

October 2016

## Comparison and Consolidation of Models of Personal Epistemologies

Linda Urman  
*DeVry University*

Gene L. Roth  
*Northern Illinois University*

Follow this and additional works at: <http://ir.library.illinoisstate.edu/jste>

---

### Recommended Citation

Urman, Linda and Roth, Gene L. (2016) "Comparison and Consolidation of Models of Personal Epistemologies," *Journal of STEM Teacher Education*: Vol. 47 : Iss. 3 , Article 4.  
Available at: <http://ir.library.illinoisstate.edu/jste/vol47/iss3/4>

This Article is brought to you for free and open access by ISU ReD: Research and eData. It has been accepted for inclusion in Journal of STEM Teacher Education by an authorized editor of ISU ReD: Research and eData. For more information, please contact [ISURed@ilstu.edu](mailto:ISURed@ilstu.edu).

## **Comparison And Consolidation Of Models Of Personal Epistemologies**

Linda Urman  
DeVry University

Gene L. Roth  
Northern Illinois University

### **Abstract**

Assumptions that students and instructors have about their personal epistemologies have important effects on their expectations and performance in career and technical classrooms and laboratories. Personal epistemologies of career and technical education students influence their behaviors in classes and their interactions with instructors. The conceptual analysis of this research was based on three major theoretical frameworks of personal epistemology: qualitative developmental stages, quantitative belief systems, and practitioner epistemological resources. Seven models of personal epistemologies were compared, and a consolidated conceptual framework is presented to career and technical educators. This new conceptual matrix is intended to provide a roadmap for better understanding theoretical frameworks of personal epistemologies, and give career and technical education educators insights for further research and implications for practice.

---

Linda Urman was a Senior Professor of English, DeVry University, Addison Campus, Addison, Illinois. She died July 30, 2010. Linda was dearly loved by her students, colleagues, family, and friends.

Gene L. Roth is Professor of Adult and Higher Education; Northern Illinois University, DeKalb, Illinois. He can be reached at [groth@niu.edu](mailto:groth@niu.edu).

## Introduction

Most experienced career and technical education (CTE) instructors have occasionally experienced baffling responses from students, evidence that they were not connecting on basic assumptions about what was supposed to be happening in the instructor—learner relationship. For example, I recall leading a stimulating discussion regarding the possible meaning behind the title of a classic poem with students in a career-oriented university. Whereas I felt a sense of instructional grandeur from leading a terrific discussion, my teacher bravado came down with a resounding thud when a student asked, “So, what’s the right answer?” I replied that I didn’t know and the class broke into angry accusations. What kind of a teacher was I if I couldn’t tell them the right answer? It was my job as a teacher to explain these things properly.

In this case, and several others, I was stumped for a way to connect with the students. This puzzlement was the catalyst for this research into assumptions about knowledge -- personal epistemologies. I sought understanding of what was going on in these occasional interludes of deep confusion between instructor and learner. Different assumptions about knowledge can create varying expectations, behaviors, and goals. Recognizing and discussing these underlying assumptions might help clear up some confusion.

Personal epistemology differs from classical philosophical epistemology. Classical philosophical epistemology is one of the major areas of philosophical thought and it will not be the focus of this study. It deals with how knowledge can be obtained and justified, using formal deductions and premises to attempt to establish the extent to which we can know truth. Classical epistemology overtly questions the nature, derivation, scope, and reliability of knowledge. The ancient Greek philosophers argued about the

nature and warrants of knowledge, with logical examinations of terminology and process.

Personal epistemologies, however, are usually unexamined, tacit assumptions about the nature of knowledge and how it is acquired. Most non-philosophers have never consciously considered their assumptions about knowledge. They are unaware that they even have a personal epistemology, much less whether their assumptions about knowledge are logical or useful for the reality of their worlds. Nevertheless, these unexamined assumptions have an influence over the expectations of students, instructors, and administrators in CTE settings, as well as the opinions of policy makers and the general public.

As a starting point for this article, we need to also offer a view of knowledge. Theoretical reasoning and practical reasoning were the two categories of knowledge offered by Aristotle (Hager, 2000). Aligned with this dichotomy, Oakshott (1962) noted that practical knowledge is uncodifiable in principle, and therefore difficult, if not impossible, to teach. It is within this realm we position knowledge for the purpose of this study – not with an emphasis on theoretical reasoning, but rather the tacit knowledge we possess but are unable to articulate (Polanyi, 1967).

For the purpose of this study, personal epistemologies refers to (and is limited to) tacit assumptions about the nature of knowledge and how it is acquired. Studying these underlying assumptions is a complex task. The literature seems to go in all directions at once, with inconsistencies in definitions, focus, and methods. The purpose of this study is to compare and consolidate seven prominent models of personal epistemologies. Given that CTE instructors and faculty members have important roles in student development (Threeton, 2007), this article is intended to help CTE

practitioners and scholars better understand the nature of personal epistemologies of students.

### **Method**

This study relied on review and synthesis of literature as a basis for developing a new conceptual framework for personal epistemologies. Through this review and synthesis the authors were able to ascertain the extent of the research that has been done on this topic, identify common terms and constructs in the literature, and gain a historical perspective on personal epistemologies in education contexts. Literature that pertains to knowledge and epistemology is vast; however, studies specific to personal epistemologies are limited in number. Through the use of various database searches, reference lists that honed in on seminal works, and well known texts, the seven major models were selected for analysis in this study. In this article the seven models are represented as the Perry Scheme (Perry, 1970), *Women's Ways of Knowing* (Belinky et al., (1986), Epistemological Reflection Model (Baxter-Magolda, 1992), Constructive Developmental Framework (Kegan, 1980), research by the National Center for the Study of Adult Literacy (NCSAL) (Helsing et al., 2001), Reflective Judgment Model (King & Kitchener, 2002), and Epistemological World View (Schraw & Olafson, 2002). The following sections of this article present the various approaches, terms, stages, and positions portrayed by these authors. Synthesis of these models produced a consolidated framework that is offered for further testing and future research.

### **Three Approaches to Examining Personal Epistemologies**

Although several authors are noted for their seminal work in classical philosophical epistemology (e.g., Plato, Descartes, Kant, Locke, and Russell, amongst others), the defining work associated with personal epistemology in higher education contexts is a study of how college students view knowledge (Perry, 1970). The research resulted in what was generally known as the Perry scheme, a nine position description of the intellectual and ethical development of undergraduate students. For the purposes of this literature review, researchers who focused on personal epistemology (after Perry's study) will be categorized into three groups: qualitative researchers, quantitative researchers, and practitioner researchers. The first group, qualitative researchers, continued Perry's interview methods, but with different groups of participants, different assumptions about epistemology, and different models to structure their results. These qualitative researchers, looking at different populations and focusing on different issues of epistemology, created a number of developmental models with very different formulations of the number of stages and what was contained in each stage.

Another variation of Perry's work resulted in survey instruments which could be given to large numbers of people to classify them into the perspectives of Perry's Scheme. Quantitative researchers began to challenge the idea of a general, unified epistemology. Instead of one general perspective from which students looked at knowledge, perhaps there were several independent components that developed at individual rates (Schommer, 1990). Other quantitative researchers questioned whether epistemological stance would change with the domain of that knowledge.

Finally, a third set of practitioner researchers felt that epistemology was neither a broad developmental sequence, nor a set of beliefs, but a large conglomeration of epistemological resources that are activated in specific contexts (Louca, L., Elby, A., Hammer, D., & Kagey, T., 2004). These epistemological resources appear to be the most practical strategies for CTE teachers who wish to help their students develop sophisticated views of learning and knowledge. However, not much of a research base exists yet, and issues of naming and organizing the resources, as well as the problems of generalizing from one context to another hamper the usefulness of this formulation of personal epistemology.

This literature review looks first at Perry's scheme of intellectual and ethical development in some detail, and then examines other writers who have broadened, reframed, and applied the concepts of how students, instructors, and researchers look at knowledge. The concluding section of this article includes a comparison and consolidation of the various developmental models. Hopefully this new conceptual framework will have utility for CTE practitioners and researchers, and help them better understand the personal epistemologies of learners in their respective contexts. Several qualitative studies have focused on epistemology as a form of development. Perry's work is the logical starting point for examining this strand of literature.

### **Perry's Scheme**

Perry (1981) said that he and his colleagues, in an effort to make sense out of the baffling and contradictory student evaluations they were receiving, tried to document what "stood out" for the students as they thought about their undergraduate experiences (p.77). Perry (1970) and his colleagues were looking for forms of perception, not content, of knowledge.

How did students view their experiences, make meaning of them, and determine how to use the experiences to decide how to live their lives? The researchers constructed a series of nine positions, places from which students viewed their experiences.

*The Nine Positions*

*Position 1: Basic Duality.* Knowledge is absolute. Authorities know the answer to everything. Students can accumulate knowledge by working to memorize large quantities of right answers.

*Position 2: Multiplicity Pre-legitimate.* True authorities know the right answer. Confusion is assimilated into the dualistic position. True authorities use vagueness as a teaching strategy so that students will learn to find the right answer. Other opinions are from false or poorly prepared authorities. The realization that even good authorities do not know everything challenges the holders of this position (Perry, 1981).

*Position 3: Multiplicity Legitimate but Subordinate.* Truth is out there, but not yet discovered. Different opinions are legitimate, but temporary. The assumptions of this position are challenged by the fact that student work must be evaluated, but no absolute right answers are available.

*Position 4a: Multiplicity (Diversity and Uncertainty).* Where authorities do not know the answer, any opinion is as good as any other. Perry (1981) noted that this position was often labeled relativism by other commentators.

*Position 4b: Relativism Subordinate.* The authorities expect students to determine what authorities want, so some valid grounds for finding some opinions more valuable must exist. The transition from stage 4 to stage 5 was critically important to Perry. Perry discussed the transition in Piagetian terms, moving from *assimilation* of diverse opinions as special cases under dualism, to an *accommodation* of relativism which required the restructuring of the way meaning was framed.



*Position 5: Relativism.* All knowledge and value depend on context, with some special cases where dualistic right/wrong may still be appropriate. Authority itself also has to struggle with uncertainty. Students in this position 5 must still cope with the realization that their decisions and commitments are also uncertain (Perry, 1981).

*Position 6: Commitment Foreseen.* Decisions and commitments have to be made in order to take action, without assurance that the right one is being made. This position can be threatening and disorienting (Perry, 1981).

*Positions 7-9: Evolving Commitments.* A limited commitment in a specific area is made, but it does not resolve everything. The student deals with the consequences of commitment and responsibility. How can conflicting commitments be balanced? Life will be a continual cycle of decision, reevaluation, and change in an ongoing process of identity, commitment, and responsibility. Placement in these positions was very rare during the research (Perry, 1981).

Perry's Scheme was a seminal work in examining the epistemological development of undergraduate students. The idea that personal views of knowledge and learning could affect education was not new, but the research was the first to look seriously at what those views were and how students moved through them. Issues related to the very specific nature of the students in Perry's study and the worldview of the researchers, as Perry noted, made generalization problematic. However, many researchers used the Scheme as a starting point in their own investigations.

## Women's Ways of Knowing

Belenky, Clinchy, Goldburger, and Tarule (1986) investigated whether Perry's scheme would work for other populations in different contexts. However, similar to Perry's work, their view was through a USA lens and did not focus on other cultures. Heavily influenced by both Perry and Gilligan (1977), they looked at the way women understand the nature of knowledge, and found results that reflected some of Gilligan's findings. Instead of Perry's nine positions, Belenky et al. described five ways that women "come to know" or experience knowledge.

### *Five Ways of Knowing*

*Silence.* Individuals are totally dependent on others for self knowledge and direction. The word silence is a metaphor for having no voice of their own, being passive, and seeing themselves as incompetent. Generally associated with extreme sex-role stereotypes, in this level individuals are told what to do, never why.

*Received Knowledge.* At this level, individuals are able to learn information by listening to the voices of others. They see themselves as learners of absolute truth given to them by authorities. They can reproduce a copy of the knowledge given to them, but they cannot understand, evaluate, or reason about that knowledge.

*Subjective Knowledge.* The women at this level see their own experience and intuition as the source of knowledge. Truth is private, personal, and the opposite of absolute: multiple and infinite. Authority and traditional education have failed and are irrelevant and distrusted. The women have developed an inner voice with subjective, pragmatic knowledge, valid only for themselves.

*Procedural Knowledge.* At this level, women acquire and apply strategies to obtain, evaluate, and communicate knowledge. They find processes that help them form opinions and interpretations. Two types of procedural knowledge are identified: separate knowledge and connected knowledge.

*Constructed Knowledge.* Personal and outside knowledge, objective and subjective interpretations, rational and emotional thought are all woven together into a unique and authentic voice. Cognitive issues—*how do I learn*—are combined with moral issues—*what are my rights and responsibilities*—to form a way to deal with life in all its complexities. The learner can both talk and listen, conducting a dialogue of reciprocity and cooperation (Belenky et al., 1986).

*Women's Ways of Knowing* added a more diverse perspective to developmental epistemology. The general outlines of the phases are similar to Perry's, but a wider representation of gender, race, ethnicity, and socio-economic groups changed the details and the interpretations of the phases.

### **Epistemological Reflection Model**

Baxter-Magolda (1987) initially became interested in quantifying Perry's scheme with a survey instrument she called the Measurement of Epistemological Reflection (MER). Baxter-Magolda (1992) decided to study both men and women longitudinally in an academic setting to explore gender-related differences in interpreting knowledge. Her own perspectives and assumptions shifted from a quantitative stance to a qualitative and narrative process. Baxter-Magolda (1992) referred to her new construction as the Epistemological Reflection Model. It consists of four "ways of knowing" with gender related patterns in the first three ways.

*Four Ways of Knowing*

*Absolute.* Students believe that knowledge is certain; the instructors have all the knowledge and will transmit it to them. The Receiving Pattern, more typical of females, is private, reading and listening, with little interaction. The Mastery Pattern, more typical of males, has more public interaction to demonstrate interest and secure resolution of knowledge conflicts from authority.

*Transition.* Students see some knowledge as uncertain. The female-associated Interpersonal Pattern actively seeks others' opinions and interaction, and looks for rapport with the instructor. The male-related Impersonal Pattern looks for challenge and debate, using logic and research.

*Independent.* Students see knowledge as mostly uncertain and their own opinions as valid. The female-associated Interindividual Pattern adds active engagement with others' views to their own thinking, while the male-related Individual Pattern focuses on the student's own independent thought. The emergence of Female-associated Interindividual Patterns or male-related Individual patterns from a student can be influenced by learning situations, and the degree to which the student is encouraged to connect with other learners and teachers.

*Contextual.* Students see all knowledge as uncertain, but are able to judge some perspectives as more valid based on specific, contextual criteria. With further research in adults out of college, Baxter-Magolda (2002) identified three phases in the contextual way of knowing: External Formulas, where external expectations were used to make decisions; In Search of Internal Authority; and Foundation, where an "internally generated belief system" was in place (p. 99).

Baxter-Magolda (1992) stressed the inclusion of the more collaborative, affective perspectives as important to both

sexes. While that perspective was somewhat more typical of females than males, it was not gender specific. Baxter-Magolda speculated that the perspective was not noticed before Belenky et al. simply because the perspective associated with males was assumed to be the norm. The assumptions and world view of the researcher, often male, was as important as the perspectives of the participants in terms of what the researcher would discover.

Baxter-Magolda also had observations about how education could support and encourage the development of students. She started her research hoping to redesign educational practices only to discover that what was needed was a complete transformation from separate to connected relations between learner and instructor, knowledge and experience. Students needed to be encouraged to construct meaning in collaboration, to relate their knowledge to their own experience, and to see themselves as capable of finding and interpreting meaning. These design practices can be found in contemporary CTE classrooms that feature authentic instruction and constructivist methods.

### **Constructive Developmental Framework**

Kegan (1980) attempted to integrate cognitive, emotional, and behavioral factors into a more holistic framework. Kegan defined five different stages of epistemological development as a way of looking at the way personality develops as individuals try to make meaning. His stages included the complete development of the mind's ability to organize experiences from childhood through maturity. Kegan looked specifically at the relationship between what is subject and what is object. Subject refers to what we are and what defines us, and object refers to what we can look at and reflect on (1994).

### *The Five Stages*

*Independent Elements.* Young children experience perceptions as immediate, unconnected, and temporary. They are aware only of their own consciousness.

*Durable Category.* As older children are able to examine their perceptions, they are able to see their experience as concrete and logical. They develop a self concept and an idea of their role in their social context. This stage is not appropriate for adults; in fact, Kegan considered it an explanation for sociopathic behavior (1994).

*Cross-Categorical Knowing.* Teen-agers or adults examine their concrete reality and create abstractions, self-reflective emotions, and social consciousness. Kegan considered this stage socialized traditionalism and felt that it worked for people who did not often encounter people from other cultures or who were not subject to fast moving changes in their environment.

*System/Complex.* Modernism requires that people examine their abstractions and inner states and become self-authoring individuals who can deal with multiple roles and multiple cultures.

*Trans-System, Trans-Complex.* Postmodernism adds further demands on individuals' ability to organize experience in the face of paradox, contradictions, and oppositeness (Kegan, 1994). Individuals must become self-transforming, able to accept the interpenetration of complex systems in themselves and others.

Kegan emphasized the process of meaning making and the emotional distress that accompanies the experience of development. He was also aware of Mezirow's theory of transformative learning, and saw its application to the crises that result in development (Kegan, 2000). However, he had some serious reservations about the privileging of Mezirow's

self-authoring mode, and the lack of emphasis on the affective response. If CTE educators focus only on cognitive development and ignore emotional reactions, they don't realize that they are asking students "to change the whole way they understand themselves, their world, and the relationship between the two. They are asking many of them to put at risk the loyalties and devotions that have made up the very foundations of their lives" (Kegan, 2000, p. 67).

One group that used Kegan's theories as the basis for their research was the National Center for the Study of Adult Literacy (NCSALL) Adult Development Research Group. Most studies have used university students, generally white, economically middle to upper class, born in the United States of America, as participants. Helsing, Drago-Severson, Kegan, Portknewe, Popp, and Broderick (2001) specifically targeted immigrants to the United States who were participating in Adult Basic Education courses. They identified three ways of knowing.

### *Three Ways of Knowing*

*Instrumental.* Knowledge was seen as a commodity, and a way to solve problems and achieve concrete goals. Knowledge was dualistic, right or wrong, and came from external authority. For example, these types of CTE students would believe "the purpose of education is to get X" (Helsing, et al., 2001). They would evaluate learning based on grades and diplomas and would want CTE teachers who would insist on correct performance of tasks and skills.

*Socializing.* Knowledge was what one needed to know to meet social expectations and roles. Knowledge was absolute truth, passed down from the experts. "The purpose of education is to be X" (Helsing, et al., 2001). Learning was evaluated based on the learners' attitude and ability to fit into their new culture. For example, these types of CTE learners

would want CTE teachers who would care about them and acknowledge them.

*Self-authoring.* Knowledge was necessary for personal growth and understanding, allowing students to build a better society. Knowledge was self-constructed, from a specific context, based on individual interpretation, values, and predictions. “The purpose of education is to become X” (Helsing, et al., 2001). Education was evaluated on its usefulness in contributing toward the achievement of personally constructed goals. For example, these types of CTE learners would expect a good CTE teacher to encourage CTE students to take responsibility for their own education.

### **Reflective Judgment Model**

King (1992) investigated the way people explain and justify their interpretations about controversial topics. Grounding her study in the cognitive developmental perspectives of Piaget and Kohlberg, King made four assumptions: (1) People actively construct meaning from their experiences, (2) ways of interpreting experience develop over time, (3) interaction with the environment causes development, and (4) people exhibit responses from several stages, depending on concentration and support.

King and Kitchener (2004) differ from Piaget’s and Kohlberg’s assumptions about stages in two ways: first, individuals do not use just one stage at a time, but normally have access to the adjacent stages in the way that they look at problems. Second, the stages do not make up “an invariant sequence that exists across all cultures” (p.10). In fact, King and Kitchener insist that the skills exhibited will depend on the conditions of the assessment.

King and Kitchener (2004) used 25 years of reflective judgment interviews, based on four controversial issues with a



series of probes to evidence assumptions about knowledge. Thousands of high school, college and graduate students, and other adults were interviewed and the transcripts scored to develop and verify the Reflective Judgment Model (Hofer & Pintrich, 1997). The model was structured around three major categories, made up of seven stages (King & Kitchener, 2002).

### *Three Categories, Seven Stages*

*Prereflective Thinking.* Stage 1 -- Knowledge is concrete and absolute. Stage 2 -- Knowledge is certain, but may not yet be discovered. Stage 3 -- Where knowledge is certain, authorities are the source. In areas where knowledge is not yet available, personal beliefs are the source of judgments.

*Quasi-Reflective Thinking.* Stage 4 -- Knowledge is uncertain and evidence to defend knowledge claims is specific to individual whims. Stage 5 -- Knowledge is contextual. Evidence depends on the rules for a specific domain.

*Reflective Thinking.* Stage 6 -- Knowledge is constructed. Evidence comes from many contexts and experts. Stage 7 -- Knowledge is constructed by a process of inquiry. Evidence is whatever is currently reasonable and likely, with reevaluation when new information becomes available.

Although reflective judgment is related to critical thinking, King and Kitchener (1994) chose to emphasize Dewey's (1933) concept of reflective thinking over the logical or mathematical reasoning associated with critical thinking. Reflective thinking is necessary when formal logic will not work because of controversy or doubt about the understanding and assumptions of a given issue, or because sufficient information cannot be obtained. King and Kitchener (2004) call these issues "ill-structured problems" because "they cannot be defined with a high degree of completeness, and . . . they cannot be solved with a high degree of certainty" (p. 5).

## Epistemological World Views

Defining some beliefs as naïve or as mature was an issue that Perry (1970) wrestled with and chose to deal with by explicitly explaining his underlying assumptions and values. Most of the researchers highlighted in this literature review have a similar bias toward beliefs that knowledge is complex and tentative, integrated, and constructed from interpretations of experience. Certainly not all researchers, much less all teachers, agree with this view. For example, Bull (2002) holds that teachers are being brain-washed and indoctrinated to accept the constructionist epistemology, which contradicts his moral axiology. Strangely, little research has been conducted on the epistemological beliefs of teachers, although King and Kitchener (2004) included teachers as participants in some of their studies.

Schraw and Olafson (2002) attempted to investigate teachers' epistemological world views. By synthesizing research from the disciplines of psychology, educational psychology, and education, they constructed a three category epistemological world view.

### *Three Categories*

*Realist.* Knowledge is fixed, universal and unchanging. The core body of essential knowledge and skills material is transmitted, often by direct instruction, to the students who are passive recipients. Learning should be assessed through norm-referenced, reliable, objective tests.

*Relativist.* Knowledge is subjective, self-constructed, highly changeable and idiosyncratic to the individual. No one opinion is privileged over another. The teacher creates an environment which encourages independent thinkers through modeling, questioning, and independent projects. Assessment

is based on individual learning goals and may consist of work in various media.

*Contextualist.* Knowledge is situational and changeable over time, and should have authentic application to the students' needs. It is collaboratively constructed by the students with the teacher as facilitator. A transactional, group-based approach is an appropriate means of instruction. Assessment is often by local, criterion-based instruments, or portfolios or other performance based evaluations.

Schraw and Olafson (2002) interviewed 24 K – 8 teachers and had them complete questionnaires on their epistemological beliefs, their level of agreement with the world views, a Need for Cognition Scale, a Motivation for Teaching Scale, and a written statement articulating their beliefs. The researchers noted that the longer the teachers taught, the more likely they were to support a realist world view, perhaps because they were adapting to an environment which demanded it. This message should not be lost to CTE educators – the current emphasis on assessment and accountability is apt to influence their personal epistemologies over time.

### **Quantitative Research: Epistemology as Beliefs**

Several quantitative studies have examined epistemology as beliefs about knowledge. Schommer's work is a good starting point for this strand of literature.

#### *Epistemological Belief Systems*

Schommer (1998b) became interested in epistemological beliefs because of research on the phenomenon of the illusion of learning—the belief that you know when you really do not know—did not explain why individuals had such confidence about their misunderstandings. After reviewing the

literature and noting the discrepancies between the different formulations of epistemological views, Schommer decided to attempt to synthesize the ideas, while retaining the complexity of personal beliefs about knowledge. Schommer came up with an epistemological belief system of five “more or less independent beliefs,” each of which contains a range of views.

#### *Five Beliefs*

*Certain Knowledge: Stability of knowledge.* Is knowledge certain and unchanging or is knowledge tentative and evolving?

*Simple Knowledge: Structure of knowledge.* Does knowledge consist of unrelated and isolated pieces or is knowledge made up of integrated concepts?

*Omniscient Authority: Source of knowledge.* Is knowledge received from authority or is knowledge derived from personal observation and reason?

*Quick Learning: Speed of knowledge.* Does learning occur quickly or not at all or is learning a gradual and cumulative understanding?

*Innate Ability: Control of knowledge acquisition.* Is the ability to learn fixed at birth or can the ability to learn improve over a lifetime? (Schommer-Aikens, 2002, p. 105).

Schommer's research indicated an association between an epistemological belief and an educational outcome: the more students believed in Simple Knowledge, the more likely they were to do poorly on the mastery test and overestimate their ability to understand material. More indirectly, they were less likely to use effective study strategies (Schommer, 1993).

Schommer and other researchers replicated these findings and modified the survey instrument (Jehng, Johnson, & Anderson, 1993; Schraw, Bendixon, & Dunkle, 2002), linking various beliefs with specific educational outcomes. A large amount of research material was generated in ten years,

which Schommer-Aikins (2002) summarized in a theoretical framework:

- Epistemological beliefs are a system, more than one belief, although there is nothing sacred about the idea of four or five beliefs. These beliefs can develop and mature at different times, giving people different levels of understanding about specific concepts.
- Epistemological beliefs have both direct and more subtle, indirect effects on learning. For example, someone who believed that knowledge was certain and unchanging would tend to see even tentative conclusions as definitive statements, a direct effect on comprehension. In a more indirect way, someone who believed that knowledge consisted of unrelated bits of information would see education as recalling lists of facts and see memorization as a good study strategy.
- Epistemological beliefs of a given individual may vary from domain specific to domain general, depending on the situation.
- Epistemological beliefs develop and change because of life experience and education.

Before Schommer, educational researchers had assumed that although epistemological views were complex combinations of assumptions, they developed together. Schommer (1998a) indicated that at least the beliefs about structure, stability, speed, and control could develop separately. Beliefs about the structure and the stability of knowledge tended to be a function of the amount of higher education received. The more college education students experienced, the more likely they were to see knowledge as complex and evolving. Beliefs about the speed and control of learning seemed to be a function of age. As participants got older, they were more likely to see learning as gradual and the ability to learn as improvable.

Hofer and Pintrich (1997) criticized Schommer for using belief statements which were not purely epistemological; that is, they were not based on the nature of knowledge. The first three of Schommer's original five statements came from Perry's scheme, but the last two, dealing with quickness and control of knowledge acquisition, were more about the nature of learning than the nature of knowledge, and followed Schoenfeld's (1983) work with mathematical beliefs and Dweck and Leggett's (1988) work on beliefs about intelligence. Schommer-Aikins (2002) explained that beliefs about learning were closely related to the view of knowledge and, practically speaking, were factors in such educational outcomes as persistence and value of education. Schommer-Aikins believed that the decision of which beliefs to include and exclude should depend on relationships between concepts, through the lens of the researcher, and the intended scope of the research.

### **Epistemology as Resources**

A few researchers have viewed personal epistemologies as resource based. Their work is highlighted in the following section.

#### *Framework of Epistemological Resources*

Hammer and Elby (2002) did not see personal epistemologies as either a coherent developmental theory or a system of beliefs. They saw an alternate structure, a "manifold ontology" (p. 175), based on small units of cognitive structure, beliefs that change based on both domain and context. Hammer and Elby called these elements epistemological resources, and asserted that different resources were activated in different circumstances. Hammer and Elby summarized four general categories of resources.

*Four Resource Categories*

*“Resources for understanding the nature and sources of knowledge”* (p. 177). Knowledge might be seen as “propagated stuff,” information transmitted from a source to a recipient. Or knowledge might be “free creation,” or “fabricated stuff,” new inventions, or ideas synthesized from other material (p. 178).

*“Resources for understanding epistemological activities”* (p. 179). Explanations for answering the question “How do you know \_\_\_\_\_?” include accumulation, formation, checking, and application.

*“Resources for understanding epistemological forms”* (p. 180). Forms that activate different sets of resources include stories, rules, “songs, lists, pictures, categories, statements, words, names, and numbers” (pp. 180-81).

*“Resources for understanding epistemological stances”* (p. 181). Various stances—belief, doubt, disbelief, understanding, puzzlement, and acceptance—must be understood to react to information.

The idea that epistemological beliefs are so context related that they are not part of a system of beliefs is controversial. Baxter-Magolda (2004) agreed that these “domain specific beliefs are a part of personal epistemology,” but she did not see them as separate entities. Baxter-Magolda stated “epistemological transformation is a shift to a more complex set of epistemological assumptions rather than the acquisition of particular learning strategies or skills” (p. 31).

### **Personal Epistemologies – Summary of Models**

*Qualitative Studies*

Qualitative researchers tended to end up with models of epistemological development similar to Perry’s Scheme. However, because each researcher interviewed participants

with very different demographics and issues, the research generated a number of models, with different metaphors used for explanation, and varying numbers and contents of stages (Belenky et al., 1986; Baxter-Magolda, 1992; Kegan, 1980; Helsig et al., 2001; King & Kitchener, 2002; Schraw & Olafson, 2002).

The level at which a given individual views knowledge can change over time. The qualitative researchers in this literature review characterized this change as a developmental process, leading to a contextual level that is the most mature and sophisticated (Perry, 1970; Belenky et al., 1986; Baxter-Magolda, 1992; Kegan, 1980; Helsig et al., 2001; King & Kitchener, 2002; Schraw & Olafson, 2002). Some of the researchers note that students can use more than one level (Perry, 1970; King & Kitchener, 2004); however, in general, personal epistemology is seen as a unified sequence by qualitative researchers.

#### *Quantitative Studies*

Quantitative researchers theorized independent components to epistemology instead of a general, unified concept, and developed surveys which could be given to large numbers of people. The five more-or-less independent beliefs theorized by Schommer (1994) are Certain Knowledge, Simple Knowledge, Omniscient Authority, Quick Learning, and Innate Ability. Different researchers have found results for some of these beliefs which indicate that they may develop at different times and rates (Jehng, Johnson, & Anderson, 1993; Schommer, 1994, 1998a; Schommer-Aikens, 2002; Schraw, Bendixon, & Dunkel, 2002). Most of the research concentrates on the relationship of these beliefs to educational outcomes. For example, Schommer (1990) showed that some beliefs are associated with scores on reading comprehension tests. The more that participants agreed that the speed of learning was



quick or not at all, the more likely they were to oversimplify their concluding statements, do poorly on the content test, and overestimate their understanding.

### *Practitioner Studies*

Finally, practitioner researchers conceptualized epistemology not as a broad developmental sequence, nor as a set of independent beliefs, but as a conglomeration of resources that could be activated in specific contexts (Louca, Elby, Hammer, & Kagey, 2004). Hammer and Elby (2002, pp. 178-181) summarized four general categories of resources: (1) Resources for understanding the nature and sources of knowledge, (2) resources for understanding epistemological activities, (3) resources for understanding epistemological forms, and (4) resources for understanding epistemological stances. These resources need to be studied in the context of a specific educational experience, such as the CTE context; thus, metaphors and cues used by CTE teachers to help the students activate the resources can be examined.

### **Comparing and Consolidating the Epistemological Models**

The various researchers who have looked at personal epistemology have done so from three different theoretical stances. First, some researchers saw personal epistemology as a view of knowledge that developed with increasing maturity and education. These researchers for the most part used interview strategies to obtain their data and constructed complex models of the developmental stages of personal epistemology. Second, some researchers asserted that personal epistemology was a system of separate beliefs about knowledge which developed more or less independently of each other. Their research used surveys of large numbers of people to correlate different beliefs with specific educational

outcomes. Finally, theorists who saw personal epistemology as sets of resources which could be activated in specific contexts used practitioner research to investigate these resources and how they could be used in specific environments. In general, these environments were classroom situations where specific topics required modification of common assumptions about knowledge. In order to attempt to synthesize the information from these different points of view, Table 1 presents a comparison and consolidation of the developmental epistemological models.

Table 1 Comparison of Epistemological Models

	Absolute	Subjective	Contextual
Perry's Scheme Perry (1970)	Position 1 – Basic Duality. Knowledge is absolute, quantitative, and known by authority. Position 2 – Multiplicity Pre-legitimate. True authorities use ambiguity to teach. False authority exists. Position 3 – Multiplicity Subordinate. Truth may not yet be discovered.	Position 4a - Multiplicity. Any opinion is as good as any other.	Position 4b – Relativism Subordinate. Some valid criteria exist. Position 5 – Relativism. All knowledge depends on context. Position 6 – Commitment Foreseen. Position 7 – Initial Commitment. Position 8 – Implications of commitment. Position 9 – Developing Commitment.

Women's Ways of Knowing Belenky et al. (1986)	Silence – Cannot learn from language. Received Knowledge Absolute truth given by authorities.	Subjective Knowledge – Personal experiences and intuition.	Procedural Knowledge – Strategies to get, evaluate, and share knowledge. Separate knowledge – The doubting game. Connected knowledge – The believing game. Constructed Knowledge - Personal & external knowledge, rational & emotional thought, and interwoven.
Epistemological Reflection Model Baxter-Magolda (1992)	Absolute-Certain – Knowledge transmitted by authority. Receiving Pattern – private reading and listening. Master Pattern – public interaction. Transition – some knowledge seen as uncertain.	Independent – Personal opinions are valid.	Contextual – All knowledge is uncertain, but some perspectives are more valid, based on contextual criteria.
Constructive Development Framework Kegan (1980)	Independent Elements – unconnected perceptions. Durable Category - Self-concept & social roles. Cross-Categorical Knowing – Socialized traditionalism.		System/Complex – Self-authoring, multiple cultures. Trans-System/Trans-Complex – Self-Transforming.
NCSAL Helsig et al. (2001)	Instrumental – Knowledge is a commodity from		Self-Authoring – Knowledge is self-constructed,

	authority “To get X” Socializing – Knowledge is absolute truth from experts “To be X”		contextual, “To become X”
Reflective Judgment Model King and Kitchener (2002)	Stage 1 - Knowledge is concrete and absolute. Stage 2 - Knowledge is certain, but may not yet be discovered. Stage 3 - Authorities are the source of certain knowledge; personal opinions if not yet discovered.	Stage 4 - Individual opinions defend claims to knowledge.	Stage 5 – Knowledge is contextual-specific domain. Stage 6 - Knowledge is constructed from many contexts. Stage 7 - Knowledge is constructed from inquiry and continually reevaluated.
Epistemological World View Schraw and Olafson (2002)	Realist – Knowledge is fixed, universal, and unchanging, transmitted by experts, evaluated by standardized tests.	Relativist – Knowledge is subjective and idiosyncratic	Contextualist – Knowledge is situational and changeable, constructed collaboratively, and evaluated by local, criterion-based instruments.

The seven developmental models that were reviewed in this article can be collapsed into a three level structure. The terminology used to refer to these levels has been modified to avoid the confusion engendered by the use of similar terms to refer to different stages. For the purposes of this comparison, the *Absolute* level refers to the concept of knowledge as absolute truth, transmitted by authority. The *Subjective* level indicates the assumption that knowledge is based on individual opinion and that all opinions are equally valid. Finally, the *Contextual* level represents the idea that knowledge is

uncertain and temporary, but can be evaluated by context-bound criteria.

### **Developmental Stages**

The developmental states of the consolidated model are described in the following sections.

#### *Absolute Level of Table 1*

*Perry Scheme.* In discussing his nine-stage scheme, Perry (1970) noted that two dramatic shifts in the framing of knowledge occurred as the multiplistic undergraduate educational environment collided with the students' assumptions of truth as absolute and known to authority. These two shifts consisted of, first, the realization that knowledge is uncertain, and, second, the acceptance of contextual criteria to evaluate different perspectives. The first shift occurred when the discrepancies between assumptions and experience became too great, and the students' frames of references cracked under the strain. Perry saw this first shift as vitally important: "We think this is the most crucial moment in higher education" (1970, p. 37). Prior to this first crisis point, students in positions 1, 2, and 3 in Perry's scheme saw knowledge as concrete truth from authority, although with increasing amounts of difficulty as they attempted to resolve the conflict between their assumptions and their exposure to other points of view. Because the students in these three positions continued to try to assimilate their experiences into their perspective of knowledge as absolute and transmitted by authority, they fit in the Absolute level of Table 1.

*Women's Ways of Knowing.* Belenky et al. (1986) used the Perry scheme for the basis of their research on the ways that women view knowledge; therefore, similarities between the models are apparent. Although the metaphors changed

from visual perspective to oral speech, the initial assumptions are aligned. In both Silence and Received Knowledge, certain truth comes from outside authorities. Women who are silenced have no voice, but those who have received knowledge can reflect and follow that truth. The best fit for these two ways of knowing is the Absolute level of Table 1.

*Epistemological Reflection Model.* Baxter-Magolda (1992) also used the Perry scheme as the starting point for longitudinal studies of male and female college students. The Absolute way of knowing depicts knowledge as certain and unchanging, communicated from authority. The Transition way of knowing views some knowledge as uncertain, but only in special cases. The general view of knowledge is still fixed and certain, as in Perry's stages 2 and 3, in which the student is still able to assimilate gaps in certainty. Both fit into the Absolute level of Table 1.

*Constructive Developmental Framework.* Kegan's (1980) Constructive Developmental Framework was based not on the Perry scheme, but on clinical psychology and the relationship of the mind to its surroundings. Kegan was also looking at the whole range of development, starting from childhood, not just that of college students and adults. For these reasons, Kegan's model is very different and does not fit into the three part comparison in Table 1 as neatly as the theories above. For Kegan (2000), knowledge is formed as meaning that is shaped out of the interaction of one's inner and outer experience.

Kegan's first stage, Independent Elements, is characteristic of young children who are only aware of their own immediate inner perceptions. This stage does not have enough permanence to constitute knowledge, but what is experienced is seen as the only reality that exists. Because there is only the possibility of one reality, this stage seems to fit best in the Absolute level of Table 1. Because neither the

concept of knowledge nor the idea of authority has yet emerged, this stage could arguably be considered as a precursor to epistemological thought and not appropriate for inclusion into the three levels of Table 1. The stage does have the advantage of completing Kegan's analysis to the very beginnings of experience.

The second stage, Durable Category, reflects children who have a sense of themselves and their social roles. Their experience is concrete and logical, but does not consider the needs or consciousness of others. Because of the concrete assumptions about social interactions, it fits in the Absolute level of Table 1. However, this knowledge comes from the interaction with the social environment, but it is based on individual interpretations of what is appropriate. Because the concept of knowledge as temporary and multiple does not exist, this stage is not the same as the Subjective level of Table 1, even though it is based on personal perceptions. The personal assumptions about knowledge are as fixed and immutable as the concepts transmitted by authority in the Perry-based structures, so stage two is not a transition into the free-wheeling, anything-goes Subjective level, but stays in the Absolute level of Table 1. The most important factor for inclusion into the Absolute level of Table 1 is the concept of knowledge as certain and unchanging. The source of that knowledge changes somewhat with the different theoretical perspectives of the developmental researchers.

Stage three, Cross-Categorical Knowing, is more typical of adolescents or adults who have developed the ability for abstractions, self-reflection, and social awareness. Kegan considered the knowledge of this level to be socialized traditionalism. It is unchanging and handed down by the cultural authorities. As long as the knowledge of this stage is not challenged by other cultures or rapid changes in society, it

works quite well for people. It clearly reflects the characteristics of the Absolute level of Table 1.

*National Center for the Study of Adult Literacy (NCSAL).* Using Kegan's theories as the basis of their research, and focusing on immigrants taking adult basic education classes, NCSAL formulated a model of three ways of knowing (Helsing et al. 2001). In the Instrumental way of knowing, knowledge is a commodity useful for obtaining desired goals. Knowledge is concrete, absolute, and transmitted by external authority. In the Socializing way of knowing, the goal becomes the meeting of social roles and expectations, but knowledge remains absolute truth from the social authorities. Both of these ways fit well in the Absolute level of Table 1.

*Reflective Judgment Model.* King and Kitchener (2004) based their research on the cognitive development theories of Piaget and Kohlberg, who also influenced Perry. However, King and Kitchener focused on Dewey's (1933) idea of reflective thinking, which emphasized the issues of solving complicated problems with no clear cut solution. Their three-category, seven-stage model has a different emphasis than the Perry scheme, but it fits reasonably well into the comparison table. The first category, Prereflective Thinking, consists of three stages. In stage 1, knowledge is considered to be concrete and absolute. Stage 2 corresponds to Perry's position 3: some knowledge may not yet be discovered, but upon discovery, the knowledge will be certain. Stage 3 has some elements of the Subjective level, since in areas where knowledge is not yet discovered, personal opinion is an acceptable source of knowledge. However, since stage 3 also holds that authority is the source of knowledge that has been discovered, and that authority will eventually reveal certain knowledge with further study, stage 3 belongs in the Absolute level of Table 1.



*Epistemological World View.* Focusing on the epistemological views of teachers, rather than students, Schraw and Olafson's (2002) Realist category describes knowledge as fixed, universal, and unchanging; known to the teachers as authority; and transmitted by them to the students. It fits in the Absolute level of Table 1.

*Subjective Level of Table 1*

*Perry Scheme.* In Perry's scheme, when the first crisis is reached and knowledge can no longer be seen as certain and absolute, the reaction from the students can vary. Some students choose to retreat to an earlier stage, but most move from position 3 to either position 4a or 4b. Position 4a, called Multiplicity by Perry, is the basis for the Subjective level of the Comparison of Epistemological Models, Table 1. Students in this position, according to Perry, see that unchanging truth cannot be found, and they make the assumption that no basis exists to prefer one perspective or opinion over any other. Position 4b is the beginning of the Contextual level of the comparison and will be discussed below.

*Women's Ways of Knowing.* The Subjective knowledge of Belenky et al. (1986) belongs to the Subjective level of Table 1. Truth comes from inside, from experience and intuition. Truth is multifaceted, but is only valid for the individual who owns that particular truth.

*Epistemological Reflection Model.* Baxter-Magolda's (1992) Independent way of knowing assumes that knowledge is uncertain, but sees personal opinions as valid for the holder of those opinions. It reflects the Subjective level of Table 1.

*Constructive Developmental Framework/NASCAL.* Neither Kegan's (1980) Constructive Developmental Framework nor the NASCAL (Helsing et al. 2001) study of recent immigrants in basic adult education classes contained developmental stages that were consistent with the Subjective

level of Table 1. Several reasons are possible for the lack of a Subjective level. First, Kegan came from a different theoretical stance than Perry, looking at the interaction of inner and outer realities rather than the developmental perspectives of educational theories. Second, Perry came to believe that students took two different routes to get to the idea of contextual criteria. Some went from the Absolute stance of the first three positions to 4a, a Subjective stance. Others went directly from Absolute to 4b, a Contextual stance. Not all of the students in Perry's study had a Subjective stance toward knowledge. Finally, the Comparison of Developmental Models (Table 1) emphasizes questions concerning the structure of knowledge and the appropriate means to evaluate that knowledge. Kegan's theoretical stance and research strategies look at different factors in his developmental stages. A different set of criteria in the comparison would give a very different picture of the interrelationships of the models.

*Reflective Judgment Model.* In King and Kitchener's (2002) stage 4, knowledge is seen as uncertain, and individual opinion is seen as sufficient evidence to defend a claim. The stage fits well into the Subjective level of Table 1.

*Epistemological World View.* According to Schraw and Olafson (2002), teachers who are Relativists see knowledge as self-constructed and highly individualistic, with no opinion considered more valuable than another. Relativists are clearly in the Subjective level of Table 1.

#### *Contextual Level of Table 1*

*Perry Scheme.* The second shift in personal epistemology, according to Perry (1970), comes when the students who can no longer assimilate the discrepancies in expert views under the assumptions of Absolute level, learn to accommodate the new perception that conditional truth can be evaluated by temporary criteria. Instead of the chartless

confusion of position 4a, the Subjective level, where no opinion is better than any other, position 4b establishes the beginning of the Contextual level. Students in position 4b can see that in certain situations, temporary judgments can be made using contextual criteria to evaluate some perspectives as more useful, more congruent, or effective. Positions 5 through 9 indicate a continuing evolution of commitment to defensible, but uncertain claims.

*Women's Ways of Knowing.* Procedural knowledge and Constructed knowledge, from Belenky et al. (1986) are part of the Contextual level of Table 1. Procedural knowledge can be created, evaluated and discussed. Procedural knowledge is created and grounded in personal experience, but is not limited to the individual. It can be shared, discussed, and, most importantly, evaluated. Even though the judgments are temporary, the fact that criteria exist makes Procedural knowledge part of the Contextual level. Constructed knowledge is a deliberate combination of individual and outside knowledge. Components of logic and emotion blend together in unique ways, and discussion and cooperation are possible. The possibility of finding more effective ways of dealing with the complexities of life places Constructed knowledge in the Contextual level of Table 1.

*Epistemological Reflection Model.* Baxter-Magolda's (1992) Contextual way of knowing finds knowledge uncertain, but uses temporary, situational criteria to evaluate that knowledge. It fits well in the Contextual level of Table 1.

*Constructive Developmental Framework.* Stage four, System/Complex, of Kegan's (1980) Constructive Developmental Framework, requires individuals to be self authoring, to be able to come to terms with the multiple cultures, multiple roles, and quickly changing realities of modern life. People in this stage have given up the idea of unchanging and certain truth, but they do not insist that only

their own experience and perceptions are valid. They have moved into a stage that is consistent with Perry's position 4b, where some criteria exist for choosing between the alternate truths presented by the complex environments of modern life. The fifth stage, Trans-System, Trans-Complex pushes the multiple environments even further, to paradox and confusion. To survive the contradictions of our post-modern cultures, individuals must be self-transforming, and create necessary knowledge. Both of these stages fit the Contextual level of Table 1.

*NASCAL.* NASCAL's third way of knowing, Self-Authoring, depicts knowledge as constructed for specific situations by individual interpretations. Knowledge is still useful for achieving an individual's goals, but the individual decides what is valuable. The constructed knowledge is evaluated based on its effectiveness, so the Self-Authoring way of knowing fits in the Contextual level of Table 1 (Helsing et al., 2001).

*Reflective Judgment Model.* In stage 5, King and Kitchener (2002) discuss knowledge as contextual, with the rules for evidence specific to a given domain. Although stage 5 is part of the Quasi-Reflective stage with stage 4, the recognition of situational criteria moves it into the Contextual level of Table 1. The final category of Reflective Thinking contains two stages which belong to the contextual level. Stage 6 views knowledge as constructed from many points of view. In stage 7, knowledge is constructed from inquiry and continually reevaluated.

*Epistemological World View.* According to Schraw and Olafson (2002), teachers who are Contextualists view knowledge as temporary, specific to a given situation, and constructed collaboratively. The knowledge can be evaluated by criteria which depend on the context of the situation. This view belongs in the Contextual level of Table 1.

### **Discussion and Implications for Research and Practice**

Research into student, teacher, and administrator beliefs about the nature of knowledge is important because of the pervasive influence that those beliefs have over attitude, motivation, and behavior. Career and technical education students may completely misinterpret their instructors' actions and motivations if they are operating from different assumptions about the nature of knowledge (Perry, 1970). Career and technical educators may not understand the assumptions about knowledge that guide their students. Seeking this kind of understanding can help CTE educators avoid mistakenly perceiving a student to be resistant, passive, intellectually lazy, or illogical (Belenky & Stanton, 2000). Administrators and politicians with different assumptions about the nature of knowledge may find themselves at cross purposes with teacher training and educational research (Schraw & Olafson, 2002). Exploring the personal epistemologies of each of these stakeholders is important, but difficult. The issue is complicated by the fact that the epistemological views of the researchers themselves tend to affect what strategies are used, what is noticed, and how it is interpreted. Each of the methods currently used has strengths and limitations in the exploration of personal epistemologies.

The large number of models to explain epistemological views reflects the different definitions, interests, and purposes of the researchers. Different populations of participants provide different sets of material for interpretation. The overarching beliefs held by society in general and the political regulators in particular are part of the social context in which epistemological views are negotiated. Although each of the models discussed provides rich, complex, and interesting

perspectives into the personal epistemologies of the researcher and the respective participants, each model is limited by the views of its developer and the characteristics of the group it represents. None of these models can be considered definitive for humanity in general. The intent of this article is to offer a consolidated model that may have greater utility for CTE practitioners and scholars. Future research is encouraged to test this new consolidated model and to offer viewpoints regarding its relevance for CTE contexts.

Future research that attempts to examine CTE students' assumptions about knowledge and learning, their personal epistemologies, will not be an easy task. Most people do not consciously examine their beliefs about knowledge; therefore, their assumptions remain unarticulated and difficult to define. However, these tacit beliefs appear to influence students' expectations, focus, and behavior. Measuring tacit assumptions will be tricky, particularly when the very act of investigating those assumptions brings them to light. The process of surfacing one's assumptions can cause people to reconsider or change them. Nonetheless, this research has been provided as a stepping stone for future studies that can explore personal epistemologies of CTE learners in specific contexts. We hope this comparison and consolidation of existing models of personal epistemologies provides a useful conceptual framework for CTE research and practice.

### References

- Baxter-Magolda, M. (1987). A comparison of open-ended interview and standardized instrument measures of intellectual development on the Perry scheme. *Journal of College Student Personnel*, 28, 443-448.

- Baxter-Magolda, M. (1992). *Knowing and reasoning in college: Gender-related patterns in students' intellectual development*. San Francisco: Jossey-Bass.
- Baxter-Magolda, M. (2002). Epistemological reflection: The evolution of epistemological assumptions from age 18 to 30. In B. K. Hofer & P. R. Pintrich (Eds.) *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 89-102). Mahwah, N. J.: Lawrence Erlbaum Associates.
- Baxter-Magolda, M. (2004). Evolution of a constructivist conceptualization of epistemological reflection. *Educational Psychologist*, 39(1), 31-42.
- Belenky, M. F., Clinchy, B. M., Goldberger, N. R., & Tarule, J. M. (1986). *Women's ways of knowing: The development of self, voice, and mind*. New York: Basic Books.
- Belenky, M. F., & Stanton, A. V. (2000). Inequality, development, and connected knowing. In J. Mezirow (Ed.) *Learning as transformation: Critical perspectives on a theory in progress* (pp. 71-102). San Francisco: Jossey-Bass.
- Bull, B. F. (2002, Winter). Constructionist crap in Christian colleges: The indoctrination of teacher education. *The Educational Forum*, 66, 162-164. Retrieved on July 10, 2003, from WilsonSelectPlus, <http://newfirstsearch.Oclc.org/WebZ/FSPage?pagename=tempftascii:pagetype=print:entityp...>
- Dewey, J. (1933). *How we think: A restatement of the relations of reflective thinking to the educational process*. Lexington, MA: Heath.
- Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychology Review* 95, 256-273.

- Gilligan, C. (1977). In a different voice: Women's conception of self and morality. *Harvard Educational Review*, 47, 76-116.
- Gilligan, C. (1982). *In a different voice: Psychological theory and women's development*. Cambridge: Harvard U. P.
- Hager, P. (2000). Know-how and workplace practical judgement. *Journal of Philosophy of Education*, 34(2), 281-296.
- Hammer, D., & Elby, A. (2002). On the form of a personal epistemology. In B. Hofer & P. Pintrich (Eds.) *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 169-190). Mahwah NJ: Lawrence Erlbaum Associates.
- Helsing, D., Drago-Severson, E., Kegan, R., Portnowe, K., Popp, N., & Broderick, M. (2001, October). Three different types of changes. *Focus on Basics*, 5. Retrieved September 26, 2002, from <http://gseweb.harvard.edu/~ncsall/fob/2001/adult3.html>
- Hofer, B. K., & Pintrich, P. R. (1997, Spring). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research*, 6, 88-140. Retrieved on July 8, 2003, from <Http://newfirstsearch.oclc.org/WebZ/FSPage?pagename=tempftascii:pagetype=print:entitp...>
- Jehng, J. J., Johnson, S. D., & Anderson, R. C. (1993). Schooling and student's epistemological beliefs about learning. *Contemporary Educational Psychology*, 18, 23-35.



- Kegan, R. (1980). Making meaning: The constructive-developmental approach to persons and practice. *Personnel and Guidance Journal*, 58, 373-381. Retrieved on July 17, 2003 from [http://web18.epnet.com/delivery.asp?tb=0&\\_ua=shn+1+F5EF&\\_ug=1n+en-us+sid+E0AE4...](http://web18.epnet.com/delivery.asp?tb=0&_ua=shn+1+F5EF&_ug=1n+en-us+sid+E0AE4...)
- Kegan, R. (1994). *In over our heads: The mental demands of modern life*. Cambridge, MA: Harvard University Press.
- Kegan, R. (2000). What forms transform? A constructive-developmental approach to transformational learning. In J. Mezirow (Ed.) *Learning as transformation: Critical perspectives on a theory in progress* (pp. 35-69). San Francisco: Jossey-Bass.
- King, P. (1992). How do we know? Why do we believe? *Liberal Education*, 78. Retrieved on July 17, 2003, from EBSCOhost, [http://web18.epnet.com/delivery.asp?tb=1&\\_ua=shn+4+C231&\\_ug=dbs+0%2C3%2c\\$+In...](http://web18.epnet.com/delivery.asp?tb=1&_ua=shn+4+C231&_ug=dbs+0%2C3%2c$+In...)
- King, P., & Kitchener, K. (1994). *Developing reflective judgment: Understanding and promoting intellectual growth and critical thinking in adolescents and adults*. San Francisco: Jossey-Bass.
- King, P., & Kitchener, K. (2002). The reflective judgment model: Twenty years of research on epistemic cognition. In B. Hofer & P. Pintrich (Eds.) *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 17-61). Mahwah, N. J.: Lawrence Erlbaum Associates.
- King, P., & Kitchener, K. (2004). Reflective judgment: Theory and research on the development of epistemic assumptions through adulthood. *Educational Psychologist*, 39(1), 5-18.

- Kohlberg, L. (1973). Continuities in childhood and adult moral development. In P. Baltes & K. Schaie (Eds.) *Life-span developmental psychology: Personality and socialization*. Orlando: Academic Press.
- Louca, L., Elby, A., Hammer, D., & Kagey, T. (2004). Epistemological resources: Applying a new epistemological framework to science instruction. *Educational Psychologist*, 39(1), 57-68.
- Perry, W. G. (1970). *Forms of intellectual and ethical development in the college years: A scheme*. Fort Worth: Harcourt, Brace, & Jovanovich.
- Perry, W. G. (1981). Cognition and ethical growth: The making of meaning. In A. W. Chickering (Ed.) *The modern American college* (pp. 76-116). San Francisco: Jossey-Bass.
- Polanyi, M. (1967). *The tacit dimension*. London: Routledge and Kegan Paul.
- Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology*, 82, 498-504.
- Schommer, M. (1993). Comparisons of beliefs about the nature of knowledge and learning among postsecondary students. *Research in Higher Education*, 34, pp. 355-370. Retrieved May 19, 2005, from <http://80-wos17.isiknowledge.com.proxy2.library.uiuc.edu/CIW.cgi>
- Schommer, M. (1998a). The influence of age and education on epistemological beliefs. *British Journal of Educational Psychology*, 68, pp. 551-562. Retrieved May 19, 2005 from [Http://80-wos17.isiknowledge.com.proxy2.library.uiuc.edu/CIW.cg](http://80-wos17.isiknowledge.com.proxy2.library.uiuc.edu/CIW.cgi)  
[i](http://80-wos17.isiknowledge.com.proxy2.library.uiuc.edu/CIW.cgi)

- Schommer, M. (1998b). The role of adults' beliefs about knowledge in school, work, and everyday life. In M. C. Smith & T. Pourchot (Eds.) *Adult learning and development: Perspectives from educational psychology* (pp. 127-143). Mahwah, N. J.: Lawrence Erlbaum Associates.
- Schommer-Aikins, M. (2002). An evolving theoretical framework for an epistemological belief system. In B. Hofer & P. Pintrich (Eds.) *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 103-118). Mahwah, N. J.: Lawrence Erlbaum Associates.
- Schraw, G., Bendixon, L., & Dunkel, M. (2002). Development and validation of the Epistemic Belief Inventory. In B. Hofer & P. Pintrich (Eds.) *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 261-75). Mahwah, N. J.: Lawrence Erlbaum Associates.
- Schraw, G., & Olafson, L. (2002). Epistemological world views: A concept that is useful beyond the classroom. *Issues in Education*, 8. Retrieved July 15, 2003, from EBSCO.host, [http://web9.epnet.com/delivery.asp?tb=1&\\_ug=db+0%2C3%2c4+In+en-us+sid+25D22D...](http://web9.epnet.com/delivery.asp?tb=1&_ug=db+0%2C3%2c4+In+en-us+sid+25D22D...)
- Shoenfeld, A. H. (1983). Beyond the purely cognitive: Belief systems, social cognitions, and metacognitions as driving forces in intellectual performance. *Cognitive Science*, 7, 329-363.
- Threton, M.D. (2007). The Carl D. Perkins career and technical education act of 2006 and the roles and responsibilities of CTE teachers and faculty members. *Journal of Industrial Teacher Education*, 44(1), 66-82.