



Developmental changes in college engineering students' personal epistemology profiles



Michael M. Barger^{a,*}, Stephanie V. Wormington^b, Lisa G. Huettel^c, Lisa Linnenbrink-Garcia^b

^a Department of Psychology & Neuroscience, Duke University, United States

^b Department of Counseling, Educational Psychology and Special Education, Michigan State University, United States

^c Department of Electrical and Computer Engineering, Duke University, United States

ARTICLE INFO

Article history:

Received 11 June 2015

Received in revised form 18 January 2016

Accepted 2 April 2016

Keywords:

Personal epistemology

Development

Undergraduate engineering education

Person-centered

ABSTRACT

The current study empirically tested Greene, Azevedo, and Turney-Purta's (2008) combined theory of personal epistemology development among a sample of college engineering students ($N = 917$). Participants were invited to complete surveys assessing personal epistemology at the beginning and end of a semester. Using cluster analysis, students were categorized into six clusters. Four of these clusters mapped onto the epistemic positions predicted by the combined theory (*realist, dogmatist, skeptic, rationalist*), with two novel groups identified (*uncommitted, low-all-beliefs*). Shifts between clusters over the semester were examined. There was evidence for some of the theoretically predicted shifts in membership (i.e., skeptics to rationalists), but not others (i.e., realist to dogmatist or skeptic; dogmatists to rationalist). Finally, dogmatists earned lower course grades than students in other clusters. Implications for educational practice and proposed modifications to the combined theory of personal epistemology development are discussed.

© 2016 Elsevier Inc. All rights reserved.

Whether solving math problems, determining the reliability of internet sources, or considering two sides of a debate, students constantly evaluate claims about knowledge. The way that individual students think about knowledge, which is referred to as their personal epistemology, has implications for learning strategies (Muis, 2004, Muis, 2007), motivation (Bråten & Strømsø, 2004; Buehl & Alexander, 2005; Chen, 2012), and achievement (Muis, 2004; Schommer, 1993; Trautwein & Lüdtke, 2007). Therefore, understanding the development of students' personal epistemologies through education is a critical task facing researchers and educators.

Several researchers have attempted to consolidate the vast literature on personal epistemology (e.g., Chinn, Buckland, & Samarapungavan, 2011; Hofer & Pintrich, 1997) or meld different viewpoints into a unified theory (e.g., Greene, Azevedo, & Torney-Purta, 2008; Muis, Bendixen, & Haerle, 2006). These approaches suggest that there is substantial heterogeneity in individuals' epistemologies (*multi-dimensional perspective*) and that beliefs change over time (*developmental-positions perspective*). In the current study, we tested Greene et al. (2008) combined theory of personal epistemology development in a sample of college engineering students. Specifically, we used person-centered analyses to investigate what epistemic profiles emerged, how students shifted between profiles over time (a critical gap in the current literature), and how profiles predicted achievement.

1. Theoretical background

Personal epistemology refers to beliefs about the nature and origins of knowledge (Hofer & Pintrich, 2002). Various terms are used in this field, including epistemic beliefs (e.g., specific beliefs about the nature of knowledge and knowing, Muis, 2007), personal epistemology (e.g., a system of epistemic beliefs, Greene et al., 2008), and epistemic cognition (e.g., all mental processes associated with knowledge, Chinn et al., 2011). In keeping with these distinctions, we use personal epistemology to refer to sets of epistemic beliefs (e.g., dogmatism) and epistemic belief to refer to specific dimensions (e.g., simple/certain knowledge).

Two common perspectives on personal epistemology are the developmental-positions perspective and the multi-dimensional perspective. The developmental positions perspective proposes that individuals systematically progress through different stages in their conceptualization of knowledge and knowing (see Hofer & Pintrich, 1997). At each stage, individuals take a particular stance towards knowledge (Chinn et al., 2011) such that they believe knowledge has a particular structure and manner of justification. Within the developmental-positions perspective, young children tend to be *realists*¹ (Chandler, Hallett, & Sokol, 2002; Kuhn, Cheney, & Weinstock, 2000). Realists accept all information as true knowledge, regardless of the source (Burr & Hofer,

* Corresponding author at: Department of Psychology & Neuroscience, Duke University, Box 90086, 417 Chapel Drive, Durham, NC 27708, United States.

E-mail address: michael.barger@duke.edu (M.M. Barger).

¹ While theoretical models use each term with slightly different connotations (Wildenger et al., 2010), the general developmental assumptions and trajectories bear many similarities. We focus on Chandler et al. (2002) description of development, as this view influenced the combined perspective (Greene et al., 2008).

2002). As children gain more experience with knowledge claims, they gradually realize that not all information is true and progress to *dogmatism* or *skepticism*. Unlike realists, dogmatists rely entirely on authority figures as sources of knowledge. In contrast to realists or dogmatists, skeptics (or multiplists, Kuhn et al., 2000) reject the concept of true knowledge and treat all opinions as equally valid. Dogmatism and skepticism represent dual pathways of personal epistemology development in this view (see Fig. 1). The final stage of development is *rationalism* (or evaluativism, Kuhn et al., 2000). Rationalists weigh and evaluate multiple sources of knowledge, taking a balanced view on how knowledge can be justified by both authority figures and personal experience in different contexts.

The precise timing of development remains contentious, ranging from occurring entirely during college (e.g., Perry, 1970) to progressing from early childhood to adulthood (Kuhn et al., 2000; Wildenger, Hofer, & Burr, 2010). Discrepant predictions might be due to the domain-specificity of personal epistemology (e.g., Buehl & Alexander, 2006; Muis et al., 2006). Students progress earlier in some domains (e.g., history) than other domains (e.g., mathematics; Greene et al., 2008). While the timing and nomenclature vary across researchers, the fundamental pattern of development is consistent.

In contrast to the developmental-positions perspective, the multi-dimensional perspective conceptualizes personal epistemology as a set of independent epistemic beliefs. Schommer (1990) provided early evidence of distinct belief dimensions using factor analysis. Among many belief dimensions, she consistently identified the belief in the *simplicity of knowledge* (i.e., knowledge is a collection of unambiguous facts) and *certainty of knowledge* (i.e., some true knowledge exists; Schommer, 1990, 1993; Schommer, Crouse, & Rhodes, 1992). Schommer (1990) also hypothesized that students had varying beliefs about *omniscient authority*: that knowledge is handed down by authority figures.

Building from prior research, Hofer (2000); (Hofer & Pintrich, 1997) further differentiated multiple dimensions into beliefs about *knowledge* and *knowing*. Greene et al. (2008) noted three of Hofer's dimensions that relate to developmental positions: (1) *simple/certain knowledge* (belief that knowledge is composed of a collection of unchanging facts), (2) *justification by authority* (belief that knowledge is handed down by authority figures), and (3) *personal justification* (belief that individuals can each construct different views of knowledge). Beliefs about simple/certain knowledge were reframed as components of ontological cognition and beliefs about the source of knowledge as epistemic cognition. Many researchers note methodological issues with using surveys to measure epistemic beliefs, including low measurement reliability (DeBacker, Crowson, Beesley, Thoma, & Hestevold, 2008; Hofer & Sinatra, 2010) and the implication that each dimension has an adaptive, and non-adaptive extreme (e.g., low justification by authority is adaptive; Muis, 2004; Schommer, 1990).

Synthesizing across the developmental-positions and multi-dimensional perspectives, Greene et al. (2008) proposed a combined theory describing different developmental positions (realists, dogmatists, skeptics, rationalists) based on simple/certain knowledge, justification by authority, and personal justification epistemic beliefs from the multi-dimensional perspective (see Fig. 1). Specifically, they proposed *realists* strongly endorse simple/certain knowledge, justification by authority, and personal justification. The other three positions reject the notion of simple/certain knowledge, but are differentiated by varying beliefs about knowledge sources. *Dogmatists* strongly endorse justification by authority, but not personal justification. *Skeptics* strongly endorse personal justification but not justification by authority. *Rationalists* weigh and evaluate different sources of knowledge depending on the circumstance, and therefore endorse moderate, balanced levels of personal justification and justification by authority.

The combined perspective offers several advantages. First, it combines two distinct theories for additional parsimony. Second, it acknowledges that epistemic beliefs coexist within an individual rather than assuming that they act independently (e.g., Hofer & Pintrich, 1997; Schommer, Calvert, Gariglietti, & Bajaj, 1997). This corresponds with recent theoretical understandings of students' systems of beliefs (Schommer-Aikins, 2004; Chen & Barger, 2016) and treats each person as an "organized whole" (Magnusson, 1998, p. 3). Third, this perspective acknowledges that it is sometimes appropriate to listen to experts. This differs slightly from the multi-dimensional perspective, which asserts that justification by authority beliefs are less mature. Finally, the combined perspective allows researchers to use survey measures to approximate individuals' developmental positions, which is traditionally done via time-consuming interviews.

When testing the combined perspective the main theoretical question is no longer, "What is the typical trajectory?" or "What dimensions matter?" Instead, researchers must ask (1) "What combination of dimensions exist in individuals?" (2) "Do these combinations resemble developmental positions?", and (3) "How do individuals move from one systematic combination of dimensions to another over time?" A person-centered approach (Bergman, Magnusson, & El Khouri, 2003; Laursen & Hoff, 2006) is well-positioned to answer the questions relevant to a combined perspective of personal epistemology. Person-centered analyses identify naturally-occurring combinations of variables and group similar individuals into categories (Hair, Anderson, Tatham, & Black, 1998). Such analyses provide insight into whether observed combinations of epistemic beliefs (i.e., epistemic profiles) map on to theoretically-hypothesized combinations.

Several researchers have examined profiles of epistemic beliefs (Buehl & Alexander, 2005; Chen, 2012; Ferguson & Bråten, 2013; Greene, Torney-Purta, & Azevedo, 2010). In one study, Buehl and Alexander (2005) created profiles of undergraduates' epistemic beliefs in mathematics and history using simplicity, certainty, and justification

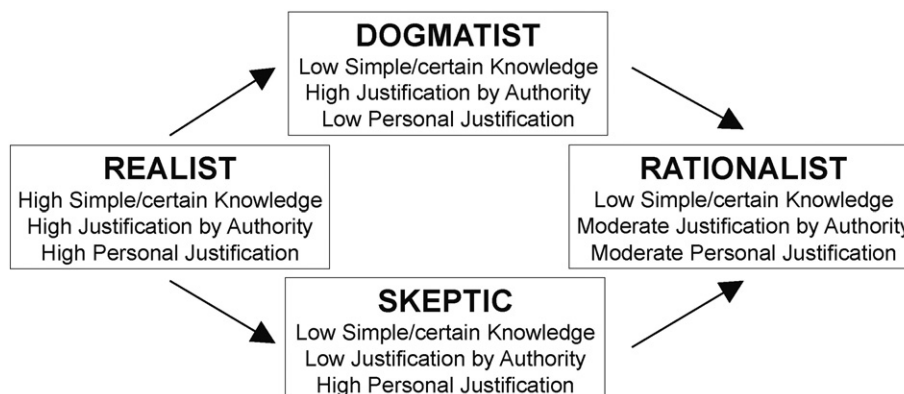


Fig. 1. Proposed developmental progression of personal epistemology with expected levels of dimensions (adapted from Chandler et al., 2002; Greene et al., 2008).

Download English Version:

<https://daneshyari.com/en/article/6844848>

Download Persian Version:

<https://daneshyari.com/article/6844848>

[Daneshyari.com](https://daneshyari.com)