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Examination of Factors that Influence Science Teachers' Attitudes toward Using Information and Communication Technologies For Teaching and Learning

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Abstract : This purpose of this study is to examine factors that influence Science Teachers' attitudes towards using ICT for teaching and learning Science. A total of 121 Science Teachers participate in this study. The findings of this study revealed that the respondents had positive attitudes towards using ICT for teaching and learning with an average mean score of 3.91 (SD = 0.540) on a Likert scale of 1-5. The respondents also competent enough at handling basic technology tasks (M= 3.86; SD = .718). The results have also indicated that s teachers were getting support from the school (M=3.57, SD= .629) and the schools were well equipped to the extent of facilitating teachers use of ICTs in the classroom (M=3.45, SD=.386). Correlation analyses showed that positive correlations between attitudes towards using ICTs for teaching and learning on one hand and ICT competency (r = .546), School support (r = .519), School culture (r = .370) and Access to Resources (r = .467). Nevertheless, a multiple regression analysis has revealed that only ICT competence, school support and school culture have significant influence on teachers' attitudes toward using ICT for teaching and learning.

Keywords: attitudes towards using ICT for teaching and learning, Information and Communication Technology, ICT competency, School support, School culture and Access to Resources

1. Introduction

Information and communication technology (ICT) has become fundamentally crucial for teaching and learning efficiency in the current dispensation. Many factors have been associated with the use of ICTs for teaching purposes, among which is the teacher. The teachers play major roles in the classroom and their predispositions towards their overall teaching function have significant impact on teaching and learning outcomes (Guskey, 1989; Saye, 1998). Hence, exploring and addressing teachers' attitudes toward technology integration in the classroom is a necessary step for ensuring that ICTs are adequately used in the classroom (Capan, 2012). Empirical evidence has shown that teachers' attitudes have significant influence on their use of computers in the classroom (Atkins &Vasu, 2000; Kim, 2002). In Bingimlas (2009), findings have shown that one of the major barriers to the success of ICT adoption in the classroom is that teachers are reluctant to use ICTs for the purpose of teaching. But using the computer is significantly dependant on the users' attitude (Liaw, 2002). Hence, it is quite necessary to ensure that teachers are favourably disposed towards ICTs in order to actualize the purpose of ICT integration (Gilakjani & Leong, 2012). Congruently to succeed in the ICT mission, teachers' unfavourable dispositions towards ICTs must be investigated and refined since the teachers' attitude is a strong determinant of ICT integration in the classroom (Sang, Valcke, Van Braak, Tondeur & Zhu, 2010).

Although many educators, researchers and policymakers for teacher educational programs may not be aware of the factors that can encourage teachers to use ICTs in the classroom (Teck, Choo, Hanafi, & Osman, 2010), it is quite obvious that they seek for explanations to the issues that hinder teachers from using these ICT tools in the classroom (Teck, et. al, 2010). Empirical evidence has shown that among the factors investigated is teachers' competence in using ICT or computer. Teachers who are capable of using ICTs efficiently are able to perform better by teaching more efficiently and improving learning outcomes (Meeplat, 2015). A study by Denis (2007) has indicated

that teachers' computer competence plays a key role in developing positive attitudes among teachers toward computers. Another study by Ocak and Akdemir (2008) has revealed that Science teachers' computer literacy level is related to their computer use it will increase their integration of computer applications in their teaching. Isleem (2003) confirmed that computer competence was the strongest predictor of attitudes towards computer use. Results of a study by Berner (2003) have also supported the theoretical and empirical arguments for the importance of computer competence in determining teachers' attitudes towards ICTs. The results have confirmed that computer competence was the most significant predictor of teachers' attitudes towards ICT in education.

Besides teachers' ICT competence, several factors were found by many researchers to be correlated with teachers' attitudes and their computer utilization in the classroom. Among them is lack of adequate ICT facilities such as computers, (Deniz, 2007), lack of supporting materials for using computers (Lam, 2000), lack of adequate training and technological infrastructures (Gulbahar, 2008). Hitherto, it was suggested in Capan (2012) that issues related to computer competence, positive cultural perceptions and computer accessibility at home and in school should be properly investigated and addressed because they have significant effects on teachers' attitudes towards computer use. In a study conducted by Melor (2007) findings have shown that majority of the teachers were identified with positive attitudes towards using ICT in teaching ESL but had no adequate access to computers. Similarly, in Shin and Son (2007) findings have shown that limited class hours, inconvenience of using computer facilities and other technical problems and issues associated with facilitating classroom functions have constituted serious hindrances to successful ICT integration in the classroom.

Further studies on teachers' teaching experience and age have also indicated that teachers' ICT use, experience, and age are inversely associated. Implicit in this proposition is the fact that more experienced teachers and older teachers tend to use computers less frequently (Van Braak et al., 2004; Bebell et. al. 2004). Overall, teachers' computer experience relates positively to their computer attitudes, such that the more experience teachers have with computers, the more likely they will be favourably disposed towards using computers (Rozell & Gardner, 1999; Yildrim, 2000). Congruently, culture is also considered as one of the factors that have influence on teachers' attitudes towards the use of ICTs in the classroom. Findings in Afshari, Abu Bakar, Su Luan, Abu Samah and Say Fooi (2009), have revealed that teachers who have positive perceptions about the cultural relevance of computer technology will apply ICTs in education. Similarly, in a study on TESOL by Rezaee, Zainol Abidin, Issa and Mustafa (2012) findings have shown that the cultural perceptions of in-service teachers and their computer competence were predictors of teachers' computer attitudes. The study has also revealed that the cultural perception of teachers was the strongest predictor of teachers' attitude towards the use of ICTs.

In another study conducted by Marthipa and Mukhari (2014) among teachers in South Africa, findings have revealed that the impending factors against the integration of ICTs in teaching and learning are: insufficient number of computers and lack of application programs; teacher generation gap; inadequate teacher training; lack of ICT skills and lack of confidence; teachers' beliefs; poor school leadership and lack of public support. Studies by Tedla (2012) and Makgato (2012) have also revealed that the successful integration of ICTs in teaching and learning depends largely on the availability of ICT infrastructure. Hitherto, findings in Termit Kaur and Samli Chan (2014) have shown that lack of technical support, lack of ICT tools and ICT knowledge were among the strongest barriers that teachers face in Malaysia against integrating ICTs in their classrooms.

2 Objective of the study

The objective of this study was to investigate the factors that influence Science teachers' attitudes toward using ICTs in teaching and learning. The factors explored in the study are: years of teaching, ICT school culture, school support, ICT competency and access to ICT resources

3 Methodology

The design of this study was descriptive and correlational. Data was collected using a survey questionnaire. A proportionate stratified random sampling technique was used to select 121 science teachers from nine districts in Selangor. The instrument consisting of five sections that solicited for information on participants' demographic background, their attitudes towards using ICT for teaching

and learning, their ICT competency, their school support, their school ICT culture and their access to ICT resources.

Teachers' attitudes toward using ICTs for teaching and learning scale was made up of 35 items adopted from Wong Su Luan's study (2004). The items were designed to measure four dimensions of teachers' attitude towards using ICTs, namely: (a) usefulness (11 items); (b) confidence (7 items); (c) their anxiety (10 items) and (d) aversions (7 items) towards using ICTs during the teaching and learning processes. Five factors were investigated in this study based on relevant information from the literature reviews. The first factor was ICT competency consisted up of 40 items adopted from Flowers and Algozzine (2000). The second factor investigated was school support. Nine items were developed for the purpose of investigating the school support received by science teachers for integrating ICTs in teaching and learning. Similarly, eleven items were used to measure teachers' perception of the school ICT culture. The last section was made up of eight items which examined how the teachers accessed ICT facilities that were available in the schools. Items measuring school support and ICT school culture, and access to ICT resources were adopted from an instrument by Albirini (2006). Except for ICT competencies, participants responded by using a five-point Likert scale indicating that they strongly disagreed (1), disagreed (2), were neutral (3), agreed (4), or strongly agreed (5) with the questionnaire statements. Meanwhile, teachers teaching experience was measured by asking them to tell the number of years they have spent teaching. All the variables used in the instrument were found to have reliable Cronbach alpha coefficients at pilot study conducted among 40 secondary school teachers who were not involved in the actual study.

4. Findings

In an attempt to properly discuss the findings of this study, a brief description of the demographic background of the respondents are presented. The participants in this study were made up of 86% females and 14% males. In terms of age, majority of the respondents were around 31 to 40 years old (38.4%). In terms of school location, 72.7% of them were mostly from schools located in the urban area while 27.3% were from schools at the rural area. Majority of the respondents had teaching experiences between 11 and 20 years while 62% had 1 to 10 years working experiences.

The dependent variable in this study was purported to investigate Science Teachers' attitudes towards using ICTs in teaching and learning. As indicated earlier, teachers' attitude was measured based on the basis of four dimensions which are usefulness, confidence, anxiety and aversion. Overall mean of this construct shows that the mean and standard deviation for attitude towards using ICTs was (Mean = 3.91, SD = .540) (refer Table 1). This implies that the respondents have positive attitudes towards using ICT in the class. Congruently, the independence variables have been identified based on extant literature.

Descriptive analyses have shown that the average mean for teaching experience is 9.81 years old (M=9.81; SD = 7.63). This indicates that the study is comprised up of a mixture of experienced and novice teachers. Average mean for teachers' ICT competencies was (M= 3.86; SD = .718) which shows that teachers are competent enough at handling basic technology tasks. In other words, the study data has shown that the participants in this study are competent in handling basic computer operations, setup, maintenances, and trouble shootings for word processing functions. This also means that the participants are competent in handling presentations and database software issues, networking operations, telecommunications, media communications and social issues - legal and ethical. School support is the third variable studied in this research. The overall mean showed that teachers were getting support from the school (M=3.57, SD= .629). Meanwhile, the ICT school culture was relatively high (M=3.89; SD = .386) which indicates that ICT school culture is recognized among schools in Malaysia. The last variable measured in this instrument was access to ICT resources for teaching and learning (M = 3.45; SD = .386) showing that schools have been well equipped to the extent of facilitating teachers use of ICTs in the classroom.

Table 1 : Mean and Standard Deviation on Dependent and Independent Variables

	Mean	Standard Deviation
Attitudes towards using ICT for Teaching and Learning	3.91	.540
Basic Technology Competencies	3.85	.717
School support	3.57	.629

ICT school Culture	3.89	.386
Access to ICT resources	3.45	.550
Years of teaching	9.81	7.63

Table 2 shows Pearson correlation coefficients of the factors investigated in this study. It can be seen that there are positive correlations between attitudes towards using ICTs for teaching and learning on one hand and ICT competency (r = .546), school support (r = .519), school culture (r=.370) and access to resources (r = .467). However, negative correlations can be seen between attitudes towards using ICTs for teaching and learning on one hand and teaching experience (r = -.192) on other hand. Findings have further indicated that positive teachers' attitude towards using ICT in teaching and learning is much related to teachers' ICT competence. Congruently, teachers having good competencies in ICTs would most probably use it during the class. On top of all these, ICT school culture is also important in determining teachers' attitude towards using ICTs, since it has been proven that such positive attitudes could be developed in teachers in the course of using the ICTs. Noteworthy is another important finding that suggest the influence of access to resources on teachers' attitude towards the use of ICTs for classroom purpose. Hence, the need for teachers to have adequate access to ICT tools and peripherals have been established in order to ensure that they use it in class. However, there is a negative significant relationship between teaching experience and attitudes towards using ICT for teaching and learning (r = -.120). This implies that experienced teachers will have more negative attitudes towards using ICTs in the classroom and probably decline from using it in the classroom.

Table 2 : Correlation Coeefficients

	Teaching Experience	ICT competency	School Support	School Culture	Access to Resources
attitudes towards using ICT	- .120**	.546**	.519**	.370**	.467**
Significance (2 tailed)	p < .001	p < .001	p < .001	p < .001	p < .001

A stepwise multiple regression was performed to predict factors that influence teachers' attitudes towards using ICTs in teaching and learning (teachers' ICT Competency, school support, culture, access to resources and teaching experience). Table 3 shows the statistics test of significance at the 0.05 (F (3,117) = 34.567, p=0.000). Table 4 also shows the multiple correlation coefficient (.685), indicating an approximately 45.6% of the variance of teachers' attitude towards using ICTs in teaching and learning being accounted for by ICT competence, school support and school culture. Based on the results presented in Table 5, there are not much differences in terms of variance of most significant contributing factors to teachers' attitude towards using ICTs in teaching and learning. Hence, ICT competence has contributed 29.8% of the variance in teachers' attitude towards using ICTs in teaching and learning while school support and school culture have each explained 29.2% variance in teachers' attitude towards using ICTs for teaching and learning.

Table 3 : ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	16.470	3	5.490	34.567	.000
Residual	18.582	117	.159		
Total	35.052	120			

Table 4 : Model Summary

R	R Square	Adjusted R Square	F Change	df1	df2	Sig. F Change
.685	0.47	0.456	8.865	1	117	0.004

Table 5: Coefficient

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	0.581	0.399		1.454	.149

ICT Competence	0.298	0.054	0.396	5.527	.000
School support	0.292	0.062	0.339	4.677	.000
School Culture	0.292	0.098	0.209	2.977	.004

5 Discussion

The integration of ICTs into learning plays a major role in improving teaching and learning in light of educational reforms (Kahveci et. al., 2011). In the 21st century, more and more technologies are explored for educational efficiency to support the teachers' classroom roles. Some of these tools can be downloaded free. However, integrating technology into instruction has still remained a serious challenge to most teachers. Extant literature has related the avoidance of integrating ICTs in the classroom to the teachers' attitude towards using such ICTs. It is of paramount importance that teachers maintain positive attitudes towards using ICTs (Capan, 2012, Gilakjani & Leong, 2012, Sang et. al., 2010). Teachers' positive attitudes will lead them to the use of ICT in the classroom. Hence, it is very important to investigate factors that are likely to influence teachers' attitudes towards using ICTs in the classroom.

This study has attempted to investigate five factors that have been associated with teachers' attitudes towards using ICTs in the classroom. Descriptive analysis has shown that teachers' attitude towards using ICTs in teaching and learning is positive based on their overall mean scores and on the average mean scores of each attitude dimensions studied. This is important because to ensure the successful integration of ICTs in the classroom, teachers' attitude must be given adequate attention. The study has revealed that teachers perceive that ICTs are useful to them in the classroom and they are confident of using them without much fears or anxiety. Overall, out of the five factors investigated in this study, correlational analysis have revealed that significant positive correlations exist between ICT competence, school support, school culture and access to ICT resources on one hand and teachers' attitudes towards using ICTs for teaching and learning on the other hand. However, negative correlations have indicated that experienced teachers are more likely to have negative attitudes towards using ICT for teaching and learning in the classroom. This finding is in line with studies by Van Braak et al., (2004) and Bebell et al. (2004) that have shown that experienced teachers were less positively inclined towards using ICTs than young teachers. Nevertheless, studies by Rozell and Gardner, 1999 and Yildrim (2000) have shown otherwise. Hence, among the factors studied, only ICT competence, school culture and school support were found to influence teachers' attitudes towards using ICT in the classroom.

Consequently, teachers need continuous support while they make efforts to develop and sustain effective technology integration. Therefore, government needs to reinforce their support to teachers for them to be more committed to the use of ICTs in the classroom. One of the important factors for the development of positive attitudes among teachers, especially those in sciences who were much experienced is to endeavor to upgrade their knowledge and competences in ICTs through continuous training and workshop programs. Previous studies have also shown that ICT competence had significant positive relationship with teachers' attitudes (Meeplat, 2015; Denis, 2007; Ocak & Akdemir, 2008; Isleem, 2003; Berner, 2003; Capan, 2012; Rezaee, et. al, 2012).

Finally, school authorities need to create positive ICT culture and environment among the school teachers as well as the students so that the use of ICTs will be consistent in schools. Positive school ICT culture has also been identified as a very important factor that could positively boost teachers' attitude towards using ICTs in the classroom (Capan, 2012; Afshari et. al 2009; Rezaee et. al, 2012). Besides that, support from the schools or the school principals are also needed by teachers not only for the purpose of using ICTs but also for the purpose of creating harmony between the teachers and the school system and culture. Studies by Shin and Son (2007), Marthipa and Mukhari (2014), Termit Kaur and Samli Chan (2014) have shown that school support is among the most important factors that influence teachers' attitudes towards using ICT in the classroom.

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