

Chapter 2

Personal Epistemology: Nomenclature, Conceptualizations, and Measurement

Jeremy Briell, Jan Elen, Lieven Verschaffel, and Geraldine Clarebout

2.1 Introduction

How cognitive flexibility relates to personal epistemology depends entirely on how the constructs are interpreted. We address the latter half of this question here.

Scholars over the generations have attempted to decipher arguably the most rudimentary element of being human – “knowledge.” Kitchener (2002) defines epistemology as a theory of knowledge, reflecting its etymological origins in the Greek words “episteme” (knowledge) and “logos” (theory). An age-old branch of philosophy, epistemology is also a significant field of study for cognitive and educational psychologists. Whereas the philosophical branch concerns professional theorizing about knowledge, the psychological branch pertains to empirical observations of the epistemology of laypersons. A host of research lines, each employing preferred nomenclatures and interpretations, belong to this field, which is collectively known as “personal epistemology” – the umbrella term notably employed by Hofer and Pintrich (1997) in their extensive review.

It is well known to the reader familiar with personal epistemology that this field struggles with fundamental and persistent issues regarding nomenclature, conceptualization, and measurement. In this chapter, we visit each of these basic questions by means of a review. Our ultimate objective is to clarify the construct so that the reader may better apprehend its significance to cognitive flexibility.

J. Briell(✉) • J. Elen • L. Verschaffel • G. Clarebout
Centre for Instructional Psychology and Technology,
K.U.Leuven, Leuven, Belgium
e-mail: jeremy.briell@student.kuleuven.be

2.2 Literature Search

The thorough review by Hofer and Pintrich (1997) is undoubtedly well known to those familiar with personal epistemology. As these reviewers note, “Defining the construct based on existing research is problematic, as there are discrepancies in naming the construct as well as defining the construct, to the extent that it is sometimes unclear to what degree researchers are discussing the same intellectual territory” (p. 111). Because personal epistemology represents a divergent and loosely defined body of research, a number of steps were taken to insure the literature in this review resembled the research Hofer and Pintrich had reviewed and how they had defined it.

In an initial step, we entered the terms “reflective judgment,” “ways of knowing,” and “epistem*” into a search of PsycINFO database. The search terms were chosen because of their usage in the six models reviewed by Hofer and Pintrich (1997).¹ The search was limited to empirical research, peer-reviewed journal articles and book sources (i.e., references to various types of books and book chapters), the English language, publications from 1998 to 2009, and adolescents and adults. The latter two limitations were chosen for the following reasons: The time frame is meant to capture literature from publication of the Hofer and Pintrich review onward. We eliminated studies of preadolescent populations, because it is our contention a joint review of children and adult epistemologies should have a more specific focus than the umbrella construct currently under review.² This step yielded in 617 references.

Of these, nearly half were excluded because the identified term did not represent a construct under investigation. For instance, Hosoda (2006) investigated a construct which is partially derived from an understanding of the “epistemology of [nursing] practice” (p. 480). Eight references were also eliminated because they were repetitive.

We were not confident, however, that all of these studies belonged under the umbrella of personal epistemological research. The constructs under investigation seemed to vary substantially with respect to terminologies and definitions. This is not surprising considering the previously mentioned nature of personal epistemology. Quite often, however, it was difficult to ascertain how the studies corresponded to the notion as it was defined and reviewed by Hofer and Pintrich (1997).

¹Various forms of the root word “epistem” were applied in the models (i.e., epistemic cognition, epistemological assumptions, epistemological beliefs, epistemological perspectives, epistemological theories, and epistemology). Because of this, and because we are aware of other more recent terms with the same root, we chose to enter “epistem*” to avoid excluding nomenclatures representative of PE.

²The target populations for the research programs reviewed by Hofer and Pintrich (1997) were predominantly college-age young adults. Recent studies have begun to investigate, or are beginning to take an interest in, personal epistemology from the perspective of child development (see Kitchener, 2002).

Hence, we sought to eliminate studies with little resemblance to personal epistemology as they had defined it. For instance, in their interpretation, personal epistemology represents a personal construct (i.e., a construct which researchers attribute to respondents). Hence, studies were excluded when this was not a feature of the identified construct. For example, Fulkova, Straker, and Jaros (2004) examined the “onto-epistemic status... of contemporary material culture” (p. 4). The term represents how contemporary society interprets works of art, which is visibly more of a social/collective construct. Studies were also eliminated when the identified construct was clearly something other than personal epistemology. For instance, we eliminated studies that dealt with “epistemic curiosity,” which Litman, Hutchins, and Russon (2005) define as “a desire for new information that motivates exploratory behavior and knowledge acquisition” (p. 559). We also removed investigations of “epistemic motivation,” meaning a “desire to acquire knowledge” (Lun, Sinclair, Whitchurch, & Glen, 2007). Studies such as Darnon, Muller, Schrager, Pannuzzo, and Butera (2006) that dealt with “epistemic conflict regulation (a conflict regulation strategy focused on the attempt to integrate both points of view)” were also excluded (p. 766).

Since the time of the Hofer and Pintrich (1997) review, the field has also begun to consider personal epistemology on a domain-specific level (see, for instance, Hofer, 2006) and, more recently, though not to the same extent, relative to a particular topic or context. We decided to be selective; a single review would not do justice to the amount of literature that has accumulated here. Therefore, we concerned ourselves only with studies that were domain general or those that contrasted differing cognitive ranges (e.g., mathematics and science epistemologies, general and history epistemologies, and comparisons of multiple context-specific epistemologies).

The literature search was conducted in November and December of 2009. In total, 151 studies were retrieved.

2.3 Section I: Nomenclature and Conceptualizations

Terminology has caused much consternation among researchers, resulting in a plethora of nomenclatures. Unfortunately, similar sounding ones can mean quite different things and vice versa. And, it is often the case that more than one term is employed in a single study. Sometimes multiple terms are used interchangeably and sometimes they are not; sometimes the meanings of different terms are explained and sometimes their meanings are assumed. Further, two studies may use different terms though their meanings are the same. For this reason, terms alone do not always clarify conceptual distinctions and mean little apart from their implementation. Our line of argument here is that distinct terms are necessary where major conceptual differences exist, but they are unnecessary if they are primarily preferential or misleading. We will argue of personal epistemology, as Pajares (1992) had of teachers’ beliefs, “that research studies would be well served by ... reasoned choice[s] commonly understood and consistently employed” (p. 311).

Table 2.1 Frequently and less frequently employed terminology

Frequently employed terms ^a		
Epistemic beliefs	Epistemic cognition	Epistemic reasoning
Epistemological assumptions	Epistemological beliefs	Epistemological perspectives
Epistemological stance	Epistemological understanding	Epistemology
Personal epistemology	Reflective judgment	Ways of knowing
Less frequently employed terms ^b		
Epistemic assumptions	Epistemic criteria	Epistemic dependence
Epistemic elaboration	Epistemic knowledge	Epistemic monitoring processes
Epistemic regulation	Epistemic stance	Epistemic styles
Epistemic validation	Epistemic worldviews	Epistemically related beliefs
Epistemological approaches	Epistemological dispositions	Epistemological forms
Epistemological frameworks	Epistemological intentions	Epistemological knowledge
Epistemological orientations	Epistemological resources	Epistemological thought
Epistemological underpinnings	Epistemological worldviews	Folk epistemology
Implicit epistemology	Psycho-epistemological styles	

^aTerms used in three or more studies^bTerms used in only one or two studies

2.3.1 *The Dual Nature of Personal Epistemology*

Table 2.1 above lists frequently and less frequently employed terms in the studies. Most of the terms are connotative of cognitive structures (e.g., epistemological assumptions, epistemic beliefs, and epistemological knowledge) or cognitive processes (e.g., epistemic reasoning, reflective judgment, and ways of knowing), which is further borne out in definitions. The vast majority of studies seemed to be aptly characterized by one or both of these groupings, the difference stemming from whether the construct was perceived as something that exists abstractly or something that occurs in thinking and learning situations. Therefore, we attempted to classify them systematically according to how constructs were introduced. Constructs were classified as conception oriented if a study referred to abstract conceptions. For instance, Brownlee, Purdie, and Boulton-Lewis (2001) define “epistemological beliefs” as “beliefs about knowing [that] reflect an individual’s views on what knowledge is, how it can be gained, its degree of certainty, the limits and criteria for determining knowledge” (p. 247). Constructs were classified as process oriented if they stood for how individuals come to know. As a prototypical example, Beaudoin and Schonert-Reichl (2006) refer epistemic reasoning as “the processes utilized by an individual for coming to terms with doubt brought about by competing knowledge claims” (p. 1000). A number of studies refer to construct(s), which we judge to be a combination of the two categories. In some instances, researchers use separate terms and definitions for the two orientations. For instance, Eigenberger, Critchley, and Sealander (2007) utilize the term “epistemic style” to represent an

Table 2.2 Classification of constructs under investigation

Categories	Studies
Conceptual construct	
• Knowledge/knowing	60
• Knowledge/knowing and learning	31
• Knowledge/knowing and other	8
• Other	9
• Not specified	3
Process construct	19
Conceptual and process construct(s)	
• Distinct terms	4
• No distinct terms	11
Other	2
Construct insufficiently defined	7

Note: Three studies separately investigated two constructs that fit into more than one of the above categories

“individual’s habitual or favored process of making a judgment or solving a problem, which is ultimately derived from one’s theory of knowledge [i.e., ‘epistemic assumptions’]” (p. 3). Table 2.2 is the result of our judgments.

In the latter example above, the researchers are making a distinction that is historical and, which we argue, imperative. Historically speaking, the Perry scheme (Perry, 1970) was devised on the premise that how students construed experiences of perceived importance is structured by their “epistemological assumptions.” Hence, the model is descriptive of an amalgamation of respondents’ abstract assumptions (about knowledge, value, and responsibility) and their associated meaning making. Another major influence on the field is the reflective judgment model (RJM; King & Kitchener, 1994, 2002, 2004; King, Kitchener, Wood, & Davidson, 1989; Kitchener, 1983; Kitchener & King, 1981). According to the RJM, certain “epistemic assumptions” (i.e., general implicit assumptions about the nature of knowledge) determine certain stages of judgment making (i.e., pre-reflective, quasi-reflective, and reflective). These and other influential researches portray forms of reasoning that are structured by abstract conceptions in a fashion that suggests an indiscernible fusion (e.g., Baxter Magolda, 1992; Belenky, Clinchy, Goldberger, & Tarule, 1986; Perry, 1970) or a straightforward relationship (i.e., RJM), a tradition that persists in the studies we reviewed.

Because of their theoretical relationship and because each is inferred from the other in studies, little emphasis is given to differentiating conception-oriented constructs and process-oriented constructs. However, they are conceptually different. What an individual believes on an abstract level and how she goes about knowing and learning are not the same. Although, theoretically speaking, an obvious relationship exists, their relations are probably more complicated than currently modeled. Regrettably, what should be treated as theory is now taken as conclusions forgone, which creates chaos in terms of understanding constructs and how they are measured.

As an example, Pizzolato and Ozaki (2007) describe, “self-authored people” as those that “employ complex cognitive processes in ways that recognizes the socially constructed nature of knowledge,” which is measured through interviews concerning participant interpretations of important experiences (p. 196). Note the reader is asked to presume the relationship and accept the inferred conceptions about knowledge. As another example, Lovell and Nunnery (2004) refer to developmental epistemologies as “forms of intellectual and ethical development” that are comprised of cognitive structures (p. 139). In essence, they are referring to the Perry scheme. In order to infer positions (of the lower half) of that scheme, they employ the Learning Environmental Preferences (Moore, 1989), a survey that measures students preferences for certain learning environments. The conundrum being that the reader would be hard-pressed to know whether the learning preferences operationalized are used to primarily infer the scheme’s abstract assumptions and only secondly to infer its corresponding forms of meaning making or vice versa or simultaneously to infer both. Even the instrument’s designer seems unable to resolve this question, when saying, “...the measure does perform as if it reflected the Perry scheme, or at least some form of cognitive development” (Moore, 1989, p. 510). The confusion occurs because too often the line between how one knows and what one abstractly conceives in researchers’ interpretations and operationalizations of personal epistemology is entirely unrecognizable, which could be ameliorated by conceiving of the umbrella construct as having two forms that are *only* theoretically related.

Based on this line of reasoning, we discuss the scope of personal epistemology from a dual-nature perspective, that is, arguments about how each form should be termed and defined are discussed individually.

2.3.2 *Review of Conception-Oriented Form of Personal Epistemology*

Seventy-three percent of the studies reviewed were categorized as purely involving a conception-oriented construct, while another 10% were classified as concerning a mix of conception- and process-oriented constructs. A number of conceptual divergences are evident in how these researches define the nature of the conception-oriented construct; these regard precisely *about what* the conceptions are and about their *cognitive form, status, and range*.

2.3.2.1 *Conceptions About What*

What the conceptions are about is a complex question requiring an intricate answer. However, we can begin with a general, obvious answer, which can be readily gleaned from the definitions researchers give. Of the 109 studies that refer to a conception-oriented construct, 90 define them as being about “knowledge” and/or “knowing.”

Often, the two descriptors are together in definitions and referred to as the “nature of knowledge and knowing.” Thirty-one of these ninety also define the conceptions as being about “learning” or “knowledge acquisition.” Constructs are also defined as being about other concepts, such as the ability to arrive at a right answer with complete certainty (Brem, Russel, & Weems, 2001), one’s competence being dependent on her ability to admit knowledge (Mugny, Chatard, & Quiamzade, 2006), “belief” (Alexander, Murphy, & Guan, 1998; Alexander, Murphy, Guan, & Murphy, 1998), “truth” (Bond, Belenky, & Weinstock, 2000; Jimmerson & Bond, 2001; Mansfield & Clinchy, 2002; Marra, 2005; Weinstock & Bond, 2000), “self as knower” (Bond et al., 2000; Bond & Burns, 2006; Burns & Bond, 2004), and the “nature of authority” (Hensley, 2001).

2.3.2.2 Cognitive Form, Status, and Range

Other questions concerning the nature of the conceptions regard their cognitive form, status, and range, which are not altogether separate issues. Traditionally, the conceptions were modeled as unitary structures (or stage-like levels), having an implicit status, and representative of knowledge in general (Baxter Magolda, 1992; Belenky et al., 1986; King and Kitchener, 1994; Kuhn, 1991; Perry, 1970).

The unitary form of the conceptions proposed in stage models was challenged by later theorists. It was discerned that such models could be teased apart into distinct conceptual facets or dimensions (see Hofer & Pintrich, 1997; Schommer 1990), which Schommer theorized operated as a system of relatively independent beliefs. Meaning, an individual could hold, for instance, the sophisticated belief that knowledge is highly complex and simultaneously believe, naïvely, that knowledge is certain (Schommer-Aikins, Duell, & Barker, 2003, p. 350). Despite the abundance of dimensional research, asynchronous development has not been formally tested (Schommer-Aikins, 2004). As a compromise between stage models that do not allow for within-stage variation and orthogonal dimensional models, Hofer and Pintrich proposed that epistemological beliefs have a theory-like structure. More recently, Hammer and colleagues (Hammer & Elby, 2002; Louca, Elby, Hammer, & Kagey, 2004; Rosenberg, Hammer, & Phelan, 2006) proposed another alternative, a structure of fine-grained cognitive resources (a concept adopted from diSessa’s (1993) phenomenological primitive or p-prims) that are “legion, sensitive to context in their activation, and linked in a network of ‘cuing’ priorities” (Rosenberg et al., 2006, p. 265). All four proposed forms for the conceptions are employed in studies reviewed to frame the conceptions investigated.

The implicit status of the conceptions has not been challenged by more recent literature, as is often evident in labels given: “epistemic assumptions” (e.g., Eigenberger et al., 2007), “epistemological assumptions” (e.g., Baxter Magolda, 2004), “epistemological forms” (Lovell & Nunnery, 2004), and “implicit epistemologies” (Pirttilä-Backman & Kajanne, 2001). It is also apparent in researchers’ descriptions. For instance, Ricco (2007) and Ricco and Rodriguez (2006) define “personal epistemology” as naïve or intuitive beliefs.

The majority of studies reviewed were conceptualized as regarding knowledge in general (i.e., domain general). It is important to note that this observation is certainly biased based on how the literature search was conducted. That said, it is still obvious that the number of studies to investigate conceptions of smaller cognitive ranges is increasing. Typically, operationalized at a disciplinary-domain-specific (e.g., Buehl & Alexander, 2005; Hofer, 2000; Schommer-Aikins, Duell, & Hutter, 2005), judgment-domain-specific (Hallett, Chandler, & Krettenauer, 2002; Kuhn, Cheney, & Weinstock, 2000), and more recently topic-specific (e.g., Trautwein & Lüdtke, 2007) or context-sensitive (e.g., Rosenberg et al., 2006) range.

2.3.3 *Argument Concerning Conception-Oriented Form of Personal Epistemology*

The above provides an overview of how researchers define what we refer to as the conception-oriented form of personal epistemology.

2.3.3.1 “Epistemic” Versus “Epistemological”

As is obvious in Table 2.1, there are basically two candidate adjectives that researchers apply to characterize the conceptions they are investigating: “epistemic” and “epistemological.” Since there is no visible difference in the conceptions the two adjectives refer to, a choice should be made between them. According to the Oxford Dictionary of Current English, an adjective is “a word used to describe a noun or make its meaning clearer, such as sweet, red, or technical.” Regrettably, neither choice of adjective escapes the possibility of obscuring the conceptions being investigated. In Richard Kitchener’s valuable contribution to this book, he points out that there are multiple ways of translating the use of these adjectives involving a number of complexities.³ His preferred translation for epistemic beliefs is beliefs about the epistemic, that is, beliefs about knowledge, to which he says is equivalent to epistemology. Kitchener also explains that epistemological beliefs can be translated as beliefs about the study of knowledge. Kitchener’s favored translations recognize the adjectives as describing what the conceptions are about. However, it is also possible to employ adjectives to describe what the conceptions are. For example, naïve beliefs are beliefs that are naïve, intuitive beliefs are intuitive, sensible beliefs are sensible, and so forth. In the same way, epistemological beliefs can be translated as beliefs that are epistemological. Epistemological is the derived adjective form of epistemology. Hence, it is viable to say epistemological beliefs are beliefs that are epistemology. Likewise, epistemic beliefs are beliefs that are epistemic, that is, beliefs that are knowledge (perhaps, justified

³Similar arguments are made by Kitchener (2002) in an earlier contribution.

true beliefs). Notwithstanding, we respect that researchers using epistemic intend to say the conceptions are about knowledge and those applying epistemological mean that the conceptions are epistemology. Recognizing this, we argue that epistemological is a better choice of adjective.

From our review, it is clear that epistemological is more commonly employed, thus suggesting a greater possibility of striking accord. Further, when epistemic is applied to mean conceptions of lay folk about knowledge, this definition is only roughly equivalent to epistemology, as not all the conceptions of lay folk about knowledge belong to the professional domain of epistemology. Conversely, when epistemological is applied to mean the conceptions are the epistemology of lay folk, then it is clear that they must somehow emulate those of professional epistemologists. As such, it then relieves confusion about what the conception are about.

Most articulations of what the conceptions are about somewhat coincide with the dimensions rendered by Hofer and Pintrich (1997). These reviewers concluded two general dimensions were common to influential lines of research and the most compatible to philosophical treatments of epistemology: *Nature of knowledge* and *Nature of knowing*. The general dimensions were specified further as pertaining to four dimensions: *Certainty of knowledge* (ranging from conceptions of knowledge being fixed to being tentative and evolving), *Simplicity of knowledge* (ranging from conceptions of knowledge as discrete pieces of information to highly interrelated concepts), *Source of knowledge* (ranging from conceptions of knowledge being derived from external authorities to conceptions of self as knower), and *Justification for knowing* (“how knowledge claims are evaluated, including the use of evidence, the use they make of authority and expertise, and their evaluation of experts” [p. 120]). Notably, the latter dimension does not refer to conceptions, but to cognitive processes. This is because the reviewers did not distinguish the two forms of personal epistemology as we have in this chapter. From a conception-oriented standpoint, this dimension could be defined as what is justified knowledge to layfolk. (The RJM and Perry scheme are both relevant in suggesting what naïve to sophisticated range might exist.)

By saying constructs investigated somewhat coincide with Hofer and Pintrich’s (1997) rendering of personal epistemology, we mean most refer to conceptions as being about the nature of knowledge and knowing. However, researchers do not always refer to the same specific dimensions. When studies do not refer to either general dimension, the conceptions referred to still largely fit the reviewers’ interpretation of personal epistemology. For instance, conceptions that were defined as being about the nature of authority, self as knower, and knowledge dependence, all have correspondence to *Source of knowing* as it was defined by Hofer and Pintrich. Sometimes, researchers do not refer to dimensions at all, as with unitary conceptualizations. In these cases, it is more difficult to know specifically what conceptions are being investigated. Hence, from our standpoint, dimensional operationalizations are advantageous because they enable a clarity of thought and expression toward the construct that unitary models seem impervious to. Even still, it remains an important empirical question as to whether dimensions develop synchronously or asynchronously.

An obvious deviation from Hofer and Pintrich's (1997) interpretation of the construct remains with respect to the inclusion of conceptions about learning. This should come as little surprise considering the popularity of Schommer's (1990) dimensional model, which includes beliefs about the speed of learning and innateness of learning ability. The inclusion of beliefs about learning has triggered an intense debate among researchers. Schommer-Aikins, Mau, Brookhart, & Hutter (2000) expressed the concern that the debate "should not overshadow the more important issue – beliefs about learning and beliefs about knowledge both appear to have a critical impact on learning" (p. 126). While this is a valid point, it does not relieve the issue, as other constructs exist that are also consequential to learning, such as motivation or self-esteem, but that alone would not justify their inclusion. We agree with Hofer and Pintrich's assessment that beliefs about the learning process do not emulate professional epistemology, and are thus not theoretically relevant. Personal epistemological researchers should take cue from professional epistemologists in drawing the conceptual borders around lay epistemology and in determining what empirical questions are relevant. This is precisely why the chapter by Richard Kitchener is so imperative to our work, as he is uniquely qualified to guide us in these respects. It is also why we prefer the adjective epistemological, as it has been frequently, traditionally, and normally interpreted to mean the conceptions are epistemology, and, in turn, commonly understood to be about the nature of knowledge and knowing, which aligns well with professional epistemology. Meanwhile, we must be open to empirical findings. For example, Baxter Magolda (2004) asserts that conceptions about knowledge and learning are intertwined. This is a pertinent question for personal epistemological researchers. If when individuals are asked to define knowledge, for instance, and those definitions include ideas about learning – as we noticed in our own work (Briell, Elen, Depaepe, and Clarebout, 2010) – then it is difficult to exclude them from the agenda of personal epistemological research. In short, professional epistemologists ask certain questions and draw certain conclusions; personal epistemological researchers ask parallel questions of lay folk and observe the answers.

2.3.3.2 "Beliefs" Versus Other Descriptions

Thus far, we have mainly used the terms "conceptions" or "cognitive structures," because we regarded them to be the most neutral. Others represent them as assumptions, beliefs, perspectives, fine-grained resources, understandings, knowledge, dispositions, etc. Such a number of characterizations are only warranted if they are insightful of major theoretical divergences, which they generally are not, since they simply refer some form of abstract cognitive structures. Using the terms "epistemological conceptions" or "epistemological cognitive structures" is not practical because of their unwieldiness, not to mention, that would simply add to the ever-growing list of terms. We argue that "beliefs" is the best candidate for consensus.

This assertion relies on the efforts of Pajares (1992), who sought to find reasonable common ground amidst a similar diversity of terms and conceptualizations of

teachers' beliefs. The predicament had arisen because of the mystery and empirical hurdles involved in understanding individuals' underlying states. Terms and definitions were attributed to "a game of player's choice" (p. 309) with choices highlighting the convoluted task of distinguishing between the intertwined concepts of belief and knowledge. He concluded, simply and broadly, that belief "speaks to an individual's judgment of the truth or falsity of a proposition ..." (p. 316). Here, the propositions are abstract assertions to questions concerning professional epistemologists, generally, about the nature of knowledge and knowing. Hence, *epistemological beliefs* would thus refer to *the abstract beliefs of lay folk that address questions relevant to professional epistemologists, typically about the nature of knowledge and knowing*. As rendered by Pajares, belief is adaptive to the spread of conceived cognitive forms, statuses, and ranges. Beliefs can be conceived as implicit or explicit and general or specific. There is little reason to object to its use to describe cognitive structures in the form of unified wholes or orthogonal dimensions or ones that are theory-like. For instance, while Hofer and Pintrich (1997) had proposed a theory-like ontology, they did not shy away from referring to their proposal as beliefs in the form of personal theories. One exception can be made. Hammer and colleagues (Hammer & Elby, 2002; Louca et al., 2004; Rosenberg et al., 2006) are correct in saying that epistemological beliefs have largely been conceived as stable and robust across contexts. Therefore, their distinctive terminology should be respected because it highlights a significant theoretical departure. Notwithstanding, our argument is that all of these conceptualizations belong to epistemological beliefs research and in almost all cases, the construct itself should be referred to as epistemological beliefs. We are certainly not suggesting that this is a perfect term or that researchers put aside their theoretical differences; we are suggesting there is common ground in an imperfect term when broadly defined.

2.3.4 Review of Process-Oriented Form of Personal Epistemology

Nineteen studies were classified as strictly referring to process-oriented constructs and another fifteen to dual-oriented constructs (i.e., conception and process construct[s]). Our initial classification provides a generic defining of these constructs, that is, how individuals come to know. Regrettably, definitions provided in studies are equally unspecified. For instance, McAuliffe and Lovell (2006) define "developmental epistemology" as "how human meaning evolves over time and in various environments" (p. 308); Tirri, Husu, and Kansanen (1999) characterize "epistemological stances" as "how individual teachers are engaged in their processes of knowing" (p. 912); and Danforth and Glass (2001) investigate "the process by which people construct meaning" (p. 515). The difficulty being that such definitions are without distinguishing qualities that would identify them as being epistemological in nature. As such, they can represent an array of constructs, even ones that are not

typically identified as belonging to personal epistemology (e.g., critical thinking, deep learning, and argumentative reasoning). Notwithstanding, three particular types of process-oriented constructs are discernible: (a) judgments about assertions, (b) salient meaning making, and (c) *Separate* and *Connected knowing*.

The first type of process construct models the judgments that individuals must undertake when confronted with propositions, usually contradictory assertions about a particular subject. Participants are queried about the validity of the assertions, why respective positions conflict, the criteria that justify a resolution to the conflict, and the certainty of their own beliefs about the matter. With one notable exception (Gottlieb, 2007), the respective types of questions are not considered individual dimensions. Instead, responses to the array of questions are normally summarized into unitary positions (e.g., dualistic, multiplistic, and rational). However, some researchers concentrate on a single type of question. For instance, Kuhn et al. (2000), Richter, Schroeder, and Wöhrmann (2009), and Schroeder, Richter, and Hoever (2008) all focus solely on judgments about the validity of assertions.

The second type depicts salient meaning making, that is, how individuals make sense of matters of personal significance. The most prominent example being the modeling of *Self-authorship*, a way of knowing originally described by Kegan (1994) and first supported empirically by Baxter Magolda (2004). The path to *Self-authorship* follows four phases (i.e., following formulas, crossroads, becoming the author of one's life, and internal foundation) and climaxes with the individual assuming responsibility for her own beliefs (epistemological dimension), identity (interpersonal dimension), and relationships (intrapersonal dimension).

The third type concerns two ways of knowing initially described by Belenky et al. (1986). *Separate knowing* represents an impersonal, objective, critical way of knowing, while *Connected knowing* represents a genuine attempt to understand from the position of the other person (Clinchy, 2002). They are described further as being distinct (Galotti, Drebus, & Riemer, 2001; Ryan & David, 2003), preferred (Knight et al. 2000), gender related (Galotti, 2001), personality related (Galotti, 2001), and spontaneously adopted (Galotti et al. 2006). They are also characterized as learning styles (Galotti, Clinchy, Ainsworth, Lavin, & Mansfield, 1999), approaches to knowledge and learning (Galotti et al., 2006), approaches to evaluating and constructing knowledge (Marrs & Benton, 2009), and processes of comprehending and evaluating assertions that entail social interaction (Schommer-Aikins & Easter, 2009).

2.3.5 *Argument Concerning Process-Oriented Form of Personal Epistemology*

As previously said, what seems to be missing about process-oriented constructs is a concise articulation of what gives these constructs their epistemological character. The obvious response being that they theoretically relate to certain epistemological beliefs. For instance, Pizzolato (2003) defines *Self-authorship* as involving the

recognition of “the contextual nature of knowledge” (p. 798). Eigenberger et al. (2007) assert that epistemic styles are “ultimately derived from one’s theory of knowledge” (p. 3). Originally, *Separate* and *Connected knowing* were evident among individuals that held epistemological beliefs associated with *Procedural knowing* (Belenky et al., 1986). Hence, one possibility of better defining process-oriented constructs would be to distinguish them as modes of knowing that are contingent upon certain epistemological beliefs. From our perspective, this is an impractical delineation, because the researcher is not always privy to such information and must rely extensively on speculation.

Alternatively, we argue they are better defined as the activities of amateur epistemologists, which mimic the work done by professional epistemologists. Siegel (1978) briefly summarizes traditional epistemology as being “concerned with the evaluation of knowledge claims – that is, with the analysis of the criteria of appraisal of various claims about the nature of the world...” (p. 17). From the perspective of an epistemologist, “[t]he objective of the analysis of knowledge is to state the conditions that are individually necessary and jointly sufficient for propositional knowledge, knowledge that such-and-such is the case” (Steup, 2006, “The analysis of knowledge”). Hence, this form of personal epistemological research is not merely concerned with how individuals come to know, but with how an individual evaluates and justifies certain assertions. The first abovementioned type of process-oriented construct (i.e., judgments about assertions) leads us to suggest at least four dimensions are relevant: (a) *assessments of the validity of assertions of others*, (b) *explanations for why assertions compete*, (c) *evaluations of the certainty of one’s own beliefs about an issue*, and (d) *decisions about the criteria that would justify an assertion*. The latter dimension concerns objective (evidence, plausibility, coherence, and reputation of the sayer) and subjective (intuition, emotions, trust) criteria. Such judgments are known by an array of terminologies, such as reflective judgments, epistemic cognition, and epistemic thinking. These terms, however, are defined by researchers in ways that would confuse the form of personal epistemology delineated here. Therefore, we recommend an altogether new term. The above dimensions are judgments of an epistemological nature that are essential components of the process of knowing and learning. Hence, we suggest they be labeled *epistemological judgments* and defined as *the judgments of lay folk that mimic those of professional epistemologists, normally pertaining to the evaluation and justification of certain assertions*.⁴

We are not suggesting that the second and third process-construct types do not contribute to this research. Both suggest that the evaluation of assertions involves social interactions, namely, Baxter Magolda’s (2004) model proposes a personal struggle can ensue in the process of accepting or rejecting assertions of personal significance between intrapersonal and interpersonal forces. For example, “following formulas” implies the acceptance of assertions based on the designs of others,

⁴We rely on our earlier arguments for choosing the adjective epistemological verses epistemic.

whereas “internal foundation” implies internal justifications, and *Self-authorship* is the developmental pathway from one to the other (Baxter Magolda, 2004). *Separate* and *Connected knowing* also suggest different ways of achieving identity and interacting with others in the process of making epistemological judgments, that is, trusting and attempting to understand another’s proposition before judging it (*Connected knowing*) or first being skeptical of its value before integrating it with prior understandings (*Separate knowing*). These two construct types imply a holistic approach, that is, not only investigating what epistemological judgments are made, but why social beings make them. Notwithstanding, they do not specifically or intentionally model epistemological judgments as we have just outlined them.

2.4 Section II: Measurement of Epistemological Beliefs

Our third argument is reserved for the measurement of epistemological beliefs because we find the most substantial measurement challenges lie therein. As stated already, epistemological beliefs and epistemological judgments each can be inferred from the other and it is not always clear the specific purpose of the investigation. Therefore, it is not possible to say certain instruments are *always* used to access epistemological beliefs and certain others *exclusively* measure epistemological judgments. Notwithstanding, the studies reviewed do suggest a number of prominent ways of assessing epistemological beliefs. To gain insight to these approaches, we begin by simply describing studies in groups according to obvious similarities in instrumentation, which we refer to as measurement clusters. The term “clusters” reinforces the actuality that descriptions are generalizations about an assortment of instruments. (Statistics of studies included in each cluster can be found in Table 2.3.) We then narrow the discussion by identifying leading methods of assessing epistemological beliefs, uncover their shortcomings, and proceed to our final argument.

Table 2.3 Cluster statistics

	Studies in primary clusters					
	I	II	III	IV	V	Other
<i>n</i>	90	19	26	8	10	3

Note: Clusters: Cluster I=studies that employ Likert-type instruments to measure unitary positions or belief dimensions. Cluster II=studies that pose direct questions about the nature of knowledge and knowing. Cluster III=studies that analyze judgments about assertions. Cluster IV=studies that analyze salient meaning making. Cluster V=studies that employ Likert-type instruments to measure *Separate* and *Connected knowing*. Other=studies that employ methodologies that cannot be easily situated within in the cluster scheme (Five studies employed multiple instruments belonging to more than one cluster)

2.4.1 Review by Measurement Clusters

2.4.1.1 Cluster I: Likert-Type Measures of Unitary Positions or Belief Dimensions

The majority of the literature is grouped into Cluster I, that is, studies that employ a Likert-type instrument to measure unitary positions or belief dimensions. For the measurement of unitary positions, the Learning Environmental Preferences is commonly employed for which a composite score is derived that corresponds to positions (of the lower half) of the Perry scheme (Moore, 1989). For the measurement of belief dimensions, the bulk of Cluster I studies, nearly all employ Schommer's questionnaire (1990, 1998), a shortened version of it, a revised version of it, or an instrument inspired or guided by it. The original questionnaire consists of 63 short statements representing subsets of five hypothesized dimensions. Initially, a four-dimensional structure was recovered (Schommer, 1990): *Simple knowledge* (knowledge is simple rather than complex), *Certain knowledge* (knowledge is certain rather than tentative), *Innate ability* (the ability to learn is innate rather than acquired), and *Quick learning* (learning is quick or not at all).⁵ The structure was subsequently replicated with other college students (Schommer, Crouse, & Rhodes, 1992) and, after slight modification to the instrument, with high school students as well (Schommer, 1993). However, the method of using subsets of items in the factor analyses by Schommer and colleagues (Schommer, 1990, 1993, 1998; Schommer et al., 1992) has been severely contested (e.g., Clarebout, Elen, Luyten, & Bamps, 2001; Hofer & Pintrich, 1997; Wood & Kardash, 2002). Many of the alternative instruments, such as Chan and Elliott's (2002) questionnaire, Epistemic Belief Inventory (Bendixen, Schraw, & Dunkle, 1998; Schraw, Bendixen, & Dunkle, 2002), Epistemological Beliefs Survey (Kardash, & Wood, 2002; Wood, & Kardash, 2002), or Jehng and colleagues' questionnaires (Jacobsen, Jehng, & Maouri, 1996; Jehng, Johnson, & Anderson, 1993), came about primarily because of evident difficulty using the Schommer questionnaire. These instruments, however, have suffered setbacks as well, such as low reliabilities, poor internal consistencies, retrieval of only a scant number of items per dimension, and so forth (see, for instance, Bendixen et al., 1998; Chan & Elliott, 2000; Debacker & Crowson, 2006; Debacker, Crowson, Beesley, Thoma, & Hestevold, 2008; Hofer, 2000; Kardash & Howell, 2000; Nussbaum & Bendixen, 2003; Wood & Kardash, 2002; Youn, 2000). Not surprisingly, researchers have had difficulty replicating dimensional structures, which is primarily attributed to questions of construct validity, methods of analysis, and lack of cultural sensitivity.

Most Cluster I investigations are domain general. Those studies that examined domain specificity (e.g., history vs. mathematic beliefs and psychology vs. science beliefs)

⁵As stated earlier, the inclusion of the latter two dimensions has been controversial because they pertain to learning rather than directly pertaining to knowledge or knowing (see Bendixen & Rule, 2004 or Hofer & Pintrich, 1997).

employed instruments modeled on or modified from the Schommer questionnaire. For example, the domain-general item “Scientist can ultimately get to the truth” (Schommer’s questionnaire) is altered for the Discipline-Focused Epistemological Beliefs Questionnaire (Hofer, 2000) to “Experts in this field [either psychology or science] can ultimately get to the truth.” Another highly utilized instrument, The Domain-Specific Belief Questionnaire (Buehl, Alexander, Murphy, 2002), is also inspired by the Schommer questionnaire.

2.4.1.2 Cluster II: Direct Questions About the Nature of Knowledge and Knowing

Studies in Cluster II pose rather open and direct questions about the nature of knowledge and knowing, often in the form of semi-structured interviews.

A number of studies based interview questions on Belenky et al.’s (1986) protocol (i.e., Berthelsen, Brownlee, & Boulton-Lewis, 2002; Bond et al., 2000; Bond & Burns, 2006; Brownlee, 2003, 2004; Brownlee et al., 2001; Burns & Bond, 2004; Jimmerson & Bond, 2001; Weinstock & Bond, 2000). The original interview schedule is composed of nine sections, requiring 2–5 h for participants to complete (Belenky et al.). Not surprisingly, researchers have attempted to distill out the more acutely epistemological aspects. These questions have tended to focus on knowledge, truth, experts, self as knower, and learning. Other interview protocols share a similar focus. For instance, Dirkx, Kielbaso, and Smith’s (2004) protocol pertains to participants’ thinking about knowledge and learning and Marra (2005) posed questions about the ideal college course, what it means to learn, definitions of knowledge and truth. In nearly every case, the coding of interview responses is guided by developmental models, such as women’s ways of knowing or the Perry scheme.

Three studies (Alexander, Murphy, & Guan, 1998; Alexander, Murphy, Guan, et al., 1998; Maggioni, Riconscente, & Alexander, 2006) utilize a paper-and-pencil instrument that asks participants to choose among graphic options depicting the relationship between knowledge and beliefs (designed by Alexander & Dochy, 1995). Participants are asked to explain and defend their choice in writing.

2.4.1.3 Cluster III: Measures of Judgments About Assertions

Cluster III is the second largest cluster; it includes studies that analyze participants’ evaluation and justification of (typically, competitive) assertions (i.e., what we refer to as epistemological judgments).

Much of this literature is firmly rooted in the RJM. The Reflective Judgment Interview (King & Kitchener, 1994) is used extensively. Participants make judgments about competing assertions that are distinguishable for being controversial issues “about which ‘reasonable people reasonably disagree’” [i.e., expert disputes] (King & Kitchener, 2004, p. 5). The original interview pertained to four issues: the safety of chemical additives in foods, the accuracy of news reporting, the creation

of human beings, and the building of the Egyptian pyramids. Questions are posed, such as “How is it possible that experts in the field disagree about this subject,” “... is it the case that one opinion is right and one is wrong,” and “On what do you base that point of view,” “Can you ever know for sure your position on this issue is correct” (King & Kitchener, 1994, p. 102).

A perusal of other utilized instruments reveals that the types of issues, probe questions, and response support can vary considerably. Some of the issues being reasoned might be regarded as widely controversial (e.g., “Should drugs be legalized” – Valanides & Angeli, 2005, p. 318), but others are certainly less so. For instance, Mansfield and Clinchy (2002) ask questions such as “Is that teacher nice or mean” or “Do those clouds mean rain” (p. 232). Beaudoin and Schonert-Reichl (2006) asked participants to judge competing claims about whether a driver’s education course should be continued and Maclellan and Soden (2004) rate individuals’ responses to the role of tutors and tutorials in gaining knowledge. Kuhn et al. (2000) consider items such as the correctness of preferences for music or spicy food and discrepancies in textbook explanations. These issues could equally be differentiated as expert, lay, or even childish. Finally, not all assertions involve competing ones. Hogan and Maglienti (2001) asked respondents simply to judge the validity of inferences.

Assessment tools employed are similar to the Reflective Judgment Interview when comparable probe questions are posed and minimal support is given in answering them (e.g., Beaudoin & Schonert-Reichl, 2006; Gottlieb, 2007; Mansfield & Clinchy, 2002; Valanides & Angeli, 2005; Weinstock, 2005; Weinstock & Cronin, 2003). Some studies employed instruments that pose fewer questions and provide support in the form of response options. For instance, the Epistemic Doubt Questionnaire (Hallett et al., 2002) presents participants with four response options representative of differing epistemological levels (e.g., “A careful analysis of what really happened will make the answer clear” – objectivist stance [p. 297]). Likewise, for Kuhn et al.’s (2000) instrument, participants need only choose and circle options regarding two questions: “Can only one of their views be right, or could both have some rightness” and “Could one view be better or more right than the other” (p. 316). Additionally, some utilized instrumentation is rather open or exploratory and does not include probe questions. For instance, Brem et al. (2001) simply asked students to evaluate internet sites of differing levels of credibility.

2.4.1.4 Cluster IV: Measures of Salient Meaning Making

Cluster IV interprets respondents’ meaning making of issues of perceived significance, such as important decisions or significant academic or lifelong learning experiences. The approach is a traditional one; it can be traced back to the work of Perry (1970). The focus of the method rests on understanding knowing from the perspective of the knower. Specifically, participants explain in their own words how they interpret salient experiences or decisions and the impact this has on their thinking. The studies that we deemed representative of this approach asked respondents

to describe: important learning experiences and their impact (Baxter Magolda, 2004; Pizzolato, 2003, 2004), how the loss of a loved one is experienced (Danforth & Glass, 2001), how one's most important decision was made (Pizzolato, 2005), challenging academic experiences (Pizzolato & Ozaki, 2007), and moral dilemmas during teaching and how they were dealt with (Tirri et al., 1999). Interviews were conducted in each study except one (i.e., Pizzolato, 2005).

2.4.1.5 Cluster V: Measures of Separate and Connected Knowing

Cluster V research concerns *Separate* and *Connected knowing*, typically referred to as spontaneously generated approaches to learning and knowledge (e.g., Galotti et al., 2006). The two approaches to knowing, as mentioned and briefly outlined above, were components of the women's ways of knowing model. Neither approach is considered more sophisticated, although there is a hint of favoritism toward the latter. The empirical basis for including the two styles, according to Clinchy (2002), was limited. Nevertheless, both forms have since received considerable attention.

All of the Cluster V studies employ Likert-type instruments, all but one the Attitudes Toward Thinking and Learning Survey designed by Galotti et al. (1999). The instrument asks participants to rate the degree to which they subscribe to each form. For example, "When I encounter people whose opinions seem alien to me, I make it a deliberate effort to 'extend' myself into that person, to try to see how they could have those opinions" (item for *Connected knowing*) or "I try to listen to other people's positions with a critical eye" (item for *Separate knowing*) (p. 754). The instrument, relies on purported behavior; nevertheless, some evidence of a correlation to actual behavior has been provided (Galotti et al., 2001).

2.4.2 Methods of Measuring Epistemological Beliefs

While each cluster briefly outlines a type of instrument utilized by personal epistemological researchers, only the first four clusters are relevant to the assessment of epistemological beliefs. This is because Cluster V studies (i.e., those employing measures of *Separate* and *Connected knowing*) give scant reference to epistemological beliefs, suggesting their inference is not a focus. The other four clusters suggest somewhat different ways of measuring epistemological beliefs (see Fig. 2.1 below), each having notable shortcomings.

2.4.2.1 Inference from Related Beliefs

Cluster I instruments suggest that epistemological beliefs can be inferred from levels of agreement to related beliefs. By related beliefs, we mean that instrument

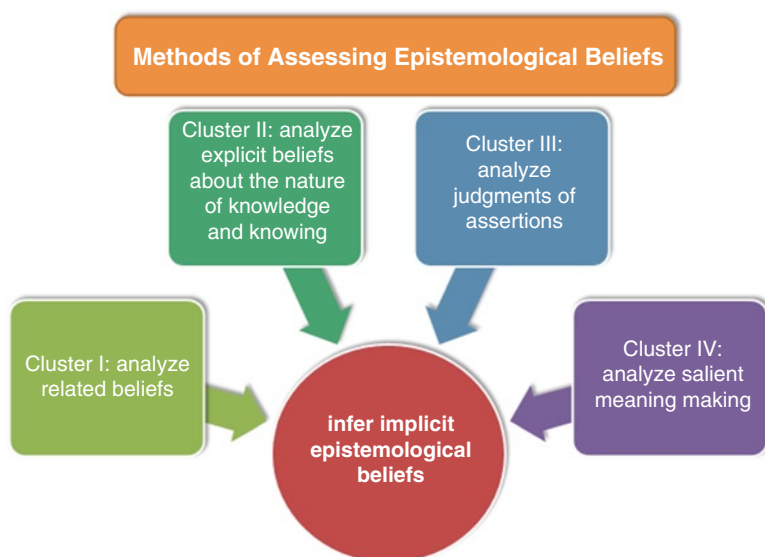


Fig. 2.1 Methods of assessing epistemological beliefs

items characteristically do not ask participants to endorse certain epistemological beliefs directly; instead, participants are asked to endorse theoretically associated beliefs. For instance, Schommer's questionnaire assesses the belief that knowledge is simple with the item "Most words have one clear meaning." Likewise, the Epistemic Belief Inventory measures the belief that knowledge is certain from the item "What is true today will be true tomorrow." Or, the Learning Environment Preferences measures positions of the Perry scheme with items such as "My ideal learning environment would emphasize basic facts and definitions" or "In my ideal learning environment, as a student I would study and memorize the subject matter – the teacher is there to teach it." The Epistemological Beliefs Survey assesses beliefs about the speed of knowledge acquisition with the item "You will just get confused if you try to integrate new ideas in a textbook with knowledge you already have about a topic." As such, the validity of Cluster I instruments hinges on their designers' ability to identify those items that accurately and adequately capture the underlying epistemological beliefs. Under Schommer's (1994) conceptualization that epistemological beliefs influence nearly all aspects of daily life, pinpointing relevant items would be challenging. This is precisely how Schommer-Aikins (2004) portrays the design of the highly influential Schommer questionnaire:

In some sense this questionnaire was a means for researchers to explore minds in search of individuals' epistemological beliefs. How could one predict exactly the right items to present? With this dilemma to face, the questionnaire became a lengthy 63 items, and a wide array of items was administered as if casting a net of inquiry in order to catch a glimpse of individuals' beliefs. (p. 22)

Considering the overall low variance and other reported difficulties when surveys are employed, it is reasonable to wonder, as Maggioni et al. (2006) have, how successful or apt they are.

2.4.2.2 Directly Assessing Epistemological Beliefs

Cluster II suggests epistemological beliefs can be measured by posing open and direct questions to respondents. We presume less attention is given to this approach since it is normally accepted that laypeople do not have formal, well-organized conceptions of knowledge as a professional philosopher might (e.g., Hofer & Pintrich, 1997), nor would respondents [particularly younger ones] be readily able to articulate them in a meaningful way (e.g., Elen & Lowyck, 1999; Rosenberg et al., 2006). Nevertheless, the predominantly young adult participants in the studies reviewed were apparently able to respond to the direct questions posed. What do these responses reveal? Are they articulated summaries of the respondents' beliefs about knowledge and knowing or do they represent fragmented ideas, reproductions of philosophical arguments, reactions to the anticipated motives of the researcher, etc.? The word "knowledge" has more than one culturally accepted and promoted definition. Hence, it could be argued that participants are not sharing their own ideas abstracted from reflecting on their own mental creations, but instead are retelling what they have been told. It can also be argued that the method is still inferential. This in the sense that "cognitive researchers have long appreciated that there is more to one's knowledge than can be put into words or can be called to mind" (Buehl & Alexander, 2006, p. 31). While the researcher can directly assess explicit beliefs, she must still infer implicit ones. Researchers have found the accounts both meaningful and perplexing. For instance, the explicit epistemological beliefs measured were deemed influential to participants' educational expectations (Burns & Bond, 2004), perceptions of instructional practices (Hofer, 2004), class involvement (Burns & Bond, 2004), conceptions of child development (Bond & Burns, 2006), and child-rearing behavior (Jimmerson & Bond, 2001). Further, when thick descriptions are provided they can be of considerable significance to educators. For instance, Hofer (2004) vividly depicts how students' epistemological beliefs might affect how instructional practices are perceived and be influenced by those practices. Conversely, researchers note significant contradictions in respondents' reports. Brownlee et al. (2001) comment, "[t]here were some students who seemed to describe beliefs as if they emerged from two different people" (p. 261). Chan and Elliott (2002) make a similar remark. The inconsistencies reaffirm that lay accounts are not as well organized as professional epistemologists. It must be assumed that eliciting explicit epistemological beliefs is a delicate matter and that such accounts do not reveal everything that a person believes about the nature of knowledge and knowing.

2.4.2.3 Inference from Epistemological Judgments and Salient Meaning Making

Cluster III and IV suggest epistemological beliefs can be inferred from how a participant reasons specific issues. There are two concerns we should like to raise about this: (a) *what kind of issues and their reasoning are the most revealing of epistemological beliefs* and (b) *what level of generality can be assumed about them*. The consistent theme in Cluster III studies, is that the issues must trigger a sense of doubt, thus, requiring epistemological judgments. The epistemological judgments are theoretically regulated by higher-order thinking, which is, in turn, dependent upon certain epistemological beliefs. This was originally proposed by King and Kitchener (see King & Kitchener, 1994, 2004; Kitchener, 1983). The consistent message in Cluster IV studies is that the issues must be of personal relevance. The only articulation of why this might be is from the earlier work of Perry (1970). When students are asked, “Would you like to say what stands out for you during this year,” “[s]tands out’ does imply a structure, that of salience, or figure against ground” (Perry, 1970, p. 19). The flexibility of his open interviews was perceived crucial to revealing precisely how the respondent (i.e., figure) accomplishes his bearing (i.e., grounding) in the world. Under this proposal, epistemological beliefs structure meaning making about matters of uncertainty and salience and, thus, ground the individual when he is disturbed by them. If a student, for example, is sorely underachieving in a certain academic course, she may seek a tutor who *knows the answers* and can prescribe them efficiently. From this, Perry might infer the student believes that there is certain, correct knowledge privy to only those in the know. There are, of course, strands of similarities between Perry’s theory and that proposed by King and Kitchener. Both suggest that the reasoning of perplexing issues will be framed by certain epistemological beliefs. Nevertheless, the variety of issues and reasoning about them operationalized in Clusters III and IV, raises the question of whether some reasoning of certain problems evoke epistemological beliefs, while certain reasoning of other issues do not, or not as much.

Another issue with these methods is deciding the generality of the epistemological beliefs. Due to the open nature of Cluster IV instrumentation, the salient meaning making observed must consist of a wide variety; the researcher is obligated to determine patterns among them and then infer the epistemological beliefs based on this (see Baxter Magolda, 2004). These studies always infer a domain-general range. Cluster III instruments can include issues that traverse a host of judgment domains and participants’ reasoning performance can also vary, the researcher determines the average or typical performance. For instance, the Reflective Judgment Interview is composed of issues from four domains (i.e., science, current events, religion, and history); participants are positioned according to the level that represents “the most commonly used set of assumptions” (King, Kitchener, & Wood, 1994, p. 140). Studies that examine domain specificity examine average performance *within* particular domains, and then infer the domain-specific epistemological beliefs. Hence, in one study, an instrument can be used for domain-general purposes

(e.g., Kuhn & Park, 2005), while in another study, the same instrument can be used for domain-specific purposes (e.g., Kuhn et al., 2000). On a context level, Rosenberg et al. (2006) observed contextual variations in the reasoning of causal explanations and then inferred fine-grained, context-sensitive epistemological beliefs. In each case, the researcher theoretically decides the generality; the inferences differ only according to how the observed variability is understood.

2.4.3 *Argument Concerning the Measurement of Epistemological Beliefs*

One of the fundamental problems with epistemological beliefs research is that it is difficult to conclusively know whether various measures are equally effective at accessing the same construct or even if they are accessing the same construct. Because epistemological beliefs are normally regarded to be implicit, inferential methods are requisite and must depend on accurately interpreting the visible manifestations of the underlying cognitive structures. The cluster review demonstrates that there are at least four unique ways that researchers access epistemological beliefs and less substantial deviations once within-cluster variations are considered. Hence, it should come as little surprise that there are confounding results between researches (see, for example, Chandler, Hallett, and Sokol, 2002). To move beyond this state of affairs, there is an urgent need to consider what constitutes a suitable inference. We believe this directs future research in two ways:

Foremost, inferences about participants' epistemological beliefs should be garnered from more than one vantage. Of all the studies reviewed, only 17 employ more than one instrument. Of these, only three draw on different instrumentation types to triangulate interpretations. Would it not be possible to bring several distinct approaches together to augment inferences? This implies generating theory about distinctive ways epistemological beliefs are manifested and then synchronizing them in instrumentation to support inferences. Pajares (1992) summarized the measurement of beliefs as something "that can only be inferred from *what people say, intend, and do* [*italics added*]" (p. 316). While the vantages he suggests may not be identical to the ways epistemological belief researchers believe epistemological beliefs are manifested, his basic argument is noteworthy: inferences should be bound by more than one type of expression. Doing so may alleviate the question of whether empirical differences are measurement related.

Lastly, not only should combining approaches be considered, but novel methods should also be sought. It is safe to say no perfect measure does or will exist. Which means future research efforts benefits from actively pursuing other "creative and effective ways to bring individuals' knowledge to the surface and to allow thoughts or understandings to be shared in natural and meaningful ways" (Buehl & Alexander, 2006, p. 31). Some efforts have been put forth. For instance, the Connotative Aspects of Epistemological Beliefs (Stahl & Bromme, 2007; Stahl, Pieschl, & Bromme, 2006) asks respondents to rate 24 pairs of opposing adjectives (e.g., simple vs. complex,

temporary vs. everlasting, and structure vs. unstructured) when thinking about a particular domain of knowledge.⁶ Although around for some time, the previously mentioned instrument designed by Alexander and Dochy (1995) that asks participants to choose among graphic depictions of the relationship between beliefs and knowledge remains a unique way of having participants think explicitly about the concepts and then explain their relations. Briell et al. (2010) ask their participants simply to draw knowledge and then explain the drawing. These and other explorations are undoubtedly consequential steps toward the betterment of our inferences of this complex construct.

2.5 Conclusions

We have attempted to make the breadth of nomenclature, conceptualizations, and instrumentation of personal epistemology manageable that it might benefit the reader interested in understanding relations to cognitive flexibility. However, the reader must also grapple with the fact that cognitive flexibility is subject to multiple meanings. To conclude this chapter, we will briefly explain how the two constructs may relate by using a point of reference that is almost certainly familiar to the reader.

Cognitive Flexibility Theory (CFT) is a general theory of learning, instruction, and knowledge representation endorsed by Spiro and colleagues (e.g., Jacobsen & Spiro, 1995; Spiro, Feltovich, & Coulson, 1996; Spiro & Jehng, 1990). Spiro and Jehng (1990) define cognitive flexibility as “the ability to spontaneously restructure one’s knowledge, in many ways, in adaptive response to radically changing situational demands (both within and across knowledge application situations)” (p. 165). In practical terms, it concerns the apprehension of abstract knowledge (i.e., patterns, themes, principles) from a collection of thematically related scenarios/perspectives and the subsequent application of that learning to other related contexts. The envisioned construct is reserved to “ill-structured domains”⁷ (Spiro & Jehng, 1990), instances for which a collision of multiple issues are involved (e.g., the personal, legal, financial, social, and ethical issues implicated in the storing of personal information in massive computer databases). Additionally, it can be taught, to the extent that the cognitively flexible individual does it routinely.

⁶Because the authors contend this is an indirect measure of epistemological beliefs via evaluative-associative assumptions, it did not fit into our cluster scheme. If viewed as a direct measure of epistemological belief dimensions, we would have regarded it as a novel Cluster II instrument.

⁷It should be noted that “ill-structured” is used differently by Spiro and colleagues than it is with the RJM. Ill-structured problems according to the RJM are problems “about which ‘reasonable people reasonably disagree’” (King & Kitchener, 2004, p. 5). Specifically, they are problems in which the necessary elements for resolving them are either unknowable or unknown, there is no single correct procedure, and “there is not a single unequivocal solution which can be effectively determined at the present moment” (Kitchener, 1983, p. 224).

Relations between cognitive flexibility and personal epistemology depend on whether epistemological beliefs or epistemological judgments are considered:

Spiro and colleagues have considered the relationship to epistemological beliefs, which is evident in a couple of their instruments (i.e., Epistemic Beliefs and Preferences Instrument (Jacobson & Spiro, 1995), Cognitive Flexibility Inventory (see Spiro et al., 1996)). While both instruments are said to measure beliefs about the nature of knowledge and learning, it is unsaid precisely what those beliefs are. It is said the beliefs demonstrate an embracing or shunning of complexity. If this is a good reference, then there needs to be theoretical efforts put forth about what specific epistemological beliefs would reveal this and why – so they can then be tested.

Relations between epistemological judgments and cognitive flexibility can be viewed from two vantages. The first is simply that those who are apt to make certain epistemological judgments may be more or less apt to think with cognitive flexibility. The challenge here is to develop theory that explains in detail why this may occur and then test it. The second way of looking at a relationship is that the two constructs may overlap, since cognitive flexibility is a distinct form of learning and epistemological judgments are an important aspect of learning. However, the magnitude of their overlap would depend on the perception of the researcher. The only epistemological judgment that is obvious according to CFT is the need for the student to decide what constitutes a justified assertion when making one. After a student has read multiple perspectives concerning an ill-structured domain, she then applies the abstract knowledge acquired in making assertions regarding a related scenario. To do so, she invariably must make judgments about the coherency and sufficiency of her own opinions. CFT does not mention that she should also evaluate the trustworthiness of opinions rendered in the learning scenarios. This is probably because CFT presumes the learning material is reputable, and that the student should be confronted with and accepting of plurality. However, other researchers may contend that real-world learning situations consist of diverse and competitive opinions that are not always or equally trustworthy. From this standpoint, the researcher may consider a student's evaluation of assertions presented in the material to be consequential to the depth and integrity of her acquired understandings. If so, the researcher may choose to redefine cognitive flexibility with the insistence that such epistemological judgments are an integral part of it.

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