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Enhancing Playful Teachers' Perception of the Importance of ICT Use in the Classroom: The Role of Risk Taking as a Mediator

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Abstract: In today's world, teaching and learning processes inevitably involve the application of information and communication technology (ICT). It seems reasonable to expect personal attributes such as cognitive playfulness to be associated with consistent application of ICT. Using survey responses from Singapore students in a teacher education programme (n = 450), structural equation modelling (SEM) found that the effect of cognitive playfulness on the perceived importance of ICT was mediated by risk taking orientation, but the mediation effect was not observed with perceived competence in ICT use. Academic self-concept had negligible relation with the two ICT variables. As personal attributes may not be malleable whereas risk taking orientation can be nurtured, the mediating role of risk taking implies a useful direction for teacher education to enhance student teachers' risk taking attitudes for promoting the application of modern technologies as pedagogical tools in schools.

The introduction of Information and Communication Technology[1] (ICT) into the teaching and learning cycle has become a global agenda. For instance, the United States of America launched *The National Education Technology Plan* (Department of Education USA, 2010), and ICT integration is an integral part of *Australian Professional Standards for Teachers* in Australia (Australian Institute for Teaching and School Leadership [AITSL], 2011). The use of ICT in education has also been emphasised by many other countries such as New Zealand (Ministry of Education, 2011), and Korea (Korea Education & Research Information Service, 2013). Likewise, in Singapore, ICT integration in education is also clearly stipulated by the Ministry of Education (MOE). The *Third Master plan for ICT in Education* (MOE Singapore, 2008) is one of a series of initiatives that introduce ICT into teaching and learning processes. A key message underlying these technology integration

[1] We adopt ICT to refer to the digital teaching and learning materials and tools used in the classroom for pedagogical purposes because this term is widely used in educational policies and in most studies cited in this paper, although a few others have used instructional technology (e.g. Miranda & Russell, 2012), or digital technology (e.g. Yeung, Tay, Hui, Lin, & Low, 2014). These two terms have been noted by some researchers (e.g. Davidson & Goldberg, 2009; Lee & Winzenried, 2009) to be able to convey a broader meaning and cover a wider range of technologies than ICT.

policies is that teaching in the 21st century inevitably involves the application of ICT. To better prepare student teachers for ICT implementation in future teaching, ICT has also been integrated into teacher education programmes at home and abroad (see, for example, Davis, 2003; Moran, Vozzo, Reid, Pietsch, & Hatton, 2013; Pearson 2003; Yeung, Tay, Hui, Lin, & Low, 2014).

Despite these concerted governmental and institutional efforts, literature has documented that ICT has not been fully accepted or effectively implemented in schools (see Bingimlas, 2009; British Educational Communications and Technology Agency [Becta], 2004; Pelgrum, 2001). Apart from external factors (e.g., school support, technological infrastructures), attitudes towards ICT, perceived importance of ICT use, competence in ICT use, pedagogical beliefs, etc. (e.g., Albirini, 2006; Drent & Meelissen, 2008; Ertmer, 2005; Liu, 2011; Miranda & Russell, 2012; Petko, 2012; Sipilä, 2014; Teo, Chai, Hung, & Lee, 2008) have been identified as teacher level factors affecting the uptake of ICT in the classroom. Previous research seems to treat teacher personal characteristics such as attitudes, belief, and competence as parallel influences on teachers' acceptance and implementation of ICT. Few studies have examined whether there are any interactions between these factors, or identified any relationships with other teacher attributes such as cognitive playfulness, risk taking or academic self-concept, which may contribute to higher adoption of ICT for pedagogical use. Of relevance to teacher education is how to enhance student teachers' valuing of ICT in teaching and their competence in applying it for pedagogical purposes. Studies on cognitive playfulness have demonstrated the association between users' playfulness attribute and valuing of ICT and engagement with it (e.g., Tan & McWilliam, 2008; Tan & McWilliam, 2009; Webster & Martocchio, 1992). In addition, cognitive playfulness also contributed to sustained high level use of ICT in education (Dunn, 2004a). Studies on risk taking and ICT (e.g., Howard, 2011; Offir & Katz, 1990) have also confirmed the role of risk taking in ICT competence and use, but what is left underexplored is the interacting relationship between cognitive playfulness, risk taking, and ICT application.

This study addresses this gap and investigates student teachers' cognitive playfulness, academic self-concept and risk taking, and the relationship of these attributes with perceived ICT importance and competence. This study was undertaken based on the belief that understanding what kinds of personality traits may affect student teachers' valuing of ICT and ICT competence can help us understand the intrinsic factors affecting teachers' technology acceptance, which is critical to enhancing the pedagogical role of ICT in their future classroom teaching. Two major ICT variables are of concern in the present study: (1) perceived importance of ICT for teaching, and (2) sense of competence in ICT use. The purpose of this paper is to: (1) delineate the differential relations of teachers' cognitive playfulness attribute and academic self-concept with these two ICT variables, and (2) examine the role of risk taking as a mediator of such relations.

Perceived ICT Importance and Sense of Competence in ICT Use

Perceived ICT importance is the extent to which student teachers believe that the integration of ICT for teaching is important. According to Peciuliauskiene and Barkauskaite (2007), there are two types of ICT competencies: basic and educational ICT competence. The latter refers to "the ability to apply ICT in educational practice and to develop learners' computer literacy including the ability to plan, operate and analyse the processes of applying ICT" (p. 400). It is this ICT application competence that is of interest to us because it is

teachers' ability to implement ICT for meaningful pedagogical use that can potentially enhance teaching and learning outcomes.

Previous research on ICT use in the classroom suggests that how teachers perceive the importance of ICT for teaching and their sense of competence in using ICT predict their attitudes towards ICT application and actual use of ICT. For example, Albirini (2006) found that teachers' perceptions of computer attributes, their cultural perceptions and ICT competence predicted their attitudes towards ICT. Miranda and Russell (2012) also reported that teachers' experience with ICT use, beliefs about ICT benefits, and perceived importance of ICT for teaching strongly predicted their ICT use in the classroom. These conclusions are further corroborated by Yeung, Taylor, Hui, Lam-Chiang and Low (2012), who have shown that given a good sense of competence, teachers are more likely to use ICT for teaching. On the other hand, teachers' perception of the importance of ICT is also essential, as the valuing of ICT in teaching and learning is likely to make ICT applications more sustainable. Petko (2012) identified teachers' perceived importance of ICT and sense of competence in ICT application as affecting classroom ICT use. The review conducted by Becta (2004) of research on barriers to teachers' uptake of ICT also concluded that sense of competence was teachers' personal level factor that affected their use of ICT in teaching. All these findings suggest that it is only when an individual perceives the value of ICT in teaching and learning and has confidence in their ability to utilise ICT for teaching will they adopt ICT in their instructional practices.

Cognitive Playfulness and ICT Variables

The construct of playfulness has been investigated and conceptualised in human-computer interactions or from the perspective of personal disposition (e.g. Barnett, 2007; Glynn & Webster, 1992; Webster & Martocchio, 1992). Webster and Martocchio (1992) defined microcomputer playfulness as "a situation-specific individual characteristic" that "represents a type of intellectual or cognitive playfulness" and "describes an individual's tendency to interact spontaneously, inventively, and imaginatively with microcomputers" (p. 202). Studies on playfulness in general have shown that it is comprised of several components and related to certain personality traits, affective styles, and motivational orientations. For instance, Proyer and Jehle's (2013) examination of the relationship between adult playfulness and personality showed that a playful adult is "humorous, cheerful, uninhibited, expressive, caring for others and enjoying intellectually challenging and creative things" (p. 815). This enjoyment of intellectual challenge and novelty is similar to what Dunn (2004b) referred to as cognitive playfulness, "an exploratory, intrinsic, individual drive within an individual that causes them to 'play' with a problem until they get it solved" (p. 3554). To Tan and McWilliam (2008), cognitive playfulness is "the learner's dexterity and agility in terms of intellectual curiosity and imagination/creativity" (p. 2). These definitions have largely associated 'cognitive' with 'intellectual', and 'playfulness' with 'curiosity, imagination, exploration and innovation'. Following Dunn (2004a), we believe that cognitive playfulness encompasses cognitive, affective, and behavioural dimensions, because an individual who is curious and inquisitive by nature will tend to be more interested in and more affectively engaged in novel things, and will go further to explore them.

One may envisage that a cognitively playful person who is inquisitive and likes to experiment with new ideas and novel things will perceive the value of new technologies such as ICT, and may demonstrate competence in such applications. This is supported by Tan and McWilliam (2008), who examined how students' cognitive playfulness influenced their

evaluation of and engagement with a Web 2.0 digital learning innovation and found that cognitive playfulness predicted students' valuing, use of, and engagement with this multimodal open-source. Tan and McWilliam (2009) also suggested that students exhibiting higher levels of cognitive playfulness tended to embrace novel innovations. Studies on playfulness predicting attitudes towards and competence in computer technology have also demonstrated a positive relationship. For example, Moon and Kim (2001) found a significant positive correlation between playfulness and attitudes towards using technology. This positive relationship between playfulness and attitudes towards computers, and self-efficacy and competence in computer use was also reported by Webster and Martocchio (1992). Padilla-Meléndez, Aguila-Obra, and Garrido-Moreno (2013) also found that perceived playfulness directly influenced females' attitudes towards using a blended learning system whereas its influence on males was mediated by perceived usefulness. These findings suggest that individuals who are cognitively playful are more likely to appreciate the importance of ICT and may be more competent in using it.

Academic Self-concept and ICT Variables

Rosenberg (1979) defined self-concept as "the totality of the individual's thoughts and feelings having reference to himself as an object" (as cited in Bong & Skaalvik, 2003, p. 7). Self-concept is another personal factor that may impact teachers' competence and efforts in learning and using new strategies in the classroom. For instance, Adeyemi's (2014) investigation of how self-concept and motivation variables affect acquisition of ICT competence found self-concept to be a strong influence on the acquisition of word processing knowledge. But what Adeyemi (2014) examined was basic ICT competence such as Microsoft word processing, data analysis, and Photoshop, rather than the educational competence under investigation in the current study. Moreover, what we explore here is academic self-concept, individuals' perceptions about themselves in academic domains (Wigfeild & Karpathian, 1991). No direct relationship between academic self-concept of teachers and their implementation of ICT has been documented in the literature, but research on self-concept in general and on academic self-concept (e.g. Arens, Yeung, Craven, & Hasselhorn, 2011; Marsh & Martin, 2011; Yeung, Kuppan, Foong, Wong, Kadir, Lee, Yau, 2010) has established that it is domain-specific and nontransferable to other domains. This suggests that one who is high in his or her perception of academic ability may not be equally competent in ICT applications. But what remains unknown is whether one who rates high in his or her perception of academic ability will also perceive the importance of ICT use.

Risk Taking

Risk seems to have a negative connotation that is associated with threat and danger. But risk taking entails not just negative consequences, but also positive exploration (Howard, 2009). In the current study, risk taking is defined as an orientation to try or explore something new even though a positive outcome is not guaranteed. According to Bandura (1993), risk taking is associated with individuals' belief in their capability in a given situation. Research on sports (e.g., Llewellyn & Sanchez, 2008) also suggests that confidence in one's own competence plays a role in people's participation in risk taking activities. For teachers, risk taking in the classroom is when they try unfamiliar strategies or practices (Dreger, 2011).

Utilising ICT in teaching is one such risk taking practice for teachers not confident enough in ICT use, as this may pose a challenge to their traditional classroom teaching practices and force them to step out of their comfort zones. Therefore, teachers who are more confident in ICT competence may be more likely to be risk-taking-oriented by trying technologies in teaching, and vice versa. Howard's (2011) investigation into teachers' risk perceptions of ICT integration also demonstrated that teachers who valued ICT more and were more competent in ICT use tended to perceive ICT use as less risky and were more willingly to adopt ICT in their instructional practices. Offir and Katz's (1990) examination of the relationship between teachers' level of risk taking and attitudes towards computer use also indicated that high-level risk taking teachers held more positive attitudes towards applying computers for pedagogical use. Hence, the role of risk taking in the implementation of ICT in the classroom needs to be investigated and understood to help teachers in their successful integration of ICT for pedagogical purposes.

As previously noted, studies on cognitive playfulness and those on risk taking have respectively shown their associations with ICT importance and competence. But what is lacking in the literature is whether there are any correlations between cognitive playfulness, risk taking, and ICT variables. One may assume that a cognitively playful teacher who is intrinsically motivated to try out new things would be more adventurous and explorative, and appreciate the opportunities afforded by ICT for teaching and learning despite the uncertainty associated with them. Therefore, an individual's risk taking propensity may play a mediating role in the prediction of cognitive playfulness on his or her valuing of ICT use.

The Present Investigation

By surveying a sample of 450 student teachers in Singapore, the present study investigates the predicting strength of cognitive playfulness and academic self-concept on two ICT variables (i.e., perceived importance of ICT for teaching and sense of competence in ICT application in teaching), with student teachers' risk taking attitude as a mediator. Based on what has been discussed in the literature review section, we propose the following hypotheses:

(1) Cognitive playfulness will positively predict perceived importance of ICT use.
(2) Cognitive playfulness will positively predict sense of competence in ICT use.
(3) Academic self-concept will not affect perceived importance of ICT use.
(4) Academic self-concept will not affect sense of competence in ICT.
(5) Risk taking mediates cognitive playfulness and perceived ICT importance.
(6) Risk taking mediates cognitive playfulness and perceived ICT competence.

Method

Participants and Procedure

Participants for the study were student teachers undertaking a one-year Postgraduate Diploma in Education (PGDE) programme at National Institute of Education (NIE), Singapore. Approval from the Institutional Review Board of the university was obtained before data collection through an anonymous online survey created and administered using the Qualtrics software. An announcement was made in the Student Portal to alert the whole

cohort of 2012 intake student teachers about the upcoming online survey. The embedded URL was sent to individual emails of all the targeted participants, together with a description of the study, its objectives and the approximate time for the completion of the survey. Participants were also assured of confidentiality and anonymity, with no individual being identified in the aggregated data and in the dissemination of findings. In case of queries, contact details were also provided. 450 participants out of a total of 1024 (response rate = 44%) provided completed responses for the data analysis.

Instruments

The participants responded to an online survey regarding teacher competencies and professional identity. The five 6-point Likert scales (1 = strongly disagree and 6 = strongly agree) under investigation were ICT importance, ICT competence, academic self-concept, cognitive playfulness, and risk taking, each comprising 4 randomised and positively worded items. The five variables and sample items, as well as the Cronbach's alpha reliability estimate for each factor are provided in Table 1. Items for academic self-concept were adapted from Marsh's (1992) Self-Description Questionnaires (SDQ) II. Items for cognitive playfulness were adapted from Tan (2009) while those for risk taking and for the two ICT variables were created by the research team.

Variable	Sample Items	Alpha
Cognitive Playfulness		.80
	I am a curious learner. I like to experiment with ideas.	
Academic Self-concept		.83
	I have always done well academically. Studying an academic discipline is easy for me.	
Risk Taking		.82
	I am willing to try new things even though I might fail. To be successful, I need to take risks and try new things.	
Importance of ICT		.82
	Adapting ICT for my teaching is important. Developing innovative ways to use ICT in teaching and learning is important.	
Competence in ICT Use		.90
	I am competent in: Finding out about how ICT could be used for instruction. I am competent in: Using ICT to engage my students.	
Note:	Each variable consists of 4 randomised items.	

Table 1: Sample Items and Alpha Reliabilities of Variables

Statistical Analysis

The collected survey data were recoded and analysed using SPSS 21.0 and AMOS 21.0. Responses were coded with higher scores representing more favourable responses. The alpha reliability of the five constructs was examined in a preliminary analysis, followed by a confirmatory factor analysis (CFA). According to Brown (2006), the CFA approach is strong in providing stringent evaluations about the model's goodness of fit. Maximum likelihood (ML) estimation was adopted for all the five CFA models tested in the study. The significance level for the analysis was set at .05.

CFA

The procedures for conducting CFA have been described by Byrne (2010) and are not further detailed here. For the evaluation of goodness of fit of all the CFA models, we chose the Tucker-Lewis index (TLI, also known as the non-normed fit index) as the primary index. The root mean square error of approximation (RMSEA) and the Comparative Fit Index (CFI) were also considered. We also reported the chi-square test statistics. We followed widely accepted criteria for the assessment of model fit. In general, CFI and TLI values equal to or greater than .90 and RMSEA value of below .08 indicate acceptable model fit (see Browne & Cudeck, 1993). Acceptable factor loadings should be larger than .30, and acceptable correlations should be below .90 for them to be distinguishable from each other.

Path Model

Based on the latent variables established in the CFA models, we performed the path analysis to test the six hypotheses by examining the relative strength of the predicting variables. Specifically, cognitive playfulness and academic self-concept were used to predict perceived ICT importance and competence. The mediating effects of risk taking on those relationships were also tested.

Results

Preliminary Analysis

The alpha reliability of each scale was acceptable (all > .70). Specifically, Cronbach's α coefficients of cognitive playfulness, academic self-concept, risk taking, perceived ICT importance and perceived ICT competence were .80, .83, .82, .82, and .90 respectively (Tab. 1), providing preliminary support for the a priori scales.

CFA

Table 2 is a summary of the goodness-of-fit indices of all the five CFA models. As shown in Table 2, all the five CFA models tested in the study demonstrated proper solutions with acceptable goodness of fit.

Model		χ^2	*df*	TLI	CFI	RMSEA
1.	2 predictors to Importance	101.72	51	.98	.98	.05
2.	Risk taking as mediator for Importance	238.96	98	.95	.96	.06
3.	2 predictors to Competence	100.51	51	.98	.98	.05
4.	Risk taking as mediator for Competence	243.66	98	.96	.96	.06
5.	5-factor CFA	353.91	160	.96	.96	.05
Note:	N=450, CFI = Comparative fit index, TLI= Tucker-Lewis index, RMSEA = Root mean square error of approximation					

Table 2: Goodness-of-fit Summary for CFA Models

The descriptive statistics and the correlations between the five variables are summarised in Table 3. The factor loadings of all the five variables were acceptable (all > .50). The factor correlations ranged from .12 to .71, showing that there were positive correlations between these factors and they were distinguishable from one another.

Variable	**Cognitive Playfulness**	**Academic Self-concept**	**Risk Taking**	**ICT Importance**	**ICT Competence**	**Uniquenesses**
Mean	4.39	3.99	4.38	4.76	3.60	
SD	0.75	0.82	0.79	0.87	0.86	
Factor Loadings						
Playfulness1	.54*					.71*
Playfulness2	.77*					.40*
Playfulness3	.74*					.45*
Playfulness4	.79*					.37*
Academic1		.68*				.53*
Academic2		.71*				.50*
Academic3		.76*				.42*
Academic4		.82*				.32*
Risk Taking1			.81*			.35*
Risk Taking2			.85*			.28*
Risk Taking3			.76*			.43*
Risk Taking4			.51*			.74*
ICT Imp1				.80*		.37*
ICT Imp2				.88*		.23*
ICT Imp3				.88*		.22*
ICT Imp4				.88*		.23*
ICT Com1					.82*	.33*
ICT Com2					.92*	.16*
ICT Com3					.92*	.15*
ICT Com4					.86*	.27*
Factor Correlations						
Playfulness						
Academic	.51*					
Risk Taking	.71*	.38*				
ICT Imp	.22*	.12*	.36*			
ICT Com	.46*	.30*	.34*	.26*		
Note:	N = 450, * $p < .05$					

Table 3: Descriptive Statistics and Solution of Path Model 5

Path Analysis

The path from cognitive playfulness to perceived ICT importance was significant (β = .22, p < .001, Fig. 1) and it was mediated significantly by risk taking attitude (β = .40, p < .001, Fig. 2). Figure 2 showed that cognitive playfulness correlated significantly with risk taking (β = .69, p < .001), and its effect on perceived ICT importance became insignificant when being mediated by risk taking. On the contrary, the paths from academic self-concept to both ICT variables were not significant (β = .01 and β = .09 respectively, p > .05, Figs. 1 and 3). Figure 3 showed that cognitive playfulness also correlated significantly (β = .42, p < .001) with sense of competence in ICT use, but it was not mediated by risk taking (β = .01, p > .05, Fig. 4). Figure 5 showed the paths from the two predictors to the two outcomes, with risk taking as the mediator.

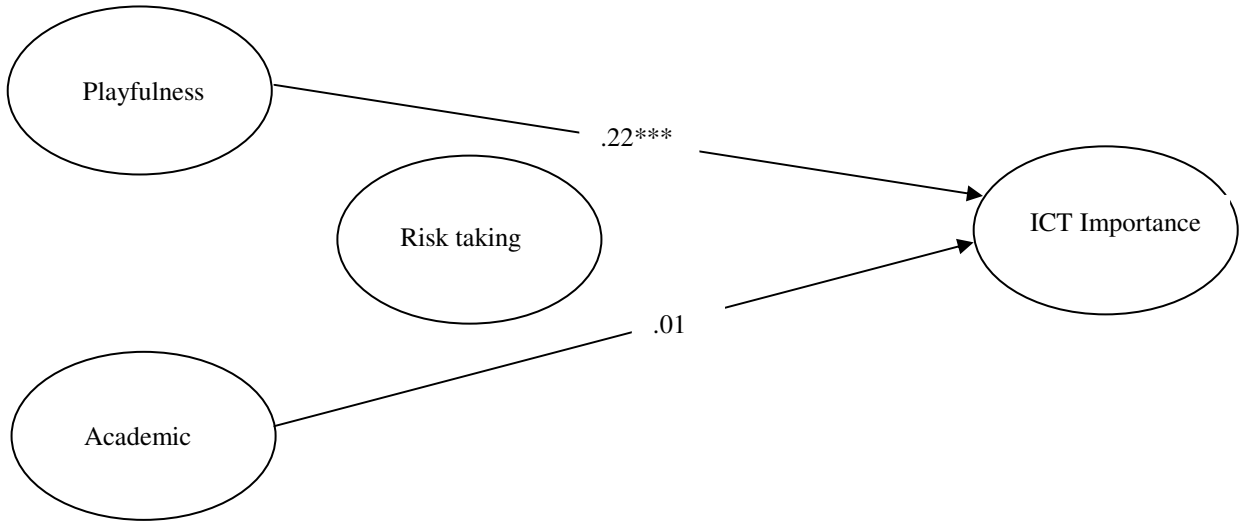

Figure 1: Model 1, Cognitive Playfulness and Academic Self-Concept Predicting ICT Importance
Note: *** p < .001

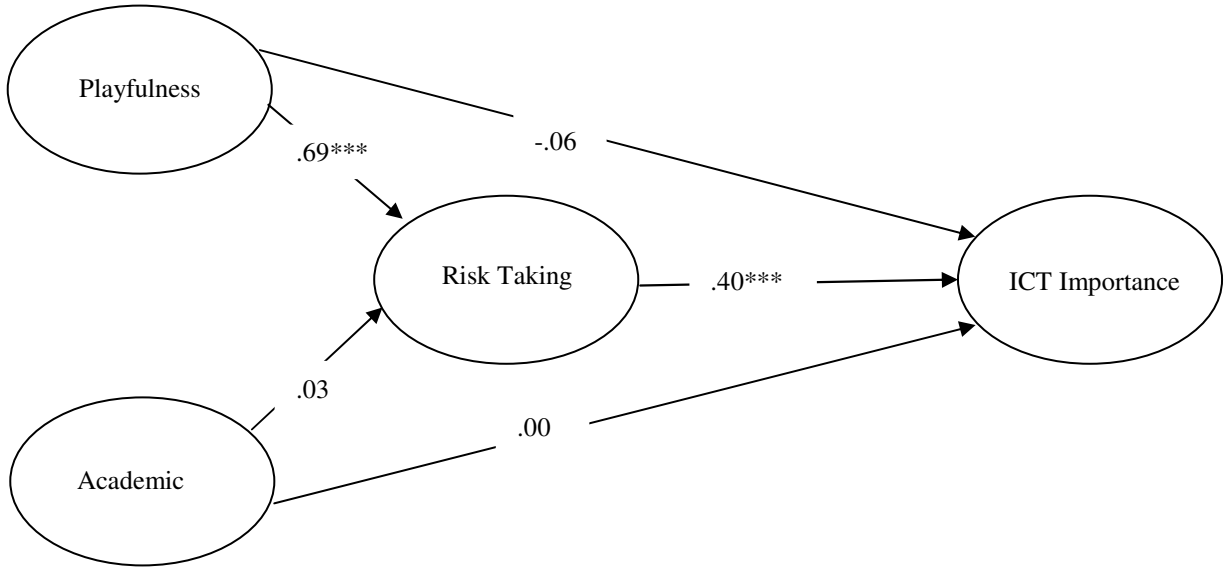

Figure 2: Model 2, Risk Taking as a Mediator of Two Predictors to ICT Importance
Note: *** p < .001

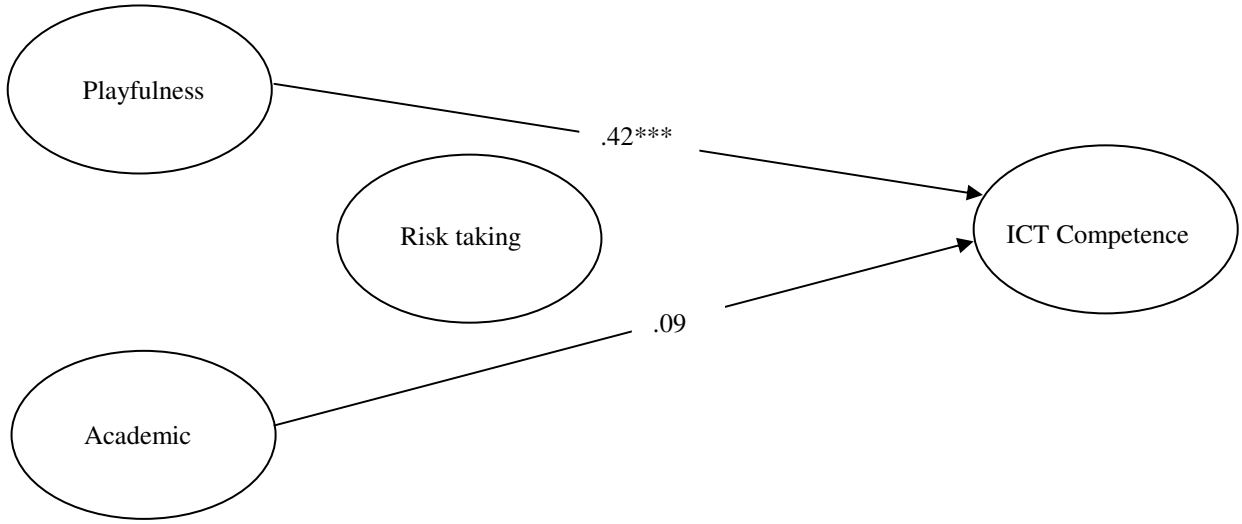

Figure 3: Model 3, Cognitive Playfulness and Academic Self-Concept Predicting ICT Competence
Note: *** $p < .001$

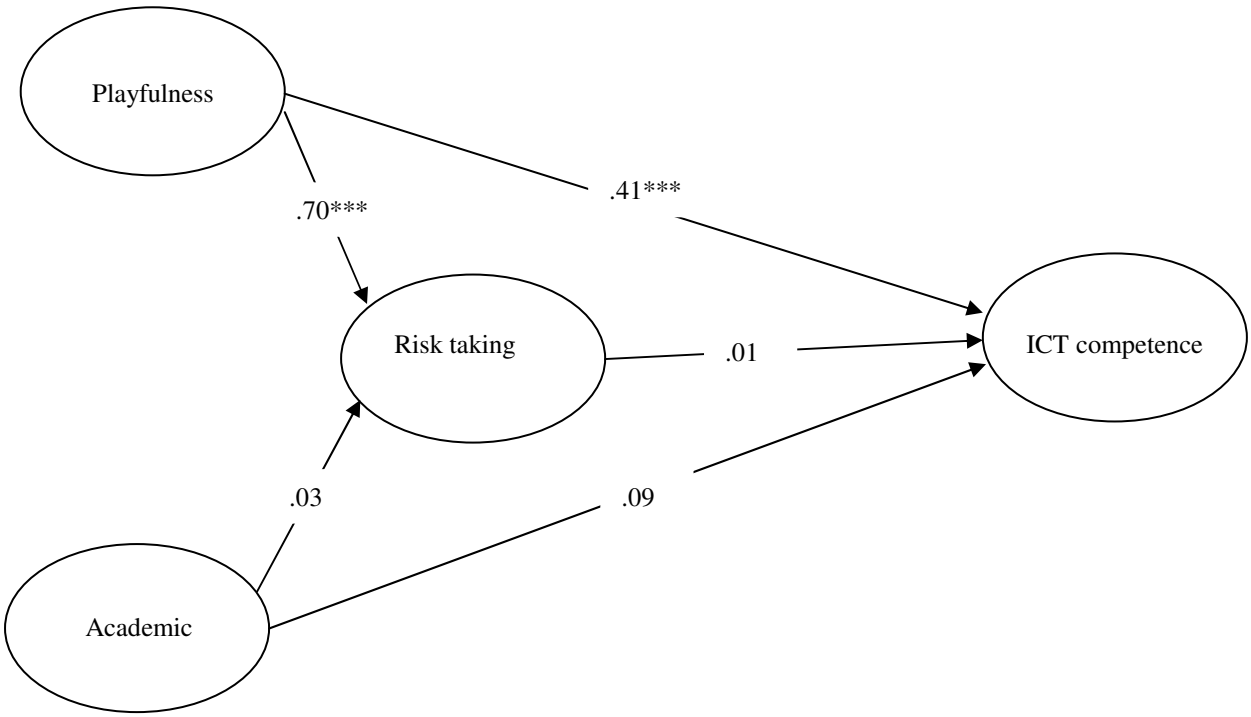

Figure 4: Model 4, Risk Taking as a Mediator of Two Predictors to ICT Competence
Note: *** $p < .001$

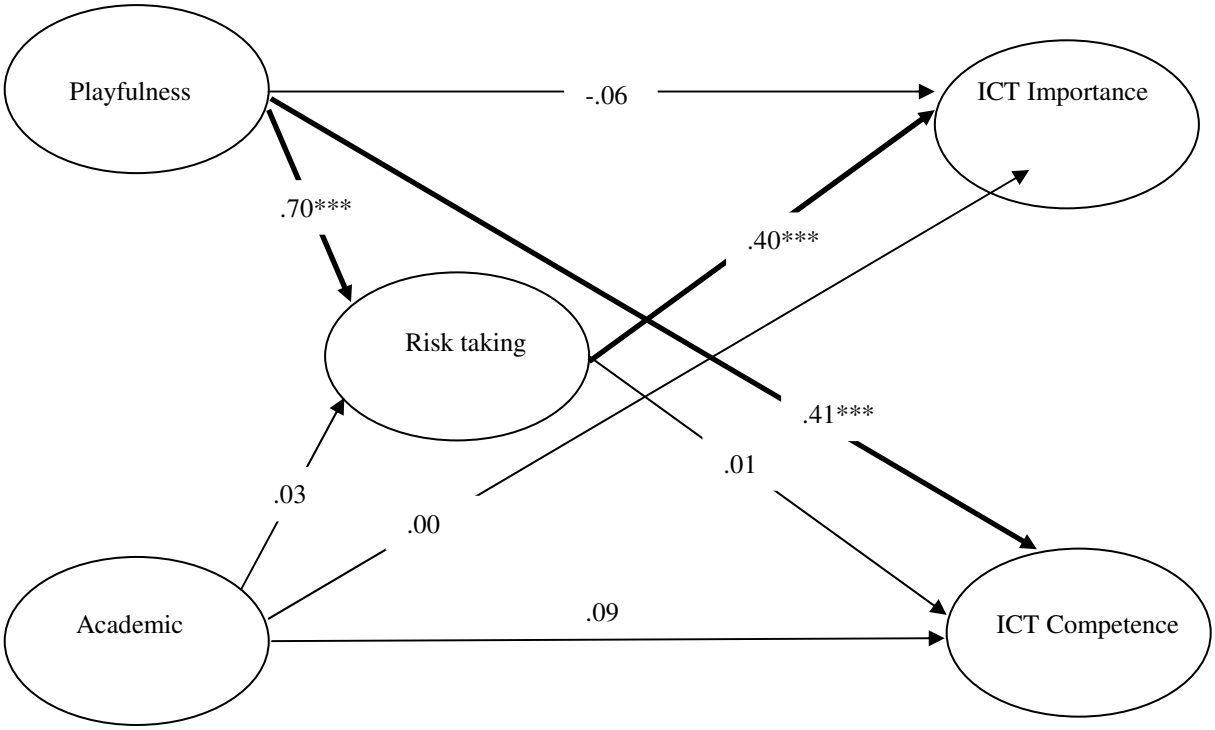

Figure 5: Model 5, Risk Taking as a Mediator of Two Predictors to ICT Importance and ICT Competence
Note: *** $p < .001$

Summary of Findings

The path model using cognitive playfulness and academic self-concept as predictors to perceived importance and sense of competence in ICT use with or without risk taking as a mediator revealed that cognitive playfulness correlated significantly with both perceived importance of ICT use and sense of ICT competence. Additionally, risk taking significantly mediated the effect of cognitive playfulness on perceived ICT importance, but the mediating effect was not observed in ICT competence. Therefore, the mediation analyses did not support risk taking as a mediator of the association between cognitive playfulness and perceived ICT competence. Of noting is that cognitive playfulness has a direct influence on ICT competence while its effect on ICT importance was indirect, through the mediating role of risk taking. On the contrary, academic self-concept had negligible relations with both ICT variables. These findings have supported hypotheses 1 to 5, but not hypothesis 6.

Discussion

The present study investigates the influence of Singapore student teachers' cognitive playfulness attribute and academic self-concept on their perceived importance of ICT use and sense of competence in applying ICT for classroom teaching, with their risk taking orientation as a mediating variable. The path analysis showed that cognitive playfulness was positively associated with both perceived importance of ICT use and sense of competence. Hence, our first two hypotheses were supported. This is consistent with the work of Tan and McWilliam (2008, 2009) about the predicting effects of cognitive playfulness on the valuing and use of ICT. It is possible that individuals who are cognitively curious and inquisitive tend to explore

new ways of doing things, and thus will value ICT use in teaching and gradually build up their competence in ICT use. This finding underscores the possibility of cognitive playfulness as an inner trait that can motivate teachers to engage with and embrace the enormous educational potentials of modern technology. On the other hand, academic self-concept was found to have had a negligible relation with the two ICT variables, which supports the third and fourth hypotheses of the study. This is probably because academic competence is attained through more traditional processes than through innovative ICT applications, and second, academic-specific competence perceptions are domain-specific and are unlikely to transfer to other domains such as ICT applications; hence, academic self-concept did not have any positive bearing on ICT variables. Therefore, our findings support self-concept studies regarding the domain-specific and nontransferable nature of academic self-concept. However, our study did not support Adeyemi's (2014) findings about the strong influence of self-concept on the acquisition of ICT competence. This is probably because Adeyemi (2014) examined the basic ICT competence while we investigated educational competence, specifically student teachers' competence in the application of ICT in teaching.

Furthermore, this study addresses the gap in the literature by examining the mediating effects of risk taking on the relationships between cognitive playfulness and ICT variables. The path analysis found that the effect of cognitive playfulness on perceived ICT importance was mediated significantly by risk taking orientation. This finding suggests that student teachers' risk taking attitude plays a pivotal role in explaining the influence of their cognitive playfulness attribute on the valuing of ICT in teaching. However, the role of risk taking as a mediator was not significant with regard to the effects of cognitive playfulness on a sense of competence. Therefore, cognitive playfulness directly predicted ICT competence while its influence on the valuing of ICT is indirect, through the mediating role of risk taking. To summarise, these findings contribute to research on ICT in education by emphasising the role of cognitive playfulness on the valuing of ICT use in teaching and competence in ICT application, as well as the mediating effect of risk taking on its relationship with perceived ICT importance in this sample.

Our findings suggest that it is vital to instill in student teachers a cognitively playful attitude. To prepare student teachers for teaching in this technology age, we need to raise their perception of the importance of ICT and sense of competence in it. But of greater importance is to understand the mindsets of teachers who are more likely to use ICT in the classroom and what we can do to develop teachers so as to optimise such applications. Our findings suggest that the encouragement and enhancement of student teachers' cognitive playfulness may be helpful in raising their perception of the importance of ICT and sense of competence in it, and may ultimately contribute to their acceptance and successful use of ICT in the classroom. The mediating effect of risk taking on the influence of cognitive playfulness on ICT importance points to the importance of cultivating a risk taking orientation in student teachers. Petrides' (2011a, b) belief-importance theory posits that individuals who see the value of a goal will be motivated to strive for the attainment of it. The implication for the current study is that individuals who value the importance of ICT in teaching will aspire to develop their competence in ICT, which in turn will contribute to the valuing of ICT implementation. Drent and Meelissen (2008) also suggest that if risk taking is encouraged, individuals with a playful mindset are more likely to adopt innovative use of ICT in teaching, which will contribute to enduring ICT application in education. Classroom teaching inevitably involves a certain extent of risk taking when teachers try new forms of practices, for example, integration of ICT in teaching. But what distinguishes great teachers from good teachers is their willingness and commitment to take risks (Brazeau, 2005). Therefore, it is essential for teacher education

programmes to inculcate in student teachers the importance and willingness to take risks in their daily teaching.

Implications

This study has implications for teacher education and future research. First, the practical implication from our research for teacher education is that the enhancement of cognitive playfulness should be recognised regarding ICT application for teaching. The findings about the predicting power of cognitive playfulness on perceived ICT importance and competence suggest that it is important to instill in student teachers a cognitively playful attitude, making them become aware of the importance of this inquisitive and explorative personality trait and encourage the development of it. Second, the importance of risk taking should not be neglected. Risk and uncertainty are integral to technology implementation in teaching. Our finding about the mediating role of risk taking in the predictive strength of cognitive playfulness on the valuing of ICT points to the importance of encouraging and cultivating a risk taking orientation in student teachers during teacher education. Therefore, results from this study can be used to inform teacher education in the direction of enhancing the risk taking attitude and cognitively playful attribute of student teachers and directing them towards acceptance and enhancement of ICT use in future teaching practices.

Furthermore, this study can also inform future studies on researching associations between ICT variables and personal attributes such as cognitive playfulness and risk taking. First, the models tested in this study have reflected the role of student teachers' cognitively playful attribute in their valuing of ICT and sense of ICT competence, so future research on the use of ICT in the classroom by in-service teachers can also look into this relationship to see whether it can be generalised across different samples. Future studies can also explore the predicting influence of cognitive playfulness on other ICT factors, for example, usefulness and ease of use, as these two variables have been supported by some studies as also affecting teachers' acceptance and implementation of ICT (e.g., Collis, Oscar & Pals, 2001; Lai & Chen, 2011). Second, research examining risk taking as a mediator of cognitive playfulness and ICT variables is very limited, so further studies in other contexts can explore this with various samples to reconfirm our findings and to enrich the literature on ICT in education. Another implication for future research is that academic self-concept may not predict ICT importance and competence, or may need to be looked into more narrowly to investigate its effect on teachers' valuing of ICT and competence in using it.

Limitations

This study is not without limitations. First, we only examined the mediating role of risk taking in the effect of cognitive playfulness on ICT variables. It is possible that the valuing of ICT may also play a mediating role in the positive association between cognitive playfulness and competence in ICT use, which can be explored in future research. Second, we looked at the broad construct of academic self-concept rather than self-concept more narrowly defined, for example, self-concept in a specific area of the ICT domain. This may explain the absence of the influence of academic self-concept on perceived importance of ICT and competence in using ICT for teaching. Third, we looked at ICT in general rather than specific aspects of ICT, for example, the use of digital learning materials (e.g., Kreijns, Van Acker, Vermeulen, & Van Buuren, 2013), e-learning (e.g., Mahdizadeh, Biemans, & Mulder, 2008)

or e-portfolio for teaching. There may be varying degrees of power in the predicting role of cognitive playfulness and the mediating effect of risk taking on different dimensions of ICT application. In addition, this study has the limitation of using indirect measurement, as the data were collected via an online survey and were self-reported. Student teachers' actual ICT competence may differ from their self-reported competence; therefore, findings from this study should be interpreted with caution. Future studies can triangulate the findings with the use of interview data to clarify the relationships among cognitive playfulness, risk taking and ICT variables. Notwithstanding these limitations, the current study contributes to the discussion on the enhancement of student teachers' ICT competence by demonstrating the influence of cognitive playfulness on ICT importance and competence, and the pivotal role of risk taking in meditating such effects.

Conclusion

This study examined the predicting strength of cognitive playfulness and academic self-concept in student teachers on their perceptions about the importance of ICT and sense of competence in applying ICT for classroom use. We also investigated the mediating effect of risk taking in the predicting relationships. Results showed that cognitive playfulness significantly predicted both perceived importance and sense of competence, while academic self-concept did not have any bearing on either of the two ICT variables. It was also found that student teachers' risk taking orientation was a determinant in mediating the relationship between cognitive playfulness and perceived ICT importance. Our findings have implications for teacher education and further research on ICT.

References

Adeyemi, B. A. (2014). Self concept and motivation variables as correlates of acquisition of ICT competence among social studies students of Obafemi Awolowo University, Ile-Ife, Nigeria. *World Journal of Education*, *4*(2), 76-82. http://dx.doi.org/10.5430/wje.v4n2p76

Albirini, A. (2006). Teachers' attitudes toward information and communication technologies: The case of Syrian EFL teachers. *Computers & Education*, *47*, 373-398. http://dx.doi.org/10.1016/j.compedu.2004.10.013

Arens, A. K., Yeung, A. S., Craven, R. G., & Hasselhorn, M. (2011). The twofold multidimensionality of academic self-concept: Domain specificity and separation between competence and affect components. *Journal of Educational Psychology*, *103*, 970-981. http://dx.doi.org/10.1037/a0025047

Australian Institute for Teaching and School Leadership [AITSL]. (2011). *Australian Professional Standards for Teachers*. Retrieved from http://www.aitsl.edu.au/australian-professional-standards-for-teachers/standards/list

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational psychologist, 28*, 117-148. http://dx.doi.org/10.1207/s15326985ep2802_3

Barnett, L. A. (2007). The nature of playfulness in young adults. *Personality and Individual Differences, 43*, 949-958. http://dx.doi.org/10.1016/j.paid.2007.02.018

Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, Science and Technology Education*, *5*, 235-245.

Bong, M., & Skaalvik, E. M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology Review, 15*, 1-40. http://dx.doi.org/10.1023/A:1021302408382

Brazeau, G. A. (2005). Risk taking: A distinguishing factor of good versus great teachers. *American Journal of Pharmaceutical Education, 69*, article 74, 541-542.

British Educational Communications and Technology Agency [Becta]. (2004). *A review of the research literature on barriers to the uptake of ICT by teachers*. Retrieved from http://dera.ioe.ac.uk/1603/1/becta_2004_barrierstouptake_litrev.pdf

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York, NY: Guilford.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp.136-162). Newbury Park, CA: Sage.

Byrne, B. M. (2010). *Structural equation modelling with AMOS: Basic concepts, applications, and programming* (2nd Ed.). New York, NY: Routledge.

Collis, B., Oscar, P., & Pals, N. (2001). A model for predicting the educational use of information and communication technologies. *Instructional Science, 29*, 95-125. http://dx.doi.org/10.1023/A:1003937401428

Davidson, C. N., & Goldberg, D. T. (2009). *The future of learning institutions in a digital age*. Massachusetts: Massachusetts Institute of Technology.

Davis, N. (2003). Technology in teacher education in the USA: what makes for sustainable good practice?. *Technology, Pedagogy and Education*, *12*, 59-84. http://dx.doi.org/10.1080/14759390300200146

Department of Education, USA. (2010). *The national education technology plan for 2010*. Retrieved from http://www.ed.gov/sites/default/files/netp2010.pdf

Dreger, A. (2011). Taking risks in the classoom: A seminar to college teachers in Michigan State University. *MSU Teaching Thoughts*. Retrieved from https://www.msu.edu/~taprog/thoughts/tt2.doc

Drent, M., & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively*? Computers & Education*, *51*, 187-199. http://dx.doi.org/10.1016/j.compedu.2007.05.001

Dunn, L. L. S. (2004a). *Cognitive playfulness, innovativeness, and belief of essentialness: Characteristics of educators who have the ability to make enduring changes in the integration of technology into the classroom environment* (Doctoral dissertation, University of North Texas, the United States of America). Retrieved from http://digital.library.unt.edu/ark:/67531/metadc4620/m2/1/high_res_d/dissertation.pdf

Dunn, L. (2004b). Cognitive playfulness and other characteristics of educators who make enduring changes. In L. Cantoni & C. McLoughlin (Eds.), *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2004* (pp. 3553-3560). Chesapeake, VA: AACE. Retrieved from http://www.editlib.org/p/12027

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology, Research and Development, 53*(4), 25-39. http://dx.doi.org/10.1007/BF02504683

Glynn, M. A., & Webster, J. (1992). The adult playfulness scale: An intial assessment. *Psychological Reports, 71*, 83-103. http://dx.doi.org/10.2466/pr0.1992.71.1.83

Howard, S. (2009). *Teacher change: Individual and cultural risk perceptions in the context of ICT integration* (Doctoral dissertation, University of Sydney, Australia). Retrieved from http://ses.library.usyd.edu.au/bitstream/2123/5340/1/sk-howard-2009-thesis.pdf

Howard, S. K. (2011). Affect and acceptability: Exploring teachers' technology-related risk perceptions. *Educational Media International*, *48*, 261-272. http://dx.doi.org/10.1080/09523987.2011.632275

Korea Education & Research Information Service. (2013). *2013 White Paper on ICT in Education Korea*. Retrieved from http://english.keris.or.kr/whitepaper/WhitePaper_eng_2013.pdf

Kreijns, K., Van Acker, F., Vermeulen, M., & Van Buuren, H. (2013).What stimulates teachers to integrate ICT in their pedagogical practices? The use of digital learning materials in education. *Computers in Human Behavior*, *29*, 217-225. http://dx.doi.org/10.1016/j.chb.2012.08.008

Lai, H.-M., & Chen, C.-P. (2011). Factors influencing secondary school teachers' adoption of teaching blogs. *Computers & Education*, *56*, 948-960. http://dx.doi.org/10.1016/j.chb.2012.08.008

Lee, M., & Winzenried, A. (2009). *The use of instructional technology in schools: Lessons to be learned*. Victoria: ACER Press.

Liu, S.-H. (2011). Factors related to pedagogical beliefs of teachers and technology integration. *Computers & Education*, *56*, 1012-1022. http://dx.doi.org/10.1016/j.compedu.2010.12.001

Llewellyn, D. J., & Sanchez, X. (2008). Individual differences and risk taking in rock climbing. *Psychology of Sport and Exercise*, *9*, 413-426. http://dx.doi.org/10.1016/j.psychsport.2007.07.003

Mahdizadeh, H., Biemans, H., & Mulder, M. (2008). Determining factors of the use of e-learning environments by university teachers. *Computers & Education*, *51*, 142-154. http://dx.doi.org/10.1016/j.compedu.2007.04.004

Marsh, H.W. (1992). *Self description questionnaire (SDQ) II*. Australia: University of Western Sydney.

Marsh, H. W., & Martin, A. J. (2011). Academic self-concept and academic achievement: Relations and causal ordering. *British Journal of Educational Psychology*, *81*, 59-77. http://dx.doi.org/10.1348/000709910X503501

Ministry Of Education (MOE), Singapore. (2008). *Third masterplan for ICT in education (2009-2014)*. Retrieved from http://www.moe.gov.sg/media/press/2008/08/moe-launches-third-masterplan.php

Ministry Of Education (MOE), New Zealand. (2011). *ICT in schools*. Retrieved from http://www.minedu.govt.nz/NZEducation/EducationPolicies/Schools/Initiatives/ICTInSchools.aspx

Miranda, H. P., & Russell, M. (2012). Understanding factors associated with teacher-directed student use of technology in elementary classrooms: A structural equation modeling approach. *British Journal of Educational Technology*, *43*, 652-666. http://dx.doi.org/10.1111/j.1467-8535.2011.01228.x

Moon, J. W., & Kim, Y. G. (2001). Extending the TAM for the World-Wide-Web context. *Information and Management*, *38*, 217-230. http://dx.doi.org/10.1016/S0378-7206(00)00061-6

Moran, W., Vozzo, L., Reid, J-A., Pietsch, M., & Hatton, C. (2013). How can technology make this work? Preservice teachers, off-campus learning and digital portfolios. *Australian Journal of Teacher Education*, *38*(5), 116-130, http://dx.doi.org/10.14221/ajte.2013v38n5.9

Offir, B., & Katz, Y. (1990). Computer oriented attitudes as a function of risk□taking among Israeli elementary school teachers. *Journal of Computer Assisted Learning, 6*, 168-173. http://dx.doi.org/10.1111/j.1365-2729.1990.tb00364.x

Padilla-Meléndez, A., Aguila-Obra, A., & Garrido-Moreno, A. (2013). Perceived playfulness, gender differences and technology acceptance model in a blended learning scenario. *Computers & Education*, *63*, 306-317. http://dx.doi.org/10.1016/j.compedu.2012.12.014

Pearson, J. (2003). Information and communications technologies and teacher education in Australia. *Technology, Pedagogy and Education*, *12*, 39-58. http://dx.doi.org/10.1080/14759390300200145

Peciuliauskiene, M., & Barkauskaite, P. (2007). Would-be teachers' competence in applying ICT: Exposition and preconditions for development. *Informatics in Education-An International Journal*, *6*, 397-410.

Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: Results from a worldwide educational assessment. *Computers & Education*, *37*,163-178. http://dx.doi.org/10.1016/S0360-1315(01)00045-8

Petko, D. (2012). Teachers' pedagogical beliefs and their use of digital media in classrooms: Sharpening the focus of the 'will, skill, tool' model and integrating teachers' constructivist orientations. *Computers & Education*, *58*,1351-1359. http://dx.doi.org/10.1016/j.compedu.2011.12.013

Petrides, K. V. (2011a). A general mechanism for linking personality traits to affect, motivation, and action. *New Ideas in Psychology*, *29*(2), 64-71. http://dx.doi.org/10.1016/j.newideapsych.2010.02.001

Petrides, K. V. (2011b). An application of belief-importance theory with reference to trait emotional intelligence, mood, and somatic complaints. *Scandinavian Journal of Psychology*, *52*, 161-167. http://dx.doi.org/10.1111/j.1467-9450.2010.00832.x

Proyer, R. T., & Jehle, N. (2013). The basic components of adult playfulness and their relation with personality: The hierarchical factor structure of seventeen instruments. *Personality and Individual Differences*, *55*, 811-816. http://dx.doi.org/10.1016/j.paid.2013.07.010

Rosenberg, M. (1979). *Conceiving the self*. New York, NY: Basic Books.

Sipilä, K. (2014). Educational use of information and communications technology: Teachers' perspective. *Technology, Pedagogy and Education*, *23*, 225-241. http://dx.doi.org/10.1080/1475939X.2013.813407

Tan, J. P.-L. (2009). *Digital kids, analogue students: A mixed methods study of students' engagement with a school-based Web 2.0 learning innovation* (Doctoral dissertation, Queensland University of Technology, Australia). Retrieved from http://eprints.qut.edu.au/30396/1/Jennifer_Tan_Thesis.pdf

Tan, J. P.-L. & McWilliam, E. (2008). Cognitive playfulness, creative capacity and generation 'C' learners. *Cultural Science*, *1*(2), 1-7. Retrieved from http://www.cultural-science.org/journal/index.php/culturalscience/article/view/13/51

Tan, J. P.-L. & McWilliam, E. (2009). From literacy to multiliteracies: Diverse learners and pedagogical practice. *Pedagogies : An International Journal*, *4*, 213-225. http://dx.doi.org/10.1080/15544800903076119

Teo, T., Chai, C. S., Hung, D., & Lee, C. B. (2008). Beliefs about teaching and uses of technology among student teachers. *Asia-Pacific Journal of Teacher Education*, *36*, 165-176. http://dx.doi.org/10.1080/13598660801971641

Webster, J., & Martocchio, J.J. (1992). Microcomputer playfulness: Development of a measure with workplace implications. *MIS Quarterly*, *16*, 201-226. http://dx.doi.org/10.2307/249576

Wigfeild, A., & Karpathian, M. (1991). Who am I and what can I do? Children's self-concepts and motivation in achievement solutions. *Educational Psychologist, 26*, 233-261. http://dx.doi.org/10.1080/00461520.1991.9653134

Yeung, A. S., Kuppan, L., Foong, S. K., Wong, D. J. S., Kadir, M. S., Lee, P. C. K., Yau, C. M. (2010). Domain-specificity of self-concept and parent expectation influences on short-term and long-term learning of physics. *New Horizons in Education*, *58*(2), 54-72.

Yeung, A. S., Taylor, P. G., Hui, C., Lam-Chiang, A. C., & Low, E.-L. (2012). Mandatory use of technology in teaching: Who cares and so what? *British Journal of Educational Technology*, *43*, 859-870. http://dx.doi.org/10.1111/j.1467-8535.2011.01253.x

Yeung, A. S., Tay, E., Hui, C., Lin, J. H., & Low, E.-L. (2014). Student teachers' motivation in using digital technology. *Australian Journal of Teacher Education*, *39*(3), 134-153, http://dx.doi.org/10.14221/ajte.2014v39n3.1

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