Preservice Teachers' Epistemic Beliefs and their Online Interactions in a Knowledge Building

Community

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Abstract: *This is a case study that investigates how teachers' epistemic beliefs are related to their online interactions. The study investigated 24 preservice teachers' epistemic beliefs through a quantitative survey and examined how teachers' beliefs were correlated with their online interactions. The knowledge building community (KBC) was employed as the pedagogical model to facilitate the co-construction of knowledge among the teachers. The results indicate that the teachers' epistemic beliefs are related to their online interactions. Further studies in these areas are suggested.*

Keywords: Epistemic beliefs, knowledge-building, online interaction

Introduction

Research on the use of technologies in education has focused on issues like teacher's confidence, ICT competencies and resistance to change (BECTA, 2004). A critical factor that has been neglected is that of teacher's epistemic beliefs, which could influence how teachers teach and learn, and this in turn will have an impact, directly or indirectly, on the students they teach (Chan, 2010; Schraw & Olafson, 2002; Woolfolk-Hoy, Davis, & Pape, 2006;). As technology advances, it is necessary for educational researchers to study different epistemological stances demanded by the technology for productive learner's engagement (Mason & Boldrin, 2008). This study contributes to current literature by studying the epistemic beliefs of teachers and how these beliefs influence their online interactions in a Computer-Supported Collaborative Learning (CSCL) environment.

Literature Review

Epistemic beliefs are beliefs that individuals hold with regard to the nature of knowledge, the source of knowledge and the justification of knowledge (Hofer & Pintrich, 1997). Perry's (1970) research identified several developmental stages of personal epistemic beliefs, which were supported by later research (Belenky, Clinchy, Goldberger, & Tarule, 1986; King & Kitchener, 1994). We summarized these stages in Table 1.

Table 1. Developmental Stages of Epistemological Beliefs

Epistemological developmental stages	View on knowledge	Source of knowledge
Dualist/ Objectivist	Knowledge as certain	Experts and authorities
Multiplist	Most knowledge as certain	Experts and authorities
Relativistic	Most knowledge as evolving	Reliance on self
Committed relativist/ Evaluativist	Knowledge as evolving and contextual	Self as source of knowledge through some forms of justification

The above mentioned studies of the developmental stages of personal epistemology rely mainly on qualitative interview as the method of data collection. Schommer (1990) proposed that epistemic beliefs comprise various dimensions that can develop more or less independently. These dimensions are "the structure, certainty, and source of knowledge, and the control and speed of knowledge acquisition" (Schommer, 1990, p. 498). She created the Epistemological Belief

Questionnaire to measure personal epistemology and her pioneering work inspired many subsequent variations of questionnaires. Studies employing questionnaires to investigate the relationships between students' epistemological beliefs and their learning performances indicate that sophisticated epistemic beliefs are positively correlated to better performances in reading comprehension, conceptual learning, and dealing with controversy (Mason & Boscolo, 2004; Qian & Alvermann, 2000; Schommer, 1990). However, Schommer's (1990) questionnaire has suffered from problems associated with the replicability of the factor structure. In the Asia, Chan and Elliott's (2004) instrument for measuring teachers' epistemic and pedagogical beliefs is emerging to be an instrument that can measure teachers' epistemic beliefs with fairly stable factors accompanied by acceptable reliability coefficients (Wong & Chai, 2010; Hofer, 2010).

Studies that investigate preservice teachers' epistemic beliefs indicate that most of them are more inclined towards relativistic epistemic beliefs with fewer participants in the dualist/multiplist or evaluativist stage (Brownlee, 2004; Chai, Teo & Lee, 2010; Cheng, Chan, Tang, Cheng, 2009). As beliefs tend to affect learning behaviors (Chan, 2010), an investigation on teachers' beliefs and how it affects their professional development is an essential area to explore.

The Knowledge Building Community (KBC) proposed by Scardamalia and Bereiter (2006) was adapted in this study in order to facilitate teachers' professional development for both the preservice and inservice teachers in implementing ICT enriched constructivist pedagogy. This model demands users to function as knowledge constructors in collaboration with other participants. Key principles that underlie the KBC include working with authentic problems and treating all ideas as tentative and improvable. Participants are required to assume epistemic agency in identifying the problems and refine initial ideas through collective cognitive responsibility and constructive use of authoritative resources. The KBC is social constructivist in orientation and its focus is on collaborative knowledge creation instead of knowledge acquisition, hence, different demands are

placed on the participants' epistemological stance (Brett, 2004). Previous study in employing the KBC for teachers' development indicates that it is conducive in promoting teachers' beliefs that are congruent with constructivist-oriented teaching (Chai & Merry, 2006). But how students and teachers' epistemic beliefs would affect their functioning in a KBC has not been studied in Asia.

To contribute to the research gaps identified in the literature review, the following research questions were generated to help focus the study: (1) What is the relationship between the teachers' epistemic beliefs and their pattern of participation in the online discourse? and (2) How is the teachers' epistemic beliefs related to the depth of interaction?

Method

Participants and context of study

Twenty four preservice teachers attending a six week (12 sessions) course entitled "Computer-supported Collaborative Learning" were recruited for this study. The course was designed to function with the principles of KBC in mind. The main activities involve teachers' identification of authentic problems that they have faced in designing ICT integrated lessons and the co-construction of lesson ideas for implementation. Teachers helped to improve each other's lesson ideas by sharing relevant resources and teaching strategies. The other aspect of the course was the online discussion about key ideas revolving around ICT integration and the use of ICT as a cognitive tool (Jonassen, 2000). Knowledge Forum (KF) was employed as the online platform for the teachers to discuss and improve their ideas. The first author was the facilitator for all the above-mentioned courses.

Data Collection and Analysis

An instrument adapted from Chan and Elliott (2004) was administered at the beginning of the one year preservice teacher education programme. The instrument measures six dimensions of teacher's beliefs: authority/expert knowledge; certainty of knowledge; learning effort and processes;

innate ability; traditional beliefs of teaching and constructivist belief of teaching. The first four dimensions pertaining to epistemic beliefs were adapted from Schommer's (1990) questionnaire. The last two dimensions were developed by Chan and Elliott (2004) to measure preservice teachers' pedagogical beliefs. All items are measured on five points Likert scale and high score indicates agreement to the dimension measured. The data was analyzed and the structural models of the preservice teachers' epistemic and pedagogical beliefs generated have been published (see Chai et al., 2010). The data of the 24 preservice teachers' was drawn from this larger set of data. The alpha coefficients, means, and standard deviations for each construct were computed for this smaller sample before we analyzed the correlations between the teachers' beliefs and their online interactions (see Table 3).

The teachers' online posts were also collected for content analysis. Computer log files were obtained through submission of the KF database to the Analytic Toolkit®, which generates data such as number of online notes written, number of words written, percentage of notes read etc. These data provide comprehensive and objective measurements for the study of the teachers' level of participation.

Gunawardena, Lowe and Anderson's (1997) Interaction Analysis Model (IAM) was adopted to assess the depth of the teachers' interaction. The IAM model was chosen for it is founded on social constructivist theories which are consistent with the KBC. In addition, it is also one of the more reliable and user-friendly models available (Marra, Moore & Klimczak, 2004). All posts were coded based on the model reported by Chai and Khine (2006) in an earlier study. Each post is a unit of analysis and only given a phase code. Inter-rater reliability for the coding within the same phase code was 0.75. Table 2 shows the main phases of IAM:

Table 2. The Five Phases of Interaction Analysis Model

Phase 1: Sharing/Comparing of Information
Phase 2: Discovering dissonance, gaps in understanding or areas for improvements among ideas or concepts
Phase 3: Negotiation of meaning/ co-construction of knowledge
Phase 4: Testing and modification of proposed synthesis or co-construction
Phase 5: Agreement statements/ application of newly-constructed knowledge

Based on the phase codes generated, an index labeled as Mean Interaction Depth (MID) was created. MID is a weighted mean to indicate the average level of interaction that the participant is engaged in. It is computed by summing all the phase codes and dividing it with the total number of online postings. For instance, a participant who had contributed three notes that were rated as phase 1, 2, and 3 respectively will have a MID scores of 2 derived from $((1+2+3)/3)$.

Results and Discussion

Epistemic beliefs and online interactions of the preservice teachers

Table 3 below reports the epistemic profile of the preservice teachers and table 4 present the data pertaining to their online interactions. In general, the epistemic profiles we obtained are in general agreement with our earlier research in terms of the means and standard deviations (Chai et al., 2010). The preservice teachers can be regarded as generally relativistic in their epistemic beliefs; they are inclined to believe in learning effort rather than innate ability and they also agree more with the constructivist teaching approach (see also Cheng et al., 2009).

Table 3: Preservice teachers' beliefs profile

Beliefs Subscales	Alpha	Mean	Std. Deviation
Learning Effort and Process (LEP)	.57	4.13	0.58
Innate ability (IA)	.77	3.10	0.88
Certainty of Knowledge (CK)	.71	3.02	0.75
Expert Knowledge (EK)	.67	3.44	0.68
Constructivist Teaching (CT)	.79	4.20	0.48
Traditional Teaching (TT)	.78	2.57	0.58

Table 4: Preservice teachers online interactions

Online Interactions Indices		
Mean Interaction Depth (MID)	1.64	0.41
Note Posted (NPost)	33.29	15.97
Note Read (NRead)	176.4	77.12
Word Written (WW)	5171.13	3045.46

Table 5 below tabulates the correlations among the various aspects of the preservice teachers' beliefs and their online interactions. The results indicate positive correlations between the participation indices such as notes posted, notes read, and words written. However, the depth of interaction is not related to the participation patterns. The pattern of correlations between the belief subscales is generally consistent with reported studies (Chai et al., 2010).

Table 5: Correlations between preservice teachers' beliefs and their online interactions

	1	2	3	4	5	6	7	8	9	10
1. MID	-									

	1	2	3	4	5	6	7	8	9
2. Npost	-.018	-							
3. NRead	.012	.449*	-						
4. WW	.147	.931**	.483*	-					
5. LEP	-.093	-.464*	-.101	-.405*	-				
6. IA	.000	-.087	.057	-.070	.157	-			
7. CK	.059	.558**	.109	.414*	-.516**	-.270	-		
8. CT	.004	-.153	.304	-.255	.228	-.081	-.084	-	
9. TT	-.136	-.126	.126	.037	-.056	.256	-.622**	-.124	-
10. EK	.273	.370	.169	.311	-.258	-.231	.416*	.080	-.584**	-

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

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

The pattern of correlations between the preservice epistemic beliefs and their online interactions is somewhat surprising. First, the depth of interactions was not significantly correlated to any other dimensions. Second, preservice teachers who are inclined to believe in certainty of knowledge are also more likely to write more posts and also write more words online. If we accept a lower standard of significance, preservice teachers who are more inclined towards relying on expert knowledge are also more likely to write more posts (.37, p=0.075). Third, the beliefs towards learning effort and processes, which is more akin to pursuing depth of understanding, is negatively correlated to the posting and writing of online notes. However, this result should be interpreted with care as the alpha value for this dimension is lower than what is required to establish meaningful correlation. It should also be noted that it is not uncommon to find low alpha values in survey of

epistemic beliefs. Fourth, the preservice teachers' beliefs about pedagogy are not associated with their online knowledge building. In summary, the online participation indices seem to be negatively associated with advanced epistemic beliefs. One possible explanation for this surprising result could be that the course is demanding in that only six weeks were allocated for the course and the preservice teachers had completed a number of major tasks (see earlier). This may put off the epistemologically more advanced preservice teachers and encourage task completion rather than mastery learning, which is of key importance for the KBC.

Conclusions

Teachers play critical roles in implementing new pedagogies with technologies. To date, much effort has been devoted to address issues like technological competency of teachers, time availability and logistic for the purpose of promoting ICT integration in classroom. As indicated by this case study, teachers' epistemic belief is a latent factor that may have a deep impact on the ways they learn about new pedagogies and subsequently the ways they implement these pedagogies (Ertmer, 2005). We would like to propose to advance this research in the following ways: (a) verify the results with larger sample of teachers, (b) employing other frameworks for the study of teachers' epistemic beliefs, (c) employing different schemes of assessing online interactions (see Park, 2009 on cognitive presence) and (d) investigate ways to change the teachers' epistemic beliefs when possible.

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