An exploratory study on pre-service teachers’ perceptions of the differences between knowledge and belief

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An Exploratory Study on Pre-Service Teachers’ Perceptions of the Differences Between Knowledge and Belief

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The main intention of this study was to understand how pre-service teachers perceived the relationships between knowledge and belief, their criteria, and the sources which contribute to the formation of the two constructs. In addition, we were motivated to explore whether these perceptions by pre-service teachers were significantly different across countries by comparing the findings collected from similar studies. The data in this study were collected from 153 pre-service teachers who completed a questionnaire. We reported important findings such as teachers’ perceptions of knowledge and belief and discussed the implications for teacher training program.

Keywords: knowledge; belief; epistemic belief; pre-service teachers

“I think that it is possible to have knowledge of something and not believe in it.”, “knowledge are usually facts whereas belief most of the time are myth.”, “I feel that knowledge is more dependent on facts while belief are more flexible.” How do pre-service teachers derive definitions for these two constructs? How do pre-service teachers determine what is belief and what is considered as knowledge? The following are actual excerpts obtained from this study. How do pre-service teachers derive definitions for these two constructs?

A current trend of research in learning and instruction moves towards the examination of the roles played by belief and knowledge in learning. Specifically, while some reported relationship between epistemological beliefs and students cognitive or strategic engagement (Qian & Alvermann, 1995), others like Alexander and Dorchy (1995) reported an association between education and epistemological beliefs. Murphy and Alexander (2004) conducted a study on persuasion and found that after reading persuasive texts, there were strong significant changes in readers’ belief and knowledge. Given the pivotal role of knowledge and belief in learning, there arose a need to specifically examine these two concepts as they are used interchangeably frequently (Boldrin & Mason, 2009). For instance, Alexander, Schallert, and Hare (1991) did not make a distinction between knowledge and belief while Siegel and Smith (2004) commented that teacher educators often viewed the terms knowledge and belief as synonymous thus employing them interchangeably in their writings. In recent years, numerous researchers have embarked on epistemic inquiry by examining the change of epistemic beliefs and its interactions with teaching and learning (Brownlee, 2001; Brownlee, Walker, Lennox, Exley, & Pearce, 2009; Moore 2002; Schommer-Aikinsmer-Aiken, 2004), and few empirical studies (see Boldrin & Mason, 2009; Maggioni, Riconscente, & Alexander, 2006; Sinatra, Reynolds, & Jacobson, 2003) have focused on understanding the distinction between knowledge and belief. Others have reported
on the influence of culture on knowledge and beliefs (Alexander, Murphy, Guan & Murphy, 1998; Maggioni et al., 2006) and the use of different epistemic criteria to differentiate these two constructs (Boldrin & Mason, 2009). Such findings provided the main motivations to the current study for two particular reasons. First, they were mostly conducted in the western countries. As such, relatively less is known about the relationship between knowledge and belief in Asia. Second, Alexander et al. (1998) conducted a cross cultural comparison using samples of teachers from USA and Singapore. It appeared that Singapore teachers were less inclined to perceive knowledge and belief as overlapping but more inclined to perceive belief as embedded within knowledge compared to their American counterparts. In terms of defining knowledge and belief, participants in both countries had used different sets of key words. For instance, Singapore teachers were less likely to use “faith” to define belief as compared to the American teachers (Alexander et al., 1998). Based on the differences, we were motivated to pursue a similar line of inquiry as to our knowledge, studies in this area involving pre-service teachers were rare and that the findings from the few empirical studies described earlier may not be broadly generalized outside of their countries due to cultural differences.

The Notions of Belief and Knowledge

The concepts of belief and knowledge have been explored and debated in educational psychological and cognitive psychology (Boldrin & Mason, 2009). According to Alexander, Schallert, and Hare (1991), there was no distinction between knowledge and belief. Researchers like Chan (2001) regarded belief as nonscientific views or preconceptions, and on the other hand, Richardson (2003) adopted a more philosophical distinction between knowledge and belief. Richardson reckoned that knowledge is a set of warranted propositions held by a community of experts whereas belief are propositions that are accepted as true by an individual holding the belief, but they do not need epistemic warrant. Smith and Siegel (2004) conducted an extensive literature and suggested that it might be useful to understand the usage of the terms knowledge and belief along nine continua: objective/subjective, rational/irrational, public/personal, verified/unverified, verifiable/unverifiable, certain/tentative, static/dynamic, not a basis for action/a basis for action, implying low commitment/implying high commitment. Despite the variations in defining knowledge and belief, knowledge was usually conceived as justified “true” belief, in the context of learning (Siegel, 1998), or a true reflection of reality, supported with objective, rational justifications (Southerland & Sinatra, 2003). In contrast, belief was mostly thought to be personal truths about the world (Smith, Siegel & McIlnerney, 1995) which are subjective, intertwined with affect and not based on evaluation of evidence (Southerland & Sinatra, 2003). Most conceptual change researchers would agree that belief can be understood as initial understandings that are not necessarily true or justified and thus not deemed to be considered as knowledge from an epistemic perspective (Murphy, Alexander, Greene, & Edwards, 2007) and that learners’ initial understandings (belief) is a process of conceptual change to align with more scientifically proven understandings (Mason, 2001; Vosniadou, 2007a, 2007b)

Importance of How Pre-Service Teachers’ Perceive Belief and Knowledge

Chinn and Brewer (2001) commented that teachers do not consider students’ distinction between knowledge and belief because they assume that students believe what they had learned. However, students may provide correct answers for assessment purposes but may not necessarily believe in what they have learned. By using hypothetical cases from their previous studies, Chinn and Brewer (2001) found that when a teacher viewed learning to be simply as knowledge change, they got only a partial view of the learning process, which may involve changes in both understood models and believed models. Chan (2010) echoed this view by stating that when pre-service teacher only believes in simple knowledge and surface learning and engages in rote learning, is expected to be at a superficial level of learning with little transformation. Failing to distinguish what students know and what they believe may lead to ineffective instructions and lead to superficial understanding of the complex nature of learning. Duit, Widodo and Wodzinski (2007) conducted a video-study of German and Swiss lower secondary physics lessons and found that teachers possessed limited views about their students’ learning. For instance, teachers were not aware of students’ interpretational frames and the role of students’ pre-instructional conceptions because they thought that giving good instructions was enough to guarantee successful learning. Given the importance of
understanding learners’ knowledge and belief, do our pre-service teachers know what constitutes belief and knowledge? If both are viewed as different constructs, what criteria are used by these pre-service teachers to help them differentiate? What sources do pre-service teachers rely on to form their knowledge and belief? By adopting the view that conceptual change is a process in which students’ belief are modified to align more closely with scientifically held understanding (Olivia, 2003; Chiu, Chow, & Lin, 2002), there is a need to understand how our pre-service teachers perceive knowledge and belief so that they can be prepared for future challenges as teachers.

Rationale of Current Study

To be effective teachers, pre-service teachers should be developed to cope with the complexity of classroom learning in terms of the instructions they would give to students. A prerequisite for effective instructions is that teachers should understand students’ views of knowledge and belief. In order to do this, teachers have to be aware of their own perceptions as this may affect the way the design and deliver lessons. From the literature, studies on understanding how pre-service teachers perceive the relationships between knowledge and belief were few. Those that have explored the relationships between knowledge and belief (e.g., Alexander & Dochy, 1995; Boldrin & Mason, 2009; Maggioni et al. 2006; Sinatra et al. 2003a) were mostly conducted in Western countries and none had used pre-service teachers as participants. Among the few, we have identified one that was conducted by Alexander et al. in 1998 which compared the differences in the perceptions of knowledge and belief between students and teachers from Singapore and USA.

This aim of this study was to understand how pre-service teachers perceive the relationships between knowledge and belief, their criteria, and the sources which contribute to the formation of the two constructs.

METHOD

Participants

Data were collected from 153 pre-service teachers who were enrolled in the one-year postgraduate diploma in education (PGDE) program at one of the teacher training institutions in Asia in July 2009. The age range of the participants was 25 to 30 and all of them possessed at least a Bachelor’s degree. Of the 153 participants, a large majority had at least six months of teaching experience in the schools. Sixty-three percent of the participants were female students and 33.3% (51) of them were trained to teach in primary schools while the rest 66.7% (102) were trained to teach in secondary schools. Students destined to teach in the primary schools were trained to teach English Language, Science, Mathematics, and Social Science. For the participants who would be teaching in the secondary schools, they were teaching the same subjects offered in the primary schools plus Accounting and Additional Mathematics.

These participants were invited to take part in the study when they were attending a core course in the use of technology in teaching and learning. No course credits or other forms of reward were given. During the data analysis, eight participants were excluded due to incomplete information in their questionnaire. Therefore, data from a total of 145 participants were used in this study.

Measure

The questionnaire we gave our participants consisted of two sections. The first section comprised the knowledge and belief instrument that was developed by Alexander and Dochy (1995) and later used by other researchers (Alexander et al. 1998; Boldrin & Mason, 2009; Maggioni et al. 2006). The items were designed to understand how pre-service teachers perceive the relationships between knowledge and belief. This instrument was chosen for its ability to yield valid and reliable scores in prior studies. There were five graphical representations on the relationships between knowledge and belief (see figure 1). Option A represented knowledge and belief as unrelated entities (separate). Option B suggested that knowledge is a subset of belief (knowledge subsumption) whereas option C suggested that beliefs are embedded within knowledge (belief subsumption). Option D showed that knowledge and belief are two inseparable entities and option E described knowledge and belief as partially overlapping entities. Option F provided a space for participants who would like to draw their own conceptions. We asked our participants to select one option and justify their reasoning by writing on the spaces provided below each of the representations. The nine categories of patterns of justifications emerged in Maggioni et al.’s (2006) study and were used as a guiding framework for content analysis.
Option A
This picture represents knowledge and beliefs as distinct and unrelated entities

Option B
This picture represents knowledge as a subset of beliefs

Option C
This picture represents beliefs as embeded within knowledge

Option D
This picture represents knowledge and beliefs as overlapping or inseparable

Option E
This picture represents beliefs and knowledge as partially overlapping entities that retain some unique qualities or dimensions

Option F (you are free to create your own. Write a sentence to explain your drawing)

Key: [ ] Belief [ ] Knowledge [ ] Belief and Knowledge

My choice is Option:

The reason for my choice is:

Figure 1: Graphical representations of the relationships between knowledge and belief

Approximately 30% of the responses' justifications were coded by two independent researchers. Both researchers had used the categories suggested by Maggioni et al. (2006) for coding the justifications. Two meetings were conducted after the coding to discuss the differences in coding and consensus was reached. An inter-rater reliability was computed and found to be high by conventional standard (Kappa = .837, p<.001) (e.g., Landis & Koch, 1977). Thereafter, the rest of the justifications were coded by one of the researchers.

In the second section of our instrument, we adopted and modified the instrument used in Boldrin and Mason (2009) to examine whether our pre-service teachers were able to distinguish between knowledge and belief, and the sources of these two constructs. Thirty statements were adopted from the original list in order to suit our context. Statements such as “The French Revolution began in 1789” were not included due to cultural differences. Also, being a culture of diverse ethnic and religious, statement such as “Human beings were created at the image of God” was considered to be religiously sensitive and not included. Of these 30 statements, 15 were regarded as knowledge items whereas the other 15 were considered as belief items, following the assignment by Boldrin and Mason (2009). To be consistent with our literature review, we referred to knowledge as factual and validated information and belief as non factual and non validated information. The Cronbach alpha reliability coefficient for the knowledge and belief items was .70 and .60, respectively. Although the reliability coefficients were moderately low, this was considered appropriate for an exploratory study (Nunnally, 1978).

Participants were asked to indicate the belief and knowledge statements according to their preference. Next, to assess the source that contributed to their formation of knowledge or belief, they were asked to rate the extent to which they had used the five categories of source (media, friends, family, personal experience/ideas and school) to form their knowledge and belief by using a seven-point scale (1= not at all, 7= very much). We excluded “politics” and “religion” as sources as these were considered sensitive in our context.

Procedure
Participants from various intact classes were invited to complete the questionnaire provided by the researchers. In other words, 100% of the invited
participants responded to the survey. All participants were briefed on the purpose and procedure of this study and their rights not to participate and to withdraw from the questionnaire completion at anytime during or after the data collection. On average, each participant took approximately 30 minutes to complete the questionnaire.

RESULTS

Understanding the relationship between knowledge and belief

Analyses were performed to examine how pre-service teachers understand the relationship between knowledge and belief. Significant differences were found among pre-service teachers' choices of the graphical representations \( \chi^2 (5) = 176.89, p < .001 \). Similar to what was reported in other similar studies (Alexander et al., 1998; Maggioni et al., 2006), we had more participants choosing option E (57%) as they considered knowledge and belief as overlapping entities. The responses for Option B (knowledge subsumption) comprised 14.5% while for Option C (belief subsumption) comprised 13.8%. The percentage of participants who chose Option A (separate) was 4% and those who chose Option F (chose to create their own drawing) was only 2%.

Patterns of justifications

To examine the patterns of justifications that corresponded to the choice of graphical representations provided by our pre-service teachers, we used the nine categories of justifications by Maggioni et al. (2006) as a framework for coding the responses. Except for 1 particular response that was not able to be coded under any of the categories as it suggested overlapping codes, all responses from the participants in this study were coded under the nine categories. Figure 2 showed the distribution for each category of code. Most pre-service teachers regarded knowledge and belief as two partially intertwined constructs (22.9%). A total of 17.7% of pre-service teachers' justifications fell under category 4 (priority of knowledge) whereas there were 15.1% of those who thought that belief are starting point (category 5-belief as starting points) in the learning process. Meanwhile, 9.9% of pre-service teachers' justifications were categorized under category 9 (complete separation), and 10.9% of the respondents' justifications were categorized as category 8 (knowledge as the only truth). A total of 7.2% of justifications were coded as category 3 (overall integration), and 6.7% were categorized as category 6 (belief as cognitive self-awareness). Category 1 (Complete coincidence) and category 2 (Encompassing knowledge) were two categories with lowest percentages.

Percent frequencies of written categories on Knowledge & Belief

![Figure 2: Frequencies (%) of written categories on knowledge and belief]
Patterns of justifications in relation to the choice of graphical representations

To understand the relationship between the choice of graphical representations and their corresponding justifications, we examined the frequency for each category of justifications and compared these against participants’ choices of graphical representations. The results showed a dominant category in each option. For instance, we found that, from the participants who selected Option A (separate), 50% of their justifications were classified under category 9 (complete separation). The rest either viewed belief as cognitive self awareness (category 6) or knowledge as the only truth (category 8). For those who selected Option C (Belief subsumption), 55% of their justifications were regarded as category 4 (priority of knowledge), the other justifications were placed under category 1 or 2 (encompassing knowledge). For those who have selected Option D, 45% of their justifications were classified under category 3 (overall integration), while the rest chose either category 4 or 5 (belief as starting point). Among those who chose Option E, 45.6% provided justifications that were classified under category 7 (partial coincidence), and 14.8%, under category 5. Interestingly, we found that for those who selected Option B, their justifications mainly fell under category 5 (22%), 6 (27%) and 8 (27%).

Distinguishing between knowledge and belief and their sources

To understand whether our pre-service teachers view belief and knowledge differently, a t-test was performed. The results showed significant differences found between knowledge and belief items ($t = -4.11, p < .001$).

To examine whether our pre-service teachers would identify different sources as the basis of their belief and knowledge, we performed correlation analyses on the various sources with knowledge and belief items. We found that none of the sources (media, school, family and personal experience) were significantly correlated with belief. On the other hand, we found significant correlation between school and knowledge and between school and friends (see Table 1). In addition, school was found to be a significant predictor of knowledge although it only accounted for approximately 10% of the variance ($F_{(1,143)} = .280, p < .001$).

DISCUSSION AND IMPLICATIONS

Towards better understanding on how pre-service teachers perceive the relationship between knowledge and belief

In order to relate and contribute to existing research, we checked our results against what were reported in the related studies we identified earlier on. The results showed that our sample has a higher percentage of pre-service teachers (14.5%) viewing knowledge as a subset of belief compared to other samples reported in the similar studies. In terms of the percentage of those perceiving belief as embedded within knowledge, our pre-service teachers (13.8%) appeared to be close to the American sample (14%) as reported in Maggioni et al.’s study (2006). In terms of regarding knowledge and belief as inseparable constructs, our sample had the same percentage as those American students reported in Alexander et al.’s study (1998). Similar to other studies, we had the largest number of participants who viewed knowledge and belief as overlapping entities. Such findings may suggest that while our pre-

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* p < .05; ** p < .001; *** The sum of knowledge scores was obtained by aggregating the scores from all item pertaining to Knowledge.
service teachers shared some commonalities with the western samples in terms of perceiving the relationship between knowledge and belief, they were also unique in some ways.

When we compared our participants with the Singapore teachers reported in Alexander et al.'s study (1998) which is the only similar study we have found, we learned that our teachers are now less inclined to perceive belief as embedded within knowledge and they are more likely to perceive knowledge and belief as overlapping entities (see Table 1). This shift in perception suggested that with an increasing percentage of pre-service teachers perceiving knowledge and belief as overlapping entities, teacher educators must modify to align more closely with scientifically-held understanding (Chiu et al., 2002; Olivia, 2003) then the results of this study may provide important insights into the way we design instructions for teacher preparatory programs. Specifically, it may suggest that our pre-service teachers are giving the same level of attention to belief as they did to knowledge a decade ago. They may be more aware of what they believe considering the interactions between their belief and knowledge.

Upon comparing our participants and those reported in other similar studies, we found that not only our pre-service teachers' perceptions on the relationship of knowledge and belief were different; their views were also different from a sample of Singaporean teachers who were studied a decade ago in Alexander et al.'s study (1998).

In the knowledge age during which learning becomes more complex and the education landscape fast evolving, it was important to pay attention to the role that culture plays (Maggioni et al., 2006) as well as the changes in curriculum and instructions in the shaping of epistemological belief. At the higher institution such as our teacher training institute where we train hundreds of pre-service teachers, it became imperative that we construct a thorough understanding on how these teachers perceive the relationship between knowledge and belief so that necessary intervention may help them to reconsider their epistemological belief. This perhaps would prepare our pre-service teachers for their future instructional planning that considers the needs of their future students.

The Emphasis on the Importance of Knowledge
It was no surprise that we found the largest percentage of justifications classified as category 7 (partial coincidence) as this regarded knowledge and belief to be partially intertwined, a finding similar to Maggioni et al. (2006). However, while 40% of Italian and 50% of American participants in Maggioni et al.'s study had their justifications classified under this category, those of our participants' had merely contributed 22.9% to this category. The other category with the next highest percentage of justifications was category 4 (priority of knowledge) with 17.7% of responses. There seemed to be an emphasis on the importance of knowledge as this was also reflected in category 8 (knowledge as the only truth-10.9%) and category 9 (complete separation, 9.9%). Interestingly, although we found a dominant category of justification for each option of graphical representation, we discovered that this was not so for those who perceived knowledge as a subset of belief. This group of participants had varied justifications (belief as starting point-22%, belief as cognitive self-awareness- 27%, knowledge as the only truth-27%). This was indeed not contradictory as in many of those justifications that were classified under belief as starting point, they also emphasized that once belief is proven, it is considered as knowledge. For instance, one participant said: "knowledge is actually a set of justifications that were classified under belief as overlapping entities, teacher educators must align with this shift in order to equip the pre-service teachers with the skills and knowledge to effectively guide their future students. If we understand learning as a process through which learners’ initial belief are

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learners develop a view of knowledge as constantly evolving, they become more open to changing their conceptions of scientific phenomena (Sinatra, Southerland, McConaughy, & Demastes, 2003) which may lead to conceptual change. Powerful learning activities such as model building (Jonassen, 2008) which requires learners to actively restructure their mental models and reconcile their naïve theories may help learners to become more aware of the interplay of their knowledge and belief.

The need to integrate knowledge and belief into instructions

When we examined the sources for knowledge, we discovered that school was the only significant predictor of knowledge and that none of the sources were predictor of belief. This implied that our participants had perceived formal context (school) as the reliable and dominant factor for the formation of their knowledge and that individuals who are inclined to see authority as the source of knowledge are also likely to see knowledge as certain (Chai, Teo & Lee, 2010). For this reason, participants may consider what they had acquired in the school or higher institution as true and unchangeable (Boldrin & Mason, 2009). This suggested that changing pre-service teachers' initial belief may be a daunting task even when the information that they received contradicts with their belief (see Chinn & Brewer, 1993, 1998). Perhaps teacher preparatory program should consider interventions such as Critical-Analytic Pedagogies (Chinn, Anderson, & Waggoner, 2001) which are pedagogical approaches that emphasize on interrogating or questioning the topics in search of the underlying arguments, hypotheses, or worldviews. Murphy (2007) described two cases of Critical-Analytic Pedagogies as persuasive pedagogy and collaborative reasoning. These pedagogies were effective in altering students' understanding as they require them to consider their position, to take a stand, and support their perspectives. For instance, in persuasive pedagogy, teachers and students critically and analytically evaluate their prior knowledge and beliefs through the use of reason, evidence and justification (see Buehl, Manning, Cox, & Fives, 2005; Edwards, Higley, Zeruth, & Murphy, 2005). Alexander, Fives, Buehl, and Mulhern (2002) have documented that when students were exposed to persuasive pedagogical practices, they made changes on their knowledge as well as their beliefs about that knowledge. Pedagogical approaches such as these gave learners the opportunities to critically and analytically evaluate their prior belief and knowledge.

CONCLUSIONS AND LIMITATIONS

Although it may appear that this study is a replication of some of the studies indicated in the earlier section of this manuscript, the significance of this study should not be negated. As learning become more complex, teachers need to develop and acquire better understanding on the profiles of their students, in particular, what students perceive and believe about learning. To do so, teacher preparation programs should: (1) provide and create opportunities for pre-service teachers to become aware of their own perceptions about knowledge and belief, (2) encourage them to critically examine their views on the relationship of knowledge and belief, and (3) evaluate and analyze the implications of such views in relation to their future teaching.

This study is an initial effort to explore how pre-service teachers perceive the relationship between knowledge and belief. There are limitations which warrant the readers' attention. While it is interesting and exciting to discover that school was the primary source of knowledge, we were not able to probe deeper into this issue due to the nature of the survey method. In future research, it will be beneficial to examine the influence of school on pre-service teachers' formation of their understanding on knowledge and belief, and the degree of such influence. When we asked our participants to identify the belief and knowledge items, they have been in a way constrained to dichotomize the statements. As a result of this, it became impossible to perform analysis to understand the complexity of the way they perceive knowledge and belief. In our subsequent efforts, we hope to conduct more in-depth inquiry to generate a possible framework to guide teacher educators planning for interventions to help pre-service teachers to become more aware of the way they perceive knowledge and belief.

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