

Hong Kong Teacher Education Students' Epistemological Beliefs and their Relations with Conceptions of Learning and Learning Strategies

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A questionnaire was administered to 231 teacher education students of a university in Hong Kong to examine their epistemological beliefs, conceptions of learning, and learning strategies. The three variables were measured respectively using the Epistemological Beliefs Scale (EBS) (Chan & Elliott, 2002), Conceptions of Learning Inventory (COLI) (Purdie & Hattie, 2002) and Revised Two Factor Study Process Questionnaire (R-SPQ-2F) (Biggs, Kember, & Leung, 2001). Correlation and path analysis showed significant relations between epistemological beliefs and conceptions of learning and learning strategies. The results suggest the significant roles of epistemological beliefs in learning, through their impact on and relations with the conceptions of learning and strategies adopted by the students. Implications were drawn with suggested ways for further research on their relationships and other metacognitive variables in learning such as achievement or motivation goals. The research findings would provide significant and valuable knowledge in this area and enable a better understanding of the nature and process of learning.

It is a common notion that students' characteristics, e.g. beliefs, conceptions of learning and motivation influence the learning process and learning outcomes or achievement. The notion is supported by research findings reported in literature and is depicted in theoretical frameworks such as the 3P Model of Learning (Biggs & Moore, 1993). The 3Ps stand for Presage, Process and Product. The Presage factor includes student characteristics and teaching context, interacting with each other and influences the Process (learning and teaching processes) and eventually the Product (outcomes of learning). Research has shown that students' conceptions of learning are related to their learning motivation and cognitive strategies (Chan, 2003; Pillay, Purdie & Boulton-Lewis, 2000;

Purdie, Hattie, & Douglas, 1996). Researchers also opined that students' conceptions of learning have explanatory power in terms of the quality of learning outcomes (Purdie & Hattie, 2002; Vermunt & Vermetten, 2004). Thus, many studies investigating students' learning process and outcomes have concentrated on the influence and interrelationships of conceptions of learning, motivation and learning strategies.

Conceptions of learning refer to the beliefs and understanding held by the learners about learning. Previous studies on students' conceptions of learning indicated that students conceive learning in different ways, commonly categorized into two broad categories, quantitative and qualitative. The quantitative conception refers to the quantity of

knowledge acquired and reproduced and is considered a surface conception. The qualitative conception refers to abstraction of meaning and personal change through learning and is considered a deep conception (Biggs & Moore, 1993; Marton, Dall'Alba, & Beaty, 1993; Purdie & Hattie, 2002). It is usually assumed that the conceptions of learning exist in a hierarchy: the interpretive/constructivist view of learning at the upper level and the acquisition/reproduction view of learning at the lower level (Marton, Dall'Alba, & Beaty, 1993; Purdie & Hattie, 2002). As different social and cultural contexts influence the learners' conceptions of learning, the generalization based on identified findings in the Western culture needs to be examined using cross-cultural samples. Previous studies on conceptions of learning mainly took the qualitative approach, whereby, interview data or reflective writings were the primary source of data for analysis. However, the findings from qualitative data cannot be generalized to people in a larger sample. Purdie and Hattie (2002) developed the Conceptions of Learning Inventory (COLI) using a quantitative method to measure nine dimensions of learning. The inventory has made it possible to use quantitative analysis of a large sample to test hypothesis and theories.

Since the late 1970s, numerous studies have been conducted on student learning approaches and strategies. In general, two approaches or strategies to learning can be identified, the deep approaches and the surface approaches (e.g. Marton & Saljö, 1976a, 1976b). Instruments have been developed by different researchers to measure these, for example, the Study Process Questionnaire (SPQ), and the Learning Process Questionnaire (LPQ) developed by Biggs (1993), the Approaches to Studying Inventory (ASI) and the Revised Approaches to Studying Inventory (RASI) (Entwistle & Ramsden, 1983; Entwistle & Tait, 1994). The surface approach is usually linked to reproduction of words and details by rote learning, and rehearsal strategies. The deep approach intends to maximize understanding, reflection of the author's meaning through reading widely and reflecting. The Study Process

Questionnaire (SPQ) has been frequently used to study the approaches and strategies adopted by students in different cultures including Australia, Hong Kong and other Asian countries. Although Biggs has proposed a three factor model, including a third approach, viz. the achieving approach, the items of the achieving approach were found to cross-load with the items for surface and deep approaches and the third subscale not validated. Recently, Biggs and others have modified the SPQ with confirmatory factor analysis to develop a shortened revised version known as Revised Two-factor Study Process Questionnaire (R-SPQ-2F), which was considered a simpler and a better scale for teachers to measure deep and surface strategies in terms of construct validity and reliability (Biggs, Kember, & Leung, 2001).

Besides conceptions about learning and strategies in learning, other cognitive and affective factors, such as students' beliefs, causal attributions and self-concepts have also been found to be influential determinants of students' learning (e.g. Hau, & Salili, 1996; Salili, 1995).

One area of beliefs research that has received increasing interest in the late 1990s is epistemological beliefs and the influence of students' epistemological beliefs on learning. By definition, epistemological beliefs refer to beliefs about the nature of knowledge and knowing (knowledge acquisition). The early works done by Piaget and Inhelder (1969) on genetic epistemology and Perry (1968) on the patterns of development in thought and values of college students have stimulated researchers to investigate the nature and acquisition of knowledge and subsequently develop theoretical frameworks and instruments to study epistemological beliefs (King & Kitchener, 1994, 2002; Schommer, 1990; 1994). An often-cited researcher in literature is Schommer (1990) who proposed a multidimensional, more or less independent system of epistemological beliefs. In her hypothetical framework, Schommer proposed five dimensions, viz. "Omniscient Authority, Certain Knowledge, Simple Knowledge, Quick Learning, and Innate/Fixed Ability." according to the source, certainty,

and organization of knowledge, as well as the control and speed of learning (Schommer, 1990, 1994). Based on this framework, Schommer developed a 63-item epistemological beliefs questionnaire, grouped into 12 conceptual subscales. She then administered the questionnaire to a group of North America university undergraduates. The items were rated on a five-point scale ranging from strongly disagree to strongly agree. With factor analysis of the 12 conceptual subscales, Schommer was able to extract four factors or dimensions, but the proposed dimension "Omniscient Authority" was not extracted. Schommer then used the computed factor scores of the four extracted dimensions to study the effect of epistemological beliefs on reading comprehension, and to examine if there were any significant gender difference and whether epistemological beliefs were domain specific or general. Her study has encouraged other researchers to conduct similar research with Schommer's questionnaire or scales developed from it. Controversial findings have been reported in other studies by different researchers, such as different dimensions of epistemological beliefs identified in different cultures, and variations as regards domain specificity, gender and age differences in epistemological beliefs (Chan & Elliott, 2000; Hofer, 2000; Jehng, Johnson & Anderson, 1993; Paulsen & Wells, 1998; Schommer & Walker, 1995; Schommer, Duell, & Barker, 2003). All these have led to arguments and criticism about the instrument and the method used by Schommer. Also, different structures of epistemological beliefs have been proposed (Chan, 2006; Chan & Elliott, 2004b; Clarebout, Elen, Luylen & Bamps, 2001; Hofer & Pintrich, 1997) and different methodologies and instruments for measuring epistemological beliefs developed (Schraw, 2001; Schraw, Bendixen, & Dunkle, 2002; Wood & Kardash, 2002).

Nevertheless, the significant contributions of Schommer to epistemological beliefs research cannot be neglected. In fact, the significant contributions to and influences of epistemological beliefs on learning and teaching have been

highlighted in research literature in the last two decades. Research has shown that such beliefs are culture specific, and that there are different dimensions of beliefs across different cultural groups (Arredondo, & Rucinski, 1996; Chan & Elliott, 2004a; Youn, 2000). Further, it has been reported that epistemological beliefs are related to metacognitive variables in learning including text comprehension (Kardash & Scholes, 1996; Ryan, 1984; Schommer, 1990), problem solving (Schoenfeld, 1985) conceptual change (Mason & Boscolo, 2004; Qian & Alvermann, 2000), motivation, learning strategies, academic performance (Cano, 2005; Chan, 2003; Paulsen, & Feldman, 1999; Schommer, 1993; Schraw & Olafson, 2002) conceptions and approaches of teaching (Chan & Elliott, 2004b). As most of these research findings are from Western studies (mainly in North America) and studies of similar nature conducted in Eastern countries and Chinese culture are scarce, and the degree to which such claims and findings are applicable to Hong Kong Chinese students is unknown. Since epistemological beliefs are culture specific and conceptions of learning are shaped by the cultural values the learners hold (Purdie & Hattie, 2002; Rao, Moely, & Sachs, 2000), and that both variables are cognitive in nature and related to metacognitive variables in learning and teaching, close relations may exist between epistemological beliefs and conceptions of learning, as well as learning strategies, and these relations are awaiting to be explored. The beliefs and conceptions about learning held by pre-service teacher education students as well as their learning strategies are worthy of examination as these variables not only affect their learning as prospective teachers but might also affect the instructional strategies they adopt in the classroom and hence influence the expected learning outcomes of the students they teach.

OBJECTIVES OF THE STUDY

The present study aims to investigate the relationships of epistemological beliefs,

conceptions of learning, and learning strategies adopted by Hong Kong Chinese pre-service teacher education students, using a quantitative approach with three different scales as stipulated in the method section. Related to the objectives of the study, the epistemological beliefs, conceptions of learning and learning strategies held by a sample of Hong Kong pre-service teacher education students were separately investigated and their relations examined with the use of structural equation modeling and path analysis to find out if there are any significant relations between the variables.

METHOD

A questionnaire was administered to 231 pre-service teacher education students of a university in Hong Kong to examine their epistemological beliefs, conceptions of learning and learning strategies. The three variables were measured respectively by the Epistemological Beliefs Scale (EBS) (Chan & Elliott, 2002), the Conceptions of Learning Inventory (COLI) (Purdie & Hattie, 2002) and the Revised Two Factor Study Process Questionnaire (R-SPQ-2F) (Biggs, Kember, & Leung, 2001). The three scales were translated into Chinese and moderated by a panel of two Chinese educational psychology lecturers who were experienced in teaching the subject in both Chinese and English courses. Before administration, modification of the items was conducted until consensus was reached within the panel that the items were comprehensive and that they matched the meaning of the English version.

Participants

The 231 teacher education students who participated in this study were from a full-time four-year bachelor in education degree program. Of those who indicated their gender, 59 (27.2%) were male and 158 (68.4%) were female, representing the relatively high proportion of female to male students in the university which offers only teacher education programs. Consent was sought from the

students to participate in the study. Excluding 22 missing cases, the mean age and standard deviation (in parenthesis) of the sample was 20 years (2.34). The age of the participants ranged from 18 to 44 years and the majority were around 19 (71.0%) and 20 (74.0%) years old.

Instruments

Epistemological beliefs scale (EBS)

Epistemological beliefs were measured by the 30-item *Epistemological beliefs scale (EBS)* developed by Chan (Chan & Elliott, 2002) in a previous study. The scale was adapted from Schommer's 63-item epistemological beliefs instrument through iterative processes of factor analysis, item identification, deletion and revision. The scale was validated by confirmatory factor analysis with LISREL 8 for Windows (GFI = .93, AGFI = .90, RMSEA = .058) and the reliability Cronbach alpha values of the four subscales/dimensions ranged from .60 to .70 (Chan & Elliott, 2002), values acceptable for the present study. The details of the development of the validated EBS can be found in the study reported by Chan and Elliott (2002). Illustrative examples of items in the EBS include "Sometimes, I don't believe the facts in textbooks written by authorities" (*Authority/Expert Knowledge*); "Scientists will ultimately get to the truth if they keep searching for it" (*Certainty Knowledge*); "Our abilities to learn are fixed at birth" (*Innate/Fixed Ability*); and "If people can't understand something right away, they should keep on trying" (*Learning Effort/Process*). A 5-point rating scale from 1 (*strongly disagree*) to 5 (*strongly agree*) was used.

Conceptions of learning inventory (COLI)

The 45-item COLI was developed by Purdie and Hattie (2000) who used a quantitative method to measure nine dimensions of learning. With regard to satisfactory goodness of fit index and psychometric properties, NNFI = .98 and RMSEA = .05 were reported in literature. The COLI inventory has actually been used in a number of different cultures such as Australia, Malaysia and

America in cross-cultural studies with good validation. Illustrative examples of the nine dimensions are: "When I learn, I am filling my head with new facts" (*Learning as an increase in knowledge*); "When something stays in my head, I know I have really learned it" (*Learning as remembering and reproducing*); "When I have learned something, I know how to use it in other situations" (*Learning as a means to an end*); "Learning is finding out what things really mean" (*Learning as understanding*); "learning changes my way of thinking" (*Learning as seeing something in a different way*); "Increased knowledge contributes to me becoming a better person" (*Learning as personal fulfillment*); "I have an obligation to learn" (*Learning as a duty*); "It is possible to learn in any situation, not only at school" (*Learning is process not bound by time or context*); and "learning is knowing how to get on with many different kinds of people in society" (*Learning as developing social competence*). *Learning as an increase in knowledge* and *Learning as remembering and reproducing* represent a quantitative conception of learning and the rest a qualitative conception of learning. A 7-point rating scale was used, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Revised two factor study process questionnaire (R-SPQ-2F)

The Biggs R-SPQ-2F instrument was employed to assess both the surface and deep approaches to learning. This questionnaire was derived from the original version of the SPQ with both modified and new items, and which ended up with 20 items in the final version (Biggs, Kember & Leung, 2001). Each approach comprised 10 items consisting of the motive and strategy subscales (5 items each). The scale was validated by confirmatory factor analysis (CFI = .99, SRMR = .02). The reported alpha values for *Deep Approach* and *Surface Approach* were .73 and .64 respectively, .57 for *Surface Strategy* and .63 for *Deep Strategy*. As the aim of the present study is to examine the learning strategies of students, only the *Surface Strategy* and *Deep Strategy*

subscales (each consisting of five items) were employed. Illustrative examples include "I only study seriously what's given out in class or in the course outlines" (*Surface Strategy*); and "I test myself on important topics until I understand them completely" (*Deep Strategy*). A 5-point rating scale was used, ranging from 1 (*this item is never or only rarely true of me*) to 5 (*this item is always or almost always true of me*).

Data Analysis

Confirmatory factor analysis was applied to validate the three scales used in the present study to ensure that the scales were suitable for use with different samples and cultural contexts. The goodness of fit indexes were around and above .90 and the reliability Cronbach alphas of the scales were satisfactory. In summary, the psychometric properties of the scales were similar to the reported figures in literature supporting the validity and applicability of the three scales in this study.

Descriptive statistical analysis followed by multivariate analysis was conducted to obtain the students' profiles of epistemological beliefs, conceptions of learning and learning strategies and also to study if there was any significant difference among the three variables across gender groups. The inter-relations between epistemological beliefs, conceptions of learning and learning strategies were first examined using Pearson correlation analysis, and then structural equation modeling and path analysis. Two structural equation models were proposed, in both of which epistemological beliefs were hypothesized as the predictor variables, the learning strategies and conceptions of learning as outcome variables in models 1 and 2 respectively.

RESULTS

Descriptive statistics and multivariate analysis

Epistemological beliefs

The highest mean score was found for the dimension/subscale *Learning Effort/Process* (mean = 3.87, SD = .39) followed by *Innate/Fixed Ability* (mean = 2.85, SD = .53), *Authority/*

Table1.
Pearson Correlation matrix for epistemological beliefs, conceptions of learning and learning strategies

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AK	1														
CK	.19**	1													
LEP	.07	.23**	1												
IA	.04	-.06	-.18**	1											
LIK	.05	.19**	.37**	-.07	1										
LRR	.06	.20**	.33**	-.30	.61**	1									
LME	-.19**	.08	.42**	-.06	.54**	.58**	1								
LAU	-.07	.14*	.37**	-.06	.61**	.57**	.64**	1							
LSD	-.19**	-.05	.32**	-.16*	.43**	.38**	.60**	.64**	1						
LPF	-.06	.08	.42**	-.14*	.54**	.42**	.60**	.63**	.71**	1					
LAD	.00	-.01	.33**	.02	.51**	.35**	.43**	.55**	.53**	.66**	1				
LPT	-.09	-.10	.38**	-.09	.46**	.36**	.63**	.59**	.65**	.62**	.55**	1			
LSC	-.09	.01	.34**	-.15*	.49**	.37**	.62**	.62**	.66**	.61**	.46**	.78	1		
DS	-.06	.11	.33**	-.17*	.36**	.23**	.26**	.36**	.31**	.38**	.37**	.35**	.29**	1	-.05
SS	.27**	.18**	-.02	.22**	.03	.02	-.12	-.03	-.16*	-.13	.06	-.21**	-.12	-.05	1

* P<.05
**p <.01

- Note
- | | | | |
|--------|---|---------|---|
| 1. AK | Authority/Expert Knowledge | 9. LSD | Learning as seeing something different |
| 2. CK | Certainly Knowledge | 10. LPF | Learning as personal change |
| 3. LEP | Learning Effort/Process | 11. LAD | Learning as a duty |
| 4. IA | Innate/Fixed ability | 12. LPT | Learning as a process not bound by time and context |
| 5. LIK | Learning as an increase in knowledge | 13. LSC | Learning as developing social competence |
| 6. LRR | Learning as remembering and reproducing | 14. DS | Deep Strategy |
| 7. LME | Learning as a means to an end | 15. SS | Surface Strategy |
| 8. LAU | Learning as understanding | | |

Expert Knowledge (mean = 2.82, SD = .54) and lastly *Certainty Knowledge* (mean = 2.57, SD = .64), which had the lowest mean score. All of them were significantly different from each other. Analysis of variance (ANOVA) showed no significant gender differences in epistemological beliefs except in the dimension *Authority/Expert Knowledge* (male: N = 59, mean = 2.59, SD = .53; female: N = 155, mean = 2.94, SD = .52, $F = 19.91$, $p = .00$).

Conceptions of learning

Of the nine conceptions of learning, seven conception dimensions had mean scores above 5, the highest mean score was recorded for *Learning as a process not bound by time or context* (mean = 5.76, SD = .74) and two dimensions with mean scores above 4 but below 5, viz. *Learning as an increase in knowledge* (mean = 4.79, SD = .77) and *Learning as remembering and reproducing* (mean = 4.72, SD = .87). The means of the nine conceptions differed significantly from each other. Analysis of variance (ANOVA) showed no significant difference in the nine conception dimensions between male and female students.

Learning strategies

The *Deep Strategy* (mean = 3.34, SD = .57) had a higher mean value than the *Surface Strategy* (mean = 2.97, SD = .65), and the mean values of the two learning strategies were significantly different. Analysis of variance (ANOVA) showed no significant gender difference in the learning strategies although the mean values of both deep and surface learning strategies for male students were higher than that for female students.

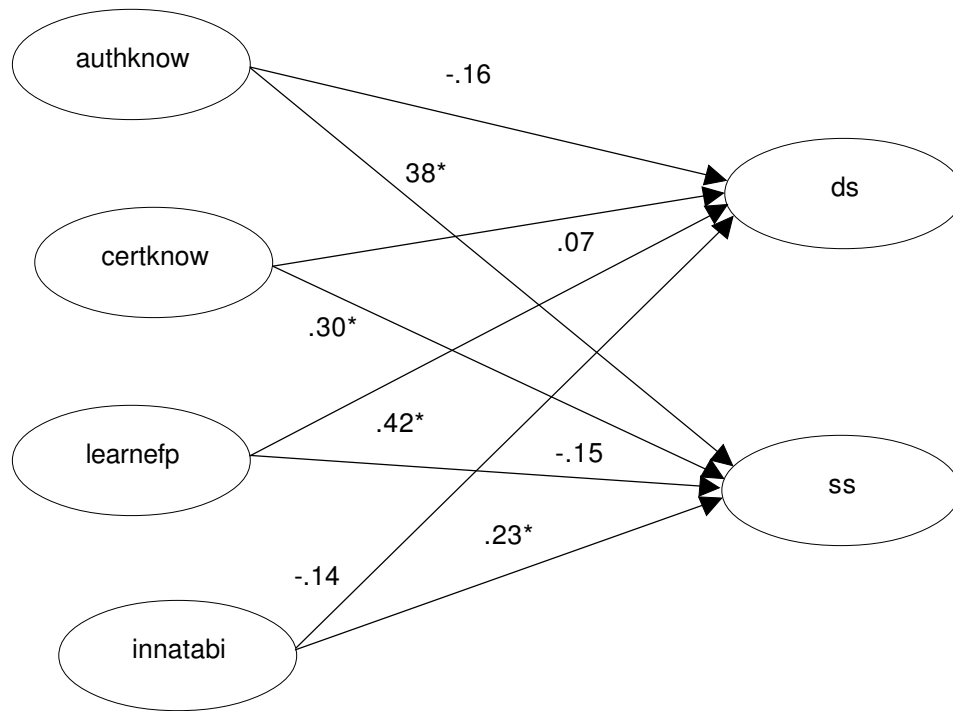
Relational Analysis

Table 1 shows the Pearson correlation coefficients between pairs of epistemological beliefs, conceptions of learning, and learning strategies. Significant pairs at .05 and .01 level were identified. The significant pairs are interpreted and explained in the Discussion section.

Path Analysis: To further examine the relations of epistemological beliefs, conceptions of learning, and learning strategies, path analysis was conducted for the variables. Due to the limits in length of the paper, only two conception subscales representing typical meaning of quantitative and qualitative conceptions of learning (*Learning as remembering and reproducing* and *Learning as understanding*) were selected as illustrative examples for analysis and the results are given in Figures 1 and 2.

In Figure 1, four significant path coefficients ($p < .05$) were identified, including paths from *Learning Effort/Process* to *Deep Strategy*, from *Certainty Knowledge* to *Surface Strategy*, from *Innate/Fixed Ability* to *Surface Strategy* and from *Authority/Expert Knowledge* to *Surface Strategy*. The significant path coefficients showed that the predictor effects of epistemological beliefs on learning strategies were moderate. The structural model demonstrating the direct effect of the four epistemological beliefs on the two learning strategies as depicted in Figure 1 was validated by confirmatory factor analysis with LISREL 8.5 for Windows and goodness of fit index equal to or near .90 was obtained (RMSEA = .04, NNFI = .89, CFI = .90, IFI = .91, GFI = .87, AGFI = .84, RMR = .069).

Figure 2 shows the path diagram between the four epistemological beliefs and two conceptions of learning: *Learning as remembering and reproducing* and *Learning as understanding*. The former represents the quantitative conception and the latter the qualitative conception. Three significant path coefficients ($p < .05$) were identified, including paths from *Learning Effort/Process* to *Learning as understanding*, from *Innate/Fixed Ability* to *Learning as remembering and reproducing* and from *Learning as understanding* to *Learning as remembering and reproducing*. The significant path coefficient between the two conceptions of learning was strong and the path coefficients between the two aforementioned epistemological beliefs and conceptions of learning were moderate to moderately weak. The hypothesized model of



* $p < .05$

Note:

- | | | | |
|----------|------------------------------|----------|------------------------|
| authknow | = Authority/Expert knowledge | innatabi | = Innate/Fixed ability |
| certknow | = Certainty knowledge | ds | = Deep strategy |
| learnefp | = Learning effort/process | ss | = Surface strategy |

Figure 1
Path diagram with standardized estimates of coefficients
for epistemological beliefs and learning strategies

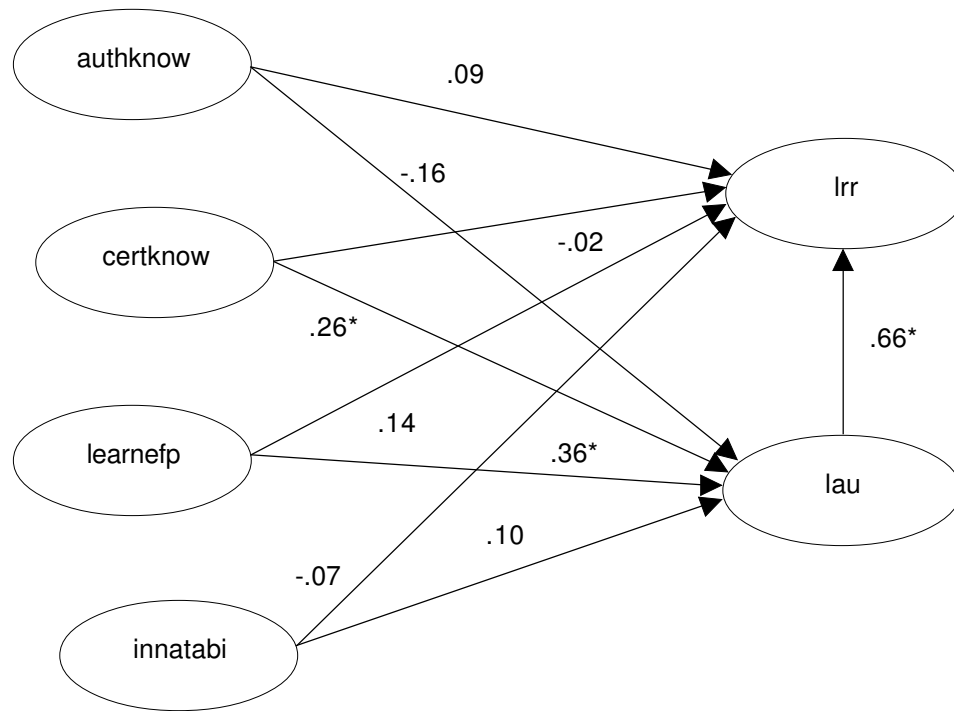
the relations between the four epistemological beliefs and the two conceptions about learning fits with the data and goodness of fit index equal to or near .90 were obtained (RMSEA = .043, NNFI = .89, CFI = .91, IFI = .91, GFI = .86, AGFI = .83, RMR = .068).

DISCUSSION

Epistemological beliefs

In general, the result of the present study is similar to those of a previous study reported by Chan (Chan & Elliott, 2002) with another sample of teacher education students in the Certificate of

Education (non-degree) program. In both studies, four dimensions of epistemological beliefs were found: *Authority/Expert Knowledge*, *Certainty Knowledge*, *Learning Effort/Process* and *Innate/Fixed Ability*, and the students showed a very high tendency to believe that knowledge is created through learning effort and process. The distinctly high mean score of the dimension/subscale *Learning Effort/Process*, which significantly differed from other beliefs signifies the relative importance of the traditional Confucian Chinese value placed on education, effort and hard work. To the Chinese, education and learning have always been associated with effort (Lau, 1996). The Chinese people often attribute a person’s success,



* $p < .05$

Note:

authknow = Authority/Expert knowledge
 certknow = Certainty knowledge
 learnefp = Learning effort/process

innatabi = Innate/Fixed ability
 lrr = Learning as remembering and reproducing
 lau = Learning as understanding

Figure 2
Path diagram with standardized estimates of coefficients
for epistemological beliefs and conceptions of learning

especially academic achievement to effort and hard work, and this has been reported in a number of attribution studies with Hong Kong Chinese students (Hau & Salili, 1990, 1996; Salili, 1995). In this study, the mean score of the dimension *Innate/Fixed Ability* suggests that many of the students tended not to believe that ability is innate or fixed. Close examination of the frequency distribution showed that 56.7% of the responses were below the mid-point (3) of the scale, with a minimum of 1.0 to a maximum of 4.50 in the spread. In summary, while some students tended to believe in *Innate/Fixed Ability*, more students tended to disagree, that is, these students tended to believe that learning ability is acquired and is

changeable. This belief may be associated with the traditional Chinese value and belief in effort which enables students to think they can improve their ability and achievement through effort and hard work. The mean score of the dimension/subscale *Authority/Expert Knowledge* indicates there is a tendency for students in the present study not to believe that knowledge is handed down by authorities or experts, but rather from personal experience. This may be surprising when we consider the influence of the traditional Chinese Confucian culture and value and expect that the students have the desire to abide by authority figures. Close examination of the frequency distribution of the participant responses showed

that 49.4% of the responses were below the mid-point (3) of the rating scale, suggesting that nearly half of the participants did not agree that knowledge is handed down by authorities or experts. The spread is from a minimum of 2 to a maximum of 4 out of a five-point rating scale. The result could be an influence of the paradigm shift in learning nowadays in Hong Kong. The paradigm shift promotes the constructivist approach instead of the traditional didactic approach in learning and teaching; it emphasizes the value of reflection and inquiry learning to permissive reception of knowledge. The results suggest that the paradigm shift towards constructivism tended to function and influence the beliefs of the sample under study. In addition, due to continued exposure to Western thoughts and philosophies, the traditional Confucian Chinese culture and philosophy on the need to respect and abide by authority might have been weakened with the increasing demand for individual rights and freedom for the next generation. Nevertheless, in this study, female students had a significantly higher mean score than male students indicating that female students had a greater tendency to abide by authorities and hence had a stronger belief that knowledge is handed down by authority/expert figures.

The mean score of the dimension or subscale *Certainty Knowledge* positioned it at the lower end of the five-point rating scale, suggesting that a number of students in the present study tended to disagree that knowledge is fixed and certain, instead they tended to believe that knowledge is tentative and ever-changing.

Conceptions of learning

Nine dimensions of conceptions about learning were identified for the sample of Hong Kong teacher education students in the present study and the results were similar to what Purdie and Hattie (2002) had found. Seven conception dimensions had mean scores above 5 and the highest mean value was recorded for the dimension *Learning as a process not bound by time or context*. The two dimensions which had mean values above 4 but below 5, viz. *Learning as an increase in*

knowledge and *Learning as remembering and reproducing* represent the quantitative and surface conceptions of learning whereas the dimensions representing qualitative and deep conceptions of learning, including *Learning as understanding*, *Learning as seeing something in a different way*, *Learning as a personal fulfillment*, *Learning as developing social competence* and *Learning as a process not bound by time or context* had higher mean values. The qualitative and deep conceptions of learning are considered to be at a higher level of learning, emphasizing process and inquiry of learning while the quantitative and surface conceptions are considered to be at a lower level, emphasizing increase in the quantity of knowledge gained and memory work. The relatively significant difference in mean values between the qualitative and quantitative conceptions about learning reported in the Results section suggest that students in the present study had a greater tendency to hold qualitative and deep ideas rather than quantitative and surface conceptions about learning. The finding might be unexpected in comparison to the usual Western perception that Chinese students relied much on memory work, rote and surface learning rather than inquiry mode of deep learning, with understanding and personal changes. The misperception of the Westerners on the Chinese conceptions of learning has been pinpointed in literature by Biggs after his teaching and research with Chinese students in Hong Kong University (Watkins & Biggs, 1996).

Learning strategies

While both surface and deep learning strategies were prevalent among the students, there was a greater tendency for students in the present study to adopt a deep strategy in learning. Once again, this differed from the usual Western perception that Chinese students emphasized rote learning and memory work and adopt a surface approach or strategy in learning (Chalmers & Volet, 1997; Watkins & Biggs, 1996). This might also be accounted for by some researchers such as Kember (1996), Kember and Gow (1990), Marton, Watkins, and Tang (1997) who termed the

approaches and memorization work taken by the Hong Kong Chinese students as “Deep memorization”. That is, while students are trying to memorize the materials or reading, they are also trying to understand the contents, the working together of these two processes help students remember better the contents with comprehension.

Relations among epistemological beliefs, conceptions of learning and learning strategies

Significant pairs were found in the correlation matrix as can be seen in Table 1. For example, *Authority/Expert Knowledge* was negatively related to *Learning as a means to an end*, and *Learning as seeing something in a different way*. This is understandable in terms of the meaning of the dimension *Authority/Expert Knowledge*, which refers to the belief that knowledge is handed down by authority or expert figures. If a person believes strongly in authorities and experts as the source of knowledge, they would have little doubt about the nature and truth of knowledge, and would subsequently conceive this is as the end of learning. The perception or views taken will follow that of authority or expert figures; all of which are contradictory to the meaning attached to the two conceptions about learning mentioned here. The epistemological beliefs dimension *Learning Effort/Process* is positively and significantly related to all nine dimensions of conceptions about learning, and relatively speaking, the magnitude of correlation is moderate to moderately high. This is much more strongly related to the conceptions of learning than other epistemological beliefs, signifying the important relation or influence of epistemological beliefs with the conceptions of learning held by students. *Innate/Fixed Ability* was found to be negatively and significantly related to three conception dimensions: *Learning as seeing something different*, *Learning as personal change* and *Learning as developing social competence*. Obviously a student who believes that ability is inborn and fixed and that nothing can be done to change it, through for example effort and learning, might not conceive learning to bring

any personal change in perception or development of social competence and this explains the negative relationship identified. *Certainty Knowledge* was found positively and significantly related to the three conception dimensions: *Learning as an increase in knowledge*, *Learning as remembering and reproducing* and *Learning as understanding*. Believing that knowledge is certain and unchanged might drive students to conceive learning as something tangible, and learning is to gain an increase in knowledge and to ensure its existence through remembering, reproducing and understanding. Once knowledge is acquired, it is held in memory and unchanged.

In terms of the relationship between epistemological beliefs and learning strategies, it was found that *Authority/Expert Knowledge*, *Certainty Knowledge* and *Innate/Fixed Ability* were significantly and positively related to *Surface Strategy*, whereas, *Learning Effort/Process* was significantly and positively related to *Deep Strategy*. *Innate/Fixed Ability*, on the other hand was negatively and significantly related to *Deep Strategy*. The results were similar to those of an early study conducted by Chan (2003) who investigated the relations between epistemological beliefs and learning approaches and strategies with another sample of non-graduate teacher education students.

As for the relations between conceptions and strategies in learning, Table 1 shows that all dimensions or subscales of conceptions of learning were positively and significantly related to *Deep Strategy*. The correlation coefficients were from moderately weak ($r = .23$) for *Learning as remembering and reproducing* to moderate ($r = .38$) for *Learning as a personal change*. In general *Surface Strategy* was negatively related to all the dimensions of conceptions of learning, except *Learning as an increase in knowledge*, *Learning as remembering and reproducing* and *Learning as a duty*. Of the nine dimensions of conceptions about learning, *Learning as seeing something in a different way* and *Learning as a process not bound by time or context* were significantly and negatively related to *Surface*

Strategy. The correlations were weak ($r = -.16$) to moderately weak ($r = -.21$) respectively. While the qualitative and deep conceptions of learning, such as *Learning as understanding* and *Learning as a personal change* were positively and significantly related to *Deep Strategy*, it was interesting and somewhat unexpected to find that the quantitative and surface conceptions of learning such as *Learning as an increase in knowledge* and *Learning as remembering and reproducing* were also positively and significantly related to *Deep Strategy*. The results suggest that the pre-service teacher education students in the present study carrying the quantitative conception that “Learning is to increase and memorize knowledge” were using a deep strategy, which involve understanding. *Deep Strategy* was also found to be positively and significantly related to the conception dimension *Learning as understanding*, the correlation coefficient was from moderate to moderately strong. In other words, students in the present study use a strategy which can be considered as “deep memorization,” a strategy which was mentioned above, and which was identified and proposed by researchers in their previous study of Hong Kong Chinese students (Kember, 1996; Kember & Gow, 1990; Marton, Watkins & Tang, 1997).

Path analysis

Path analysis of the two hypothesized models supports the expected close relations and possibly the predictor effects of epistemological beliefs on learning strategies and conceptions of learning, as evidenced by the significant path coefficients shown in Figures 1 and 2, as well as the satisfactory goodness of fit index in confirming the structural model relations between the variables.

The close association between *Learning as understanding* and *Learning as remembering and reproducing* as evidenced by the strong and significant path coefficients between the two conception dimensions (see Figure 2) suggest that students might consider *Learning as understanding* important although they try to remember the knowledge or the material in the

learning process. It is only through understanding the materials they read that they could later better remember and reproduce, hence ensuring an increase in knowledge in their perception (refer to Figure 2). Students might adopt a deep learning strategy in their learning to help their understanding of the material or knowledge. However, the strong and positive association between conceiving *Learning as understanding* and *Learning as remembering and reproducing* implies that the two conceptions are not contrasting; instead, it is one leading to the other. Such a relation supports that some researchers’ claim that Hong Kong Chinese students use a “deep memorization” approach or strategy in learning rather than a surface approach and rote learning (Kember, 1996; Kember & Gow, 1990; Marton, Watkins & Tang, 1997).

CONCLUSION AND IMPLICATIONS

Three scales with satisfactory reliabilities were validated and used to measure epistemological beliefs, conceptions of learning, and learning strategies of teacher education students in a university in Hong Kong. Four dimensions of epistemological beliefs: *Authority/Expert Knowledge*, *Certainty Knowledge*, *Learning Effort/Process* and *Innate/Fixed Ability* were identified. Students had the highest tendency to believe in *Learning Effort/Process* as indicated by the highest mean score value which greatly differed from the other epistemological belief dimensions. The epistemological beliefs held by the Hong Kong teacher education students, especially the stronger beliefs in *Learning Effort/Process* were explained in terms of the traditional Chinese Confucian culture which places high value in education, effort and hard work as well as obedience and abiding to authority. This is occurring together with the long exposure of Hong Kong to the Western culture, thoughts and philosophy and the recent promotion of constructivism and reflective thinking in the education curriculum and the teacher education program in Hong Kong schools and universities.

Nine dimensions of conceptions of learning were identified, viz: *Learning as an increase in knowledge*, *Learning as remembering and reproducing*, *Learning as a means to an end*, *Learning as understanding*, *Learning as seeing something different*, *Learning as personal change*, *Learning as a duty*, *Learning as a process not bound by time and context*, *Learning as developing social competence*. That is, both quantitative and qualitative, surface and deep conceptions about learning were identified with the sample of students in the present study. Based on the relative mean score values, there was a greater tendency for the students to hold qualitative and deep conceptions such as understanding, personal change and personal fulfillment, as a means to an end despite the conceptions of seeing learning as increasing knowledge and remembering and reproducing also being prevalent. In addition, the conception of seeing learning as a duty had a relatively high mean score, reflecting a social goal of the Hong Kong Chinese students to learn as an obligation or duty in response to the value and expectation from their parents and family members. The higher proportion or tendency of students' conceptions towards the qualitative and deep conceptions of learning could also be taken as an increasing influence of constructivism in learning and the "deep memorization" strategy adopted by Hong Kong Chinese students who memorize knowledge not at a surface level but accompanied by understanding (Kember, 1996; Marton et al., 1997; Sadler-Smith & Tang, 1998). This was supported by the higher mean score value of *Deep Strategy* found for the sample of students in comparison with *Surface Strategy*.

The present study supported the findings of previous research undertaken both locally and abroad (e.g. Chan, 2003; Paulsen & Feldman, 1999; Paulsen & Gentry, 1995) that epistemological beliefs held by students were significantly related to the deep and surface strategies adopted and even had a predictive effect. The present study also found significant relations between epistemological beliefs and learning

strategies as well as between epistemological beliefs and conceptions of learning.

Although limited by the relatively small sample size, the present study is significant in that it contributes to the research of epistemological beliefs and learning. This study highlights the important influence of epistemological beliefs on the conceptions about learning held by students, their learning strategies and how the constructs are related. Teacher educators could help students be aware of their own epistemological beliefs and the influential relations with learning strategies and conceptions of learning for any anticipated changes in learning.

Given more space and allowance, interested researchers can continue to examine the relations of different combinations of pairs of epistemological beliefs, conceptions about learning and learning strategies in order to generate a fuller picture and better understanding of the relations among the variables by means of structural modeling and path analysis.

In addition, further research between epistemological beliefs and motivation, such as achievement or motivational goals of students could be conducted so as to better understand how motivation including achievement or motivational goals are related to or influenced by epistemological beliefs. While it is reported in research literature that achievement or motivational goals (e.g. learning/mastery goals and performance goals) are important driving forces of learning and that achievement goals are related to deep and surface learning strategies adopted by students, it is possible that such relations may be accounted for by the interrelationships existing between epistemological beliefs, motivation goals and learning strategies. Research findings obtained would add new and significant knowledge in this area, not only helping teachers and educators to better understand the nature and relations between the cognitive, metacognitive and affective variables in learning, but also by providing implications to make use of the identified relations to promote effective learning.

The present study is limited by the sample size, especially the male students due to the unique characteristic of teacher education programs which usually consist of a higher proportion of female students. Therefore, the results of the present study should be interpreted with caution when external generalization is intended. Nevertheless, this study is significant as an exploratory study since research of similar nature is scarce, particularly in the Hong Kong Chinese cultural context. This study could be taken as a starting point where more related studies in epistemological beliefs and metacognitive and affective variables in learning could be conducted in different cultural contexts, with larger sample sizes of male and female students not confined to teacher education. It is anticipated with more and further studies of the types suggested, the findings would broaden and deepen our understanding of student learning and prove valuable and significant to educators and researchers.

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