Article

Journal for the Education of the Gifted
2019, Vol. 42(2) 164–184

DOI: 10.1177/0162353219836924
journals.sagepub.com/home/jeg
SAGE

Epistemological Differences Between Gifted and Typically Developing Middle School Students

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Abstract

Students' personal epistemologies, or their beliefs about knowledge and knowing, have a substantial impact on learning, affecting their responses to curriculum, strategy selection, and psychosocial variables. Changes in epistemological reasoning occur similarly to other stage-based developmental schemes, with qualitative shifts in worldviews at each stage. Some research suggests that gifted students tend to develop higher levels of epistemological reasoning earlier than same-aged typically developing peers. The current study extends research in developmental differences to middle school students. A total of 189 sixth-, seventh-, and eighth-grade gifted or typical students completed the Learning Context Questionnaire. An analysis of variance was conducted to determine differences by Gifted Status and Grade Level. Results of the analysis revealed significant differences between gifted and typical students, with modest effect size, at each grade level. The discussion includes implications for understanding giftedness and related need for rich inquiry-based learning environments.

Keywords

gifted learners, adolescents, advanced development, personal epistemology

> The notion of the infinite variety of detail and the multiplicity of forms is a pleasing one; in complexity are the fringes of beauty, and in variety are generosity and exuberance. (Dillard, 1973, para. 8)

The impact of students' beliefs about the knowledge and learning has gained increasing attention in educational psychology. Beliefs about whether knowledge is simple or complex, absolute or derived, creates a *personal epistemology* through which a student

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interprets educational experiences. Some students believe that all knowledge is established and unchangeable; motivated students who hold this belief are bent on memorizing everything in sight. Other students believe that knowledge is derived from assembling facts into a whole; when motivated, they use facts as building blocks to form original ideas. Research findings related to personal epistemology hold implications for the development of sophisticated, complex thinking, a chief aim of gifted education programs. Identifying developmental differences between gifted and typical students along schemes of personal epistemology could help to codify how gifted students differ from the norm and provide further evidence that gifted students require qualitatively different instruction. The aim of this study was to compare the epistemological reasoning of gifted and typically developing middle school students.

A Developmental Trajectory of Personal Epistemology

Personal epistemology is broadly defined as "an individual's cognitions about the nature of knowledge and the nature of knowing" (Pintrich, 2002, p. 390). Most contemporary research on personal epistemology derives from Perry's (1968) scheme of ethical and intellectual development. Perry was a Harvard professor and counselor whose job included interviewing students about their college experience. Across 20 years of interviews, he noted a consistent pattern in the evolution of students' beliefs about the nature of knowledge, and related shifts in their notions of learning, as they progressed from freshmen to senior year. Over time, Perry formalized his observations into a developmental scheme comprising nine positions grouped within four stages. Numerous researchers have since validated the general progression outlined by Perry (Baxter-Magolda, 1992; King & Kitchener, 1994, 2002; Kuhn, Cheney, & Weinstock, 2000; Schommer, 1998), spawning a generation of research into personal epistemology.

The Perry Scheme

Perry's (1968) *Forms of Ethical and Intellectual Development in the College Years* is the best source for a thorough understanding of his scheme. What follows is a general overview of the four stages of development as described by Perry.

The lowest level of Perry's model is *Dualism*, or naïve epistemology. Students whose beliefs represent Dualism tend to believe that all valid questions have clear-cut, right-or-wrong answers, and that "truth" is absolute. According to people who hold this viewpoint, right answers are dispensed from all-knowing Authorities, including their textbooks, teachers, or indeed, anyone proclaimed to be an authority (e.g., fame can be confused with authority).

Over time, most students come to realize that some important questions do not have absolute black-or-white, right-or-wrong answers; these students enter the second stage of the Perry scheme called *Multiplicity*. Students at this stage have many questions but few answers; what is worse, they have no means of finding answers. Instead, they are plunged in a quagmire of ambiguity where "truth" is based on personal opinion rather than judgment and where competing ideas seem equally right because everyone has a right to an opinion. For this reason, the transition from Dualism to Multiplicity has been described as moving "from ignorant certainty to intelligent confusion" (Kroll, 1992, p. 98).

In the third stage, *Contextual Relativism*, reliance on opinion gives way to a belief in the need for well-supported reasoning. Students begin to use criteria and context to interpret information, and they recognize that experts use intellectual tools to assemble ideas, and they judge the merit of competing ideas. They see that each field has a different "toolbox" of thinking skills and perspectives used to construct meaning from information, and tend to prefer one, often to the exclusion of others.

At the highest stage of the Perry scheme, *Commitment* W*ithin Relativism* or *Dialectic*, students recognize that learning involves a lifelong commitment to unraveling complexity. Students at this stage want mentors to guide their learning journey, not all-knowing Authorities. The few students who reach this stage realize that any given problem can be viewed from many different paradigms: scientific, economic, political, and so on. Students may prefer one paradigm more than others, but they simultaneously accept the legitimacy and contributions of alternate viewpoints. Moore (2002) explained that people who achieve this level understand important questions are answered with reasoned arguments informed by a professional, and often a personal, philosophy. They also understand that they may need to change their stance on a significant question when confronted with new information.

The perspectives associated with each stage create different frames of reference that affect how students interpret all the information they encounter. They also affect how students interpret the aims of education, from global objectives to classroom activities. For instance, given an assignment to weigh the merits of Genetically Modified Organisms (GMOs), a student in Dualism will try to find the "truth" about whether GMOs are good or bad; a student in Multiplicity will select a position for or against GMOs but will say others have a perfect right to a different opinion, regardless of the evidence; a student in Contextual Relativism will consider the scientific literature and decide based on the best available empirical research; and a student in Dialectic will judge the merits of GMOs on scientific knowledge but will also consider the merits of social, economic, and political arguments, understanding all the while that new information may compel a change in position. The four stages of the Perry Scheme and related beliefs about the nature of knowledge and the roles that students and teachers play in the learning process are summarized in Table 1.

Movement from one stage to the next entails a qualitative reorganization of beliefs. Although the transition is gradual, a student's point of view eventually undergoes a wholesale transformation. This is consistent with other developmental theories that suggest the accumulation of a critical mass of information eventually forces cognitive restructuring (Dabrowski, 1964; Erikson & Erikson, 1998; Piaget & Inhelder, 1962).

Development along this continuum takes many years, beginning in late childhood and extending through the college years, although growth to the highest levels is not guaranteed and few adults reach the highest levels of epistemological development. Most college graduates hold beliefs representative of Multiplicity (King & Kitchener,

Table 1. Perry's Stages of Epistemological Development.

Stage	Premises	Beliefs regarding the nature of knowledge	Beliefs regarding the role of learners	Beliefs regarding the role of teachers or authorities
Dualism	"Truth" is black and white. Legitimate questions have absolute right answers; all other answers are wrong. Differing opinions or interpretation of information is perceived as errors or incompetency.	Knowledge is concrete and absolute, as defined by Authorities.	To acquire, store and retrieve concrete knowledge as needed, and in great quantity to demonstrate high achievement.	Effectively deliver concrete information, provide strategies to aid in memorization, discriminate between right and wrong.
Multiplicity	Differing opinions may be necessary until the "truth" is found. Recognition that some questions will never have certain answers; in the absence of right answers all opinions are considered equally valid.	Knowledge is uncertain and can be constructed by anyone with equal validity.	To think for oneself. To build and defend (although not necessarily support) an opinion or argument.	To guide discussion and give space for different points of view (although not to value one over another).
Relativism	Recognition that knowledge and values are both situated in context. Acknowledgment that the world requires relativistic commitment causes anxiety because of the need to take a stand.	Knowledge is interpreted within a context and therefore can be seen differently in different situations.	To use context as part of building understanding. To use analytical tools to make abstractions and analyze multiple interpretations.	To be an expert in disciplinary thinking, who can also help make sense of a body of information.
Commitment Within Relativism (Dialectic)	Initial commitments in career, lifestyle, and values are made. Exploration to the selected commitments, the consequences of those commitments. Affirmation of many different commitments and responsibilities, including acceptance of positive and negative consequences of choices.	Knowledge is contextualized and being knowledgeable requires unraveling complexity and building ideas within ambiguous situations.	To construct personal truth based on developed and examined commitments to personal and professional values and points of view. To acknowledge limitations and change thinking when confronted with compelling information.	To act as a mentor and a role model for and intellectually and personally committed way of living.

Note. Derived in part from Rogers, Mentkowski, and Sharkey (1995).

2002; Pavelich & Moore, 1996; Perry, 1968; Wise, Lee, Litzinger, Marra, & Palmer, 2004). Perhaps the most comprehensive data on epistemological development comes from King and Kitchener (2002) whose Theory of Reflective Judgment is based, in part, on Perry's work and has a parallel structure. In a multiyear investigation of 1,334 students, King and Kitchener found that high school students were typically in what they call "pre-reflective" or Dualistic stages as freshmen, and show only modest change as seniors, graduating in the transition from Dualism to Multiplicity. They replicated this finding in subsequent studies, observing a slow-but-steady developmental trend from adolescence to early adulthood, with most college seniors finishing university in Multiplicity and graduate school students reaching Relativism and Contextual Relativism (Kitchener, King, & DeLuca, 2006). These findings point to the influence of environment, and specifically of formal education, on the developmental trajectory. However, Belenky, Clinchy, Goldberger, and Tarule (1986) tested the Perry scheme outside of higher education and demonstrated that many different life experiences could serve as developmental catalysts.

Although progression to the highest levels is not guaranteed, it seems desirable, especially for future innovators, problem solvers, and global leaders. The habits of mind and attitudes characteristic of the highest levels of epistemological reasoning parallel qualities associated with expert thinking, including open-mindedness, appreciation for multiple perspectives, and commitment to a life of inquiry (Bing & Redish, 2012; Hammer & Elby, 2002; Kuhn et al., 2000).

Perry's original work initiated a new and robust area of investigation in student cognition, which is now replete with research and evolving theoretical perspectives. Hofer and Pintrich (2002) suggested "personal epistemology" as an umbrella term to replace Perry's "forms of ethical and intellectual development," although researchers continue to clarify how the concept is defined and measured (Briell, Elen, Verschaffel, & Clarebout, 2011). Questions under investigation include whether personal epistemology is global or domain specific (Muis, Bendixen, & Haerle, 2006; Schommer-Aikins & Duell, 2013), and whether or how to break the omnibus concept into component parts (King & Kitchener, 2002; Schommer, 1990). These discussions notwithstanding, research into personal epistemology contains important findings regarding the acquisition of sophisticated forms of thinking. To the extent that sophisticated thought is a goal for gifted education, understanding how gifted students move through the developmental progression of personal epistemology seems not only relevant but essential.

Distinguishing Between Beliefs About Knowledge and Beliefs About Learning

Debate continues regarding where to draw lines of demarcation separating personal epistemology from other psychological theories. Numerous studies have investigated the intersection between personal epistemology and notions such as the Nature of Science (Yenice, 2015) and theories of mind (Burr & Hofer, 2002). Particularly important in the current gifted education zeitgeist is the distinction between personal epistemology and theories of implicit intelligence, or "mindset." Based on seminal work by

Dweck (1999), implicit theories of intelligence refer to students' beliefs about *the nature of intelligence* (e.g., whether intelligence is fixed or changeable); in contrast, personal epistemology refers to students' beliefs about the *nature of knowledge* (e.g., whether knowledge is simple or complex; Holma & Hyytinen, 2015).

In a study of 178 Norwegian undergraduate students attending a highly competitive and rigorous business program, Bråten and Strömso (2005) found that epistemic reasoning was distinct from implicit theories of learning. Participants in this study completed measures of both epistemic reasoning and Dweck's (1999) Theories of Intelligence Scale, which measures students' implicit conceptions of intelligence. They also completed a measure of mastery goal orientation and self-regulatory strategies. A regression analysis revealed that epistemological stance made significant and unique contributions to student self-regulated learning, leading the authors to conclude that, "Epistemological beliefs were found to play more important roles in goal adoption than implicit theories of intelligence" (Bråten & Strömso, 2005, p. 377). In a different study of 1,225 middle and high school students, Chen (2012) drew more nuanced conclusions. He revealed distinct but interacting relationships between mindset and epistemological stance such that mindset affected student self-efficacy and motivation, but epistemological stance directly affected strategy choice, self-regulated learning, and metacognition.

Impact of Personal Epistemology on Learning

Personal epistemology is acknowledged to have a pervasive influence on learning, affecting the way students interpret classroom activities and many other aspects of learning, including motivation, mastery orientation, strategy selection, deep-level information processing, and achievement. The research in this area is vast, and there are excellent summaries (e.g., Hofer, 2001; M. Smith, 2016) and compendiums (e.g., Bendixen & Feucht, 2010; Hofer & Pintrich, 2002) to consult for a more comprehensive review. The literature included here selects from an extensive body of research to summarize studies on topics particularly relevant to the field of gifted education.

Inquiry-Based Curriculum

A student's epistemological stance affects his or her reaction to different learning experiences. C. L. Smith, Maclin, Houghton, and Hennessey (2000) found that fifth-grade students with more mature epistemology were more responsive to constructivist instruction than students with more naïve epistemological stances. As a part of a larger study of epistemology, Muis and Franco (2010) gave 78 university students epistemological inventories and then asked them to engage in a think-aloud problem-solving activity. The students with more mature epistemological stances performed better on the open-ended problem solving task. Schommer, Crouse, and Rhodes (1992) found that epistemological stance predicted students' performance on different kinds of mathematics problems. In their study, students at lower levels of epistemological development performed better on well-structured problems; students at higher epistemological levels performed better on open-ended or ill-structured mathematics problems. Lodewyk (2007) reported similar findings in his study of 447 high school students: students with more mature epistemological views were better at solving ill-structured problems than students with more naïve views. Based on his findings, Lodewyk (2007) concluded that

> [s]tudents who see knowledge as simple . . . tend to experience more difficulty with the ambiguous features of tasks that call for reflective judgments, perseverance, and appropriate self-regulated learning. Viewing knowledge as simple can limit subsequent conceptual change and performance. (p. 324)

Consistent with Maslow's (1966) contention that, "it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail" (p. 15), students' epistemological lenses may cause them to misinterpret assignments. Hammer and Elby (2003) described how epistemology affects how students perceive learning in a physics class:

> Students who have difficulties often view physics knowledge as a collection of facts, formulas, and problem solving methods, mostly disconnected from everyday thinking, and they view learning as primarily a matter of memorization. By contrast, successful learners tend to see physics as a coherent system of ideas, the formalism as a means for expressing and working with those ideas, and learning as a matter of reconstructing and refining one's current understanding. (p. 54)

Scholars of personal epistemology note that misalignments between classroom pedagogy and student epistemological stance cause able students to underachieve in college. Ramsden (1988) studied struggling college students and noted that to do well, students must first correctly interpret the intent of their assignments. He claimed, "learning difficulties experienced by new college students were not rooted in their lack of motivation, their study skills, or their ability; *they sprang from their view of knowledge itself*" (p. 18, emphasis added). The implication is that even an expertly designed inquiry-based task might fail if students do not believe that inquiry is a valid way to learn. Conversely, a student who is reasoning at a higher level of Perry's scheme may be inclined to see rote assignments as trivial or unimportant. Neber and Schommer-Aikens (2002) found that traditional didactic high school physics caused work avoidance among students with advanced epistemologies, while nontraditional discovery-based physics motivated these students to initiate learning and engage in metacognitive reflection.

Strategy Selection

The lens through which students view their learning experiences, filtered through their epistemological stance, also affects their selection of learning strategies. Tsai (1998a) found that students who believed science was simply a set of facts tended to select learning strategies that helped with rote memorization, regardless of the actual cognitive demands of the task. Students with more mature epistemological views used metacognitive strategies more effectively when constructing their responses. As a result, these more mature reasoners not only recalled more information, they recalled it with more precision and depth. In a related study of 202 eighth-grade students, Tsai (1998b) found that students with more mature epistemologies learned by actively engaging with information, while those with naïve views were passive, relying on rote memorization. Liang and Tsai (2010) replicated these findings in another study of college students.

Schommer et al. (1992) found that students who believed that knowledge comprised isolated facts were less likely than others to select learning strategies that would help them find relationships among facts or build conceptual understanding. Other studies corroborate these findings, reporting that students with more advanced epistemological beliefs are better at forming logical arguments (Weinstock, Neuman, & Tabak, 2004).

Working with a sample of 518 university students, Holschuh (1998) found that students with more mature stances tended to select deep learning strategies, while students with naïve stances tended to select surface learning strategies. This finding has been replicated in other studies (Hammer & Elby, 2003; Rodriguez & Cano, 2007; Schreiber & Shinn, 2003; Zhang & Watkins, 2001). Bath and Smith (2009) attempted to use epistemology, personality characteristics, self-efficacy, and change-readiness to predict lifelong learning behaviors. They conducted a regression analysis based on data from 110 college students and concluded that "[e]pistemological beliefs and an openness to intellectual experience personality were the two most important individual predictors of the characteristics of lifelong learning" (p. 185).

Motivation and Attribution

Personal epistemology also affects student motivation, such that students who believe that knowledge is constructed are more likely to engage actively with information. Hofer (1994) investigated the relationship between epistemology, motivation, and achievement in 438 first semester calculus students across several classrooms. She found that students with a more mature epistemology were significantly more motivated to achieve mastery. Buehl and Alexander (2005) had similar findings in another study investigating the impact of epistemological level on achievement in either mathematics or history classes; students with more mature epistemological beliefs were more motivated to learn in both subjects. By applying structural equation modeling to a sample of 201 educational psychology students, Muis and Franco (2009) drew causal relationships from epistemological reasoning to educational goal selection, from goal selection to strategy use, and from strategy use to achievement.

Students at higher levels of personal epistemology also feel more empowered as learners. Studying a sample of 278 undergraduate students, Terzi, Cetin, and Eser (2012) found that students with mature epistemological beliefs were significantly more likely to have an internal locus of control, another factor related to positive educational outcomes. Paulsen and Feldman (2007) also found a significant relationship between aspects of mature epistemology and internal locus of control, as well as higher levels of self-efficacy and intrinsic goal orientation.

Academic Achievement

Given the association between epistemological stance and influential learning variables such as task interpretation, deep-level information processing, self-efficacy, locus of control, and conceptual learning, it makes sense that epistemology might also affect academic achievement. Schommer (1998) made this connection in a study of high school students, noting that students who believed that knowledge is certain were more likely to have a lower grade point average (GPA) than students who believed that knowledge is constructed. This finding was replicated in a study of German high school students, where more naïve epistemology was an indicator for low achievement even after controlling for family environment and intelligence (Trautwein & Lüdtke, 2007). The trend was observed again in a study of 459 low-income students, where epistemological stance predicted science grades (Ricco, Pierce, & Medinilla, 2010). Pizzolato, Chaudhari, Murrell, Podobnik, and Schaeffer (2008) compared the individual and combined predictive power of several variables including epistemology, GPA, SAT scores, and ethnic identity. They found that, when combined, ethnic identity and epistemology predicted college GPA nearly as well as GRE and SAT scores, and that students with more mature epistemological stances and stronger ethnic identity tended to have higher grades than other students.

The relationship between epistemology and achievement is not always direct. Numerous studies have used structural equation modeling to investigate the direct and indirect impact of epistemological stance on learning. Phan (2009) constructed a model using information from 275 university students that demonstrated that mature epistemology had a significant indirect effect on achievement. In his model, epistemological stance had a significant direct effect on mastery goals, mastery goals had a significant direct effect on strategy selection, and strategy selection had a significant direct effect on achievement. Epistemology also had a significant indirect effect on student effort. Using data from 1,041 sixth-grade students, Kizilgunes, Tekkaya, and Sungur (2009) constructed another causal model that traced a path from epistemological stance to achievement. In this model, epistemological position had an indirect impact on learning approach through students' self-efficacy, learning goals, and performance goals. Learning approach, in turn, predicted achievement. Similarly, in a study of 1,600 high school students, Cano (2005) found that epistemology not only had a significant direct effect on achievement but it also had a significant indirect effect on achievement through its direct effect on students' learning choices.

DeBacker and Crowson (2006) constructed a model demonstrating that mature epistemology had a significant direct effect on the adoption of mastery goals. Mastery goals, in turn, led to a more meaningful cognitive engagement with content. Mature epistemology also had a significant direct effect on cognitive engagement. Conversely, naïve epistemological views were associated with surface-level engagement. Based on their findings, DeBacker and Crowson concluded that "educators who wish to encourage their students to forego the less effective shallow engagement strategies and adopt the use of strategies for meaningful engagements may need to scaffold students toward more mature epistemological beliefs" (pp. 546–547).

Taken together, this body of research suggests that students who have more mature epistemological beliefs learn differently than students who hold more naïve beliefs. Students who believe that knowledge is certain and absolute, and that memorization leads to effective learning, prefer curriculum that is straightforward and didactic; to learn this curriculum they select cognitive strategies that assist in surface-level, rote learning. They are more likely to misinterpret the intent of open-ended assignments. Students who have more mature epistemological stances are likely to enjoy open-ended, inquiry-based tasks, and to select deep-level strategies that help them find meaningful relationships among facts.

Epistemology and Ability

Although many studies document a relationship between mature personal epistemology and advanced achievement, reported above, and several studies into personal epistemology use gifted students as participants (Enman & Lupart, 2000; Koskal & Yaman, 2012; Otting, Zwaal, Tempelaar, & Gijselaers, 2010), only a few directly compare the epistemological development of gifted students with typically developing students. Research in other areas of human development suggest that gifted students are advanced relative to their age-mates in acquiring formal operational reasoning (Berninger & Yates, 1993) and in developing openness to experience (McCrae et al., 2002); it makes sense that they may be advanced along this continuum as well.

In the first of several studies on this topic, Schommer (1993) gave 1,000 high school students a measure of epistemological reasoning. Regression analysis revealed that gifted high school seniors were more likely than other students to believe that knowledge is complex and integrated. A more direct comparison is provided by Schommer and Dunnell (1994), who gave a measure of epistemology to 72 gifted and 216 typically developing high school students. They found no difference between gifted and typically developing high school freshman and sophomores, but there were significant differences between gifted and typically developing high school juniors and seniors. Among the high school juniors and seniors, gifted students were significantly more likely to believe that knowledge is complex, not simple.

Ismail and Abdel-Majeed (2006) also found differences in the epistemological reasoning of gifted and typically developing students. In this study, 37 gifted and 126 typical male Saudi Arabian students studying English completed several measures associated with learning, including epistemological reasoning, self-regulation, and an English Foreign Language (EFL) Goal Orientation Questionnaire, which had subscales measuring performance goal orientation, performance avoidance, and learning goal orientation. The researchers also had access to the students' GPA and class grades. Students were identified as gifted based on teacher nomination, EFL proficiency, GPA of at least 4 out of 5, and a threshold score of 550 on the paper-based Test of English as a Foreign Language (TOEFL). Gifted students were significantly higher than typically developing students on the measure of epistemological reasoning, particularly in their understanding that knowledge results from integrating information, not from memorizing discrete facts. Three elements of epistemological belief—knowledge as an integrated body, knowledge as changeable, and knowledge as having an organized structure—predicted student GPA; the belief that knowledge is integrated and changeable also predicted students' self-regulated behavior.

A second question is whether gifted students' development of personal epistemology follows the same developmental path as other students. In an attempt to answer this question, Schommer and Dunnell (1997) gave a measure of epistemological reasoning to 69 gifted high school students. They found that younger gifted students tended to have more naïve beliefs than older gifted adolescents; they also found that gifted students with naïve beliefs were more likely to give simplistic answers to science questions. This pattern suggests that gifted students move through the same developmental progression, although perhaps faster or earlier than typically developing students. Moreover, they speculated that naïve epistemological beliefs could act as a background variable contributing to the underachievement of some highly gifted students.

Thomas (2008) also charted the path of epistemological change in gifted students attending a 3-year state-funded residential school for gifted students. Thomas followed the students' epistemological development from sophomore to senior year using the Learning Context Questionnaire (LCQ; Kelton & Griffith, 1986). Analysis of three graduating classes across their high school years revealed that (a) the average gifted sophomore was in Multiplicity and (b) over the course of 3 years, students grew, on average, a half-stage along the Perry scheme. At graduation, the majority were in transition from Multiplicity and Contextual Relativism. Thomas' findings suggest that these gifted students were, on average, at least one stage in advance of typically developing age-mates throughout their high school years and were at reasoning at the same level as college seniors upon high school graduation (King & Kitchener, 2002).

Neither Schommer and Dunnell (1997) nor Thomas (2008) compared developmental trends of gifted and typically developing students (i.e., looking across both age and ability group). Furthermore, little or no research has investigated possible differences in epistemology between gifted and typically developing middle school students. The current study builds on the current literature in that it extends the investigation of gifted students' epistemological development to middle school ages, and it includes a comparison group of typically developing students. The questions investigated in the current study were the following: (a) Do gifted middle school students have advanced epistemological development as compared to typically developing peers? (b) Do eighth-grade students have significantly higher levels of epistemological development than sixth-grade students? (c) Is there a grade-by-ability interaction effect in the middle school students' epistemological development?

Method

Participants

Participants in the study attended a charter school for gifted students in the southeastern United States. Although the school is designed to meet the needs of gifted students, the charter law required open enrollment via lottery to all who applied. Because of the

Table 2. Mean and Standard Deviation LCQ Scores Gifted Status × Grade Level.

	Sixth grade		Seventh grade		Eighth grade		Total	
Gifted status	*M* (*SD*)	*N*	*M* (*SD*)	*N*	*M* (*SD*)	*N*	*M* (*SD*)	*N*
Gifted	3.44 (0.84)	29	3.11 (0.84)	42	3.43 (0.75)	44	3.32 (0.81)	115
Typically developing	3.11 (0.93)	26	2.67 (0.51)	26	2.83 (0.43)	22	2.83 (0.71)	74

Note. LCQ = Learning Context Questionnaire.

enrollment policy, any student, regardless of ability, could apply to the school. As a result, the school application did not request information about student ability. After the lottery, the school gathered information regarding the academic background of admitted students, including whether students met the state criteria for identification as gifted. Students who had not been tested for gifted identification in their elementary school (i.e., students from private or home schools) were assessed by school personnel according to state identification criteria. State identification guidelines allowed students to enter the gifted program via alternate paths comprised of a combination of (a) demonstrated advanced reasoning ability (cognitive abilities at the 96th national age percentile using nationally recognized measures), (b) demonstrated academic achievement (94th national percentile or higher on approved achievement tests), and/or (c) demonstrated academic performance (GPA of 3.75 out of 4.00). A combination of two of three of these categories qualifies students for gifted education services.

In the time of this study, the school enrolled 55 students in the sixth grade, 68 students in the seventh grade, and 66 students in the eighth grade, all of whom participated in the study. Of the 189 middle school students, 115 met the state criteria for gifted education, and 74 did not. The distribution of students across Gifted Status and Grade Level is included in Table 2.

Instrument

Although qualitative measures of personal epistemology provide the most nuanced information, they are also time consuming and inconvenient for use in schools. In this study personal epistemology was measured using the LCQ III (Kelton & Griffith, 1986). The LCQ III is a Likert-type measure containing 50 statements rated on a 6-point scale from *Strongly Agree* (1) to *Strongly Disagree* (6).

The LCQ III was developed as part of the 3-year Project Match, an early think-tank for scholars interested in epistemological constructs. The initial form of the LCQ comprised 44 scored items and six experimental items. Items were developed by the form authors and confirmed by three experts trained in scoring open-ended Perry measures. Norms for this form were based on students from ninth grade to college senior. A subsequent principal component analysis led to a substitution of 12 new items and created the LCQ II. Construct validity of the LCQ II was tested by rating applicant college essays of 687 high school seniors according to the Perry scheme and grouping applicants according to Perry level. A discriminant analysis was conducted to determine whether items on the LCQ II distinguished among groups. A further revision randomized item presentation to address concern over patterned responses. This revision created the current version of the form, the LCQ III.

The LCQ III was validated against the open-ended Reflective Judgment Dilemma Interview (King & Kitchener, 1994) with initial results supporting the LCQ as a reliable measure of the four global Perry levels. However, subsequent cluster and discriminant analysis identified that it lacked adequate reliability. The current scoring procedure for the LCQ III is based on items with an alpha reliability of .77 and a Spearman-Brown split-half correlation coefficient of .75. Kelton and Taft (as cited in Kelton & Griffith, 1986) assessed whether the LCQ III scores were confounded by social desirability instead of intellectual development. They found no relationship between the Harlowe-Crowne Social Desirability scale and LCQ III scores. The LCQ III has not been used with middle school students. To guard against a vocabulary-knowledge effect in student responses, school faculty reviewed the measure a week before administration and confirmed that students would understand a majority of the terms on the form.

Approximately a total of 26 of the 50 LCQ III items are scored to create an initial total ranging from 26 to 156. This score is converted to a scale of 1 to 7 using the formula 0.75(LCQ III) – 3.13. The converted total scores are used to determine level of epistemological reasoning: values between 1.0 and 3.49 indicate Dualism, 3.50 and 4.49 Multiplicity, 4.50 and 5.49 Relativism, and 5.50 and 7.0 Relativism with Commitment/Dialectic.

Procedure. Teachers asked their students to complete the LCQ during homeroom in the first month of school. No time limit was imposed, and most students finished the questionnaire before the end of homeroom. Students who did not finish were provided extra time to complete the form. Teachers were instructed to help students with definition of terms as needed, but to give no further assistance. Student responses were scored and added to a database that contained student grade level (sixth, seventh, eighth) and gifted status (Gifted/Typical).

Data analysis. Data analysis began by applying a Levene test to determine the homogeneity of variance. Afterwards, a two-way analysis of variance (ANOVA) was conducted using LCQ as the dependent variable and Grade Level and Gifted Status as independent variables. Fisher's protected least significant difference (LSD) was used for post hoc comparisons.

Results

A Levine test for equality of variance of scores yielded nonsignificant results, verifying homogeneity of variance across groups $F(5, 183) = 1.24$, critical value = 2.26. A two-way ANOVA yielded a main effect for Gifted Status $F(1, 187) = 13.70$, $p < .00$,

Table 3. Two-Way ANOVA Gifted Status × Grade Level Analysis of LCQ Scores.

Source	SS	*Df*	MS	*F*	*p*	Omega squared
Gifted	8.00	1	8.00	13.7	.00	0.06
Grade	4.57	2	2.28	3.91	.02	0.03
Gifted × Grade Interaction	0.71	2	0.36	0.61	.55	0.00
Error (Within Groups)	106.83	183	0.58			

Note. LCQ = Learning Context Questionnaire; ANOVA = analysis of variance, SS = Sums of Squares; MS= Mean Square.

with a modest effect size, $w^2 = 0.06$. These data indicate the gifted students' average level of epistemological development ($M = 3.32$, $SD = 0.81$) was significantly higher than typical students ($M = 2.89$, $SD = 0.71$). The main effect on Grade Level was also significant (2, 187) = 3.91, $p < .02$, with a small effect size, $w^2 = 0.03$. The interaction of Gifted Status × Grade Level was not significant. Group mean scores on the LCQ are included in Table 2; ANOVA statistics are presented in Table 3.

After a homogeneity of variance test across Grades 6 to 8 using Levine's test F (2, 186) = 1.18, critical value = 3.04, a post hoc analysis was conducted on the Grade Level variable. Fisher's LSD test revealed that the average LCQ scores for Grade 6 ($M = 3.29$, $SD = .82$) and Grade 8 ($M = 3.25$, $SD = 0.71$) were not significantly different but both were significantly higher than the LCQ scores for Grade 7 ($M = 2.94$, $SD = 0.77$).

Discussion

The current study was designed to assess whether gifted middle school students have advanced epistemological development compared to their typically developing peers, whether eighth-grade students have significantly higher levels of epistemological development in sixth-grade students, and whether there is there a Grade Level × Gifted Status interaction effect in the epistemological development of middle school students. Gifted students in this sample were consistently significantly higher in epistemological development as measured by the LCQ, with modest effect size. Eighth graders were not significantly higher than sixth graders and there was no Grade Level × Gifted Student interaction.

For both gifted and typical students, there was little or no increase in epistemological reasoning from sixth to eighth grade. This is consistent with the previously discussed slow-but-steady pace of developmental change in epistemological reasoning reported by others (King & Kitchener, 2002; Schommer & Dunnell, 1994). The significant difference found among grade levels resulted from a significant dip in scores in seventh grade. This dip may be an anomaly or an unusual characteristic unique to the seventh-grade group, but it was consistent across the Gifted and Typical students. This seeming backsliding in scores of seventh graders could reflect the fact that development is not strictly linear and that transitions from one stage to the next are not unequivocal. Rather, they may resemble the ebb and flow of waves as the tide rolls in. Students may alternately progress and recede for a while making the transition from one position to the next. This trend has been observed by others researching personal epistemology (King & Kitchener, 2002), but further research is necessary to identify whether this observation represents a fluke, a trend, or something else altogether.

Across grades, the identified gifted students in this study had higher levels of epistemological development than the typically developing students. The observed trends were consistent and not a function of an outlier group of gifted or typical students at a given grade level. Typically developing students were in Dualism at each grade level; in eighth grade, their average LCQ scores were lower and had a smaller standard deviation than in sixth grade. Given the normal distribution of scores, more than 80% of the typically developing eighth-grade students remained below the threshold for Multiplicity. The average score for the gifted sample was near the transition into Multiplicity, and again, given a normal distribution, it is reasonable to think that at least half of the student body was well into Multiplicity, and a few beyond. The eighth-grade results are particularly interesting because these students had attended the same school and experienced the same curriculum for 3 years, yet their scores on the LCQ were significantly different. The modest effect size suggests that the difference between these two groups is not trivial.

The findings here are at odds with those of Schommer (1993), who did not find significant differences between gifted and typical students until after the sophomore year in high school. A likely explanation for this is instrumentation. Schommer's (1990) questionnaire includes factors representing implicit theories of intelligence, or mindset, as well as epistemology; the LCQ is based exclusively on the Perry Scheme. One reason instrumentation seems a more likely factor than other explanations is the striking alignment between the current results and those reported by Thomas (2008), who also used the LCQ as a research measure. In the current sample, gifted students in sixth and eighth grade had average LCQ scores slightly over 3.4. In Thomas's high school sample, 10th-grade students scored an average of 3.89, within the range representing Multiplicity, and seniors scored an average of 4.46, within the range representing Relativism. Although Thomas did not include a control group in his study, the progression of scores across the two gifted samples show a remarkable unity that would be interesting to test in a longitudinal study of gifted and typical samples.

Limitations of the study constrain inferences made from this data. Despite assurances from the faculty, and although students were encouraged to ask for clarification as needed, the readability level of the LCQ may have been too advanced. The self-selection of students into a charter school designed for gifted students may have created a "typical" pool that was somewhat more advanced, which would, in theory, falsely reduce differences between the gifted and typically developing groups. The study would have benefited from a larger sample, and from longitudinal measurement from sixth to eighth grade for a more accurate assessment of age-based increases. Opportunities for future research abound, including longitudinal study, study using different measures and age groups, studies with more direct connection between epistemological level and specific ability and achievement measures, and studies that assess the impact of instructional interventions on levels of personal epistemology. Finally, this study addresses whether there are developmental differences, but it does not address why.

These findings add to a group of studies that point to developmental differences between gifted and typically developing students in early adolescence. McCrae and colleagues (2002) reported differences between gifted and typical students in Openness to Experience, a personality trait he claims continues to evolve from childhood through adolescents. Referring to the 0.5 standard deviation difference between gifted and typical students in the sample, the authors surmised that “At age 12, [gifted students] have already reached the level of [Openness to Experience] characteristic of [typical] 15-year-olds” (McCrae et al., 2002, p. 1463). Berninger and Yates (1993) also reported a 3-year developmental difference, favoring gifted students, in the acquisition of formal operational reasoning during their middle school years. This intriguing convergence across different developmental measures also suggests that gifted students enter the cognitive aspects of the pivotal adolescent transition as much as 3 years earlier than their typically developing age-mates. The findings also provide a new perspective from which to view the academic discontent of talented teenagers (Csikszentmihalyi, 1990; Kanevsky & Keighley, 2003). The desire for more open-ended curriculum, for more complexity, and for more in-depth investigation may be an outward expression of gifted students’ epistemological beliefs about what constitutes a meaningful education.

If, as the theory purports, each stage of epistemological reasoning represents a qualitative shift in worldview, these results add more evidence to the contention that, at least in some respects, gifted students are qualitatively different than their typically developing age-mates. Because many elements of development involve qualitative shifts, small measured differences can have substantial practical implications. The movement from Dualism to Multiplicity is as consequential as the shift from concrete to formal operational reasoning. The differences observed here gain weight when combined with other research documenting differences between gifted and typically developing students in characteristics such as intensity and overexcitability (Kitano, 2010), Openness to Experience (McCrae et al., 2002), and Intuition (Sak, 2004).

The results reported here, in combination with the wealth of research on personal epistemology, have implications for programming for gifted students. Advanced levels of epistemology are desirable among intellectual leaders and innovators; therefore, the long-term goals for gifted programs should include objectives that encourage progression from one stage to the next. The developmental path of personal epistemology could be considered a scope-and-sequence of sorts to move students from simple to sophisticated reasoning (Gallagher, 1998). Summarizing research findings on learning environment and epistemology, Hofer (2001) suggested that methods that encourage epistemological growth, including curriculum based on ill-structured problems, authentic research experiences, and discussion of the nature of knowledge. Research already supports the use of a familiar model, problem-based learning (PBL), to encourage epistemological development, along with more general strategies associated with inquiry (Belland, Gu, Kim, Turner, & Weiss, 2015; Hofer, 2004; King & Kitchener, 2002). Further research based on other models of curriculum and instruction would probably expand the list. Given the different learning needs associated with each stage of epistemological development, these findings provide further evidence that gifted students require qualitatively different learning experiences grounded in abstract, complex, and inquiry-based learning activities (Gallagher, 2006, 2008) Most of all, continued conversation about the implications of personal epistemology for gifted education will provide a venue for considering how to create a new generation of thinkers who, like Annie Dillard, find opportunity, and also beauty, in complexity.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author received no financial support for the research and/or authorship of this article.

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