Factors Predicting Impact of ICT-Use on Students: An Exploration of Teachers' Perceptions

Allan H.K. Yuen, The University of Hong Kong, hkyuen@hku.hk
Man Wai Lee, The University of Hong Kong, manwai.lee@hku.hk
Nancy Law, The University of Hong Kong, nlaw@hku.hk
Albert Chan, The University of Hong Kong, kwai4444@hkucc.hku.hk

Abstract

As a secondary analysis of the SITES 2006 data, the present paper focused on the exploration of the factors associated with the impact of ICT-use on students' 21st-century skills as perceived by teachers, in which students' 21st-century skills included information-handling skills, problem-solving skills, self-directed learning skills, collaborative skills, communication skills, ICT skills, and ability to learn at students' own pace. In order to predict and understand teachers' perceptions of the impact of ICT-use on students' 21st-century skills, we proposed a model embracing five factors: (1) teachers' perceptions on teacher-practice orientation 21st-century learning, (2) student-practice orientation of 21st-century learning, (3) pedagogical ICT competence, (4) teachers' perceptions on the presence of a community of practice on professional collaboration, and (5) teacher-related obstacles in using ICT. Results of the path analysis revealed three direct effects on student-impact, namely teacher-practice orientation, student-practice orientation, and pedagogical ICT competence. Findings revealed that teacher perception on student-practice orientation was the strongest predictor of student-impact than other factors. The direct effects of teacher-practice orientation, student-practice orientation, and pedagogical ICT competence on student-impact were positive. The pedagogical ICT competence had direct as well as indirect effects on student-impact. However, the effects of pedagogical ICT competence on the mediated factors teacher-practice orientation and student-practice orientation were negative. The indirect effects of community of practice on professional collaboration and teacher-related obstacles in using ICT on student-impact were mediated through teacher-practice orientation, student-practice orientation, or pedagogical ICT competence. The effects of community of practice on professional collaboration on all mediated factors were positive whereas the effects of teacher-related obstacles in using ICT on all mediated factors were negative. Finally, implications for teacher professional development are discussed.

Keywords: *secondary analysis, teacher perceptions, student impact, path analysis*

Introduction

"Educational systems around the world are under increasing pressure to use the new information and communication technologies (ICTs) to teach students the knowledge and skills they need in the 21st-century" (UNESCO, 2002; p.10). Thus, the key concern driving policy and community interest in the pedagogical integration of ICT is the premise that ICT is important for bringing changes to classroom teaching and learning so as to foster the development of students' 21st-century skills. Specifically, these skills include the ability to become lifelong learners within a context of collaborative inquiry and the ability to work and learn from experts and peers in a connected global community (Law, Pelgrum & Plomp, 2008; p. 121).

In the SITES 2006 (Law, Pelgrum & Plomp, 2008), teachers who indicated that they had used ICT in the teaching of their target classes were also asked to indicate the extent to which ICT use had impact on their students in 15 different areas. These areas of impact can be categorized into 8 groups, namely traditional outcomes, inquiry skills, collaboration, ICT skills, self-paced learning, affective impact, achievement gap, and socioeconomic divide. The results indicate that the use of ICT has not helped to narrow the achievement gap among students nor the socioeconomic divide. However, it is important to note that the perceived impacts in these two areas were lower than those perceived in other six impacts, indicating that teachers generally perceived the positive impacts on students to outweigh the negative ones. The highest impact on students was in the area of improved ICT skills as perceived by both mathematics and science teachers in all participating systems. The profiles of the different perceived impacts on students were very similar across the two teacher populations, indicating that both teacher populations perceived ICT to have brought about small, but positive impacts on students in various areas of affective and cognitive outcomes.

A number of studies have indicated that teachers' perceptions can have a profound effect on the teaching-learning process in particular teachers' perceptions of students are fairly static and difficult to change. These perceptions influence the expectations that teachers have for their students and hinder teachers' ability to estimate accurately students' learning potentials (Ferguson, 1998; Lawrence, 2005). As a secondary analysis of the SITES 2006 data, the present study focused on the exploration of the factors associated with the impact of ICT-use on students' 21st-century skills as perceived by teachers, in which students' 21st-century skills included information-handling skills, problem-solving skills, self-directed learning skills, collaborative skills, communication skills, ICT skills, and ability to learn at students' own pace. In order to predict and understand teachers' perceptions of the impact of ICT-use on students' 21st-century skills, a well-defined model is essential. We proposed a model embracing two groups of factors. The first group included teachers' perceptions on

teacher-practice orientation 21st-century learning, student-practice orientation of 21st-century learning, and pedagogical ICT competence. The second group included teachers' perceptions on the presence of a community of practice on professional collaboration and teacher-related obstacles in using ICT.

Methodology

Participants

In the SITES 2006 study, a large scale international survey was conducted in 22 education systems (Law, Pelgrum, & Plomp, 2008). Schools, in each system, were randomly sampled and two to four mathematics and/or science teachers teaching at the target grade (Grade 8) were respectively selected from each of the sampled schools. Across the 22 education systems, data collected from twelve of them were examined on the basis of a path analysis method. Such education systems include Chile, Chinese Taipei, Finland, Hong Kong SAR, Israel, Italy, Japan, Singapore, Slovak Republic, Slovenia, Catalonia, and Ontario Province. The selection of such systems is based on whether a participating system can fulfill the IEA participation rate requirement, i.e., at least 70% of the schools in each system need to be participated. As ten systems were unable to fulfill the IEA participation rate requirement, data collected from such systems were not considered. Thus, the sample size of the current study was reduced to 35,567 teachers working in 8,702 schools, in which the schools were located in 12 education systems.

Measures

The research instrument used in the study was the teacher questionnaire of SITES 2006, which was used for three purposes: (1) to develop different quantitative indicators like teacher's role orientation and student's role orientation so that such indicators can be used to identify the key pedagogical approaches and practices adopted by teachers in their teaching activities, (2) to assess the importance assigned to using ICT when implementing these different approaches and practices, and (3) to document the perceived impacts of ICT-use on students (Law, Pelgrum, & Plomp, 2008). To help achieve the above-mentioned purposes, the teacher questionnaire was divided into eight categories during its design process. Such categories are: (1) information about the target class, (2) curriculum goals, (3) teacher practice, (4) student practice, (5) learning resources and tools, (6) impact of ICT use, (7) information about you and your school, and (8) specific pedagogical practice that uses ICT. Despite one of the questions in Part 8, each part contains a number of questions and sub-questions which can be answered by clicking boxes. Thus, quantitative survey data can be collected from the designed questionnaire.

The collected survey data were subsequently analyzed on the basis of the Exploratory Factor Analysis (EFA) Method. Finding shows that six factors can be used to measure the important conditions for ICT-use and innovative pedagogy. These six factors are: (1) the twenty-first century's student impact (SI21), (2) twenty-first century student-practice orientation as reflected by teachers' report (SP21), (3) twenty-first teacher-practice orientation (TP21), (4) pedagogical ICT competence (PEDA), (5) perceived presence for community of practice on professional collaboration (COP_COL), and (6) teacher-related factors pertaining to competence, confidence, and time availability (OBS_TEA). The following table (Table 1) provides a summary of the measurement items consisted in each construct.

Table 1: Summary of the Structure of Constructs

Constructs	*Measurement Items in the Teacher Questionnaire*
OBS_TEA (These are yes-or-no questions)	• Lack of ICT-related skills • Lack of ICT-related pedagogical skills • Insufficient confidence to try mew approaches alone • Lack of time to develop and implement ICT-using activities • Unable to identify which ICT outside of the school
COP_COL (0.582)	• Teacher co-teaches with colleagues • Teacher discusses problems experienced at work with colleagues • Teacher works with teachers in other schools on collaborative activities • Teacher works with teachers in other countries on collaborative activities
PEDA (0.920)	• Preparation of lessons where students use ICT • Knowledge of pedagogical situations suitable for ICT-use • Finding useful curriculum resources on the Internet • Using the Internet to support student learning • Using ICT to monitor students' progress and evaluate students' learning outcomes • Using ICT to give effective presentations • Using ICT to collaborate with others
TP21 (0.812)	• Help/advise students in exploratory and inquiry activities • Organize, observe, or monitor student-led whole-class discussions, demonstrations, presentations • Organize, monitor, and support team-building and collaboration among students • Organize and/or mediate communication between students and experts/external mentors • Liaise with collaborators (within or outside school) for student collaborative activities • Collaborate with parents/guardians/caretakers in supporting/monitoring students' learning and/or in providing counseling
SP21 (0.810)	• Students learning and/or working during lessons at their own pace • Give presentations • Determine own content goals for learning (e.g., theme/topic for project) • Explain and discuss own ideas with teacher and peers • Collaborate with peers from other schools within and/or outside the country • Engage in self- and/or peer-evaluation • Reflect on own learning experience review (e.g., writing a learning log) and adjust own learning strategy • Communicate with outside parties (e.g., with experts) • Contribute to the community through their own learning activities (e.g., by conducting an environmental protection project)

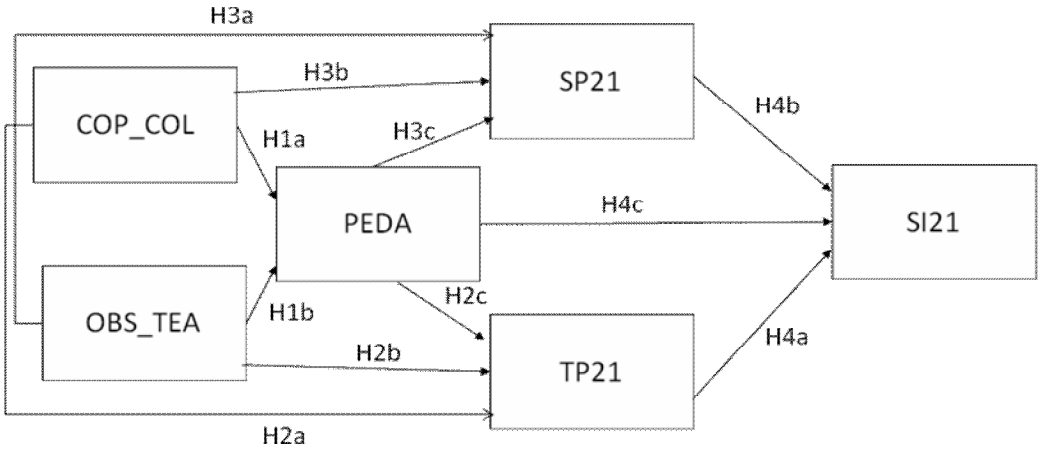
SI21 (0.866)	• Information-handling skills • Problem-solving skills • Self-directed learning skills • Collaborative skills • Communication skills • ICT-skills • Ability to learn at own pace

Note: Cronbach alpha reliability coefficients are in brackets.

Hypotheses Development

In our study, we hypothesized that COP_COL, OBS_TEA, PEDA, SP21, and TP21 may directly and/or indirectly create an effect to SI21. To explore the hypotheses, we classified the constructs into four categories, namely school context, competence, orientation, and perception. Figure 1 summarizes our hypotheses aiming to explore: (1) the relations among school context, competence and orientation, (2) the relations among competence, orientation, and perception, and (3) the relations between orientation and perception. Details of each category and the related hypotheses are discussed as follows.

Figure 1: Hypothesized Model Linking with Variables



The category of school context contains two constructs: OBS_ TEA and COP_COL. In terms of the OBS_TEA, teachers were asked if they had experienced in having the obstacles mentioned in Table 1 during their teaching activities. Regarding the COP_COL, teachers were questioned whether they had performed the professional collaboration activities as those mentioned in Table 1. Since our study aims at exploring the effects of various constructs including COP_COL on SI21, it is argued that the consideration of COP_COL is deemed necessary as prior study had already pointed out that the presence of a community of practice is a positive factor supporting pedagogical innovation and charge in schools (Dexter, Seashore,

& Anderson, 2002; Geijsel, Sleegers, van den Berg, & Kelchtermans, 2001, Law, Pelgrum, & Plomp, 2008). In the teacher questionnaire, teachers were asked to indicate their self-perceived levels of competence in the pedagogical uses of ICT (PEDA). Such competence include: (1) preparation of lessons which involve ICT-use by students, (2) knowledge of pedagogical situations suitable for ICT-use, (3) finding useful curriculum resources on the Internet, (4) using ICT to monitor students' learning progress and evaluating their learning outcomes, (5) employ ICT as a tool to give effective presentations, (6) using ICT to collaborate with others, and (7) using the Internet to support student learning. Cronbach alpha reliability test was also performed to assess the quality of the identified construct. Finding indicates that the classification of pedagogical ICT competence on the basis of the statements mentioned in Table 1 was very high, of which the reliability score is 0.920. We propose:

H1a: Perceived presence for community of practice on professional collaboration (COP_COL) has an effect on pedagogical ICT competence (PEDA)

H1b: Teacher-related factors pertaining to obstacles (OBS_TEA) has an effect on Pedagogical ICT competence (PEDA)

Exploratory factor Analysis (EFA) result showed that there are two constructs which can be used to measure the pedagogical-practice orientations. Such orientations include a TP21 and SP21. The TP21 aims at exploring how often teachers adopt lifelong learning skills and connectedness skills as those summarized in Table 1, whilst the SP21 includes the measurement of employing lifelong learning skills and connectedness skills used by students (Law, Pelgrum, & Plomp, 2008; p. 131). For both orientations, Cronbach alpha reliability scores shows that the reliabilities for both constructs are very good, with reliability scores of 0.812 and 0.810 for TP21 and SP21 respectively. We propose:

H2a: Perceived presence for community of practice on professional collaboration (COP_COL) has an effect on twenty-first teacher-practice orientation (TP21)

H2b: Teacher-related factors pertaining to obstacles (OBS_TEA) has an effect on twenty-first teacher-practice orientation (TP21)

H2c: Pedagogical ICT competence (PEDA) has an effect on twenty-first teacher-practice orientation (TP21)

H3a: Teacher-related factors pertaining to obstacles (OBS_TEA) has an effect on twenty-first century student-practice orientation as reflected by teachers' report (SP21)

H3b: Perceived presence for community of practice on professional collaboration (COP_COL) has an effect on twenty-first century student-practice orientation as reflected by teachers' report (SP21)

H3c: Pedagogical ICT competence (PEDA) has an effect on twenty-first century student-practice orientation as reflected by teachers' report (SP21)

Teachers who indicated that they had adopted ICT in their teaching activities were also asked to report to what degree ICT-use had influenced their students in the 21st-century's student impact (SI21). Here, the SI21 include several kinds of impact as those mentioned in Law, Pelgrum, and Plomp (2008), including inquiry skills, collaboration, ICT-skills, and self-paced learning (see Table 1). The reliability of SI21 is very high, of which its Cronbach alpha reliability score is 0.866. We propose:

H4a: Twenty-first teacher-practice orientation (TP21) has an effect on twenty-first century's student impact (SI21)

H4b: Twenty-first century student-practice orientation as reflected by teachers' report (SP21) has an effect on twenty-first century's student impact (SI21)

H4c: Pedagogical ICT competence (PEDA) has an effect on twenty-first century's student impact (SI21)

Finding and Discussion

Table 2 provides pair-wise correlations among the variables of interest for the full sample. As shown in the table, we found that all constructs are significantly correlated ($p<0.01$). Despite OBS_TEA, all constructs are positive correlated with each other. Such a finding indicates that COP_COL, PEDA, SP21, and TP21 create a positive and significant contribution to SI21. The negative correlation found between OBS_TEA and other variables indicate that OBS_TEA creates a barrier to the 21st-century's student impact.

Table 2: Correlation Matrix of Model Variables

	COP_COL	*PEDA*	*SP21*	*SI21*	*OBS_TEA*	*TP21*
COP_COL	1.000	.205**	.332**	.267**	-.097**	.269**
	(11394)	(11023)	(10503)	(6045)	(11037)	(10742)
PEDA		1.000	.257**	.350**	-.514**	.243**
		(11300)	(10453)	(6020)	(10956)	(10695)
SP21			1.000	.435**	-.107**	.655**
			(10818)	(5803)	(10428)	(10400)
SI21				1.000	-.172**	.401**
				(6196)	(6029)	(5954)
OBS_TEA					1.000	-.126**
					(11285)	(10658)
TP21						1.000
						(11130)

**p<0.01 (2-tailed); N in brackets

Due to the identified constructs are highly correlated, a path model was subsequently

developed on the basis of a Windows-based Structural Equation Modeling software package, LISREL (Release 8.7.2) (Jöreskog & Sörbom, 2004). The direct and indirect effects of each factor were tested, which aimed to test a structural model of the theoretical constructs. The power of structural equation modeling is the ability to estimate a complete model incorporating both measurement and structural considerations. Fit indices for the model were considered. Findings from the created model were illustrated in Figure 1 and Table 3, which also validated the hypotheses made in the previous section. In other words, we found that there are significant relations (1) among school context, competence, and orientations; (2) among competence, orientation and perception, and (3) between orientation and perception.

At the school context level, it appears that the COP_COL creates positive effects to PEDA, SP21, and TP21, whereas OBS_TEA creates negative effects to such variables. Such finding indicates that the teacher-related obstacle may create a barrier to the development of pedagogical competence, student-practice orientation and teacher-practice orientation. The competence level and the orientation level in Table 3 shows that PEDA creates a negative effect on the SP21 and TP21. Though the negative effect is small, however, the reason for the barrier is not particularly clear in the current study, and it deserves further analysis and investigation. For the relations between the competence layer, the orientation layer and the perception layer, it appears that the constructs like PEDA, SP21 and TP21 made a positive and significant contribution to the prediction of SI21.

Table 3 provides a summary of the model testing and the goodness of fit statistics. As shown in the table, overall, the path analysis model, SI21, contains a Comparative Fit Index (CFI = 0.97 > 0.9), a Normed Fit Index (NFI = 0.96 > 0.9), and the root mean square error of approximation (RMSEA = 0.061 < 0.08), which indicates that the model has a very good fit (Kuo et al., 2008). The R^2 of SI21 model is 0.33 indicating that the model explains 33% of the total variance of SI21 by SP21, TP21 and PEDA.

Regarding the prediction of SP21 and TP21, the Comparative Fit Index (CFI = 0.95), the Normed Fit Index (NFI = 0.95), and the root mean square error of approximation (RMSEA = 0.065) indicates that the model has a very good fit. The R^2 values of the SP21 model and the TP21 model equals 0.89 and 0.69 respectively, indicating that 89% of the SP21 and 69% of the TP21 were explained by PEDA, COP_COL, and OBS_TEA.

For the prediction of PEDA, the Comparative Fit Index, the Normed Fit Index, and the root mean square error of approximation are 0.97, 0.97, and 0.066 respectively. Such findings indicate that the model has a very good fit. The R^2 of the PEDA model indicates that 41% of the PEDA can be explained by two variables OBS_TEA and COP_COL.

Table 3: Summary of Model Testing

Dependent Variable	*Predators*	*Path Coefficients*	*R-square*	*CFI*	*NFI*	*RMSEA*
PEDA	COP_COL	0.2 * (H1a)	0.41 *	0.97	0.97	0.066
	OBS_TEA	-0.59 * (H1b)				
TP21	COP_COL	0.9 * (H2a)	0.69 *	0.95	0.95	0.065
	OBS_TEA	-0.057 * (H2b)				
	PEDA	-0.19 * (H2c)				
SP21	COP_COL	1.03 * (H3b)	0.89 *	0.95	0.95	0.065
	OBS_TEA	-0.039 * (H3a)				
	PEDA	-0.23 * (H3c)				
SI21	TP21	0.15 * (H4a)	0.33 *	0.97	0.96	0.061
	SP21	0.31 * (H4b)				
	PEDA	0.24 * (H4c)				

*p<.05

Conclusion and Implications

The successful use of computers in the classroom depends on the teachers' attitudes towards computers (Lawton & Gerschner, 1982). Nonetheless, teachers' attitudes and perceptions have not been emphasized in the implementation of technology into the classroom, though studies stated that teachers' attitudes as well as knowledge and skills in using computers are major factors affecting their initial acceptance of computer technology and their future behavior regarding computer usage (Violato, Mariniz & Hunter, 1989; Koohang, 1989). Kluever, Lam and Hoffman (1994) also indicated that teachers' attitudes towards computers affect their instructional use of computers and likelihood of profiting from training. The present study focused to explore the factors associated with the impact of ICT-use on students' 21st-century skills as perceived by teachers. In order to predict and understand teachers' perceptions of the impact of ICT-use on students' 21st-century skills, we propose a model including teachers' orientations, competence, and perceived contextual factors. Overall, it was concluded that the model was suitable and valid. Results of the path analysis revealed three direct effects on SI21, namely TP21, SP21, and PEDA. Findings revealed that teacher perception on SP21 was the strongest predictor of SI21 than other factors. The direct effects of TP21, SP21, and PEDA on SI21 were positive. The PEDA had direct as well as indirect effects on SI21. However, the effects of PEDA on the mediated factors TP21 and SP21 were negative. The indirect effects of COP_COL and OBS_TEA on SI21 were mediated through TP, SP, or PEDA. The effects of COP_COL on all mediated factors were positive whereas the effects of OBS_TEA on all mediated factors were negative.

What are the implications of the findings? Firstly, teacher perception on SP21 is the strongest predictor on SI21, as "the role played by students in their learning practices arguably provide the most important information about the pedagogical orientation of any teaching and learning

situation" (Law, Pelgrum, & Plomp, 2008; p. 131). Thus, it seems important to reinforce the notion of "students' engagement" in pedagogical practices. It would help teachers to orient themselves in student-practice ways towards teaching and learning. Who are the important figures in the learning process? Answers would be varied amongst teachers. However, it remains the question about the balance of the role of students and teachers in the learning process.

Secondly, it is found that OBS_TEA has negative effect on teacher pedagogical ICT competence, teacher-practice orientation, and student-practice orientation, in which OBS_TEA refers to "teacher-related factors pertaining to competence, confidence, and time availability" (Law, Pelgrum, & Plomp, 2008; p. 198). Of course, it is important to build up teachers' confidence in using technology in general, which would hence increase their intention and willingness to use technology in the future (Yuen & Ma, 2008). Summers (1990) found that the lack of knowledge and experience in the computing area is one of the most common reasons for teachers' negative attitudes towards computers. Therefore, it is useful to develop a school environment which enables teachers to have more hands-on experience in new technologies (Allan, 2007; Fleming et al., 2007), as Yunus (2007) indicated that teachers' development necessitates not merely providing additional training opportunities, but also aiding them in experimenting with technology before being able to use it in their practices. It is argued that a digital mindset is required in the teaching profession though teachers differ widely in their attitudes and ability to cope with technology (Smith, 2000; Sutherland-Smith, 2002).

Finally, it is found that the perceived presence for community of practice on professional collaboration (COP_COL) has significant positive effect on teacher pedagogical ICT competence, teacher-practice orientation, and student-practice orientation, in particular the effect on teacher-practice and student-practice orientation are high. However, it is reported in the SITES 2006 that the "professional collaboration had the lowest perceived presence in most systems" (Law, Pelgrum, & Plomp, 2008; p. 204) amongst the four aspects of community of practice. Thus, it is important to foster a culture of professional collaboration in and amongst schools. Culture and professional development are inter-related because professional development activities contribute to a culture of collegiality, critical inquiry, and continuous improvement; whereas the school culture stimulates ongoing professional development (Hord & Boyd, 1995). Professional development models for teachers cannot simply be imposed, rather, we must create environments that provide teachers and principals with ongoing support for change that are situated in and address their practical needs. Teachers and principals need to have the opportunities to participate in discussion, reflection, and action that promote curriculum innovation as well as idea exchange for generating new ways of pedagogical

practices using ICT.

References

Allan, M.K. (2007). Millennial teachers: Student teachers as users of information and communication – A New Zealand case study, *International Journal of Education and Development Using ICT*, 3(2), 16-29.

Dexter, S., Seashore, K., & Anderson, R. (2002). Contributions of professional community to exemplary use of ICT. *Journal of Computer Assisted Learning*, 18 (4), 489-497.

Fleming, L., Motamedi, V. & May, L. (2007). Predicting Preservice Teacher Competence in Computer Technology: Modeling and Application in Training Environments, *Journal of Technology and Teacher Education*, 15(2), 207-231.

Geijsel, F., Sleegers, P., van den Berg, R., & Kelchtermans, G. (2001). Conditions fostering the implementation of large-scale innovation programs in schools: Teachers' perspectives. *Educational Administration Quarterly*, 37, 130-166.

Hord, S. & Boyd, V. (1995). Professional development fuels a culture of continuous improvement. *Journal of staff Development*, 16(1), 10 – 15.

Jöreskog, K., & Sörbom, D. (2004). *LISREL 8.7* [Computer Software]. Lincolnwood, IL: Scientific Software International, Inc.

Kluever, R.C., Lam, T.C.M. & Hoffman, E.R. (1994). The computer attitude scale: assessing changes in teachers' attitudes toward computers, *Journal of Educational Computing Research*, 11(3), pp.251-256.

Koohang, A. A. (1989). A study of attitudes toward computers: Anxiety, confidence, liking and perception of usefulness. *Journal of Research on Computing in Education*, 22(2), pp.137-150.

Kuo, J-K, Lai, C-N, & Wang C-S (2008). Social Participation and Life Satisfaction: From Youth's Social Capital Perspective, *Journal of American Academy of Business*, 12(2), pp. 237-242.

Law, N., Pelgrum, W. J., & Plomp, T. (2008). *Pedagogy and ICT Use in Schools around the World: Findings from the IEA SITES 2006 Study*. Hong Kong: Springer.

Lawton, J. & Gerschner, V. T. (1982). A review of the literature on attitudes towards computers and computerized instruction. *Journal of Research and Development in Education*, 16(1), pp.50-55.

Smith, R. (2000). The Future of Teacher Education: principles and prospects, *Asia-Pacific Journal of Teacher Education*, 28(1), 7-28.

Summers, M. (1990). New student teachers and computers: An investigation of experiences and feelings. *Educational Review*, 42(3), pp.261-271.

Sutherland-Smith, W. (2002). Weaving the literacy Web: Changes in reading from page to screen, *The*

Reading Teacher, 55(7), 662-669.

Violato, C., Mariniz, A. & Hunter, W. (1989). A confirmatory analysis of a four-factor model of attitudes toward computers: A study of pre-service teachers. *Journal of Research on Computers in Education*, Winter, pp.199-213.

Yuen, H.K., & Ma, W.K. (2008) Exploring Teacher Acceptance of e-Learning Technology, *Asia-Pacific Journal of Teacher Education*, 36(3), 229-243.

Yunus, M.M. (2007). Malaysian ESL teachers' use of ICT in their classrooms: expectations and realities, *ReCALL*, 19(1), 79-95.