Teacher Education Students' Epistemological Beliefs - A Cultural Perspective on Learning and Teaching

Kwok-wai CHAN

Hong Kong Institute of Education

Abstract

A questionnaire instrument adapted from Schommer's was developed for measuring epistemological beliefs of preservice teacher education students in the Hong Kong cultural context. Factor analytical study supplemented by qualitative data from interview identified four epistemological belief dimensions viz. innate/fixed ability, learning effort/process, authority/expert knowledge and certainty knowledge. The results were both similar to and different from Schommer's findings with North America university students in terms of the number and nature of belief dimensions. Cultural context would be a possible influence on the development of student teachers' epistemological beliefs. No significant differences were found between age, gender and elective groups when MANOVA analysis was applied to study the relation of these groups with their epistemological beliefs. Implications were drawn for future development in teacher education and possible direction of research.

Introduction

The role of beliefs on teaching and learning has been evidenced in research literature as influencing the success or failure of curriculum and instruction (Clark & Peterson, 1986; Richardson, 1996). Accompanied this is an upsurge of interest and literature on teachers' beliefs (Fang, 1996). Within the domain of teachers' beliefs, there are various types of beliefs depending on their source and nature. This includes beliefs about teaching effectiveness (teacher efficacy), beliefs about values, beliefs about teaching and learning, and beliefs about the nature of knowledge and knowledge acquisition (known as epistemological beliefs). Different types of beliefs are assumed to be clustered and connected/related to one another in a network manner within the belief system (Peterman, 1991; Rokeach, 1968). There are many literatures on teachers' efficacy, and teachers' images and conceptions about teaching and learning, but research studies on epistemological beliefs are not plentiful but developing.

One line of research was a focus on the developmental stages of epistemological beliefs, based on the work done by Perry (1968) and Ryan (1984), followed by King and Kitchener and (1994) on the development of reflective thinking of students. The other line was on studies of epistemological beliefs dimensions begun by Schommer (1989, 1990) with the North American University/College students based on her theoretical framework of five dimensions. In her factor analytical study with North American University students, Schommer (1990) was able to identify four epistemological dimensions out of five in her proposed framework. These four dimensions were labelled by her as Fixed or Innate Ability, Certain Knowledge, Simple Knowledge and Quick learning. The other dimension, Omniscent Authority was not extracted in factor analysis. In Schommer's (1990) study, she reported that students' beliefs in Simple and Certain Knowledge were related to knowledge
integration and comprehension. Her work was followed by a number of researchers who replicated Schommer's work with North America university/college students, such as Jehng, Johnson and Anderson (1993), Qian and Alvermann (1995). Their studies have demonstrated that epistemological beliefs are related to meta-cognitive processes such as reading comprehension, active inquiry, and integration of learning materials. Implications are drawn that epistemological beliefs are influential on one's decision making and cognitive activities in ill-defined situations (Schommer, 1994a, 1994b). Since classroom teaching is considered an ill-defined situation, with all sorts of possibilities of changes, accordingly, epistemological beliefs have a possible role to play in class teaching and learning. However, the relation between epistemological beliefs and teachers' beliefs about teaching and learning is not well understood. How teachers' epistemological beliefs are related to and interact with their beliefs about teaching and learning need to be explored. Also, the relation between epistemological beliefs with age, gender education and electives are to be determined as different findings were reported by Jehng et al. (1993) and Schommer (1998) and co-workers (Schommer & Walker, 1995). In addition, these research studies were conducted with North America university students and whether the findings hold for non-western cultures are subject to investigation.

Objectives

So far, available literature and instruments used in epistemological beliefs research are based on framework and studies conducted in western countries, mainly North America. There is no similar kind of studies or instrument available in Hong Kong context. Thus, epistemological beliefs study in Hong Kong context is difficult but significant when it is considered as an extension of such study in other cultural context.

The research reported in this paper explores the epistemological beliefs held by Hong Kong teacher education students. There is considerable research, following the initial proposals by Schommer (1989) that such beliefs can be characterised by a more or less set of independent dimensions and can be investigated using a set of measurement scales. What is absent from most of the research is a consideration of the particular cultural context of the research.

This research seeks to address this gap in research and, in doing so, seeks to answer the following research questions.

1. What are epistemological beliefs held by Hong Kong teacher education students?
2. How do these compare with those of university students in western societies (North America)? How can identified differences be accounted for?
3. Are there any differences of epistemological beliefs in terms of age, gender and electives groups of students?

This paper is organized in several sections. First, it consists of a reporting of the development of an instrument for measuring epistemological beliefs of teacher education students in Hong Kong context. Following which, a primarily quantitative study of how epistemological beliefs are related to variables including age, gender, electives and courses. Based on the results, theoretical and pedagogical implications are drawn for future direction of research.

Method

The study adopts primarily a quantitative approach complemented by qualitative data from interviews (Greene, Caracelli & Graham, 1989). Exploratory factor analysis was used in the
development of a questionnaire instrument adapted from Schommer's 63-item questionnaire, followed by confirmatory factor analysis with LISREL8-SIMPLIS to validate the instrument.

MANOVA studies were tried to examine if there were any statistical significant differences between epistemological beliefs and age, gender and elective groups. A confidence level of .01 was set to reduce the inflation of Type I error. The age group was divided into four levels from below 20 to above 30 in an interval of five years of age. The gender group consisted of the male and female groups. For electives or fields of study, there were five groups according to the subjects classification adopted by the Hong Kong Institute of Education: Business and Technology, Cultural Subjects, Language Subjects, Mathematics and Science, and Social Subjects. The Course groups comprised of two: the Chinese and the English Courses.

Subjects of Study

385 teacher education students of the Certificate in Education Course (abbreviated as CE Course) of the Hong Kong Institute of Education were chosen for study. There are two streams of the CE Course: the English and the Chinese Course. The age ranged from 19 to 40. Many were around 21 and 22 and only very few was below 20 or above 30. There were 115 male and 263 female students. The male to female ratio was 1:2.3, approximately the same as that of the population in the Institute. The CE Course is a two-year full-time sub-degree course. The CE course is the only course to educate non-graduate teachers for the primary level and junior secondary level (Form 1 to Form 3) school teaching. The entrance requirement of the two-year full-time CE course is two Advanced Level subjects pass, similar to the entrance requirement of universities in Hong Kong. Therefore the student teachers of this study were roughly equivalent to the undergraduates of universities and were chosen for study in comparison with the findings of university students in North America as reported by Schommer (1990) and other researchers (Jehng et al., 1993).

Study with Schommer's 63-item epistemological beliefs questionnaire

As noted by Marsh (1981), it is necessary to test the applicability of an instrument developed in one culture to be applied in another culture situation. Therefore, the study began with the application of Schommer's 63-item epistemological beliefs questionnaire. A five-point Likert scale was used to collect data from 352 student teachers of the Hong Kong Institute of Education. Schommer's 12 conceptual subscales were used as variables for factor analysis, making use of Principal Axis factoring, followed by varimax and oblimin rotation (Comrey & Lee, 1992) as what Schommer did (1990). Analysis of the response data cast doubt on the reliability and validity of the scale and also on the general applicability of the scale across cultural groups to measure epistemological beliefs.

With eigen value of 1 as cut-off and scree plot test, only 3 factors were extracted from the 12 subscales proposed by Schommer cumulative percentage variance = 46.5%). The fourth one has a cut-off at eigen value of .98. If the fourth one was included, the cumulative percentage of variance = 54.7%. (see Tables 1 and 2 for the varimax and oblimin Rotated factor matrix).
Table 1 Loading for Three Factors with Eigen Values Greater than 1.00 as Cut-off (PAF: Varimax Rotated Factor Matrix) in Descending Order:

<table>
<thead>
<tr>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can't learn how to learn</td>
<td>.688</td>
<td>.214</td>
</tr>
<tr>
<td>Success is unrelated to hard work</td>
<td>.605</td>
<td>.097</td>
</tr>
<tr>
<td>Learn first time</td>
<td>.412</td>
<td>.117</td>
</tr>
<tr>
<td>Avoid integration</td>
<td>.351</td>
<td>.260</td>
</tr>
<tr>
<td>Concentrated effort is a waste of time</td>
<td>.316</td>
<td>.022</td>
</tr>
<tr>
<td>Don't criticize authority</td>
<td>.109</td>
<td>.804</td>
</tr>
<tr>
<td>Knowledge is certain</td>
<td>.087</td>
<td>.429</td>
</tr>
<tr>
<td>Learning is quick</td>
<td>.234</td>
<td>.400</td>
</tr>
<tr>
<td>Ability to learn is innate</td>
<td>.159</td>
<td>.090</td>
</tr>
<tr>
<td>Avoid ambiguities</td>
<td>.012</td>
<td>.062</td>
</tr>
<tr>
<td>Seek single answers</td>
<td>-.293</td>
<td>.192</td>
</tr>
<tr>
<td>Depend on authority</td>
<td>.016</td>
<td>.235</td>
</tr>
</tbody>
</table>

Table 2 Loading for Three Factors with Eigen Values Greater than 1.00 as Cut-off (PAF: Oblimin Rotated Factor Matrix) in Descending Order:

<table>
<thead>
<tr>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can't learn how to learn</td>
<td>.669</td>
<td>-.399</td>
</tr>
<tr>
<td>Success is unrelated to hard work</td>
<td>.606</td>
<td>-</td>
</tr>
<tr>
<td>Learn first time</td>
<td>.405</td>
<td>.169</td>
</tr>
<tr>
<td>Seek single answers</td>
<td>-.331</td>
<td>.309</td>
</tr>
<tr>
<td>Concentrated effort is a waste of time</td>
<td>.321</td>
<td>-</td>
</tr>
<tr>
<td>Avoid integration</td>
<td>.319</td>
<td>-.214</td>
</tr>
</tbody>
</table>
Avoid ambiguities - .490 -
Depend on authority - .275 -.200
Don't criticize authority - -.106 -.859
Knowledge is certain - -.440
Learning is quick .175 .155 -.367

The result was similar to that reported by Schommer (1990) in terms of the number of factors extracted in factor analysis.

Differences existed, however, with regards to the loading of subscales and the type of factors/dimensions extracted in this study compared with that of Schommer (1990). In this study, the subscale "Don't criticize authority" for the dimension Omniscient Authority loaded on one of the factor with substantial loading (.804). Dimensions such as Simple Knowledge and Quick Learning as proposed by Schommer were not extracted distinctly in this study. Instead, some of the subscales designed to measure Quick Learning tended to load with subscales intended to measure Innate/Fixed Ability. As well, there were merging or complex factors appearing in the extracted factors, for example, subscale "Knowledge is certain" for Certain Knowledge loaded (with moderate loading value: .429) together with the subscale "Don't criticize authority" for Omniscient Authority. (Chan & Elliott, 1998).

Following this study a decision was made to test the assumption that the 63 items did actually load into the 12 proposed conceptual subscales. If they did not, then this may account for the inconsistencies of the results noted in the first pilot study. Using the 63 items of Schommer's questionnaire as variables in an exploratory factor analysis, the 63 items did not cluster or load together in the manner Schommer proposed for her 12 conceptual subscales. With eigenvalue set greater than 1 as cut-off and Principal Axis factoring, followed by varimax and oblimin rotation respectively for cross-checking, 21 factors were extracted instead of 12. When the scree-plot check was taken into account, four factors were identified. An inter-item reliability check of the 12 hypothetical or conceptual subscales yielded surprisingly low to moderate Cronbach alpha values, ranging from below .1 to .58. In particular, the subscales titled "Seek single answers" and "Avoid integration", which were assumed to tap the latent construct "Simple Knowledge" proposed by Schommer, had alpha values of less than .2. Reliability analysis of the whole questionnaire gave a Cronbach alpha value of .69, which was acceptable. However, it must be noted that this Cronbach alpha value was generated from a questionnaire of 63 items, and the large number of items which constituted the questionnaire would contribute to its Cronbach alpha value (DeVellis, 1991; Lewis-Beck, 1995).

Accordingly, Schommer's 63-item questionnaire (based on her 12 hypothetical or conceptual subscales as variables) was judged not to be entirely appropriate for the Hong Kong cultural context. This was not surprising as many of the instruments in psychological studies are produced in North America and may have a restriction in their application in other social and cultural contexts.

Discrepancies were also reported in the factor structure extracted by other researchers in applying Schommer's questionnaire in the study of epistemological beliefs. For example, Mori (1997), who used the 63 items instead of the 12 conceptual subscales proposed by Schommer in the study of Japanese learners, identified factors similar and different from that of Schommer.
Arredondo and Rucinski (1996), in a study of epistemological beliefs of Chilean educators and school reform efforts, found that Chilean teachers’ epistemological beliefs scores (calculated using Schommer's previously determined factor structures) differed markedly from those of teachers engaged in similar school reform project in the United States. The study by Arredondo and Rucinski (1996) suggested that Schommer's factor structures might be somewhat less stable among Chilean educators. Cross-cultural differences seemed likely as Pai (1990) has speculated that epistemological beliefs may be affected by family influences, especially among Hispanic Americans on the items concerning “nature of learning”. Arredondo and Rucinski (1996) also indicated that as data analysis proceeded, they became increasingly uncertain about the validity of using Schommer's existing factor structure for Chilean teacher and principal responses to the 63-items on the epistemological questionnaire.

Lee (1995) in his study of Korean postgraduate students using Schommer's questionnaire reported the Cronbach alpha values of all the five dimensions ranged from .47 to .69. A similar range of low Cronbach alpha values (inter-item reliabilities) were reported by Jehng et al. (1993) who made use of Schommer's items in study. The results imply that Schommer's subscales of items were problematic in internal consistency and might not be applicable to other cultural contexts.

That is, Schommer’s epistemological questionnaire might be inappropriate for the assessment of Chilean teachers’ epistemological beliefs, perhaps because of cultural bias in the items. A similar situation may happen in the Hong Kong context as reflected from the result obtained in the first study shown above. The finding of Schommer with her 63-item questionnaire not replicable in the Hong Kong context indicates a need to modify Schommer's instrument and develop one suitable for use in this study.

**Development of scale for tapping epistemological beliefs in the Hong Kong cultural context**

Accordingly, a specifically adapted version of this instrument was developed through three iterations of development. The strategies suggested by both Burnett and Dart (1997) and Fanshawe and Burnett (1991) were adopted. This involved iterative processes of

- Item identification
- Exploratory factor analysis
- Tests of consistency
- Follow up interviews with respondents
- Item clarification

with about 300 different students for each trial.

Three trialings were conducted after the replication studies of Schommer's questionnaire. Eventually, the process resulted in a scale of 30 items and this was subject to confirmatory factor analysis with LISREL8 (Byrne, 1989; Joreskog & Sorbom, 1993; Schumacher & Lomax, 1996) indicating a good fit model. \((GFI = .93, AGFI = .90, RMSEA = .058)\). The 30 items were loaded on four factors, constituting four subscales with Cronbach alpha values ranging from .60 to .70, which was higher than that reported in the replication of Schommer's instrument and that reported by Jehng et al.(1993). The value was acceptable for comparative study as the instrument was on the way of further development and refinement.

In summary, a scale of 30 items falling into 4 subscales as follows was developed from adaptation of Schommer's 63-item epistemological questionnaire. The labels of the subscales and the number of items contained within each subscale were given as below.
S1: Innate/Fixed Ability $\mu = .69$

S2: learning Effort /Process $\mu = .66$

S3: Authority/Expert Knowledge $\mu = .60$

S4: Certainty Knowledge $\mu = .60$

Results.

The study identified four epistemological belief dimensions held by Hong Kong teacher education students viz. Fixed/Innate Ability, Authority/Expert knowledge, Certainty Knowledge, Learning Effort/Process.

These four dimensions of epistemological beliefs vary along a continuum with polarities at two extreme ends. Fixed/Innate Ability refers to students' believing in one's ability is inborn and fixed in one end to a belief that one's ability is not innate and changeable. Authority/expert Knowledge ranges from students' believing in the source of knowledge as handed down by experts and authority to knowledge is derived from one's experience and judgment. Certainty Knowledge relates to the nature of knowledge. It ranges from a belief that knowledge is certain and unchanged to knowledge is tentative and ever changing. Learning Effort/Process points to whether one believes that knowledge acquisition (learning) requires effort and process of learning how to learn and understanding.

MANOVA (with a significance level set at .01 to reduce Type I error) study indicated there were no statistical significant differences in demographic variables, such as age (Wilks = .962, $F = 1.18$, df = 12, 955.41, $p > .01$), gender (Wilks = .988, $F = 1.08$, df = 4, 372, $p > .01$) and electives 1 (Wilks = .932, $F = 1.64$, df = 16, 1115.73, $p > .01$) and electives 2 (Wilks = .970, $F = .70$, df = 16, 1115.73, $p > .01$) with epistemological belief dimensions, but there were differences between the students in terms of their courses - the English course and the Chinese course (Wilks = .955, $F = 4.43$, df = 4, 378, **$p < .01$). Significant statistical differences lie in the dimensions of Innate/Fixed Ability ($F = 10.51$, Sig. of $F .001**$) and Authority/Expert Authority ($F = 7.68$, Sig.of $F .006**$) between the Chinese and English Course.

With the adoption of a five-point Likert Scale (1 = Strongly Disagree, 3 = neutral/undecided, 5 = Strongly Agreed), the average subscale scores of the four epistemological beliefs dimensions indicated the following pattern among the sample of Hong Kong student teachers in their beliefs towards the nature of knowledge and knowing.

For Innate/Fixed Ability, the mean subscale core was 2.82 (S.D. = .49), suggesting that while a number of students have beliefs as to whether ability is innate or fixed, many are uncertain. This is evidenced by the modal value of 3. It is also interesting to note that more students believe that learning ability is changeable than those who believe ability is innate/inborn and fixed. Thus, while only a very small number of students appear to hold beliefs compatible with the extremes of the scale, students are mildly dispersed towards the lower end. That is, the Hong Kong teacher education students tended to disagree that learning ability is innate/inborn. Instead, there is a tendency for the students to believe that learning ability is acquired and changeable. Also, there is a fairly large range exhibited in the respondents' responses from a maximum of 4.38 to a minimum of 1.13. In other words, while some student teachers tended to believe in innate/fixed ability, more student teachers tended to disagree.
For the dimension of Learning Effort/process, the mean of the subscale scores is 3.92, (S.D. = .35) which is considerably above the mid-point of 3 and close to 4 on the five-point scale. The position of the mean subscale score at the higher end of the five-point scale implied that the student teachers tended to believe that knowledge is created through learning effort and process. A mode of 4.00 might be taken as additional support for this interpretation that more student teachers agreed with the item statements and tended to believe that the acquisition of knowledge needs effort and a process to learn.

As for the dimension Authority/expert Knowledge, the mean subscale score was 2.62 (S.D. = .47). This suggests that there is a tendency amongst the students to believe that knowledge is created from personal experience rather than being handed down from authority figures. A large proportion of student teachers (over 70%) disagreed with the items representing Authority/Expert Knowledge, casting doubt on the belief that knowledge comes from authority figures or experts.

The situation is similar to that in the dimension certainty Knowledge. The mean subscale score was also 2.62 (S.D. = .56), positioned at the lower end of the scale. Using the same principle of interpretation as above, the result implies that the central tendency was towards the lower extreme of her scale. While many student teachers were uncertain as to whether knowledge is fixed and certain, to a limited extent, they tended to believe that knowledge is tentative and ever changing.

Discussion

On the whole, Hong Kong student teachers tend to believe that learning is a process of knowledge construction requiring effort, understanding and judgment but not that derived entirely from authority figures or limited by innate ability. Also, the Hong Kong student teachers tend to believe that knowledge is tentative and changing instead of being permanent. This is inferred from the relative position of the mean or average subscale score of the four dimensions on the five-point scale as analyzed above.

Semi-structured interviews with 23 volunteered students on the source and nature of knowledge, and elements and process in knowledge acquisition revealed similar findings but to a greater depth of understanding of students’ response. Nevertheless, it was worth to point out that some of the responses from the interviewees were a bit fluctuating and contradictory sometimes with respect to the nature, such as certainty versus tentative nature, or simple against the complex nature of knowledge. Interviewees could give examples illustrating their beliefs in that knowledge is permanent and unchanging as well as tentative and ever-changing. Some students even said that knowledge could be conceived as partly permanent, and partly changing. This might also account for the difficulty of measuring beliefs by scaled items and resulted in a lower Cronbach alpha values for the dimension on certainty Knowledge compared with others such as Learning Effort/Process and Innate/Fixed Ability. For the latter dimensions, interviewees seemed to be more obvious and close in consensus in their beliefs that ability is malleable by factors including effort and the process of learning.

No significant statistical relationship between age, gender, and fields of study was identified with the epistemological beliefs held by student teachers in MANOVA study. However, as different findings were reported for elective/discipline groups (Jehng et al., 1993; Schommer & Walker, 1995), further investigation in this area was needed before confirming the effect of electives/disciplines on epistemological beliefs.
MANOVA study indicated there was a significant differences in epistemological beliefs between the Chinese and the English courses. Compared with the English course, it appeared that more students in the Chinese course disagreed with the items that ability is innate/inborn than students in the English Course. This is reflected in the mean of the subscale scores assigned to the dimension Innate/Fixed Ability in the two courses (Chinese Course: 2.77 versus English Course: 2.91). The mean subscale score of he Chinese Course was positioned further toward the lower extreme of the five-point scale. A similar result was found with the dimension Authority/Expert Knowledge across the two courses. It seemed that more students in the Chinese Course than the English Course disagreed with the belief items. This is reflected in the minimum, maximum and the mean values of the two groups. Student teachers of the Chinese Course, to a somewhat greater extent than those of the English Course, seemed to believe that knowledge is constructed from one's experience and judgment. A 2-tail significance t-test for Innate/Fixed Ability and Authority/Expert Knowledge indicated that there was a significant difference between the beliefs between the Chinese and English Course (p< .01) (refer to the Wilks value in MANOVA study given above).

The result that Hong Kong student teachers tended believe in knowledge acquisition from learning effort and process and that ability is changeable and malleable through effort is understandable in that the traditional Chinese confucian-heritage culture laid much value on diligence, working hard and effort. However, the results showing Hong Kong student teachers tended not to believe in Authority/Expert knowledge and certainty Knowledge is somewhat out of expectation from perception of many westerners as they usually consider Chinese students are abide to authority and obedient, relying on rote method of learning, involving memorization and surface approach of learning. The different results obtained from expectation are possibly accounted for by the weakening traditional Confucianism-heritage culture in Hong Kong (Chinese) context, due to the increased influence of western thoughts and philosophy and the experiences encountered by the students. This is because Hong Kong is a unique place, under the British rule for a long time and has being exposed to both Chinese and western cultures continuously. Related to this are some misperception of westerners on the study approaches adopted by the Chinese students as discussed by Watkins and Biggs (1996).

There was a significant statistical difference in e epistemological beliefs held by students in the Chinese and the English Course. The students in the Chinese Course tended to disagree more with the belief in Innate/Fixed Ability and Authority/Expert Knowledge than students in the English Course. Again a somewhat unexpected result if one just interpreted the findings simply based on the traditional Chinese culture. Perhaps, it was due to the different entering beliefs, or different exposure and interaction with western cultures, thoughts and philosophy as students of the English Course were taught by expatriate lecturers from western countries and usually students who entered in the English Course had better results in the public examination than that of Chinese Course. Consequently, students in the English Course might tend to believe more in Innate/Fixed Ability while students in the Chinese Course tended to believe more in learning effort. As well, English had been considered an essential language in Hong Kong and an important condition for social mobility in the past, subsequently, students might consider the expatriate lecturers from the western countries were authorities/experts figures and an important source of knowledge.

Conclusion

Concerning epistemological beliefs, Schommer's 63 item epistemological beliefs questionnaire is not entirely applicable to the Hong Kong context. The result was not replicable. Schommer's hypothetical framework of a multi-dimensional system of more or less independent epistemological beliefs was in general supported. The hypothesis,
however, might need modification with extraction of merged or complex factors/ dimensions
- Learning effort/Process (results from two subscales measuring learning effort and learning process) and in the replication study of Schommer's scale, the subscale for Omniscient Authority and Certain Knowledge loaded together.

Taking into consideration of different cultural context as a possible influencing factor on epistemological beliefs, a questionnaire instrument adapted from Schommer was developed for the Hong Kong cultural context. On applying the adapted questionnaire developed for the Hong Kong context, four epistemological belief dimensions were identified. These dimensions were labelled by the author as Innate/Fixed Ability, Authority/Expert Knowledge, certainty Knowledge and learning Effort/Process. The dimensions identified are, in some way, similar to and different from Schommer. It was similar to that of Schommer's findings in that only four epistemological beliefs dimensions were identified, supporting her theoretical framework of a multi-dimensional system of epistemological beliefs. However, the type and nature of belief dimensions identified in this study was different from that of Schommer. That is, Schommer's work was not replicable in the Hong Kong (Chinese) context. Hence care must be exercised in applying an instrument and hypothesis developed in the western countries to another cultural context and modification deemed necessary for research in this area with the development of another instrument suitable for local purpose.

The different pattern in epistemological beliefs identified within the Hong Kong sample under study possibly is due to the impact of traditional Chinese confucian-culture together with the influence of the western culture and philosophy. This is because Hong Kong is a unique place in which there is a mixing of both traditional Chinese and western culture and philosophy due to its previous British ruling.

The non-significant difference between age, gender and fields of study on epistemological beliefs are still subject for more and further investigation before confirming the effect of disciplines on epistemological beliefs since different findings in

This area have been reported.

**Implications**

**Theoretical and Pedagogical Implications**

The paper considers the impact of epistemological beliefs on the process of learning to teach in terms of the specific findings. The fact that findings of North America students (eg. by Schommer, 1990) did not replicate in this study implies that cross-cultural and contextual differences exist in epistemological beliefs. Caution must be exercised in applying epistemological hypotheses developed for studies in different contexts, and modification of these seems necessary before considering their relevance in a different context. As well, educational environments and academic practices in a culture, irrespective of students' gender and fields of study, seem to be an influential factor in shaping/developing one's epistemological beliefs. Hence, the role played by age, gender and fields of study on the development of sophisticated epistemological beliefs still need verification.

Epistemological beliefs are significant in teacher education, in understanding meta-cognitive activities and processes of learning how to teach. Research can be conducted to examine how epistemological beliefs are related to the student teachers' conceptions about teaching and learning. Teacher educators can help student teachers to be aware of their epistemological beliefs and hence relation of epistemological beliefs with personal theories, in learning how to teach through discussion and analysis of what they believe to work in their
teaching. Teacher education institutions and universities, eg. the Hong Kong Institute of Education can make use of the applicants' epistemological beliefs in the general interviews as references to their future orientation to teaching and learning, thus assisting the selection of prospective teachers.

A further implication arising from the result of this study lies in teacher education development (particularly in Hong Kong context) that reflective thinking and inquiry is encouraged and that ability is changeable by effort and learning process, and it is important to understand. With this notions valued in teacher education development. Student teachers may be motivated and take a more positive attitude and appropriate study approaches towards their learning and teaching practice in schools.

**Implications for future research**

The epistemological beliefs instrument developed in this study is a new attempt for application in the Hong Kong context. It can be considered as a base for future development and research in this direction as it is expected to be on going development and refinement.

Similar studies of epistemological beliefs and personal theories with samples from other countries can be tried with an attempt for a cross-cultural comparative study.

Despite a hypothetical framework has emerged from the obtained results to address the issues related to the nature of epistemological beliefs (Hofer & Pintrich, 1997), further exploration of the nature and structure of the epistemological belief system is expected. Related to this, more research may have been conducted before confirming the effect of age, gender and fields of study on epistemological beliefs and personal theories. As an extension of this kind of research, the interaction effect of certain variables, such as age and gender, gender and fields of study on epistemological beliefs and personal theories may be investigated with a much larger sample of study.

Moreover, longitudinal and cross-sectional studies of student teachers' epistemological beliefs and personal theories would provide an interesting area of inquiry to examine the changes and influencing factors. Connected with this, comparative studies of pre-service and in-service student teachers at different levels (eg. primary versus secondary level) would provide understanding of the influence of entry characteristics, maturity and teaching experiences, and the impact of teacher education experiences/program effect on beliefs changes.

As pointed out in the previous sections, epistemological beliefs are conceived to be linked to many meta-cognitive activities and strategies, thus, it is possible and of value to study the relation between epistemological beliefs and study strategy and approaches adopted by the students. Through this sort of study, it may provide better understanding of students' choices of study approaches and the influence of their epistemological beliefs on their adopted approaches, in turn, helping teachers to provide a proper guidance on students' adoption of study approaches/strategies.
References


Rokeach, M. (1968) *Beliefs, attitudes, and values: A theory of organization and*


