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Singaporean and Taiwanese pre-service teachers' beliefs and their attitude towards ICT: A comparative study

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Abstract: Teachers' epistemological and pedagogical beliefs and their attitude about ICT are identified as the second-order barrier for the integration of ICT into classrooms. In this paper, we report the findings obtained from our recent survey and conducted among Singaporean and Taiwanese pre-service teachers (N=108). The results indicate that the teachers' epistemological beliefs were generally relativistic. They were also inclined to believe rather strongly the constructivist notion of teaching. The profile we obtained in this study seems to suggest that pre-service teachers from Singapore and Taiwan are holding beliefs that are congruent to the education reform efforts. However, the teachers' attitude about ICT use does not seem to relate to their epistemological and pedagogical beliefs. The findings suggest that further effort needs to be taken in order to foster more productive use of ICT to support constructivism-oriented teaching. These results need to be verified with further study.

Keywords: Epistemological beliefs, pedagogical beliefs, attitudes toward ICT

1. Introduction

The emergence of the knowledge-based economy has resulted in educational reforms in many developed and developing countries across the world. In essence, these reforms aim to develop active learners to work collaboratively with others to construct knowledge. Pedagogically, they demand a teaching practice that is learner-centred and constructivist-oriented [1]. The role of information technology (ICT) in this context of teaching and learning is to function as a cognitive tool that enhances students' thinking. Although the general provision of ICT resources are getting better, changes in teaching practices are less forth coming. Hu and colleagues [2] survey indicates that although teachers are already using ICT for routine work, they do not engage learners to co-construct knowledge constructively with ICT. Ertmer [3] reported a similar phenomenon in America and attributed this to teachers' pedagogical beliefs as a deeply rooted barrier. The aim of this study is to explore pre-service teachers' epistemological and pedagogical beliefs, and the relationships between these beliefs and pre-service teachers' attitude towards ICT use.

2. Literature Review

In this study, we study beliefs about knowledge and about knowing, beliefs about teaching, and beliefs about learning, in relation to teachers' attitude towards the use of computer. These constructs are reviewed next with a focus towards studies on pre-service teachers.

Research on beliefs about knowledge and about knowing or personal epistemology by educational researchers began in the late 60s [4]. Generally, it was reported that college students progressed from believing that knowledge is certain and is passed down from authority to a more relativistic stance that emphasized knowledge to be uncertain and constructed by individuals based on warrants. This general pattern of development was also observed by later researchers who also rely on interview as the method for data collection [5]. Sutton, Cafarelli, Lund, Schurdell, and Bichsel [6] reported the epistemological development of 32 student teachers near the end of their teacher education. More than half of them were assessed to be at the higher end of epistemological development. White [7] and Brownlee's [8] study on student teachers further strengthened Sutton et al.'s findings. In summary, these studies indicate that student teachers' epistemological beliefs are distributed across the developmental stages with more holding relativistic beliefs. Pre-service teachers holding on to absolutists/dualistic epistemological beliefs are rare.

Schommer [9] proposed a model of five more or less independent dimensions of epistemological beliefs, namely the "the structure, certainty, and source of knowledge, and the control and speed of knowledge acquisition". The last two dimensions reflect beliefs about learning. To measure these dimensions, Schommer developed the Epistemological Beliefs Questionnaire (EBQ). On the issue of students' learning, myriad of studies have documented that epistemological beliefs are associated with learning strategies, academic achievements, interpretation of text and conceptual change [5]. In general, sophisticated epistemological beliefs are positively associated with learning and higher order thinking. However, studies that explored the relationships between teachers' epistemological beliefs, pedagogical beliefs and teaching practice are generally lacking [10].

The relationship between teachers' epistemological beliefs and their beliefs about teaching and learning is complex. Beliefs about what teaching and learning can be broadly classified under the knowledge transmission category or the knowledge construction category [11]. The former is characterized as teacher-centred, content-oriented didactic teaching practice that emphasizes on passive reception of knowledge by students. As for the later, it is usually characterized as student-centred, learning-oriented constructivist teaching that encourages students to actively make sense of their experiences situated within the social cultural contexts. Teachers with more sophisticated epistemological beliefs seem to be more engaged than their peers, with regards to personal learning [12]. However, the relationship between pre-service teachers' epistemological beliefs and their pedagogical beliefs may be incongruent at times. Review of studies focusing on pre-service teachers' beliefs indicates that these teachers are likely to perceived teaching as an unproblematic process of knowledge transmission [13]. Chan and Elliot [10] surveyed 385 Hong Kong pre-service teachers and reported that most of the teachers were relativistic in their epidemiological outlooks. However, they were not inclined towards constructivist teaching. The pre-service teachers may view epistemological beliefs and their pedagogical beliefs as two independent belief systems. Study of American student teachers, however, indicate that teachers who see knowledge as evolving and learning as a process of constructing understanding are also more receptive towards the idea of teaching as facilitating knowledge and beliefs revision among students[14]. Based on these reviews, it seems clear that more cross-cultural studies are required [15].

Research that studied the relationships between teachers' epistemological beliefs and their perception of ICT generally suggests that teachers who hold constructivist belief are more likely to engage their students to use computers and the Internet [16]. However, epistemological belief is just one factor among many other factors that influence teachers' views of ICT. Zhao and his colleagues' [17] analyses indicate that successful integration of ICT depends on the interrelationship between the school contexts, the teachers driving the integration project and the technology involved. Specifically, when the technology chosen

for implementation is compatible with the teachers' pedagogical beliefs, there is a higher chance for integration to occur. Fox and Henri [18] investigation reveals that emphases towards producing good examination results will inhibit teachers' use of ICT.

In summary, the literature review highlighted the complex relationships between teachers' epistemological beliefs, pedagogical beliefs and their perception of ICT. In light of the review above, this study investigates the following research questions:

1. How do the participants perceive the measured beliefs?
2. Are there significant differences between Singaporean and Taiwanese pre-service teachers in terms of the measured beliefs?
3. How are pre-service teachers' epistemological and pedagogical beliefs related to their attitude towards use of ICT?

3. Methods

The participants for this study were pre-service teachers in teacher preparation courses. Table 1 shows the background of the participants.

Table 1: Background information of the participants

Nation	Age		Qualification		Gender	
	Mean	SD	Undergraduate	Postgraduate	Male	Female
Taiwan(TW, N=49)	24.0	2.47	23	26	24	25
Singapore(SG, N=50)	26.8	2.99	0	59	28	31
Overall	25.5	3.08	23	85	52	56

The questionnaire contained four parts. The first part of the questionnaire solicits demographic data that could affect the teachers' beliefs. The second part of the questionnaire was an adapted version of Schommer's EBQ used in Chan and Elliott's [10] study. This modified version covers four dimensions: Certainty of Knowledge (CK) and the Authority/ Expert knowledge (AEK) as core dimensions of epistemological beliefs; Innate/Fixed Ability (IA) and the Learning Effort/Process (LEP) as core dimensions related to beliefs about learning. The third part of the survey measure teachers' attitude towards the use of computers [19]. The fourth part of the survey examines the participants' conceptions about teaching and learning (traditional/ constructivist), developed by Chan and Elliot [14]. All items employed a 5-point Likert scale (5 = strongly agree, 1 = strongly disagree). A high score indicates favorable respond towards the measured construct. Alpha reliabilities of the measured dimensions range from .67 to .90. The overall reliability of the measured constructs is satisfactory [10, 12, 20].

4. Results and Discussion

Table 2 below provides the statistical information required to answer the research questions.

Table 2: Mean, SD and t-test values for the measured constructs

Dimensions measured	TW/SG	N	Mean	SD	t-test
Certainty of Knowledge (CK)	TW	49	2.70	.77	-.356
	SG	59	2.75	.71	
Authority/ Expert Knowledge (AEK)	TW	49	2.36	.60	1.501
	SG	59	2.51	.48	
Innate Ability (IA)	TW	49	2.68	.59	1.090
	SG	59	2.56	.55	
Learning Effort/ Process (LEP)	TW	49	3.94	.43	1.425
	SG	59	3.82	.45	

Constructivist teaching (CT)	TW	49	4.41	.38	3.119**
	SG	59	4.15	.48	
Traditional teaching (TT)	TW	49	2.85	.42	2.149*
	SG	59	2.67	.44	
Computer attitude (ATU)	TW	49	3.54	.70	-.721
	SG	59	3.64	.73	

*.05, **.01

The results indicate that both Singaporean and Taiwanese pre-service teachers are not inclined to believe in authority and expert as source of knowledge. They are also not inclined to view knowledge as certain and unchanging. The epistemological beliefs that these teachers hold are generally consistent with what we have reviewed earlier. In particular, surveys of Hong Kong and Singapore pre-service teachers' epistemological beliefs using the same instrument documented comparable epistemological profile [10, 20]. Eighty five of the participants are degree holders and the remaining 23 undergraduate are in their third years. The epistemological profile we obtained is therefore not surprising. These teachers have the basic epistemological outlooks that are consistent with constructivist teaching. Furthermore, the teachers have also expressed a lesser inclination towards the beliefs of innate ability and they express a stronger inclination towards learning effort and processes. These profiles should also support the constructivist-oriented reforms.

Both Singapore and Taiwan pre-service teachers are strongly inclined towards constructivist teaching and less inclined towards traditional teaching. This should be a logical stance given their epistemological profile. However, this may not always be the case as Chan and Elliot's [10] study testified. Based on the reported mean score, it seems that Hong Kong pre-service teachers are neither inclined towards constructivist (M=1.86) nor traditional teaching (M=2.63). Statistical differences are detected between the Taiwanese and Singaporean teachers' pedagogical beliefs. While the Taiwanese teachers express stronger inclination towards constructivist teaching, they are also expressing stronger inclination towards traditional teaching. One explanation is that the pre-service teachers may view epistemological beliefs and their pedagogical beliefs as two independent belief systems. Survey of Hong Kong pre-service teachers indicates that while the participants held relativistic epistemology, they were not inclined towards constructivist teaching [10].

In terms of the attitude toward the use of computers, both Singaporean and Taiwanese teachers express moderately positive attitude. The absolute mean score is not high, indicating that there may be some barriers that they are aware of. This could be an important area for further research. The result for the Singaporean teachers is comparable to another recent research [19]. To understand the relationships of the measured constructs, we ran additional correlation tests. It was found that there were no significant correlations between Attitude towards Computer Use (ATU) and all types of teachers' epistemological beliefs (Pearson's correlation efficiencies ranging from -.12 to .26) expect for a significant negative correlation between ATU and AEK for the Singaporean group. It indicates a negative attitude towards use of ICT corresponding with the epistemological beliefs in expert knowledge. In addition, it was also found that there were no significant correlations between Attitude towards Computer Use (ATU) and Constructive Teaching (CT) ($r = .11$, $p > .05$, for the Taiwan group; and $r = .23$, $p > .05$, for the Singapore group). The findings suggest that additional effort to help both Taiwanese and Singaporean teachers learn to use ICT to support more constructive teaching is necessary. Furthermore, in terms of relationships between Attitude towards Computer Use (ATU) and Traditional Teaching, a significant correlation ($r = .30$, $p < .05$) is found for the Taiwan group, but not found for the Singapore group ($r = .01$, $p > .05$). The findings suggest that Taiwanese pre-service teachers are more likely than Singapore pre-service teachers to embrace an attitude towards use of

ICT in support of traditional teaching. As mentioned in the literature review, how epistemological beliefs and pedagogical beliefs are related to the teachers' attitude towards computers is a less researched area; therefore, these results need to be verified with further study.

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