studies have shown that teachers in Malaysia may not be adequately prepared to integrate ICT in the learning environments. It was found that more that half of the teachers surveyed in the state of Malacca in Malaysia possessed only moderate levels of IT competence (Juanna, Wong & Samsilah, 2005). Juanna et al. (2005) indicated that the teachers were able to perform basic computer tasks only with some assistance.

In a study of English Language teachers, Melor (2007) found that ICT was not widely used for language learning. About 98% of all English language teachers sampled reported minimal use of ICT to guide students in establishing networks with language experts outside of their schools and only a handful of teachers used the Internet to source for teaching materials. Sharil (2007) reported that the level of ICT use among Malaysian Science teachers for teaching and learning was unsatisfactory despite their being equipped with laptops from the MMOE. In addition, most of the teachers had reported using computer technology only for ancillary activities such as managing students' records and grades.

Further evidence suggests that teachers do not use technology to its fullest potential. Samuel and Zaiton's (2006) study found several factors affecting the uptake of ICT among Malaysian teachers. One of the main reasons was the lack of ICT training. For example, teachers who were granted laptops by the MMOE in 2003 were not trained to use and integrate ICT tools into the learning environments (Mas Nida, Mosses & Wong, in press). Other major reasons included: the limited number of computer laboratories, lack of teachers' understanding of the usefulness of computers, and their perception that computer technology was difficult to use (Samuel & Zaiton, 2006). Samuel and Zaiton (2006) further added that negative attitudes toward ICT was another factor that possibly hinders teachers' use of such technology.

PURPOSE OF THE STUDY

With the proliferation of technology in Malaysian schools, teachers need to ensure that they are adequately equipped to utilize technology tools effectively for instructional purposes. This need was made more acute with a recent initiative by the MMOE for all schools to be transformed into Smart Schools. In essence, teachers have to acquire new competencies to keep up with constantly changing technologies in education. Not only are they expected to possess the right level of knowledge, they are also expected to exhibit a positive attitude toward technology. For this reason, there is an

urgent need to understand Malaysian teachers' technology acceptance.

This study aims to apply the TAM to a sample of Malaysian student teachers. The results of this study may provide insights into the factors that influence the technology acceptance among Malaysian student teachers. A search of major databases such as Eric Reproduction Service, Proquest Education Journals, Science Direct, and Ebscohost has revealed that currently no study has employed the TAM as a research framework to examine the technology acceptance of Malaysian student teachers. In addition, the results of this study have the potential to inform the research community on the validity of the TAM in a non-Western context such as Malaysia.

HYPOTHESES DEVELOPMENT

This section presents the research hypotheses based on the Technology Acceptance Model (TAM) by Davis (1989). In the TAM (see Figure 1), technology usage is determined by behavioural intentions to use a system that in turn is jointly determined by the user's attitude towards computer use and perceived usefulness. Attitude towards computer use is also jointly determined by perceived usefulness and perceived ease of use. Lastly, perceived usefulness is influenced by perceived ease of use and external variables such as system features, training, documentation and user support. Therefore, the three variables that are fundamental to the TAM are perceived usefulness, perceived ease of use and attitude towards computer use. It is important to note that the hypotheses in this study are to be considered in the context of computer technology for student teachers.

Hypothesis for perceived usefulness (PU) and perceived ease of use (PEU)

The definitions of perceived usefulness (PU) and perceived ease of use (PEU) are adapted from the original definitions proposed by Davis, Bagozzi and Warshaw (1989). In this study, PU is defined as the degree to which a student teacher believes that using computer technology will enhance his or her job performance in school. There is evidence to suggest that teachers tend to use technology when they believe that it can enhance their job performance such as facilitating students to achieve learning goals, conducting administrative duties, and managing students (Ma, Andersson & Streith, 2005).

PEU refers to the degree to which the student teacher believes that using computer technology will be free from effort. It is possible that while users may believe that technology is useful, they may, at the same time, perceived the use of technology to be too difficult and that the performance benefits of usage are outweighed by the effort of using the technology (Davis, 1989). While PU has a direct impact on attitude towards use, PEU influences attitude towards use indirectly through PU.

H1: PU will be significantly influenced by PEU

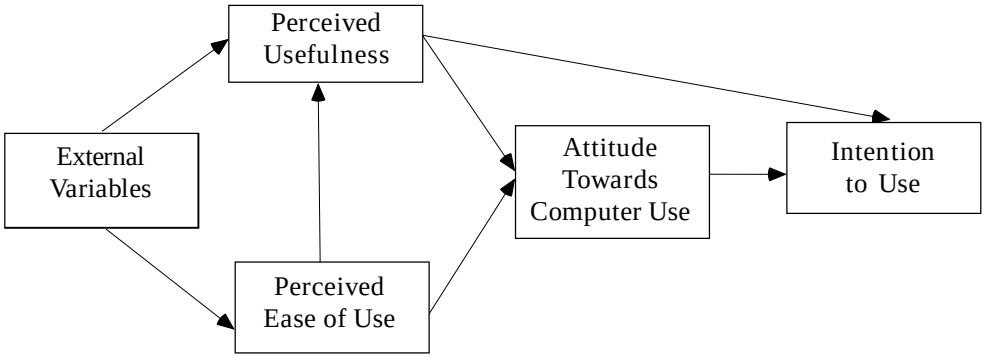

Figure 1. *Technology Acceptance Model (Adapted from Davis, Bagozzi & Warshaw, 1989)*

Attitudes towards computer use (ATCU)

From the technology acceptance viewpoint, attitude towards use is a potential user's affective evaluation of the cost and benefits of using the technology (Ndubisi, 2006). Yildrim (2000) stressed that it is unlikely for teachers with negative attitudes toward computer use to be able to transfer their computer skills to students, let alone encourage students to use computers. In the context of this study, it is reasonable to expect that student teachers with positive attitudes toward the computer use are more likely to accept and use computers in the classrooms (Wong et al. 2006).

H2a: ATCU will be significantly influenced by PU

H2b: ATCU will be significantly influenced by PEU

Intention to use (ITU)

The dependent variable in this study is an individual's intention to use (ITU) technology. Based on the TAM, there is a direct influence by PU and ATCU on ITU. Additionally, ITU is indirectly influenced by PEU, which is mediated by PU.

ITU has been proven to have a strong link to actual behaviour (Gao, 2005). In other words, ITU leads to actual use of a system (Chau, 2001). ITU is used as the dependent variable in this study because it is a practical way to measure technology acceptance. Although student teachers in this study have used technology for personal and academic purposes, most of them possess little or no experience in using technology in the actual school environment. As such it was deemed to be more accurate to measure student teachers' intention to use technology, rather than their actual usage.

H3a: BI will be significantly influenced by PU

H3b: BI will be significantly influenced by ATCU.

METHODOLOGY

Subjects and procedures

Participants of this study were student teachers from the Faculty of Educational Studies, Universiti Putra Malaysia (UPM). Currently, there are two kinds of entry mode into a teaching programme in Malaysia. Those who have completed the matriculation or pre-university (Form 6) programmes are eligible to apply for such a programme. Student teachers in this study are therefore, considered representative of Malaysian student teachers as they possess either one of these post secondary qualifications.

Student teachers were selected in the study for two reasons. Firstly, all student teachers, upon graduating from the teacher training institutions, will be employed by the MMOE as permanent teachers in the schools. Secondly, computer technology courses are provided in all teacher-training programmes in Malaysia. Hence, student teachers would have been well trained in using technology for instructional purposes by the time they become practicing teachers in the schools. As such, student teachers serve as good proxy and whose opinions may mirror those of future teachers (Teo, Lee & Chai, 2008).

There were 245 participants in this study (183 females and 62 males) and all of them owned a computer at home. They had an average of 6.6 years of computer experience (S.D.= 3.8) and reported their average daily computer to be 3.1 hours (S.D. = 2.4). The mean age of the participants was 23.4 years (S.D.= 5.5).

Data were collected from participants who volunteered via an online survey questionnaire written in PERL (Practical Extraction and Report Language) and PHP (Hypertext Preprocessor).

Instrumentation

The online survey questionnaire comprised 15 Likert-type items with each item yielding a score of 1 (strongly disagree) to 5 (strongly agree). The items were in the English language. These items were adapted from various published sources, as indicated in Table 1.

Table 1
List of constructs and corresponding items

Construct	Item	
Perceived Usefulness (adapted from Davis, 1989)	PU1	Using computers will improve my work.
	PU2	Using computers will enhance my effectiveness.
	PU3	Using computers will increase my productivity.
	PU4	I find computers a useful tool in my work.
Perceived Ease of Use (adapted from Davis, 1989)	PEU1	My interaction with computers is clear and understandable.
	PEU2	I find it easy to get computers to do what I want it to do.
	PEU3	Interacting with computers does not require a lot of mental effort.
	PEU4	I find computers easy to use.
Intention To Use (adapted from Davis, 1989)	ITU1	I will use computers in future.
	ITU2	I plan to use computers often.
Attitude Towards Computer Use (adapted from Thompson, Higgins & Howell, 1991; Compeau & Higgins, 1995)	ATCU1	Computers make work more interesting.
	ATCU2	Working with computers is fun.
	ATCU3	I like using computers.
	ATCU4	I look forward to those aspects of my job that require me to use computers.

RESULTS

The statistical analysis comprised two stages. The first stage assessed the reliability and construct validity of the measure used in this study. The second stage tested the proposed research model.

Factor structure

The items were subjected to Principal Axis Factor (PAF) analysis with oblique rotation. PAF is used when the purpose of the research is to identify latent variables that contribute to the common variance of the set of measured variables, excluding variable specific (unique) variance (Kline, 2005). As such, PAF is preferred for purposes of structural equation modelling (SEM) as it accounts for the covariation among variables. For these reasons, PAF was considered suitable for this study.

Table 2 shows the PAF analysis of the four constructs. The total variance explained by the four components is 71.84%. All the items have factor loadings of over 0.60 except for PU4 and PEU3. This research accepted factor loadings of 0.6 and above as practically significant (Hair, Black, Anderson & Tatham, 2006). For this reason, items PU4 and PEU3 were eliminated for further analysis.

Convergent validity

In this study, the item reliability of each measure and the composite reliability of each construct were used as measures to assess convergent validity.

First, to ascertain the item reliability of an item, its factor loading should be greater than 0.5 (Hair et al., 2006). The factor loadings of all items retained in the measure ranged from 0.610 to 0.938

Table 2
Principal axis factor analysis of all items

Note: Rotation Method: Oblique

	PU	PEU	ATCU	ITU
PU1	**.858**	.505	.674	.555
PU2	**.931**	.443	.573	.524
PU3	**.934**	.399	.593	.534
PU4	**.568**	.335	.479	.508
PEU1	.410	**.788**	.466	.315
PEU2	.458	**.694**	.454	.444
PEU3	.224	**.496**	.319	.180
PEU4	.325	**.808**	.416	.342
ATCU1	.594	.397	**.820**	.471
ATCU2	.542	.505	**.806**	.471
ATCU3	.503	.466	**.819**	.499
ATCU4	.405	.475	**.610**	.411
ITU1	.566	.368	.595	**.615**
ITU2	.561	.420	.569	**.938**
Eigenvalues	6.780	1.491	1.015	0.772
% of Variance Explained	48.43	10.65	7.25	5.51

(Table 2). These values exceeded the threshold set by Hair et al. (2006) and demonstrate adequate convergent validity at the item level.

Secondly, Cronbach's alpha was used to assess the composite reliability of each construct. DeVellis (2003) suggested that an alpha value of .70 is considered acceptable. As shown in Table 3, the reliability scores of all the constructs are between .73 and .88, exceeding the guidelines (>.70) set by DeVellis (2003).

The results in Tables 2 and 3 appear to meet the recommended criteria in the literature, suggesting convergent validity for the proposed constructs and indicators in this study.

Table 3
Construct reliability

Construct	Cronbach's α
Perceived Usefulness (PU)	.93
Perceived Ease of Use (PEU)	.81
Attitude Towards Computer Use (ATCU)	.84
Intention To Use (ITU)	.75

Table 4
Inter-correlations among the items

	PU1	**PU2**	**PU3**	**PEU1**	**PEU2**	**PEU4**	**ITU1**	**ITU2**	**ATCU1**	**ATCU2**	**ATCU3**	**ATCU4**
PU1	1	**.807****	**.799****	.459**	.477**	.358**	.565**	.555**	.599**	.582**	.540**	.420**
PU2		1	**.864****	.391**	.417**	.362**	.508**	.512**	.539**	.478**	.457**	.392**
PU3			1	.372**	.441**	.273**	.506**	.522**	.550**	.504**	.482**	.379**
PU4				.269**	.327**	.268**	.431**	.483**	.401**	.409**	.397**	.345**
PEU1				1	**.589****	**.627****	.351**	.318**	.320**	.457**	.416**	.321**
PEU2					1	**.544****	.341**	.454**	.362**	.402**	.368**	.403**
PEU3						**.424****	.171**	.194**	.265**	.236**	.235**	.333**
PEU4						1	.292**	.358**	.290**	.406**	.341**	.373**
ITU1							1	**.598****	.552**	.491**	.468**	.346**
ITU2								1	.459**	.476**	.506**	.412**
ATCU1									1	**.684****	**.626****	**.492****
ATCU2										1	**.676****	**.439****
ATCU3											1	**.571****
ATCU4												1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Divergent validity

Divergent validity is the extent to which measures of different constructs are distinct (Campbell & Fiske, 1959). There should be low correlation with measures of different constructs (Aiken, 1994). To establish divergent validity, it should be shown that measures which are not related should not be related (Trochim, 1999). The item scores from the same construct exhibited moderate to high levels of correlation among themselves compared to the item score form other constructs (Table 4). Based on these values, divergent validity at the item level was considered adequate.

MODEL FIT

Test of the proposed model

Structural equation modelling (SEM) was performed to test the fit between the research model and the obtained data. In this study, AMOS 7.0 (Arbuckle, 2006) was used to estimate the model using the maximum likelihood (ML) procedure. Because SEM requires large samples, Hair et al. (2006) indicated that any study with five or fewer constructs, each with more than three items, and high item communality with .60 and higher, could adequately be estimated with a sample size of 150. On this basis, the sample size of this study (N=245) was considered adequate**.** Although ITU comprised only two items, it does not pose an identification problem in the model, given its adequate convergent and divergent validity and relationship with other constructs.

In this study, the Goodness of Fit (GFI), Normed Fit Index (NFI), Standardised Root Mean Residual (SRMR), and the Comparative Fit Index (CFI) were used. Table 5 shows the level of acceptable fit and the fit indices for the proposed research model in this study. Except for χ^2, all values satisfied the recommended level of acceptable fit. In the case of χ^2, it has been found to be too sensitive to sample size differences, especially for cases in which the sample size exceeds 200. Hair et al., (2006) noted that, as the sample size increases, there is a great tendency for the χ^2 to indicate significant differences. Therefore, this anomaly is assumed to be applicable in the present study with a sample of 245. However, the results of the χ^2 / df value in the present study is well within the recommended χ^2 / df < 5. As can be seen from Table 5, there is a good fit for the proposed research model.

Figure 2 shows the resulting path coefficients of the proposed research model. All hypotheses were supported by the data. The results show that perceived ease of use significantly influenced perceived usefulness ($\beta = 0.526$, $p < 0.05$), supporting hypothesis H1. Attitude towards computer use was influenced by perceived usefulness ($\beta = 0.515$, $p < 0.05$) and ease of use ($\beta = 0.315$, $p < 0.05$), supporting hypotheses H2a and H2b. Intention to use was found to be influenced by perceived usefulness ($\beta = 0.350$,

Table 5
Fit indices of the proposed research model

Fit Index	Recommended Level of Fit	Proposed Research Model
χ^2	n.s at $p < .05$	93.496, $p < .01$, significant
χ^2 / df	< 5	2.078
GFI	> 0.90	.941
NFI	> 0.90	.951
SRMR	< 0.05	.04
CFI	> 0.90	.973

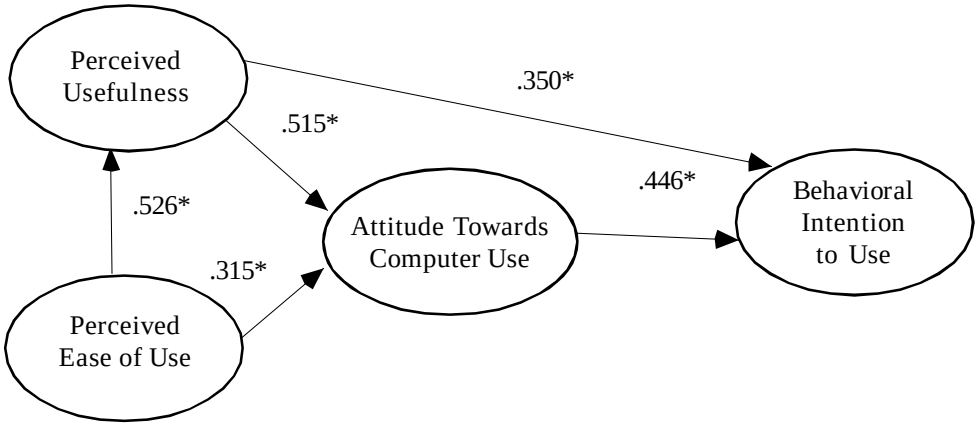

Figure 2. *Path coefficients of the research model*

Table 6
Hypothesis testing results

Hypotheses	Causal path	Path coefficient	Results
H1	PEU → PU	.526*	Supported
H2a	PU → ATCU	.515*	Supported
H2b	PEU → ATCU	.315*	Supported
H3a	PU → ITU	.350*	Supported
H3b	ATCU → ITU	.446*	Supported

* $p < .05$; ** $p < .001$

$p < 0.05$) and attitude towards computer use ($\beta = 0.446$, $p < 0.05$), thus supporting hypotheses H3a and H3b.

PU was found to be significantly determined by PEU, resulting in an R^2 of 0.323. That is, PEU explained 32.3%% of the variance in PU. ATCU was significantly determined by PU and PEU and the percent of variance explained was 55.4% ($R^2 = .554$). ITU was significantly determined by PU and ATCU resulting in an $R^2 = .685$. That is, the combined effects of PU and ATCU explained 68.5% of the variance of ITU. A summary of the hypotheses testing is shown in Table 6.

Consistent with the findings of major TAM studies, the proposed model of this study demonstrates that intention to use technology is significantly influenced by PU and ATCU, the latter being significantly influenced by PU and PEU. Finally, PU is significantly influenced by PEU.

DISCUSSION

This study aimed to explore Malaysian student teachers' intention to use technology. The results support all the hypotheses proposed in this study. It was found that perceived usefulness, perceived ease of use, and attitude towards computer use are significant determinants of the intention to use technology. However, perceived usefulness was found to be a significantly stronger influence than perceived ease of use on attitude towards computer use. Perceived usefulness has a direct impact on intention to use while perceived ease of

use influences intention to use indirectly through attitude towards computer use and perceived usefulness. Attitude towards computer use also has a direct effect on intention to use.

The results of this study suggest that perceived ease of use is an important predictor of student teachers' intention to use technology. Yuen and Ma (2002) explained that teachers would probably use computers once they believe that such machines do not require much effort. This means that student teachers who participated in this study would mostly likely use computers either for personal or academic purposes when they perceive that they could use such tools with relatively little effort. The findings of this research found a strong link between perceived ease of use and perceived usefulness. In addition, the significant relationship between perceived ease of use and attitude towards computer use in this study supports the notion that positive computer attitudes are associated with perceived ease of use (Teo et al., 2008). Therefore, it is important to ensure that training in the use of technology for student teachers are designed to foster the development of positive perceptions towards the ease of use, with a view to strengthen student teachers' intentions to use technology (Yuen & Ma, 2002).

As shown in this study, perceived usefulness has a greater influence on intention to use. This finding is in congruence with that of Davis and colleagues' (1989). Yuen and Ma (2002) stressed that when teachers do not have an overview of how computers can be integrated into the teaching and learning process, these tools may not be perceived as useful. This suggests that when student teachers understand how useful computers are to them, they will most likely use these tools in their formal (academic purpose) or informal settings (leisure and entertainment purposes).

This study also found that attitude towards computer use influenced intention to use significantly, indicating that students with positive attitudes are more inclined to use computers. This finding clearly supports prior research that found a strong relationship between computer attitude and computer use (Yildrim, 2000; Wong et al, 2006).

To summarise, the lack of ICT training or ineffective training sessions afforded to teachers, limited ICT infrastructures in schools, teachers' ignorance of the usefulness and perceived ease of use of ICT tools, and unfavourable ICT attitudes are some of the factors that explain why Malaysian teachers do not use computer technology to its fullest potential (Samuel & Zaiton, 2006; Mas Nida et al., in press). It is therefore necessary to ensure that student teachers are exposed to effective use of computers and that they receive adequate training in both scholastic and non-scholastic environments. Suffice to say, encouraging student teachers to use computer technology can help enhance positive attitudes, and promote beliefs about the usefulness and perceived ease of use of such tools. When these factors are taken into consideration and given proper emphasis by the MMOE, there is a strong possibility that the current low level of technology adoption in Malaysia may go up to a higher level.

CONCLUSION

The results of this study suggest that the TAM is a parsimonious model to predict student teachers' technology acceptance. In this study, the TAM was found to be a valid model in predicting student teachers' intentions to use computers. Specifically, perceived usefulness, perceived ease of use and attitude towards computer use were found to be significant determinants of student teachers' intentions to use computers. For this reason, technology-training programmes should focus on developing positive perceptions of computer usefulness and its ease of use as well as to encourage positive attitudes towards computer use among student teachers.

LIMITATIONS

Firstly, student teachers were used as participants. Several researchers have warned that their views might differ from those of practicing

teachers (Teo et al, 2008; Yuen & Ma, 2002) mainly because practicing teachers' technology use is directly impacted by the school environment (Teo et al., 2008). The student teachers in this study may not have been exposed to the demands and challenges of a real school setting equipped with computer technologies.

Despite careful attention given to the methodology, it is important to note that the data collected was based entirely on participants' honesty and their perceptions toward computer technology. It also must be recognised that the participants involved were undergraduate students who majored in education in one public university and had volunteered to participate in this study. Therefore, caution must be exercised when attempting to generalise any findings for the entire population at the faculty where this study was conducted.

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