Defining personal epistemology:

A response to Hofer & Pintrich and Sandoval

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Abstract

Some researchers, including Hofer & Pintrich (1997) and Sandoval (2005), argue for defining *personal epistemology* as views about the nature of knowledge and knowing but not views about the nature of learning. Others continue using a more expansive definition of *personal epistemology* that includes views about learning. I argue that the scope of *personal epistemology* should not be decided entirely *a priori*. If people's views about the nature of knowing and knowledge turn out to be separable from (despite being intertwined with) their views about the nature of learning, then it makes sense to define two separate areas of study corresponding to those two separable sets of psychological constructs. From some theoretical perspectives, however, empirical results may support the interpretation that views about knowledge are inseparably entangled with views about learning. In that case, excluding views about learning from *personal epistemology* obscures rather than elucidates the content and cognitive structure of students' views. To be clear, I do not think the community should decide, now, to etch "views about the nature of learning" into the definition of *personal epistemology*. I argue instead that it is more productive *not* to converge on a definition until further empirical and theoretical progress points us toward the best way to "carve nature at its joints" (Plato, 1995).

Introduction

Researchers concerned with students' views about the nature of knowledge and the effects of those views on reasoning and learning have not reached consensus about how to define *personal epistemology*. Some, such as Hofer & Pintrich (1997) and Sandoval (2005), argue for defining *personal epistemology* as views about the nature of knowledge and knowing but not views about the nature of learning. Others, such as Schommer-Aikins (Schommer, 1990; Schommer-Aikins, 2004), Hammer (1994), and myself (Elby, 2001) include views about the nature of learning in their epistemology research. In this commentary, I argue that the scope of *personal epistemology* should not be decided entirely *a priori*. The decision should hinge on empirical and theoretical developments. If people's views about the nature of knowledge and knowing turn out to be separable from (despite being intertwined with) their views about the nature of learning, then it makes sense to define two areas of study corresponding to those two separable sets of psychological constructs. From some theoretical perspectives, however, empirical results may support the interpretation that views about knowledge are inseparably entangled with views about learning. In that case, excluding views about learning from *personal epistemology* obscures rather than elucidates the content and cognitive structure of students' views; it constitutes a failure to "carve nature at its joints" (Plato, 1995).

Defining personal epistemology narrowly: arguments and responses

I now present and respond to three arguments from Sandoval (2005) and Hofer & Pintrich (1997) about why the definition of personal epistemology should exclude views about learning:

(1) *Conflation:* By including views about learning in studies of personal epistemologies, we risk conflating epistemological views with students' other motives and beliefs;

(2) *Definitional alignment:* Including views about learning in the definition of *personal epistemology* fails to align with how most psychological and philosophical treatments have defined the domain of epistemology.

(3) *Clarity:* Delimiting *personal epistemology* to include only views about knowledge and knowing provides clarity to research and theory-building.

1. The conflation argument

Sandoval argues for excluding beliefs about the nature of learning from *personal epistemology*:

> Psychological research on personal epistemology has suffered, however, from a conflation of beliefs about knowledge with beliefs about learning (Hofer & Pintrich, 1997). They are clearly related, as one's beliefs about knowledge are likely to influence how one approaches learning, but they are definitely not the same. A flaw in psychological studies of personal epistemology has been to infer that expressed beliefs

> about how to best learn reflect epistemological beliefs, as opposed to other beliefs or motives (e.g., how to most easily succeed in school) (Sandoval, 2005).

In part, Sandoval is flagging a distinction several researchers have highlighted between students' *epistemological* views about the nature of knowledge and knowing (and perhaps learning) and students' *expectations* about what is rewarded in school or in a particular class (Elby, 1999; Elby & Hammer, 2001; Hammer, 1989; Redish, Saul, & Steinberg, 1998). For instance, Hammer (1989) studied "Ellen," a university student who initially approached her pre-med physics course believing that the formulas and concepts could make sense to her. Ellen's expectations about the course soon changed, however: She came to believe that the fast-paced class emphasized rote problem-solving and that trying to understand the concepts more deeply would actually lower her grade by sucking time away from memorization and practice. As a result, Ellen unhappily abandoned her sense-making approach after a few weeks. But she never abandoned her beliefs about what it means to know physics. Her expectations changed, but her epistemology did not.

My study of community college physics students (Elby, 1999) further supports Sandoval's point that psychological studies must tease apart epistemology from expectations. In a survey, I asked multiple-choice and open-ended questions about students' study habits and approaches to learning in their physics course. After several pages of this, the survey next asked students to imagine

> Diana, a student just like you, with the same abilities, background knowledge, and time constraints. Diana's grade in the course doesn't matter; in fact, she's taking the

> course pass-fail. So, she does not need to worry about grades. *Her goal is simply to understand physics more deeply*. . .

The survey then asked how Diana should study, using the same questions about study habits and approaches to learning that students had answered earlier in the survey. By design, and as written responses confirmed, students' answers *about themselves* mostly reflected their expectations of what the course rewarded, while their answers *for Diana* mostly reflected their epistemological views about what it means to know physics. As probed in this way, most students' expectations and epistemologies differed markedly.

So, I agree with Sandoval that failure to tease apart epistemologies from expectations constitutes an important flaw in psychological studies. For two reasons, however, the existence of this flaw is not an argument for eliminating views about learning from the field of *personal epistemology*. First, as the Ellen and Diana studies demonstrate, even when researchers include views about learning in *personal epistemology*, they can tease apart epistemology from expectations, at least partly. Second, the need to discriminate epistemologies from expectations persists even if *personal epistemology* is defined narrowly. For instance, Ellen expected that the knowledge needed to get a good grade consisted of piecemeal equations and algorithms. By contrast, her epistemological views included the idea that "real" physics knowledge is conceptual and coherent. Many respondents in the Diana study expressed similar views. So, even if *personal epistemology* is restricted to views about knowledge and knowing, researchers still need to work hard to separate students' epistemologies from their other beliefs and motives, particularly their expectations about school or about specific courses. In brief, excluding views about learning from *personal*

epistemology is neither necessary nor sufficient for disentangling students' epistemologies from their other beliefs and motives. Therefore, the failure of some psychological studies to tease apart epistemologies from expectations does not constitute or support an argument for defining *personal epistemology* narrowly. In other words, the conflation argument, though it points to a stumbling block in studies of students' epistemologies, is not a reason to exclude views about learning from the definition of *personal epistemology*.

This does not imply that *personal epistemology* should include views about the nature of learning. I am arguing that we should *not* converge on a definition until further empirical and theoretical progress points us toward the best way to "carve nature at its joints" (Plato, 1995).

2. The definitional alignment argument

Hofer & Pintrich write,

> It is not clear that beliefs about learning, intelligence, and teaching should be considered as central components of epistemological beliefs. On the one hand, they do not explicitly deal with the nature of knowledge and knowing *in terms of how knowledge is defined and justified as most philosophical and psychological treatments have defined this domain* (Hofer & Pintrich, 1997). (emphasis added)

By this argument, the definition of *personal epistemology* should align to the extent possible with established definitions of the domain of "epistemology" as used by experts. Hofer & Pintrich acknowledge a counterargument:

> On the other hand, beliefs about learning and teaching are related to how knowledge is acquired, and in terms of the psychological reality of the network of individuals' beliefs, beliefs about learning, teaching, and knowledge are probably intertwined (Hofer & Pintrich, 1997).

They ultimately opt for the narrow definition of *personal epistemology*, however, because of the definitional alignment argument and the clarity argument discussed below. I now build on their counterargument to dispute their conclusion. Specifically, I show that naïve psychological constructs do not necessarily align with disciplinary constructs defined by experts.

The argument runs as follows. First, using an example from naïve physics, I show that according to a plausible "knowledge in pieces" cognitive framework, students' conceptions about the physical world cut across the disciplinary categories that physicists assign to physics concepts. Therefore, according to that cognitive framework, disciplinary categories are not the most productive footholds around which to organize research on naïve physics conceptions. According to other plausible cognitive frameworks, by contrast, naïve physics ideas, even when incorrect, *do* fall into experts' disciplinary categories. So, preemptively defining naïve physics constructs to align with physicists' disciplinary constructs favors some cognitive frameworks at the expense of others, something we should avoid until further empirical and theoretical work gives us warrant to pick a winner. The same argument, I then show, applies to personal epistemologies. According to a plausible "knowledge in pieces" cognitive framework, some elements of students' personal epistemologies cut across the

categories *views about knowledge and knowing* and *views about learning*. Other cognitive frameworks for describing personal epistemologies respect those boundaries. My point is that preemptively defining *personal epistemology* to exclude views about learning would favor some cognitive frameworks at the expense of others, before we have empirical and theoretical grounds for doing so. Indeed, *if* students' views about knowledge and knowing are inseparable from their views about learning (according to well-supported, theoretically grounded accounts), then the narrow definition of *personal epistemology* could hinder attempts to explore the substance and cognitive structure of students' epistemologies.

Category alignment in naïve physics. Just as expert philosophers and psychologists distinguish between the nature of knowledge and the nature of learning, expert physicists distinguish between kinematics and dynamics. Kinematics, the study of motion but not the causes of motion, includes the relationships among position, velocity, and acceleration. Dynamics, the study of the causes of motion, includes the various kinds of forces (pushes and pulls) and how the overall force felt by an object affects its motion. To physicists, kinematics and dynamics are cleanly separable; if the laws of dynamics suddenly changed, the kinematics chapters of physics textbooks would not need to change.

Suppose a physics education researcher wants to follow Hofer & Pintrich's (1997) heuristic of aligning psychological areas of study with the corresponding disciplinary categories defined by experts. Given the clean distinction between kinematics and dynamics, the researcher would need to distinguish between *personal kinematics*, students' preconceptions about kinematics, and *personal dynamics*, students' preconceptions about dynamics. It turns out, however, that elements of students' naïve conceptions may cut across these two categories. An example documented by diSessa (1993) arises in the following

scenario. Imagine a ball thrown straight up, and consider the instant when it momentarily comes to rest at its peak. At that moment, is the ball's acceleration positive (upward), negative (downward), or zero? What about its velocity? What about the overall force on the ball?

Most people answer "zero" to all three questions, and their reasoning is consistent with the following story: The ball's motionlessness at its peak triggers an intuitive sense of "balancing" between upward stuff and downward stuff. This sense of balancing leads to the conclusion that the velocity or acceleration or force is zero rather than upward or downward. (The force and acceleration are not actually zero, but that is irrelevant to the argument I'm making.[1])

DiSessa's results, like any empirical results, cannot prove that *personal kinematics* and *personal dynamics* are unsuitable for categorizing naïve physics conceptions. The researcher's theoretical perspective also bears on this issue. For example, a researcher who attributes robust, stable (mis)conceptions to students could explain diSessa's data by attributing two separate misconceptions: a kinematics misconception about the relation between acceleration and velocity (perhaps an instantiation of a more general conflation of *amount* with *rate*), and a dynamics misconception along the lines of "no motion implies no force" or "force is proportional to speed." And indeed, the physics misconceptions literature posits these misconceptions (Thornton, 1995; Thornton & Sokoloff, 1998). By contrast, within diSessa's knowledge-in-pieces theoretical framework of p-prims and other fine-grained cognitive

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[1] A physicist would say the ball at its peak feels a net downward force (due to gravity) and therefore has a downward acceleration. Though motionless (zero velocity), the ball at its peak is out of balance in the sense that it feels an unbalanced force and therefore doesn't "float" at the peak indefinitely; its velocity is in the process of *changing* from upward to downward. The velocity therefore remains zero for an infinitesimally short time.

resources (diSessa, 1993; Hammer, 1996, 2000), it's more parsimonious to attribute a single cognitive element, *balancing*, that gets triggered when a student considers the ball at its peak and that drives students' answers to both kinematics and dynamics questions. By this account, *balancing* doesn't cleanly belong to students' personal kinematics or to their personal dynamics. It cuts across those two categories. If the same goes for many of the other cognitive resources that contribute to students' naive conceptions about physics, then it makes no sense to cordon off *personal kinematics* from *personal dynamics*. Novices' preconceptions about kinematics and dynamics are inextricably entangled, according to this account, and learning physics involves disentangling kinematics from dynamics.

The kinematics-dynamics example illustrates two points. First, students' views/preconceptions might not respect the boundaries between experts' disciplinary categories. Second, adherents of different theoretical perspectives will sometimes disagree about whether a body of data counts as evidence for or against the existence of two separable sets of psychological constructs. As just discussed, a misconceptions theorist has good reason to interpret diSessa's (1993) data in a way that maintains the distinction between *personal kinematics* and *personal dynamics*, while a knowledge-in-pieces theorist has good reason to posit a cognitive resource that doesn't respect that boundary.

Category alignment in personal epistemologies. These two points apply equally well to the boundary that Hofer & Pintrich (1997) and Sandoval (2005) want to draw between *personal epistemology* and views about the nature of learning, an area I'll call *personal pedagogy*. Within some theoretical frameworks that ascribe epistemological *beliefs* to students (Hofer, 2002; Hofer & Pintrich, 1997), this distinction may make sense. By contrast, within the "epistemological resources" framework that David Hammer and I have discussed

in this journal and elsewhere (Hammer & Elby, 2002, 2003; Louca, Elby, Hammer, & Kagey, 2004), the distinction might not be parsimonious.

To explain why not, I must briefly review some characteristics of epistemological resources. They are fine-grained knowledge elements contributing to people's epistemological views, and their activation depends on context. One such resource we posit is *knowledge as propagated stuff*, the intuitive idea that knowledge can be passed from a source to a recipient (Hammer & Elby, 2002). To see how this resource differs from a transmissionist belief, consider a kindergartener who has been asked, How do you know what's for dinner? The kindergartener might respond, "Because daddy told me," showing that she possesses the cognitive machinery to view knowledge acquisition as a matter of receiving something from a source, even if she cannot articulate this view or apply it consistently. We call that cognitive machinery a "resource," in this case *knowledge as propagated stuff*. Similarly, the kindergartener possesses *knowledge as constructed*, a resource that enables her to view knowledge as something that can be figured out. For instance, when her birthday arrives and her mother walks in holding something behind her back, the kindergartener might squeal, "a present!" When asked how she knows, she might say, "It's my birthday and I saw you hiding something — I figured it out." So, the child has the cognitive machinery to view knowledge as something that can be figured out. We use a kindergartener in these examples to emphasize that epistemological resources are not beliefs; a kindergartener's "transmissionist" and "constructivist" views almost certainly lack the robustness or stability of beliefs. They may be largely tacit, crude, disconnected bits of cognitive machinery. However, these and other epistemological resources can form coherent, stable networks that

constitute the epistemological beliefs observed in older children and adults. More on this below.

Now that I have (slightly!) clarified the nature of *knowledge as propagated stuff*, we can ask: Is this a pedagogical resource because it contributes to a transmissionist view of learning? An epistemological resource because it contributes to a view of knowledge as a kind of shareable stuff? In our framework, it makes more sense to say *knowledge as propagated stuff* participates in views about knowledge *and* in views about learning. It ignores the boundary between *personal epistemology* and *personal pedagogy* in the same way that the *balancing* p-prim ignores the boundary between *personal kinematics* and *personal dynamics*. If lots of epistemological resources cut across the epistemology/pedagogy boundary in this way, and if data support the existence of those particular resources and the generativity of the resources-based theoretical perspective, then cordoning off *personal epistemology* from *personal pedagogy* obscures rather than illuminates the architecture and content of the cognitive structures underlying students' personal epistemologies.

Of course, empirical and theoretical developments may end up supporting the separability of those two sets of constructs. My point is simply that the decision about whether to draw a boundary between *personal epistemology* and *personal pedagogy* should be based on empirical and theoretical developments, not on *a priori* arguments based in part on the categories used by experts.

In response, a reviewer argues that *knowledge as propagated stuff* is really an epistemological resource in the narrow sense, a view of knowledge as a kind of shareable stuff. By this argument, *knowledge as propagated stuff* contributes to views about learning but is itself a claim about knowledge, and therefore my example here fails to challenge the

utility of defining *personal epistemology* narrowly. But I can equally well argue that *knowledge as propagated stuff* is a pedagogical resource that has implications for views about knowledge. After all, the primary "claim" of *knowledge as propagated stuff* is about propagation, which is ipso facto about learning. Specifically, *knowledge as propagated stuff* is the idea that knowledge acquisition — learning — consists of receiving something from a source. The associated claim about knowledge, that it is a kind of shareable stuff, follows from this pedagogical claim and has essentially no content beyond the idea that knowledge acquisition consists of receiving something from a source. So, the argument for shoehorning *knowledge as propagated stuff* into *personal pedagogy* is at least as strong as the argument for shoehorning it into *personal epistemology* narrowly defined. Instead of shoehorning, we should allow ourselves to view *knowledge as propagated stuff* as cutting across the epistemology/pedagogy boundary.

Mechanism for inseparability of epistemological and pedagogical views. Even if all resources could all be classified as either epistemological, pedagogical, or neither, our cognitive framework includes mechanisms by which epistemological and pedagogical resources become inseparably entangled. In the resources framework, the observable unit of a student's epistemology generally corresponds not to a single resource but to a locally coherent activation of a network of resources, which we call an epistemological frame (Elby & Hammer, forthcoming; Hammer, Elby, Scherr, & Redish, 2005; Redish, 2004). By "locally coherent," we mean the resources in the network are reinforced (cued) by each other, by features of the context, and/or by the student's deliberate attention to her epistemological stance. For example, consider a student who frames learning physics as memorizing formulas and algorithms provided by authority. The network of resources constituting this frame might

include *knowledge as propagated stuff*; *facts*, an epistemological resource for understanding knowledge as consisting of certain kinds of discrete bits; *accumulation*, a pedagogical resource for understanding learning as accumulating pieces of knowledge; and other resources (Elby & Hammer, forthcoming; Hammer et al., 2005). So, this memorization frame incorporates both epistemological and pedagogical resources.

Are the resources in this epistemological frame entangled inextricably? If the stability of the frame arises from contextual factors or from the student's deliberate monitoring of her epistemological stance, then the links between the epistemological and pedagogical resources are temporary, in which case researchers may have a reason to tease apart the epistemological and pedagogical components.[2] According to our theoretical perspective, however, when a frame activates repeatedly over a long period, the links between the underlying resources can become strong enough that the frame becomes structurally stable. At this point, the epistemological frame turns on all at once as a single, compiled unit of cognitive structure. Needless to say, we need further theoretical and empirical work to flesh out the mechanisms of "compilation." My point here is that, in the resources framework, mechanisms exist by which epistemological and pedagogical resources become inseparably linked within a frame. If a strict boundary is defined between *personal epistemology* and *personal pedagogy*, then such mechanisms and the resulting structurally stable frames are ruled out as legitimate targets of personal epistemology research.

In summary, using the epistemological resources perspective for illustration, I argued that an account of personal epistemology could include (i) cognitive elements that cut across

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[2] Even in such cases, we often find it more productive to consider the whole frame as our unit of analysis.

the boundary between *personal epistemology* and *personal pedagogy* and (ii) mechanisms producing inseparable entanglement between views about knowledge and views about learning. Preemptively defining *personal epistemology* to exclude views about learning would disfavor such accounts, something the community should not do so early in the development of this field.

3. The clarity argument

So far, I have addressed two arguments for defining personal epistemology narrowly. Hofer & Pintrich offer a third:

> We propose that the content of the construct of epistemological beliefs be limited to individuals' beliefs about the nature of knowledge and the processes of knowing. We recognize that beliefs about learning, intelligence, and teaching are related to epistemological beliefs… However, we think that *this delimitation of the construct will provide clarity to the research and theorizing in the field and lead to more progress in our understanding of the structure and function of epistemological beliefs than more global and inclusive definitions* (Hofer & Pintrich, 1997). (emphasis added)

This call for clarity has several facets. One sense of clarity emphasized by Sandoval (2005) is the need for clear distinctions between views about knowledge and knowing and other beliefs and motivations a person might possess. This facet of the clarity argument is really the conflation argument addressed above. To review briefly, I agreed with Sandoval about the importance of teasing apart epistemological views from other views such as expectations

(beliefs about what's rewarded in school), to the extent possible; but I argued that excluding views about learning from *personal epistemology* is neither necessary nor sufficient to avoid this conflation.

Another sense of clarity is definitional clarity. Due in part to its long history of use by philosophers and psychologists, *epistemology* has acquired an agreed-upon meaning; it concerns knowledge and knowing but not learning. This agreement allows researchers to avoid talking past each other, leading to more productive debates and collaborations. To avoid miscommunication, though, researchers just need to be clear about our individual definitions and how they get operationalized in our research methods. A shared definition might result in slightly better communication, but at a large cost, as argued above; a consensus definition that excludes views about learning from *personal epistemology* would preemptively disfavor theoretical and empirical work about cognitive structures that cut across the epistemological/pedagogy boundary.

A third sense of clarity, closely related to definitional clarity, is phenomenological clarity, the cordoning off of a narrowly- and clearly-defined phenomenon to study, in this case beliefs about knowledge and knowing. This kind of clarity helps researchers make sure we are all studying the same thing, allowing for quicker progress in separating replicable from spurious results and in building on each others' work, thereby generating a well-grounded knowledge base about the phenomenon.

I acknowledge the benefits of phenomenological clarity. Especially in the short run, it can help bring coherence to a scattered field. In the long run, though, organizing research around categories chosen to provide phenomenological clarity is not always the best way to explicate the underlying mechanisms. An example of this comes from David Hammer

(personal communication). Two hundred years ago, people studying material changes might have considered *flames and ashes* to be a separate phenomenon from *rust*. To the extent that researchers tried to keep those topics cordoned off in the interest of phenomenological clarity, they might have rejected empirical and theoretical work devoted to explaining both sets of phenomena in terms of a unifying mechanism (such as oxidation involving atmospheric oxygen). My point here, that phenomenologically clear categories do not always align with the underlying mechanisms, applies to mental processes as well. For example, phenomenological clarity favors categorizing fear of sudden noises as a separate construct from emotional detachment. But psychologists treating or studying combat veterans who suffer from one or both of these problems often find it productive to organize their work around a single psychological construct, post-traumatic stress disorder.

In brief, despite the advantages of convergence upon a clear, narrow sense of *personal epistemology*, more progress toward understanding the underlying cognitive structures and mechanisms might result from encouraging multiple definitions to co-exist for a while as researchers explore which definitions and perspectives are most fruitful. This is especially true if researchers minimize the downside of failing to converge on a single definition, by clearly defining their constructs, by discussing the interplay between their operational definitions of *personal epistemology* and other aspects of their research methods, and by finding aspects of other researchers' work that they can debate and build upon despite the definitional differences.

Conclusion

To be clear, I have not urged the personal epistemology research community to adopt a definition of *personal epistemology* that includes views about the nature of learning. I have

argued that it is more productive for the community *not* to converge on a definition until further empirical and theoretical progress points us toward the best way to carve cognitive structures at their joints.

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