Australian Journal of Educational & Developmental Psychology. Vol 2, 2002, pp 1-16

Core Beliefs about Knowing and Peripheral Beliefs about Learning: Developing an Holistic Conceptualisation of Epistemological Beliefs

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ABSTRACT

In this paper, a core-peripheral beliefs framework is used to present a structure for conceptualising epistemological beliefs, or beliefs about the nature and acquisition of knowledge. Using this framework, the structure of the epistemological belief system is seen as comprising both core beliefs about knowing and peripheral beliefs about learning. Core beliefs about knowing are central and connected to most other beliefs whereas peripheral beliefs about learning and teaching are derived from these core beliefs and are more easily reflected upon and changed. The two distinct literatures related to developmental epistemological beliefs and student learning research are therefore integrated and discussed in this paper to provide a theoretical basis for future studies.

INTRODUCTION

Epistemological beliefs

Facilitating meaningful learning in tertiary education contexts has been the focus of many research endeavours, particularly within the body of literature concerning student learning. Over the last thirty years, many researchers have noted the relationship between students' conceptions of learning and the learning approaches subsequently taken. For example, in the 1970s Marton and Säljö (1976) found that if students used surface-level processing such as rote memorising the text, students viewed learning, in that context, as reproductive. Such reproductive beliefs fostered little reflection on the process of learning. However, when students saw learning as being related to a process of making meaning they were more likely to engage in deep approaches to learning and construct well-organised concepts.

A substantial body of research is now indicating that teacher educators may also need to focus on a related, but somewhat different set of beliefs in order to facilitate learning for meaning. These are called epistemological beliefs and concern the views individuals have about the nature and acquisition of knowledge (Bendixen, Dunkle & Schraw, 1994). This paper is an overview of the literature related to epistemological beliefs and student learning. Based on this, a framework for considering perspectives of knowing and learning as an holistic set of epistemological beliefs is presented. Teaching implications will also be considered.

Personal epistemological beliefs range from naïve, dualistic beliefs in the existence of absolute truths to sophisticated, relativistic beliefs that knowledge is tentative, personal and relative to various contexts. Throughout the current study the term naïve will be used to refer to individuals who have a tendency to believe that truth is certain, absolute and able to be transferred by an authority. The use of the term sophisticated will refer to those beliefs that truth is relative, changing, and actively

constructed by the individual. This terminology is commonly used in the epistemological beliefs literature (Kardash & Scholes, 1996).

Changes in epistemological beliefs are considered to take place when students are challenged to rethink or reconstruct such beliefs into more mature ways of knowing (Hofer & Pintrich, 1997). There is evidence to suggest that education influences such epistemological development (Alexander & Dochy, 1995; Perry, 1981; Strange & King, 1981; King & Kitchener, 1994; Schommer, 1998b) where tertiary studies are likely to provide exposure to a variety of educational perspectives. For example, in Alexander and Dochy's (1995) cross-cultural study, American participants who had developed knowing and learning expertise through further education were more able to see multiple perspectives and offer tentative explanations when defending their perspectives of what constituted knowledge and beliefs. Effectively, exposure to further education may cause cognitive conflict that results in the reconstruction of simplistic epistemological beliefs into more relativistic, sophisticated ways of knowing. It is likely that, in addition to educational experiences, life experiences (Belenky et al., 1986) and physical development may facilitate epistemological development although it is not clear exactly how each of these factors influences epistemological beliefs (Schommer, 1998).

Hofer and Pintrich (1997) extensively reviewed the research related to epistemological beliefs. They described three major areas of research, which included investigations regarding how students interpret their learning experiences (see Belenky et al., 1986 and Perry, 1970); the influence of epistemological beliefs on reasoning (see King & Kitchener, 1994); and the notion of multidimensional rather than unidimensional beliefs (see Schommer, 1994). These areas will be used to structure this review of the epistemological beliefs literature.

Epistemological Beliefs: How Students Interpret Learning Experiences

Perry's Epistemological Positions

One of the most influential researchers in the area of epistemological beliefs was William Perry. In his longitudinal research spanning the late 1950s and early 1960s, 84 male liberal arts students were asked to describe their university experiences. Responses to open-ended interview questions were considered at first to be the result of certain personality characteristics but each year, as Perry and his colleagues reinterviewed the students, they discovered that a consistent pattern of change was emerging with respect to how the students viewed the world (Perry, 1988). These patterns of change were related to the cognitive (thinking), identity and ethical (care) development of students and were assumed to account for experiences both within, and external to, the university context.

Perry's description of development was represented by positions along a "pilgrim's path" (Perry, 1988). He described changes in thinking as a type of evolution in the way individuals interpret their world. According to Perry, there were four main epistemological positions: Dualism, Multiplism, Relativism and Commitment. Individuals who held dualistic views about the nature of knowledge believed that absolute truths (right/wrong) exist and could be transmitted to an individual from an authority or expert. Next, when individuals began to conceive of knowledge in a multiplistic way, they conceded that as well as absolute truths, there were some things that could not be known with any certainty. Such individuals believed that knowledge comprised both personal opinions and ultimate truths. They relied less on authorities for absolute truths, and personal opinions and truths were still considered to be "right" or "wrong". The next position, Relativism, constituted a major shift in epistemological thinking because individuals considered that knowledge was actively and personally constructed, although initially this may have occurred in some contexts only. Absolute truths could no longer exist because truth was considered to be relative to individuals' personal interpretations of experiences. In the final positions related to commitment, relativistic thinking was

still a feature, but particular beliefs were more valued than others and were committed to in a flexible manner.

These epistemological beliefs were considered to influence learning. Schommer (1993a) and Ryan (1984a) reported that the more students conceived of knowing as dualistic, the more likely they were to gauge their understanding based on factual standards. Relativist thinkers, conversely, were more likely to consider that comprehension was related to understanding and application. Students with relativistic beliefs are more able to reflect on different ways of thinking rather than focussing only on content. The ability to compare different ways of thinking reflects "meta-thinking, the capacity to examine thought, including one's own" (Perry, 1981, p. 88). Such reflective capacity enables students to see other peoples' points of view. It also enables them to reflect on relationships so they can integrate information into relational wholes rather than maintaining isolated pieces of information.

Women's Ways of Knowing

Although Perry's (1970) epistemological positions were not intended to focus on specific gender issues, the positions were derived using predominantly male Harvard university students. In subsequent research, these positions were often used to characterise female college students (Sottile, 1994). In response to these gender issues, Belenky et al. (1986) described a sequence of epistemological development by interviewing 135 women from academic and non-academic backgrounds. They asked the women to respond to a number of open-ended questions that were intended to reflect moral, cognitive and identity development. They described five ways of knowing in the development of epistemological beliefs that closely aligned with those described by Perry (1970). The positions of Silence, Received Knowing, Subjective Knowing, Procedural Knowing, and Constructed Knowing emerged in Belenky et al.'s study of womens' ways of knowing. Each will be discussed in turn.

In the first position, Silence, individuals are likely to believe that knowledge is transmitted from an authority and that knowledge is absolute and categorical. Such women lacked the ability to engage in personal reflection. Recently, Goldberger (1996b) described how Silence, from some cultural perspectives, may represent an adaptive way of knowing. For example, if cultural mores dictate silence as a mark of respect, then such silence represents a different way of knowing to those silenced through oppression and poor relationships with significant authorities in their lives. In fact, Goldberger now prefers the term Silenced to indicate that this oppressed group of people are forced into voicelessness rather than choosing to remain silent. Perry (1970) did not find this type of beliefs about knowing in his male sample.

In the second position, Received Knowing is conceived of as dualistic (categorical and absolute) and learning takes place through passively receiving knowledge. These women tend not to believe in their own ability, perceiving authorities as possessing all the answers. Goldberger (1996b) believed that received ways of knowing may not be naïve when cultural factors such as 'deference to external authority' (Goldberger, 1996b, p. 351) are taken into consideration.

In the third position, Subjective Knowing, women believe that knowledge is subjective (an inner voice) and no longer rely on the power of authorities to know. According to Belenky et al. (1986), subjective knowledge is based on intuitive ways of knowing that are often described as 'gut feelings' and often considered typical of womens' thinking. This position is similar to Perry's (1970) description of multiplism, although Perry's position included both subjective and dualistic beliefs.

In the next position, Procedural Knowing, individuals believe that knowing no longer relies on intuitive knowledge. Women in this position often use conscious systematic processes of thinking rather than relying only on content. This means that the use of such processes means individuals now have ways of interpreting the world: Content no longer offers an exact representation of the world that

can be transmitted and recalled. Truth is no longer considered absolute and is now open to interpretation (Belenky et al., 1986). Perry (1981) described this as relativism.

The final position, Constructed Knowing involves the integration of both procedural and subjective, or rational and emotive knowledge. Women who evidenced Constructed Knowing are more able to deal with high levels of ambiguity and realise that contradiction and continual evaluation of beliefs about knowing are necessary. Such constructed ways of knowing do not clearly resemble any of Perry's (1970) positions.

The Influence of Epistemological Beliefs on Reasoning

King and Kitchener (1985, 1994) also investigated the influence of epistemological beliefs on learning. Emerging from Perry's work, their Reflective Judgment Model is a description of changes in reflective processes and epistemological beliefs.

Reflective judgment beliefs are considered to influence individuals' decisions in ill-defined problem solving (Kitchener, 1983). That is, beliefs about knowing may determine the type of problem solving strategies used. King and Kitchener postulated three main types of reflective thinking in the reflective judgment model (King & Kitchener, 1985; King & Kitchener, 1994). These are pre-reflective, quasi-reflective, and reflective thinking.

Pre Reflective Thinking

King and Kitchener (1994) believed that individuals are not able to think reflectively at this stage because truth is still considered to be absolute. Therefore, when dealing with ill-structured problems, solutions are dogmatically right or wrong and "beliefs are either unexamined and unjustified or justified by their correspondence with the beliefs of an authority figure . . . " (King & Kitchener, 1994, pp. 53-54). For example, a teacher confronted with a playground conflict over ownership of some prized possession, may dogmatically re-assert the school rules about bringing such toys to school and confiscate the item. This evidences a solution that is based on a view of knowledge as absolute and categorical.

However, when truth is considered to be not immediately obtainable, individuals may also rely on subjectivity or personal opinions. Such individuals still believe that some time in the future an absolute truth will be obtainable. Therefore such individuals hold a mixture of beliefs in right, wrong and uncertain knowledge because some knowledge can now be temporarily unknown (King & Kitchener, 1985; Kitchener et al., 1993; King & Kitchener, 1994). Students' justifications for solutions to ill-defined problems rely on personal opinion and authority (King & Kitchener, 1994). Pre-reflective thinking is similar to Perry's (1970, 1981) description of dualism and the beginning of multiplism.

Quasi Reflective Thinking

This type of thinking represents a significant change in thinking because individuals are now able to reflect on knowledge in an abstract way for the first time (Kitchener et al., 1993). Individuals are likely to believe that truth is uncertain and do not merely hold a temporary belief in such uncertainty. The dualistic categories of right and wrong still exist but not to the same extent as in pre reflective thinking (King & Kitchener, 1985). People often support their beliefs by reflecting on idiosyncratic evidence and opinion (King & Kitchener, 1994). Using the previous example of the playground, a teacher may attempt to solve the problem by reflecting on similar experiences he or she had as a child. This would not necessarily involve any formal theories of child development but rather personal, subjective experiences of what might work in the particular situation. In this form of reflective

judgment, the teacher is not dogmatically referring to a set of rules to solve the problem, but an idiosyncratic justification.

In quasi-reflective thinking, individuals may also begin to think relativistically using reasoned arguments not just subjective opinions: Individuals are able to evaluate arguments in single contexts (King & Kitchener, 1985) which is similar to Perry's (1970, 1981) beginning stages of relativism. This type of thinking becomes evident across a range of contexts in the next stage.

Reflective Thinking

Reflective thinking is characterised by a belief that all knowledge is uncertain. Individuals are able to use reason and evidence to support opinion (Kitchener et al., 1993; King & Kitchener, 1994). Even though absolute, objective knowledge is not considered to exist, some personal viewpoints are more valid than others because they have been derived by using inquiry techniques that promote "relationships between sub-categories across domains" (King & Kitchener, 1985, p. 9). This stage is similar to Perry's (1970, 1981) relativism because relativistic thinking now takes place in a range of contexts as a relational thinking activity. Relational thinking is evidenced by an ability to compare and contrast two perspectives of the same topic and develop an integrating structure that emerges from both perspectives (King & Kitchener, 1994).

Individuals are likely to hold beliefs that "knowledge must be constructed through critical inquiry or through the synthesis of existing views and evidence into more cohesive and coherent explanations ... A judgment can be justified as the most reasonable current solution to a problem" (King & Kitchener, 1985, p.10). In the example of the playground conflict, the teacher would help children to solve the conflict, recognising that there may be a number of solutions to the problem. The mediating process would also be informed by a range of informed theories of child development, not subjective opinions about what may or may not work.

Multidimensional Epistemological Beliefs

The schemes of development of epistemological beliefs described so far have been criticised for their stage-like, unidimensional characteristics. Building on the work of Perry and others, Schommer conceived of epistemological perspectives as more than a unidimensional set of beliefs that developed over time. Over a series of studies, she described a multidimensional set of, more or less, independent beliefs (Schommer 1990, 1993a, 1993b). This means that individuals may hold both sophisticated (more relativistic) and naïve (more dualistic) views about the nature of knowing. Schommer (1989, 1990, 1993a, 1993b) described five dimensions of epistemological beliefs that included (a) Omniscient Authority (beliefs in the source of knowledge), (b) Certain Knowledge (beliefs in the certainty of knowledge), (c) Simple Knowledge (beliefs in structure of knowledge), (d) Quick Learning (beliefs in the speed of learning), and (e) Innate Ability (beliefs in the stability of knowledge) (Schommer, 1990).

More recently, Schommer (1994) has conceptualised such beliefs as a kind of frequency distribution where 'for example, sophisticated learners may believe a vast amount of knowledge is evolving, some knowledge is yet to be discovered, and a very small amount of knowledge is unchanging. . . On the other hand, naïve learners may believe a vast amount of information is certain, some knowledge is yet to be discovered, and a very small amount of knowledge is changing.' (Schommer, 1994, p.302). This multiplicity of dimensions suggests "that epistemological beliefs do not necessarily develop in synchrony" (Schommer, 1994, p.302) and that learning may in fact be determined by individual as well as by a combination of beliefs.

Summary and Conclusions

Epistemological beliefs have been described in terms of (a) the influence on learning (Belenky et al., 1986; Perry, 1970); (b) the influence on reasoning (King & Kitchener, 1994); and (c) multidimensional characteristics.

The positions, stages, and dimensions of the various perspectives of epistemological beliefs are summarised in Table 1. Similarity between positions in each of the schemes is indicated by the placement of such positions at the same level in the table.

Table 1: Summary of stages, positions, and dimensions in various perspectives of epistemological beliefs

Perry (1970, 1981, 1988)	**Belenky et al. (1986)**	**King & Kitchener (1985, 1994)**	**Schommer (1990, 1993a, 1993b)**
	Silenced		Naïve beliefs
Dualism	Received Knowing	Pre reflective thinking	
Multiplism	Subjective Knowing	Quasi reflective thinking	
Relativism	Procedural Knowing	Reflective thinking	Sophisticated beliefs regarding 5 dimensions
	Constructed Knowing		Omniscient Authority Certain Knowledge Simple Knowledge Quick Learning Innate Ability

In all of these schemes, epistemological beliefs are considered to develop from naïve to sophisticated. However, there is ongoing debate concerning the validity of sophisticated epistemological beliefs (relativism, procedural and reflective thinking) as developmental ideals (Goldberger, 1996a). Goldberger (1996a, 1996b) recognised that in certain cultures relativistic ways of knowing may not be appropriate, although she defended the superiority of such developmental ideals within the American context which reflects multiple perspectives of knowing. Similarly, it could be argued that there is a need to be aware of, and reflect upon, multiple perspectives in an increasingly pluralistic Australian society.

It is likely that epistemological beliefs, which are considered to filter all knowledge and beliefs, influence beliefs about learning and teaching in specific learning situations and, therefore, how a person is likely to approach learning/teaching in particular contexts. This has implications for teacher educators who wish to help students to develop contstructivist beliefs. Constructivism is the belief that “individuals learn as they wrestle cognitively with problems of concern to them" (Shaver, 1992, p.17). It refers to a particular set of beliefs that understanding exists only for the individual who actively creates such beliefs. Regardless of whether knowledge is conceived of as individually or socially constructed, constructivism involves cognitive tasks that link new to prior knowledge, the individualisation of learning outcomes, and learning that is context-specific (Tynjala, 1997). Such constructivist beliefs are more likely to result in teaching behaviours that focus on facilitating meaningful learning in students (see Arredondo & Rucinski, 1996; Hasweh, 1996; Maor & Taylor, 1995).

The epistemological beliefs literature has been reviewed with a focus on individuals' beliefs about the nature and acquisition of knowledge (Bendixen et al., 1994). Although much of the research related to epistemological beliefs has provided perspectives on how beliefs about knowing may influence learning, there has been no framework that formalises such a relationship. The next section is a description of a framework for conceptualising epistemological beliefs holistically as both core beliefs about knowing and peripheral beliefs about learning.

Epistemological Beliefs as Core Beliefs About Knowing And Peripheral Beliefs About Learning

A beliefs structure comprises both core (values) and peripheral beliefs. The more a belief is connected with others within the system (core), the more central and impervious it is to change (Bem, 1970; Nisbett & Ross, 1980; Pajares, 1992; Howard, 1987 cited in Peterman, 1991; Rokeach, 1968). Peripheral beliefs are more able to be reflected upon and changed (Howard, 1987 cited in Peterman, 1991) because other knowledge and beliefs are not dependent on them.

In Rokeach's (1968) seminal work, five types of beliefs were described as existing along a continuum from core to more peripheral in nature. These are Types A, B, C, D, and E: Type A and B beliefs are more central, while Type E beliefs are peripheral.

Type A beliefs concern those that are fundamental to our psychological existence. They are described as a set of existential, shared, often non-conscious beliefs related to the credibility of one's own senses (e.g., How do I know that my senses are not deceiving me as a way of knowing?) or an external authority as sources of knowledge (Bem, 1970). These represent a basic set of core values, which are epistemological in nature. Bem suggested that we may not even be aware that alternatives could even exist, for example that our senses may not be a reliable way of knowing.

According to Rokeach, a person's Type B beliefs include those that are primitive in nature but are not necessarily shared by other people. These include such things as phobias, delusions and ego-related beliefs.

Type C beliefs are similar to Type A beliefs in authorities (external or self) but are not primitive because they are more likely to be consciously reflected upon.

> Such beliefs, while important and generally resistant to change, are nevertheless conjectured to be less important and easier to change than Types A and B beliefs. . . Such beliefs concern not only which authorities *could* know but also which authorities *would* know. Which authorities, positive and negative, are we to trust and distrust, to look to and not to look to, as we go about our daily lives seeking information about our world? . . . any given authority belief is typically controvertible because the believer has learned that some of his reference persons and groups do not share his belief" (Rokeach, 1968, p. 10).

Type C beliefs are the product of explicit reflection and emerge from a logical, explicit awareness of the fallibility of external sources and our sensory experiences.

The next set of beliefs along the core-peripheral continuum is Type D, which are those that are derived from an authority. "Believing in the credibility of a particular authority implies an acceptance of other beliefs perceived to emanate from such authority." (Rokeach, 1968, p.10). For example, Marton and Säljö (1976) described some conceptions of learning as emerging from a process of making meaning in which individuals actively construct personal knowledge. According to Rokeach, such derived beliefs about learning might emanate from a core belief in the self as an authority and could be described as peripheral beliefs about learning.

Finally, inconsequential or Type E beliefs are related to an individual's personal taste (e.g., an individual's favourite colour) and therefore are less functionally related to other beliefs. If these were altered there would be no implications for beliefs related to self (Rokeach, 1968).

Using the structure suggested by Rokeach (1968), epistemological beliefs will now be defined in this paper as core beliefs about knowing and peripheral beliefs about learning. Core beliefs about knowing may be considered to be central or functionally connected to all other beliefs and knowledge and can be described as Type A or C beliefs in the credibility of an authority: Peripheral beliefs about learning would be derived from a core belief about knowing and be described as Type D. Hofer and Pintrich (1997) also believed that core beliefs about knowing are central values (as described by Rokeach, 1968) that are functionally connected to, and therefore influence the development of, most other beliefs and knowledge. They suggested that views about the nature of knowledge (certainty and simplicity of knowledge) and knowing (source of knowledge and justification for knowing) ". . .should be considered the core of an individual's theory, while the other beliefs about learning, teaching and intelligence may be related to the core dimensions but are peripheral to an individual's theory. . ." (p. 119). In this context "an individual's theory" is considered to reflect their belief system in relation to knowledge. Hofer and Pintrich argued further that beliefs about learning should not feature in descriptions of epistemological beliefs in general. They believed that such beliefs do not constitute the core dimensions of epistemological theories and have labelled them as 'peripheral beliefs about learning, instruction and intelligence' (p. 113). They postulated that core beliefs about knowing should include only those beliefs about 'the nature of knowledge and the nature or process of knowing' (p. 112). According to this revised definition of epistemological beliefs, the schemes described by Perry, Belenky et al., and King and Kitchener as well as three of Schommer's dimensions (Omniscient Authority, Certain Knowledge, and Simple Knowledge) would comprise core beliefs about knowing. Schommer's other two dimensions, Quick Learning and Innate Ability, would be considered to be peripheral beliefs about learning and intelligence.

Core Beliefs about Knowing: Context specific or generalisable?

The notion of core beliefs about knowing as central values implies that they may be generalised across disciplines. For example, Schommer and Walker (1995) noted in their study of college students that core beliefs about knowing were similar across the disciplines of maths and social science. King and Kitchener's (1994) research also showed that individuals' core beliefs about knowing are consistent across a range of disciplines.

Mori's (1999) recent study supported Schommer and Walkers' view that core beliefs about knowing are generalisable, although his earlier work presented a different view in this regard. In his 1997 study, Mori suggested that core beliefs about knowing were context specific rather than being similar across domains. Sheese and Radovanovic (1984), Beers (1988), and Roth and Roychoudhury (1994) similarly reported that core beliefs about knowing are more likely to be context specific.

A third perspective in this debate must also be considered. Ruddick (1996) claimed that core beliefs about knowing can be described as <u>both</u> generalised and context specific. She postulated that people have different beliefs about knowing in different contexts and yet conceded that 'prolonged focus on any of these kinds of inquiries may well produce cognitive capacities and attitudes that recur to different degrees in epistemologically dissimilar contexts' (pp. 254-255). This means that, while core beliefs about knowing may be context specific, it is also possible that they may be held across a range of contexts, giving the impression that they are generalisable. The debate regarding context-specific versus generalised beliefs about knowing is ongoing and in need of further discussion (Hofer & Pintrich, 1997).

To summarise, a substantial body of research now recognizes the relationship between knowing and learning. In particular, he notions of centrality and unavailability of core beliefs about knowing raised

earlier in the paper are important when considering belief change in teacher education. To facilitate the development of more sophisticated core beliefs, it may be necessary to help students reflect explicitly on these in order to develop higher order beliefs that are then more controvertible (Rokeach, 1968). Also, the centrality of core beliefs about knowing has implications for how teacher educators conceive of teacher education programs. If teacher educators wish to help student teachers become more cognitively sophisticated, and able to attend to multiple viewpoints within a broader social, cultural and political context (cf. Hatton & Smith, 1995), then it may be necessary to focus on developing more sophisticated core beliefs about knowing. These beliefs may then influence or filter the peripheral or derived (Type D) beliefs about learning. The next section of this paper will investigate the student learning literature in the light of the epistemological beliefs literature.

The Student Learning Research

This section of the review is a description of conceptions of learning and how they might fit within the overall epistemological beliefs system. In order to do this, however, conceptions and beliefs need to be clarified. Using the core-peripheral framework, beliefs about learning may be described as peripheral or Type D within the epistemological beliefs system. This means that beliefs related to learning are derived from core beliefs about knowing and are more open to change.

The framework presented in this paper is based on an understanding that beliefs are a subset of knowledge (Schoenfeld, 1985). In a similar way, Alexander and Dochy (1995) believed that knowledge included everything an individual knows or believes to be true despite whether or not there is evidence to support it.

Pajares (1992) described how beliefs can be distinguished from knowledge on the basis of evaluative, affective and behavioural characteristics. In order to consider how conceptions of learning might relate to beliefs about learning, the conception of learning as memorising (see Marton et al., 1993) will be used as an example. First, the success of rote learning (memorising) at school may lead to a judgment or an evaluation that this particular type of learning is valuable. Second, such a conception of learning may also have related affective qualities. For example, if an individual has experienced success with memorisation in the past, these experiences may have provided the individual with strong positive feelings that become associated with such a conception. These affective characteristics are then likely to influence learning behaviour because an individual will often expend more energy and time on learning activities that are associated with positive experiences. Conceptions of learning may be similar to beliefs about learning if individuals evaluate the nature of the particular conception of learning, develop strong feelings regarding such conceptions, and then behave in a way that reflects those understandings.

Säljö (1979) identified five different conceptions of learning which included learning as (a) an increase in knowledge, (b) memorising, (c) the acquisition of knowledge for retention or use in practice, (d) understanding, and (e) an interpretative process aimed at the understanding of reality. Marton et al. (1993) also found that Social Science students at the Open University in Britain held similar conceptions to those described by Säljö (1979) except for a sixth conception. These conceptions included (a) Increasing one's knowledge, (b) Memorising and reproducing, (c) Applying, (d) Understanding, (e) Seeing something in a different way, and (f) Changing as a person.

The first three conceptions of learning represented in the hierarchy described by Säljö (1979) and by Marton et al. (1993) are (a) increasing knowledge, (b) memorisation and (c) acquisition of knowledge for retention or use in practice. Common to these three conceptions is the notion that learning involves

the acquisition of aggregation of knowledge without any transformation of the information to develop understanding. These are quantitative in nature because students perceive that they need to acquire a range of facts that remain unconnected. There is evidence to suggest that such conceptions could be the result of previous educational experiences, particularly experiences with formal examinations (Säljö, 1984). Van Rossum and Schenk (1984) reported that a considerable number of first year university students held quantitative beliefs about learning, possibly because of their educational experiences prior to tertiary studies. However, this is not surprising considering the research that suggests that first year college students are also likely to possess predominantly dualistic or multiplistic core beliefs about knowing (see, for example, Baxter Magolda, 1993b).

The final conceptions in the hierarchy are described by Säljö (1979) as (d) understanding and (e) an interpretative process aimed at the understanding of reality and Marton et al. (1993) as (d) understanding, (e) seeing something in a different way, and (f) changing as a person. These conceptions involve a view of learning as a process of active, personal construction of meaning and change. They are qualitative in nature because understanding emerges from a transformation of the information in relation to the learners' prior knowledge rather than a focus on aggregating quantities of information that remain unconnected. Similar qualitative views of learning were also described by Van Rossum and Schenk (1984).

There are two fundamental differences between the quantitative and qualitative conceptions described by Säljö (1979) and Marton et al. (1993). The first involves how knowledge can be gained (Wilkinson, 1989). In the quantitative conceptions the learner believes that learning is acquiring external knowledge from an external source without active construction of knowledge. This view of learning is similar to the naïve core beliefs about knowing described by Perry (1970), Belenky et al. (1986), and Baxter Magolda (1993a) where knowledge is also absorbed from an external source without personal construction of meaning. The qualitative conceptions (d), (e) and (f) involve learning as a process of active knowledge construction by the individual to extract meaning from the learning task. It is possible that individuals with such sophisticated conceptions acknowledge that quantitative perspectives may also play a role in learning, although the overall focus is on qualitative perspectives of learning. Both qualitative conceptions of learning and the more sophisticated, core beliefs about knowing described by Perry, Belenky et al., and King and Kitchener are characterised by the perspective that knowledge is a construction of meaning. Considering the filtering role of core beliefs about knowing, it is possible that dualistic core beliefs will promote quantitative conceptions of learning, while relativistic core beliefs may influence the development of qualitative conceptions of learning.

The second difference between qualitative and quantitative beliefs or conceptions relates to the nature of what is learnt (Wilkinson, 1989). Individuals with quantitative conceptions of learning, according to Marton et al. (1993), view knowledge as discrete elements existing out there that can be acquired without transformation. The qualitative conceptions reflect views that knowledge is complex (not discrete but interconnected) and relative to the individual's interaction with a particular context (not absolute) and may reflect the dualistic-relativistic perspectives of knowing described by Perry (1970), Belenky et al. (1986), and Baxter Magolda (1993a). Table 2 is an overview of the literature that has been reviewed to construct an holistic conceptualisation of epistemological beliefs from a core-periphery beliefs perspective.

Teaching Implications

The literature regarding core and peripheral beliefs was reviewed to provide a useful framework for the implementation of teaching programs aimed at developing students' epistemological beliefs. Core beliefs about knowing may influence peripheral beliefs about learning (Bem, 1970; Hofer & Pintrich, 1997; Rokeach, 1968). However, students' conceptions of

learning in a specific situation may be dependent on both the way in which they have experienced learning in the past and the way in which they experience the current situation. For example, qualitative beliefs about learning and subsequent approaches to learning are likely to be the product of both sophisticated core beliefs about knowing and learning environments that promote sophisticated beliefs about learning (e.g., assessment that encourages students to actively engage in the learning tasks, collaborative learning groups, stress-free learning etc.). This means there are two main implications for teacher education. First, interventions may need to focus on helping students reflect explicitly on their core beliefs about knowing and peripheral beliefs about learning. Second, the learning context, in particular the assessment procedures, needs to be structured to encourage students to develop more sophisticated epistemological beliefs. Each of these implications for teaching will be discussed in turn.

Explicit Reflections on Epistemological Beliefs

To promote the development of relativistic core beliefs about knowing and qualitative conceptions of learning it may be important to challenge students to reflect on these with a view to possibly reconstructing such beliefs. Such beliefs are usually well developed by the time student teachers commence a teacher education course (Calderhead & Robson, 1991; Wilson, 1990). It is possible that teacher education students may be able to engage in further study without having to rethink their own beliefs. This may occur because throughout their personal school experiences they have developed beliefs about knowing, learning and teaching that have influenced their perceptions of appropriate teaching practice (Pajares, 1992).

The more a belief is connected with other beliefs, the more central the belief and the more impervious it is to change (Rokeach, 1968). Therefore, core beliefs about knowing may be difficult to change. However, explicit reflection on these may facilitate the development of higher order beliefs, which are then typically more easily changed. Such meta-metacognitive awareness, or awareness of one's epistemological beliefs, is also considered to be an essential teaching characteristic needed for dealing with ill-defined problems so typical of everyday interactions in school environments (Kitchener, 1983).

The Learning Context

It may not be sufficient to help students to reflect on their epistemological beliefs. The learning context may also need to be changed so that students are required to engage in constructivist learning behaviours that may then influence their epistemological beliefs (cf. Unger, Draper & Pendergrass, 1986). In particular, assessment is a key factor in determining students' learning behaviour and beliefs about learning in particular contexts. Biggs (1996b) described constructivist alignment of teaching objectives and assessment procedures as a way to help students engage in meaningful learning. If relativistic epistemological beliefs and related teaching objectives are aligned with assessment approaches that complement these beliefs, then alignment is likely to have a backwash effect and result in meaningful approaches to learning (Biggs, 1996b). Such assessment needs to focus on the development of understanding and the application of theory to personal situations and experiences rather than a reproductive focus on gaining facts (cf. Biggs, 1996a). Constructivist alignment of assessment and objectives may help those students with more naïve epistemological beliefs to engage in meaningful learning to fulfil assessment requirements. This change in behaviour may, over time, facilitate belief change (Unger, Draper & Pendergrass, 1986).

Table 2: Overview of literature used to construct an holistic conceptualisation of epistemological beliefs

Hofer & Pintrich (1997)	Rokeach (1968)	Perry (1970, 1988)	Belenky et al. (1986)	King & Kitchener (1985, 1994)	Schommer (1990, 1993a, 1993b)	Säljö (1979)	Marton et al. (1993)
Core beliefs (about the nature of knowledge & knowing)	Type A beliefs (existential, shared, nonconscious beliefs about credibility of senses or external source as way of knowing)	*Non Conscious Beliefs* Dualism Multiplism Relativism	*Non Conscious Beliefs* Received Subjective Procedural Constructed	*Non conscious beliefs* Pre reflective Quasi reflective Reflective	*Non conscious beliefs* Naïve Sophisticated (regarding 3 dimensions Omniscient Authority Certain Knowledge Simple Knowledge)		
	Type C beliefs (similar to Type A beliefs but consciously held)	*Conscious Beliefs* Dualism Multiplism Relativism	*Conscious Beliefs* Received Subjective Procedural Constructed	*Conscious beliefs* Pre reflective Quasi reflective Reflective	*Conscious Beliefs* Naïve Sophisticated (regarding 3 dimensions Omniscient Authority Certain Knowledge Simple Knowledge)		
Peripheral Beliefs (about learning, instruction & intelligence)	Type D beliefs (beliefs derived from authority)				*Conscious beliefs* Naïve Sophisticated (regarding 2 dimensions Quick Learning Innate Ability)	(a) an increase in knowledge (b) memorising (c) the acquisition of knowledge for retention or use in practice (d) understanding (e) an interpretative process aimed at the understanding of reality	(a) increasing knowledge (b) memorising & reproducing (c) applying (d) understanding (e) seeing something in a different way (f) Changing as a person.

Conclusion

The literature related to epistemological beliefs has been reviewed to provide a meaningful construction of the developmental epistemological beliefs and student learning research literature. This construction has been developed by using a core-peripheral beliefs framework to integrate the two distinct literatures. The framework may provide a platform for future studies that are focussed on investigating effective learning and teaching in teacher education. Teacher educators need to recognise the importance of helping students to reflect on their epistemological beliefs in order to facilitate the development of more sophisticated beliefs. However, teacher educators also need to be aware of how the environment, particularly learning activities and assessment, needs to be structured to ensure that constructivist learning behaviours occur. Such behaviour change may then also lead to changes in students' epistemological beliefs.

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