Epistemology in Education: Epistemological Development Trajectory

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Learning is a continuous process, and through the process of learning, people acquire or construct new knowledge; this knowledge is evaluated implicitly or explicitly (Hofer, 2000). Research on beliefs about knowledge has become an important field of inquiry in educational research (Hofer & Pintrich, 1997). This field of research has emerged as a way of investigating students' epistemological beliefs (Perry, 1970). Perry (1970) was the first scholar to conduct empirical research with college students to investigate their intellectual development. Since then, research on personal epistemology has been extended to be now divided into three broad categories: developmental perspective (Perry, 1970; Belenky et. al, 1986; Baxter Magolda, 1992; King & Kitchener, 1994; Kuhn, 1995), personal epistemology (Shommer-Aikins, 2002), and alternative concepts of personal epistemology (Hofer & Pintrich, 1997; Hammer & Elby, 2002). The aim of reviewing the three categories is to have a deep understanding of the construct of personal epistemology, how it has been investigated, and how the models overlap. There will be also a review of the implications of epistemology in learning and teaching.

Key Words: Epistemology, the Perry Scheme, personal epistemology, epistemic belief

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Learning is a continuous process, and through the process of learning, people acquire or construct new knowledge; this knowledge is evaluated implicitly or explicitly (Hofer, 2000). Research on beliefs about knowledge has become an important field of inquiry in educational research (Hofer & Pintrich, 1997). This field of research has emerged as a way of investigating students' epistemological beliefs (Perry, 1970). To understand the learning process, research on students' personal epistemology was essential.

An analysis of the trajectory of epistemology in education shows that research started with the work of Piaget, and it was the most important shift in the way epistemology was studied. Research on personal epistemology shifted from philosophy to psychology. Piaget (1950) made the point that philosophers studied the nature of knowledge in its current state. Piaget's work on genetic epistemology focuses on the fact that we cannot say there is a history of knowledge, and then we speak about the current state of knowledge. It is with the idea that knowledge is not static because it is a process that the field of study of epistemology shifted to be a psychological field of research.

The findings also show that the models which have been developed have the same origin; that is to say research on epistemology in education is psychological, and thus focuses on the cognitive and metacognitive processes students go through in knowing. Research on epistemology is mainly a focus on the knower and the known (Hofer & Pintrich, 1997; Hofer, 2004). The area of research has been extended to be now divided into three broad categories: First, epistemology was investigated from a developmental perspective (Perry, 1970; Belenky et. al, 1986; Baxter Magolda, 1992; King & Kitchener, 1994; Kuhn, 1995). In the second category, personal epistemology has been investigated as a system of beliefs (Shommer-Aikins, 2002). The third category deals with new concepts of personal epistemology (Hofer & Pintrich, 1997; Hammer & Elby, 2002). The analysis of the readings show that epistemology in education has implications in learning and teaching. The aim of this paper is to understand the constructs related to epistemological development. Thus, the focus is mainly on the different models in this area of research. The strategy used for the analysis is a review to research that describes the stages of the development of epistemology in education.

Conceptual Framework

The conceptual framework of this research will be based on epistemology (Perry, 1970; Belenky , Clinchy, Goldberger, & Tarule, 1986 ; Baxter Magolda, 1992; King & Kitchener, 1994; Shommer-Aikins, 2002; Hofer & Pintrich, 1997; Hammer & Elby, 2002). Epistemology was first used in philosophy, and then it was introduced by Piaget in education (Hofer, 2000). Thus, in any field of research epistemology is related to the nature of knowledge, and the way we acquire it, and most importantly in the process of acquiring this knowledge, some of it becomes as a strong true belief. After philosophers, educational psychologists (Piaget, 1950; Perry, 1970) worked on epistemology to understand how kids or students think about learning.

It can be stated that the introduction of epistemology in education started with the work of Piaget on genetic epistemology. Piaget (1950) makes the point that epistemology has always been the concern of philosophers, but they have studied knowledge as it is in present. Piaget (1950) believes that knowledge is in perpetual evolution, so there is no definitive state of knowledge because it is "a process of continual construction and reorganization" (p.4). Piaget (1950) also makes the point that the nature of knowledge is best understood when the psychological and sociological factors are understood. The first goal of investigating epistemology in education is to find out the way students approach knowledge; as Hofer (2002) states students approach the learning process into different ways, and this depends on " whether they view themselves as passive receptors or active constructors of knowledge"

(p.3). The readings on this topic show that research on epistemology has been divided into three broad categories. First, epistemology was investigated from a developmental perspective (Perry, 1970; Belenky et. al, 1986; Baxter Magolda, 1992; King & Kitchener, 1994; Kuhn, 1995). In the second category, personal epistemology has been investigated as a system of beliefs (Shommer-Aikins, 2002). The third category deals with alternative concepts of personal epistemology (Hofer & Pintrich, 1997; Hammer & Elby, 2002). The aim of reviewing the three categories is to have a deep understanding of the construct of personal epistemology, how it has been investigated, how the models overlap. In addition to this, I want to understand the gap of research in this area, and to be able to select the model that I will use as the theoretical framework in writing my thesis.

Developmental Models

The Perry Scheme. Perry (1970) studied the intellectual development of 109 Harvard undergraduate students. All students were males, and the study lasted four years. He investigated the students' personal assumptions about the origins of knowledge, and the students' cognitive processes. . He did the longitudinal research using open-ended interviews as a tool of the research. Perry (1970) built his research on the assumption that students transform their beliefs about knowledge from a position of dualistic thinking toward relativistic thinking. (p.54). He also had the assumption that students had different views on knowledge because they approached knowledge from different positions. He developed the scheme of intellectual development (fig 1) through nine positions. He then grouped the nine positions into three stages. He grouped the three first positions in the stage of "The Modifying of Dualism", and in this stage of development of knowledge "the challenge is presented by the impact of Multiplicity" (p. 57). The three middle positions represent the stage of "The Realizing of Relativism", and are characterized by "the instability of self in a diffuse Relativism" (p. 58); "The Evolving of Commitments" are the three final positions, and it is the stage of "the responsibilities of Commitment" (p. 58). In Position 1, students have a basic duality view of knowledge because "they see the world in polar terms of we-right-good vs. other-wrong bad" (p. 9). So, students perceive the world as two parts. They view the world into a dichotomy of "world of authority-right-we" and "world of illegitimate wrong others" (Perry, 1970).

Thus, students' learning is based on the right answer. In Position 2, students start to perceive that there are multiple answers, but they still focus on there are correct and incorrect answers. In this position, students view knowledge as "so we can learn to find The Answer for ourselves" (p.9). Students get only what is right, and ignore what is wrong. In Position3, students start to legitimate both diversity and uncertainty, but students focus more on how to find the right answer. In Position 4, students have an advanced perception of diversity in opinions, and at this position students think "Anyone has a right to his opinion" (p. 9). In Position 5, students "perceive all knowledge and values as contextual and relativistic" (p. 10). In this position, students have started to evaluate their answers, and most importantly think about knowledge in context. In Position 6, students realize that it is necessary to make decisions with commitment in relativistic contexts. In position 8, students "make an initial commitment in some area" (p.10). In Position 9, students "experience the implications of Commitment, and explore the issues of responsibility" (p.10), which means that students start exploring the notions of responsibility. In position 10, students realize that Commitment is an ongoing activity that students express their lives through, and so this position is an affirmation of identity (Perry, 1970).

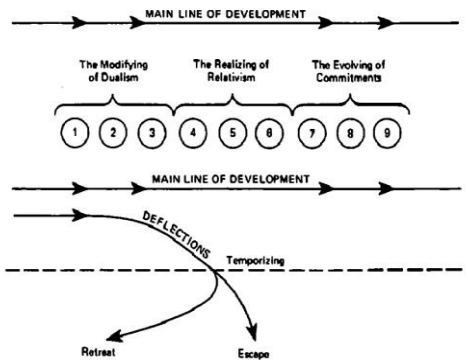

Figure 1. Schematic Presentation.

Perry (1970) divided his developmental scheme into four groups: Dualism, Multiplicity, Relativism, and Commitment. Thus, the epistemological growth goes through a cognitive development from dualist to relativist. According to Perry (1970), individuals who view knowledge as dualistic believe that the right-wrong knowledge is handed down by authority. According to Perry (1970), all individuals begin as Dualists because at this level they start by accepting the information from the world. Then, comes the Multiplicity view on knowledge in which individuals from this group hold contrasting views about knowledge, and thus some of them start trusting the inner voice. At this level knowledge is also regarded as subjective, and in spite of the fact that individuals start viewing knowledge as multiple, they still believe it is certain. At the Relativistic stage, individuals view knowledge as procedural, that is to say tentative and contextual (Perry, 1970). Individuals begin developing the view that knowledge is constructed rather than imposed. So, they start constructing their epistemic beliefs through a down-top process, in which reflective thinking plays a big role in the epistemic system development. At this level, they start to develop the belief that knowledge is uncertain. They also develop the view that there is no absolute truth, and thus truth is viewed as multifaceted. Perry (1970) developed his scheme of epistemological growth by investigating students' beliefs, but his research is very influential, and most models of personal epistemology have been developed based on Perry's work.

Women's Ways of Knowing. Perry's work was followed by a research on epistemology from a feminist perspective. In fact the critique to Perry's work was based on the fact he worked with a white male population only and an elite (Harvard students) one as well. Following his scheme, Belenky et al. (1986) interviewed women from a different educational background, different economic status and different age. Belenky et al. (1986) used Perry's scheme to interview the women, but the answers that women came up did not fit with the Perry scheme, "it was clear that many of the answers the women gave to the 'Perry questions" could not be wedged into the "Perry scheme"(p.17). The study shifted to a focus on the women's relation to knowledge and truth. Belenky et al. came with the results that women conceive knowledge from five epistemological perspectives: Silence, Received Knowledge (the voice of others), Subjective Knowledge (the inner voice and the quest of self), Procedural Knowledge (the voice of the reason), and Constructed Knowledge.

Epistemological Reflection Model

Based on Perry's scheme, Baxter Magolda (1992) conducted a longitudinal research with 109 college students. She focused on the students' beliefs about the nature, limits, and certainty of knowledge. Baxter Magolda (1992) found that at the beginning of college life, students believe that "authority figures knew the truth. Overtime they came to believe that knowledge is contextual, constructed by persons with appropriate expertise" (p. 89). Her research was based on findings answers to why students consider themselves as insufficiently knowledgeable, and then they construct different beliefs on knowledge. She also focused on the cause of change, it means if it is the professors who help change students' assumptions or it is

the students who construct different epistemic beliefs. Her research was conducted from a social constructivist paradigm because "people actively construct their perspectives by interpreting their experience" (p. 90). We also interpret our experiences by making a meaning to them through the cognitive structures, which are sets of assumptions that help us make meaning of our experiences and integrate them with the current situation (Baxter Magolda, 1992; Piaget, 1970). The researcher developed the Model of Epistemological Reflections, and she came up with the result that students' knowledge develop in patterns, and "the structures and patterns that follow are possible social constructs that young adults use to move from dependence on authority to self-authorship" (p.93). Baxter Magolda (1992) states that knowledge is socially constructed in patterns, and not in sequences. There are four patterns in the Epistemological Reflection Model: Absolute knowing, transitional knowing, independent knowing, and contextual knowing.

It is with the absolute knowing pattern that assumptions about knowledge are gender-related. For example, women receive knowledge, and men master it (Baxter Magolda, 1992). It means that women acquire knowledge through memorizing, recording information, and peer-sharing. Men are actively involved to remember the material. Then, the transition phase starts through interpersonal (for women) and impersonal (for men) patters. Students start thinking that knowledge is certain in some areas (math, science), and uncertain in others (social sciences, humanities). Most importantly, students try to comprehend knowledge at this phase. Independent knowing is the phase when students are at their third year of college, and knowledge becomes uncertain for them. In this phase men's knowledge becomes more interinvidual patterned because they begin relying on their own opinions. Women's knowledge is more interindividual patterned because they accept both one's own opinions and the opinions of others (Baxter Magolda, 1992). In contextual knowing students go through a dissonance and volition, and this creates a shift in their epistemic assumptions. Students begin thinking about the validity of the solutions, and will try to find evidence to knowledge into context.

1-4 Reflective Judgment . After a 20 year study on epistemic cognition, King and Kitchener (1994) have found that "cognitive cognition is intrinsically tied to the ability to understand the nature of ill-structured problems" (p.38). King and Kitchener's research differed from previous studies because they focused on the development of reasoning in adults. They coined the term "Reflective Judgment (RJ)" based on Dewey's observation that "reflective thinking is called for when people recognize that some problems cannot be solved with certainty" (38). It means that epistemic cognition is to be aware that not all knowledge is certain. For King and Kitchener (1994) being uncertain about knowledge is the development of reflective thinking. King and Kitchener (1994) have conducted a cross-sectional longitudinal research, and they have used problem-solving tasks to study the way people justify knowledge. They have found that people go through three stages: pre-reflective thinking, quasi-reflective thinking, and reflective thinking.

People with epistemic beliefs related to pre-reflective thinking view knowledge as certain through the figures of authority. People with such epistemic assumptions don't try to find evidence because they think what they know is absolute, and authority is a justified source of knowledge, and thus treat all problems as well-defined (King and Kitchener, 1994). People with quasi-reflective thinking claim not all knowledge is certain. They seek evidence to justify knowledge, but they don't come up with a conclusion, and thus "tend to view judgments as highly idiosyncratic" (P.40). Reflective thinking is making reasonable judgments about knowledge (King and Kitchener, 1994). People who have reflective thinking view knowledge as more and more uncertain, but they are less and less confused. They also make their own judgments and evaluations to find the truth. King and Kitchener (1994) also view the development of thinking as sequential, and they also state that reasoning change over time. The

RJ model has implications in education because it develops critical thinking.

Epistemic Beliefs

The development of personal epistemology was considered as patterned and sequential till Shommer-Aikins (1990) published her research. She made a great shift in the field of research because she changed the view of personal epistemology as sequences to a system of beliefs. Her research has been validated since by a series of eminent scholars in the field (Hofer, 2000, 2002, 2004; Hofer and Pintrich, 1997). Shommer-Aikins (2002) developed a theoretical framework for an epistemological belief system through searching personal epistemology as system of belief with multiple beliefs. She states each individual has their own epistemological beliefs, wrestle with these beliefs, and realize that present-day thinking is a one step ahead to a more understanding of knowledge (Shommer-Aikins, 1990). She used a questionnaire to find out the way beliefs could be measured. She states personal has been defined as the nature of knowledge or as set of beliefs, but what is more important is to search the source of knowledge, and the way people justify. She also makes the point that a theory of epistemic beliefs is needed because a theory allows researchers to explain, predict, and modify thinking (Shommer-Aikins, 1990). In the results of her research, Shommer-Aikins makes the point that students have epistemic beliefs that view knowledge as Certain Knowledge, Simple Knowledge, Quick Learning and Fixed Ability. The empirical research of Shommer-Aikins (1990) led to the development of a conceptual framework of the system of epistemic belief .

New Concepts

Hofer and Pintrich (1997) have developed research on personal epistemology in a way they have become the lead scholars in the field, and have published a book chapter on personal epistemology. They have made the point that individuals have personal theories about knowledge and knowledge. The research of Hofer and Pintrich (1990) was mainly a review of previous research, and they found that previous research (Perry, 1970; Belenky et al., 1986; Baxter Magolda,1992; King and Kitchener, 1994) overlap in the way personal epistemology has been defined because " there are discrepancies in naming the construct as well as in defining the construct". They have made the point that the discrepancies made the readers think the researchers are not discussing the same territory (Hofer & Pintrich, 1997).

Hofer (2001) considers that personal epistemology is to be looked at from an individual perspective because it depends on how we view ourselves "passive receptors or active constructors of knowledge" (p. 3). From the perspective that personal epistemology is as set of complicated beliefs, Hofer (2001) gives the following definition "an identifiable set of dimensions of beliefs, organized as theories, progressing in reasonable predictable, activated in context, operating as epistemic cognition" (p. 377). Epistemic beliefs refer to beliefs about knowledge (including its structure and certainty) and knowing (including sources and justification of knowledge; 2000; Hofer & Pintrich, 1997). In particular, these can include beliefs about "the definition of knowledge, how knowledge is constructed, how knowledge is evaluated, where knowledge resides, and how knowing occurs" (Hofer, 2001, p. 355). They also suggest that future research should make the way personal epistemology is approached more clearly; that is to say if personal epistemology construct is about a set of beliefs, attitudes or assumptions; cognitive development; or a cognitive process itself. Hofer (2001) states "one of the most difficult aspects of the study of personal epistemology has been how to capture something as elusive as individual aspects of knowledge and knowing" (P.9). She makes the point that research on personal epistemology is at a critical point (Hofer, 2001; 2004), and the discrepancies can be solved if there is a coordination among scholars to recognize personal epistemology as one field of study, and

she has introduced the construct as the umbrella term. Personal epistemology is now used as the umbrella term of research on the nature of knowledge, the nature of knowing, and the system of epistemic beliefs. In fact the constructs are interrelated. Hofer and Pintrich (1997) divided the field of research into two categories: the nature of knowledge (certainty of knowledge), and the nature of knowledge (source of knowledge). Hofer (2004) went further in research and categorized the field of research in paradigms: epistemological development, epistemological beliefs, epistemological theories, epistemic metacognition, and epistemological resources.

Hammer and Elby (2002) coined the term "epistemological Resources", and their research is different from previous research because they have investigated informal knowledge, and their population is children of age three. They have focused on the way resources of understanding the nature sources of knowledge. They have made the point that knowledge is propagated stuff, free creation, and fabricated stuff.

New trend in research is more oriented toward epistemology as specific to context. In the field of epistemic beliefs in learning and teaching, there is growing body of research on personal epistemology in the socio cultural context (Bendixen, & Feucht, 2010; Fives, Buehl, 2010).

Findings

The review of the concept of personal epistemology has aimed at understanding the way research on epistemology in education has been developed, and the main issues that exist in this area of inquiry. The main issue is how to measure epistemic beliefs of students or teachers is still critical, and the validity and reliability of the results is still unsolved (Hofer, 2004). Research on personal epistemology started with studying students' conception of knowledge (Perry, 1970). Most of the research that has been conducted since Perry's scheme has been qualitative. Results have also come up with considering the development of knowledge as sequential. As a critique to Perry's work, Belenky et al. (1986) changed the population, and conducted a feminist longitudinal research on the way women know. They have found that women start with a phase of silence, and there are women who don't even think they know. As a critique to Belenky et al. (1986), Moore (2002) considers knowledge does not develop in the silence phase. Silence is more a form of poverty and oppression, and thus inhibits the development of knowledge. Further research came up with regarding personal epistemology as a system of beliefs. More importantly a framework was introduced (Shommer-Aikins, 2002). Research is now focusing on the nature of knowledge, the justification of knowledge, and epistemic beliefs as a system. Research on epistemology shifted from philosophy to education (1970). In education, it was mainly a field of longitudinal inquiry, and in the 1990's, it shifted to quantitative research. New trend of research is the study of epistemic beliefs in the socio-cultural theoretical framework (Fives & Buehl, 2008).

The implications of personal epistemology in learning and teaching have been mainly established by Perry (1970). Learning is now considered as developmental, which means it is a cognitive process. According to Perry (1970), the understanding of students' personal epistemology promotes building a diverse school community. In instruction, Perry's scheme can be used by the teacher to understand how "he can be so differently perceived by various students in his class" (p. 201). In this way, the scheme is a solace to the teacher that "can free his thinking for a more differentiated address to individual students "where they are"" (p. 210).

Research on epistemic beliefs has started with a focus on students' beliefs, and the learning implications have been confirmed (Brownlee, Schraw, & Berthelsen, 2011). They claim that by understanding the way students view knowledge, teachers will help students become active agents in their own learning. Research has also focused on personal epistemologies that are activated during the learning process, but little research has focused on teachers' epistemic beliefs during the process of teaching (Hofer, 2004; Fives & Buehl, 2008;

Bendixen & Feuch, 2010). Drawing from the literature on teachers' epistemic beliefs, it can be stated that teachers hold beliefs that guide and influence their actions (Fives & Buehl, 2008). In fact, these beliefs can be either explicit or implicit. Implicit beliefs contribute the development of tacit knowledge, and teachers will not be aware of, and thus is rarely activated or evaluated (Bendixen & Feuch, 2010). When dealing with teachers' personal epistemology, research focuses on the way teachers define, construct, justify, and construct knowledge (Hofer, 2002).

Conclusion

The purpose of this review is to explain the concept of personal epistemology, and how it has been investigated. Literature shows that the research area has emerged from Piaget's work, and it has shifted from philosophy to psychology. The nature of knowledge has been researched as sequential (Perry, 1970; Belenky, Clinchy, Goldberger, & Tarule, 1986; Baxter Magolda, 1992; King & Kitchener, 1994). In the 1990's different perspectives have emerged and personal epistemology has become more and more investigated as dimensional, but with multiple beliefs. Scholars have also started looking at personal epistemology as an individual perspective about the nature of knowing and the nature of knowledge. New trends in research focus more and more on epistemic beliefs and metacognition (Hofer, 2001, 2004)

Research on epistemic beliefs helps to understand how students view knowledge, reason, and think. It is very important for teachers, educators and curriculum designers to understand students' epistemologies, as it is a way to build a teacher-student community (Perry, 1970). Teachers can understand the students' differences by finding out if they are dualistic or relativistic viewers of knowledge. As for teachers, they will be more engaged in reflective teaching, and teacher development. Hofer (2004) states teachers, who are aware about their epistemic beliefs, are those who are "more likely to engage in ill-structured problem solving" (p. 7).

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