The Relationship Between Implicit Theories of Intelligence, Epistemological Beliefs, and the Teaching Practices of In-service Teachers: A Mixed Methods Study

Cory Michael Epler

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Thomas W. Broyles, Chair
Donna M. Moore
Terry M. Wildman
Gary E. Skaggs

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ABSTRACT

The intent of this two-phase, sequential explanatory mixed methods study was to examine the role teachers’ beliefs play when making instructional decisions. The population included in-service teachers representing four Career and Technical Education disciplines located within the commonwealth of Virginia. Using a stratified random sample, 622 teachers were selected for the quantitative strand, and employing a system of four contacts, quantitative data were collected from 292 participants. Dweck’s Theories of Intelligence scale assessed the nature of in-service teachers’ beliefs about intelligence, and the Epistemic Belief Inventory was used to measure their epistemological beliefs. Finally, the participants rated their use of teacher-centered and student-centered teaching methods. In the second phase, qualitative data were collected from nine participants to further understand how in-service teachers’ beliefs are related to the teaching practices they use. The quantitative and qualitative data were combined to determine if the descriptions of teaching method used, beliefs about intelligence, and epistemological beliefs aligned with the outcomes of the quantitative questionnaire.

Significant correlations existed between the Theories of Intelligence scale and the Epistemic Belief Inventory. A significant positive relationship existed between the Epistemic Beliefs Inventory and the overall teaching practices score, indicating in-service teachers’ advanced epistemological beliefs are related to the use of student-centered teaching practices. A regression analysis indicated that teaching discipline,
epistemological beliefs, teaching experience, and highest level of education
completed predicted the teaching practices in-service teachers’ select. The qualitative
data supported the claim that beliefs about intelligence and epistemological beliefs
influence teaching practices. Six themes emerged from the qualitative data, and the
themes were used as a framework for organizing the findings.

The researcher acknowledges that teachers possess a variety of beliefs, and those
beliefs influence how teachers teach. The researcher recommends that teacher educators
attempt to identify the beliefs pre-service teachers hold, and if modifications of beliefs
are needed, facilitate interventions to modify those beliefs. While some have labeled the
direct relationship between teacher beliefs and teaching practices as “messy”, the
evidence indicates the two, are in fact, related.
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Beliefs Regarding Intelligence and Epistemological Beliefs 

Description of Teaching Methods 

Low Participants 

Beliefs Regarding Intelligence and Epistemological Beliefs 

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Chapter 1

Introduction

Until quite recently, human thinking and learning has remained somewhat of an elusive construct. Today, the world has access to an extraordinary amount of scientific work on the mind and brain, the processes of thinking and learning, and the aspects of learning related to neuroscience (Bransford, Brown, & Cocking, 2000). In fact, the science of learning ensures that learners “seek to understand complex subject matter and are better prepared to transfer what they have learned to new problems and settings” (Bransford et al., 2000, p. 13). While most learning theorists agree that learning results in a behavioral change, there remains disagreement on what causes the change. Originally, behavioral theorists argued that learning occurs in terms of environmental events and that a learner’s mental processes are not necessary to explain new behaviors. However in the 1950s an important shift occurred in psychological theories related to human learning. While early beliefs rested on conditioning and behaviorist theories, a new perspective on learning included an exploration of learner’s cognitions. Suddenly, learners were not viewed as passive recipients of information, but rather as active seekers and processors of information, a process that occurs mentally (Shunk, 2006). The development of cognitive learning theories shifted focus to the “attention, perception, encoding, storage, and retrieval of knowledge” (Shunk, 2006, p. 180). Even so, missing from many cognitive descriptions of learning is a consideration of how learning is influenced by an individual’s beliefs. According to Pajares (1992):

As such, belief is viewed as knowledge of a sort. All human perception is influenced by the totality of this generic knowledge structure – schemata, constructs, information, beliefs – but the structure itself is an unreliable guide to
the nature of reality because beliefs influence how individuals characterize phenomena, make sense of the world, and estimate covariation. (p. 310)

Beliefs influence a variety of cognitive processes and, ultimately, learning (Muis & Foy, 2010). That being said, it is necessary to define the term belief. Rokeach (1968) defines beliefs as “any simple proposition, conscious or unconscious, inferred from what a person says or does” (p. 113). Because beliefs reside in an individual’s mind, they are often referred to as implicit beliefs. This creates challenges when trying to articulate and examine one’s beliefs (Dweck, 2000; Garcia-Cepero & McCoach, 2009). Examples of implicit beliefs include beliefs about ability, morality, knowledge, and oneself (Muis & Foy, 2010). Rokeach (1968) described beliefs as having a cognitive component (represents knowledge), an affective component (capable of creating emotion), and a behavioral component (activated when action is required). It is from this description that Parajes (1992) pointed out that “beliefs cannot be directly observed or measured but must be inferred from what people say, intend, and do” (p. 314).

In an educational context, beliefs play an important role in the teaching and learning process. Students hold a variety of implicit beliefs about learning, and these beliefs ultimately determine how information is interpreted, evaluated, and understood (Hofer, 2001). Specifically, previous researchers have shown that a student’s beliefs about themselves and their competence effects their motivation, self-efficacy, and even their classroom achievement (Leondari & Gialamas, 2002). Students also possess implicit beliefs about intelligence. These beliefs play an important role in the learning process; therefore, researchers continue to explore how implicit beliefs about intelligence influences student learning. Students’ beliefs about intelligence influences the type of
learning goals they set, the amount of effort they exert in learning situations, and the frequency of self-regulatory and motivational strategies used during problem solving (Blackwell, Trzesniewski, & Dweck, 2007; Dweck, 2000; Dweck & Molden, 2005; Leggett & Dweck, 1986). Armed with an understanding of a student’s implicit beliefs about intelligence, researchers can begin describing key influencers of student motivation, achievement, and learning.

Just as students hold implicit beliefs, teachers also hold a variety of implicit beliefs. Teachers’ beliefs are teachers’ implicit assumptions about their work, student learning, students, subject matter, and even their roles and responsibilities as a teacher (Clark, 1988; Kagan, 1992; Pajares, 1992). These beliefs affect “perception, interpretation, and judgment” and impact the judgments and actions teachers make every day (Clark, 1988, p. 7). Examining teacher beliefs provides a means for understanding the relationship between beliefs and student outcomes, and it also provides insight into teachers’ classroom practices and pedagogy (Kagan, 1992; Muis & Foy, 2010). In fact, Kagan (1992) reported, “a teacher’s beliefs usually reflect the actual nature of the instruction the teacher provides to students” (p. 73). Similar to their students, teachers also hold implicit beliefs about intelligence. Specifically, teachers hold beliefs about the nature of their students’ intelligence. Researchers have illustrated the variation of teachers’ beliefs about intelligence, and their work supports the claim that a teacher’s belief about intelligence influences planning, teaching, and the type of assessment strategies used (Deemer, 2004; Garcia-Cepero & McCoach, 2009).

In accordance with their beliefs about intelligence, individuals also possess beliefs about knowledge and knowing. Known as epistemological beliefs, these beliefs relate to
how individuals come to know, and because these beliefs are activated during learning, they influence cognitive processing (Hofer & Pintrich, 1997). Research related to epistemological beliefs is rooted in the work of William Perry. Perry’s work suggests that students initially view knowledge as simple, unchanging facts that are handed down by authority, but over time this simplistic view transforms into a conception of knowledge as complex, tentative concepts based on judgment and reasoning (Braten & Stromso, 2005; Hofer & Pintrich, 1997; Perry, 1999). More recently, Schommer-Aikins (2002) (also referenced as Schommer) proposed a multidimensional conception of epistemological beliefs including five dimensions. Using Perry’s work as a guide, Schommer-Aikins’ conception includes beliefs about the structure of knowledge, the stability of knowledge, the source of knowledge, the speed of learning, and the ability to learn (Schommer-Aikins, 2002; Schommer-Aikins & Easter, 2006).

In addition to identifying individual epistemological beliefs, researchers are challenged with describing how epistemological beliefs influence aspects of learning (Schommer-Aikins, 2002). Muis and Foy (2010) pointed out that epistemological beliefs often function as an implicit belief. The idea that epistemological beliefs function as an implicit belief presents an important educational implication because implicit beliefs influence a variety of learning processes. A student’s epistemological beliefs influence motivational constructs, the depth in which they process information, the type of learning goals set, and their use of learning strategies (Chan, 2003; Dahl, Bals, & Turi, 2005; Kizilgunes, Tekkaya, & Sungur, 2009; Ravindran, Greene, & DeBacker, 2005). Additionally, teachers’ epistemological beliefs influence how they approach teaching (Brownlee, Purdie, & Boulten-Lewis, 2001; Pajares, 1992; Tickle, Brownlee, & Nailon,
2005). Specifically, there is a significant relationship between a teacher’s epistemological beliefs and their tendency to adopt specific pedagogical practices (Chan, 2003; Luft & Roehrig, 2007; Maggioni & Parkinson, 2008; Pajares, 1992). Clearly, epistemological beliefs carry important implications for students and teachers alike.

Furthermore, individuals draw upon their beliefs during information processing, decision-making, and problem solving (Munby, 1982). Mayer (1983) pointed out that “thinking [and decision-making] depends on how a person represents the world and in what way a person can manipulate or act upon this internal representation” (p. 260). In other words, an individual’s beliefs influence information processing and decision-making. In fact, an individual’s beliefs often act as a schema within the decision-making process. Schema, previously held structures that help learners organize information into meaningful and useful systems, assist learners as they organize information, encode information, and attempt to characterize their knowledge (Schunk, 2006). Because what a person knows and believes influences decision-making, it is important to examine the role beliefs play within the problem solving and decision-making processes (Braten & Stromoso, 2005; Downing, Kwong, Chan, Lam, & Downing, 2009). Additionally, teachers utilize past experiences and schema when making instructional decisions. In fact, they often develop their solutions based upon their understanding of the circumstances, an understanding that is rooted in their belief system (Decker & Rimm-Kaufman, 2008).

Because teachers make decisions and solve problems both during planning and while teaching, there remains a need to further explore the role teachers’ beliefs play when making planning and interactive teaching decisions. With this in mind, teachers
must possess an understanding of their thinking and beliefs and how they utilize such thinking and beliefs when making decisions (Paris & Winograd, 1998). Shavelson and Stern (1981) reported that teachers’ behaviors are guided by their thoughts, judgments, and beliefs, and upon an examination of teaching behaviors, researchers must identify how teacher’s thoughts and beliefs are carried into action. Artzt & Armour-Thomas (1998) stated that the decisions a teacher faces in planning and teaching are directly influenced by their ability to think about their own thinking (metacognition). Clearly, research that connects teacher thinking with problem solving and decision-making can provide practitioners with insight to practices that will influence student learning (Munby, 1982).

**Conceptual Framework, Problem Statement, and Need for the Study**

**Conceptual Framework.** The conceptual framework for this study was guided by relevant theoretical and empirical research. Generally speaking, beliefs are indicators of the decisions individuals make in their lives and are a legitimate study in diverse fields including medicine, law, sociology, and psychology (Pajares, 1992). Beliefs influence many aspects within teaching and learning; therefore, researchers continue to explore how pre-service and in-service teachers’ beliefs are formed. Pajares (1992) stated that teachers’ beliefs are be “formed by chance, an intense experience, or a succession of events” (p. 309). Nespor (1987) contended that belief formation is rooted in cognitive psychology, and that an individual’s beliefs reside in episodic memory. In an educational context, previous teachers and educational experiences are noted influencers of pre-service and in-service teachers’ beliefs (Decker & Rimm-Kaufman, 2008; Nespor, 1987; Pajares, 1992).
The beliefs held by teachers vary, and they include beliefs about their students, their subject matter, and their roles and responsibilities as a teacher. These beliefs play an important role in how a teacher teaches. Because behaviors are directly influenced by an individual’s beliefs, beliefs about teaching ultimately influence how a teacher plans and teaches. More specifically, teachers possess beliefs about the nature of intelligence, and they also hold beliefs about knowing and learning. These beliefs influence the planning, teaching, and assessment strategies pre-service and in-service teachers utilize (Garcia-Cepero & McCoach, 2009; Kagan, 1992; Muis & Foy, 2010). With this in mind, the researcher’s conceptual model examines the role beliefs about intelligence, knowing, and learning play in the selection of teaching practices and strategies. Figure 1 provides a visual model of the conceptual framework for this study. Within the model, “A, B, and C” represent the relationships of interest.

Figure 1. A visual model of the conceptual framework
Problem statement. The research presented in this study investigated how in-service teachers’ implicit theories of intelligence and epistemological beliefs influence their preference for eight teaching methods identified as either student-centered or teacher-centered (demonstrations, experiments, group projects/assignments, independent assignments, lecture, role-play, small group/partner discussion, and teacher-led discussion). Previous researchers have demonstrated that beliefs reflect the actual nature of the instructional strategies a teacher employs while teaching (Chan, 2003; Kagan, 1992; Luft & Roehrig, 2007; Maggioni & Parkinson, 2008; Muis & Foy, 2010; Pajares, 1992; Tickle et al., 2005). Therefore, it is necessary to identify teachers’ beliefs and how those beliefs influence instructional decisions, their students’ motivation, and, ultimately, student achievement (Muis & Foy, 2010). Additionally, Clark and Peterson (1986) emphasized that the process of teaching involves teachers’ thought processes, teachers’ actions and the observable effects. Teaching requires both cognitive and metacognitive processes as teachers make instructional and interactive teaching decisions. These processes play important roles in the regulation and application of the skills that are required for successful decision-making. With that in mind, attention to teacher cognitions and actions will continue to impact what is known about effective teaching (Fang, 1996).

The following research builds upon what is currently known about how beliefs influence teachers’ planning processes. As educational researchers continue to explore the influence of teachers’ pedagogy on student achievement, the necessity of this research is paramount. Formal learning environments possess a myriad of interactions that ultimately influence student learning, and this research will further clarify how teachers’
beliefs influence their pedagogical decisions (Schuh, 2004). Currently, it is known that beliefs about intelligence as well as epistemological beliefs influence teachers’ planning and pedagogy, yet little is known about the direct interaction between those components (Savasci-Acikalin, 2009; Tickle et al., 2005). Therefore, educational researchers continue to “advocate the need for closer examination and direct study of the relationship between teacher beliefs and educational practices” (Savasci-Acikalin, 2009, p. 5).

In accordance with previous accounts that naïve beliefs result in a “transmissive” approach to teaching (Brownlee, 2001), this research will shed light on how teachers’ beliefs influence their preference for teaching methods identified as either student-centered or teacher-centered. Instructional methods described as student-centered allow the student to draw upon their own experiences in which the role of the teacher is a facilitator (Cheng, Chan, Tang, & Cheng, 2009; Schuh, 2004). On the other hand, teacher-centered practices typically reflect a one-way transmission process where information is transmitted to the learner with limited interactive processes (Cheng et al., 2009). Characteristics of teacher-centered instruction include more teacher talk and questions than student talk and questions and more whole group instruction (Schuh, 2004). Finally, the results of this study can help educational researchers, teacher educators, and school administrators determine the effectiveness of interventions designed to facilitate the change of teachers’ beliefs. Because an individual’s beliefs vary in strength and can be resistant to change, Mansour (2009) pointed out that the possible effects of teachers’ beliefs on teaching practices creates a crucial question: “how can teachers’ beliefs be affected or changed?” (p. 37).
Need for study. Influenced by advances in cognitive psychology and research on human decision-making, educational researchers continue examining how students’ beliefs and cognitions influence their ability to make decisions and solve problems (Fang, 1996). While the majority of the research in this area has been conducted with students, recently researchers have shifted their focus and demonstrated an unprecedented interest in examining pre-service and in-service teachers’ beliefs, thinking, planning and decision-making (Fang, 1996; Fives & Buehl, 2010). Because teachers are professionals that make decisions within a complex and uncertain environment, their thoughts, beliefs, and judgments influence the decisions they make while teaching (Fang, 1996; Shavelson & Stern, 1981). Research that examines teachers’ thoughts, beliefs, and judgments provides a “sound basis for educating teachers and implementing educational innovations” (Shavelson & Stern, 1981, pp. 455-456). Pintrich (1990) also noted that additional research using advanced statistical methods (e.g. structural equation modeling) should be used to make stronger causal claims between teachers’ beliefs and behaviors.

Because human thinking is influenced by schema and currently held beliefs, the significance of teacher beliefs within teacher thinking and decision making cannot be overemphasized (Munby, 1982). Yet, according to Munby, it seems that “these are inadequately treated in current research” (1982, p. 216). In fact, Shavelson and Stern (1981) reported that teachers’ beliefs about education and teaching guide often guide the decision-making process. Teacher beliefs are an important part of how teachers “perceive, process, and act upon information in the classroom,” and they guide the thinking and reflective processes used to make instructional decisions (Fang, 1996, p. 49). In fact, investigations into the relationship between a teacher’s beliefs and their
behaviors have suggested that beliefs influence the teaching methods a teacher employs (Tickle et al., 2005). With that being said, it is surprising that little attention has been paid to beliefs in research on teacher thinking and decision making, in light of their obvious importance (Munby, 1982).

The relationship between teacher beliefs and practice has been widely discussed in regards to a variety of disciplines. Researchers have explored the beliefs of pre-service and in-service educators in the areas of science, elementary education, math, language, and literacy and reading (Cronin-Jones, 1991; Kagan, 1992; Li, Chen, & Kulm, 2009; Mansour, 2009; Savasci-Acikalin, 2009; Tsai, 2006; Wilcox-Herzog, 2002). Notably missing from the literature are the descriptions of Career and Technical Education (CTE) teachers’ beliefs and the influence CTE teachers’ beliefs have on their approach to teaching and their CTE program.

Purpose of the Study and Research Questions

The intent of this study was to examine the role teachers’ beliefs play in making instructional decisions. The goal of this two-phase, sequential explanatory mixed methods study (Creswell & Plano-Clark, 2011; Ivankova, Creswell, & Stick, 2006) was to obtain quantitative results and then select participants for follow-up interviews to further clarify the results. In the first phase, quantitative research questions addressed the relationship between in-service teachers’ beliefs about intelligence and epistemological beliefs in relation to eight teaching methods the teachers’ might utilize in the classroom. In the second phase, qualitative semi-structured interviews (Creswell, 2007; Seidman, 2006) were conducted to explore how in-service teachers describe the role their beliefs
played when making planning decisions. Specifically, the following research questions were clearly outlined and guided the study:

1. What are the relationships between in-service teachers’ beliefs about intelligence and epistemological beliefs in relationship to the teaching methods they use?
   a. What is the relationship, if any, of in-service teachers’ beliefs about intelligence to their epistemological beliefs?
   b. How are in-service teachers’ beliefs about intelligence related to the teaching methods they use?
   c. How are in-service teachers’ epistemological beliefs related to the teaching methods they use?

2. How do in-service teachers describe their preference for the teaching methods they commonly use, their beliefs about intelligence, and their epistemological beliefs?

3. How do the descriptions of teaching method preferences, beliefs about intelligence, and epistemological beliefs align with the outcomes of a quantitative measurement within a systematically selected sample of in-service teachers?

**Personal Epistemology**

I am compelled to describe the epistemological and ontological assumptions that guide my research. An examination of my beliefs begins with a consideration of the information-processing process in relationship to pragmatism. Pragmatists attempt to understand the world by taking into account the subjective nature of meaning which
results from a relationship between the senses and the mind (Duemer & Zebidi, 2009). I believe that information processing begins as information enters the working memory through the senses, where it remains for a short period of time before it is selected for further processing. If the information is attended to, it is transferred to the working memory. Next, there is an attempt to locate schema (or schemata) that will assist with organization, encoding, and the construction of a coherent worldview that will eventually be transferred into long-term memory.

The pragmatic belief that knowledge is a result of cognitive processes resonates with me. I believe that knowledge comes into being as the mind interprets data and organizes it into meaningful constructs and relationships. I believe an understanding of knowledge depends upon currently held schema, and that if relevant schemata are not present, an individual will attempt to adapt and assimilate new knowledge with previously held information. This is a natural process within human inquiry. Humans are constantly trying out methods in order to see what works, what solves problems, and what helps them to survive (Johnson & Onwuegbuzie, 2004).

John Dewey is recognized as one of the most famous pragmatists. Johnson & Onwuegbuzie (2004) pointed out that Dewey emphasized that the “methods of problem solving ought to be tied to the problem itself, rather than to competing paradigms” (p. 165). As a researcher, I agree with this pragmatic view. Pragmatism focuses on the outcomes of the research, and, instead of a focus on methods, pragmatists identify the most important aspect of the research as the problem being studied and the questions asked about the problem (Creswell, 2007; Pole 2007). In fact, I believe that decisions about research methodology depend upon the research question itself.
An important aspect of pragmatism is how individuals form their beliefs about the world and how conclusions regarding the nature of reality are developed (Duemer & Zebidi, 2009). Pragmatists emphasize that experience is expressed holistically, and that the meaning from experience is communicated contextually. Furthermore, pragmatists’ epistemological beliefs identify the mind as active and the search for knowledge as continual. The mind processes and assimilates data with past experiences. In fact, some pragmatists point out “it is impossible for us to divorce our cognitive processes consisting of our past experiences from how we see the world” (Duemer & Zebidi, 2009, p. 164). Knowledge is a result of cognitive processes, and making meaning of the world is the result of the relationship between the senses and the mind. As a researcher this carries great implications, as I believe that human experiences cannot be understood without taking into account the nature of meaning.

Definitions

This section includes definitions of frequently used terms used throughout this dissertation. The definitions are provided from existing literature.

Career and Technical Education (CTE). The term Career and Technical Education (CTE) refers to “organized educational activities that offer a sequence of courses that provides individuals with coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in current or emerging professions” (Carl D. Perkins Career and Technical Education Improvement Act, 2006, p. 4). In Virginia, CTE programs include Agricultural Education, Business and Information Technology, Family
and Consumer Sciences, Health and Medical Sciences, Marketing, Technology, and Trade and Industrial (Virginia Department of Education, 2010b).

**Entity theory of intelligence.** When an individual endorses an entity theory of intelligence, they believe that intelligence is fixed, concrete, and unchangeable (Dweck, 2000).

**Epistemology.** Epistemology is “concerned with the origins, nature, limits, methods, and justification of human knowledge” (Hofer, 2002, p. 4).

**Epistemological beliefs.** These beliefs focus on how individuals come to know, their beliefs about knowing, how those beliefs are a part of, and influence, cognitive processes (Hofer & Pintrich, 1997).

**Implicit theories.** Implicit theories are the conceptions, ideas, or theories that reside within an individual’s mind (Garcia-Cepero & McCoach, 2009). One specific implicit theory that individuals hold is their implicit theory of intelligence.

**Implicit theories of intelligence.** These implicit beliefs are directly related to an individual’s belief about their own intelligence and how those beliefs influence behavior (Dweck, 2000; Garcia-Cepero & McCoach, 2009).

**Incremental theory of intelligence.** When possessing an incremental theory of intelligence, an individual views intelligence as malleable, changeable, and able to be cultivated (Dweck, 2000).

**Individualized Education Plan (IEP).** An IEP is a plan that is developed for the services and placement of students with disabilities who need special education. The creation of an IEP for a student is the local school district’s responsibility (Virginia Department of Education, 2010a).
**In-service teachers.** In-service teachers are individuals that are currently employed as a teacher in formal school settings.

**Interactive decision-making.** These decisions “refer to the decisions teachers make while interacting with their students” (Borko & Shavelson, 1990, p. 325).

**Metacognition.** Metacognition refers to second order cognitions, thoughts about thoughts, and the knowledge and regulation of cognition (Metallidou, 2008; Pintrich, 2002).

**Standards of Learning (SOL).** The Standards of Learning (SOLs) are Virginia’s rigorous academic standards. They are measured annually through standardized assessments in English, math, science, and history/social science (Virginia Department of Education, 2010c).

**Student-centered teaching methods.** Student-centered teaching methods shift the focus from the teacher to the student and their learning. These methods allow learners to draw on their own experiences and interpretations as part of the learning process (Schuh, 2004).

**Teacher-centered teaching methods.** These teaching methods are often aligned with a “transmission” approach to teaching, where the information is moved from the teacher to the learner (Schuh, 2004, p. 834).
Chapter 2

Review of Literature

Chapter Two contains conceptual, theoretical, and empirical research identified by the researcher as relevant to the study. Chapter Two includes information related to the following areas: (1) implicit theories of intelligence, (2) epistemological beliefs, and (3) the influence of teachers’ beliefs on instructional decision-making.

Implicit Theories of Intelligence. Some of the most influential variables of student learning are associated with the individual characteristics of each learner. These characteristics include social, behavioral, motivational, cognitive, and affective characteristics, and among these individual characteristics resides an important educational construct: intelligence (Wang, Haertel, & Walberg, 1993). Educational researchers continue to emphasize their interest in intelligence as an important factor within the learning process, and intelligence theories are one of the most heavily researched psychological constructs in the past one hundred years (Sternberg, Conway, Kentron, & Berstein, 1981). Even so, the majority of research on intelligence theories focuses on explicit intelligence. “Explicit theories are constructions of psychologists or other scientists that are based or at least tested on data collected from people performing tasks presumed to measure intelligence functioning” (Sternberg et al., 1981, p. 37). The administration of a mental ability test and subsequent analysis of data is one example of a research study designed to examine explicit theories of intelligence (Sternberg et al., 1981).

On the other hand, a smaller research agenda has been devoted to implicit theories of intelligence. Unlike explicit theories, implicit theories are the conceptions, ideas, or theories that reside in an individual’s mind (Garcia-Cepero & McCoach, 2009). The
conceptions are not created and already exist in an individual’s mind. Implicit theories of intelligence, also known as self-theories, are directly related to an individual’s belief about their own intelligence and how those beliefs are manifested in behavior (Dweck, 2000; Garcia-Cepero & McCoach, 2009). An understanding of an individual’s implicit theory of intelligence is important because, quite often, these beliefs determine an individual’s attitudes and behaviors (Garcia-Cepero & McCoach, 2009).

The concept of intelligence is quite controversial. There remains considerable disagreement regarding the definition of intelligence and how it should be measured. In addition, another controversial facet of the implicit theories of intelligence is the issue of malleability (Aronson, Fried, & Good, 2002). Can intelligence be changed or is it fixed? Some individuals believe that intelligence is a fixed trait. Identified as an “entity theory” of intelligence, individuals with this belief view intelligence as a fixed, concrete, internal entity that cannot be changed (Ahmavaara & Houston, 2007; Blackwell, Trzesniewski, & Dweck, 2007; Dweck, 2000). In an educational context, a student with this belief deems they possess a certain amount of intelligence, and they cannot change that amount. On the other hand, some individuals view intelligence as a trait that can be changed through cultivation and effort. This is known as an “incremental theory” of intelligence. Individuals with an incremental theory of intelligence identify intelligence as malleable. In other words, they believe that their intelligence is not fixed and can be increased, improved, or changed through one’s efforts (Blackwell et al., 2007; Dweck, 2000).

The manner in which an individual views their own intelligence (as either fixed or malleable) carries important educational implications. Specifically, a fixed or malleable view of intelligence is identified as a predictor of motivational variables, often
influencing the type of learning goals an individual sets (Dweck & Molden, 2005). Students who endorse an entity theory of intelligence are more likely to set performance goals. A performance goal “is about winning positive judgments of your competence and avoiding negative ones” (Dweck, 2000, p. 15). Students with performance goals are more concerned about their current level of intelligence. They want to look smart or avoid a situation where they would not look smart. Conversely, students that view intelligence as malleable tend to set and pursue educational goals that focus on learning and development. The idea that intelligence is malleable fosters a desire to become smarter and promotes mastery goals. A mastery goal is the goal of increasing competence, and reflects a “desire to learn new skills, master new tasks, or understand new things—a desire to get smarter” (Dweck, 2000, p. 15). “Holding an incremental theory of intelligence (vs. an entity theory of intelligence) is associated with holding stronger learning goals” (Dweck & Molden, 2005, p. 124). Dweck (2000) also emphasized that learners who obsess about their intelligence often view intelligence as a fixed, concrete entity, while students who focus on learning and development tend to view their intelligence as malleable. Students who believe their intelligence can be developed are more likely to set learning goals, whereas students who believe their intelligence is fixed tend to validate their intelligence through their performance.

A method commonly used to determine an individual’s implicit theory of intelligence is Dweck’s Implicit Theories of Intelligence Scale. The original version developed by Dweck and Henderson (1989) used only entity theory items to assess the nature of one’s beliefs about intelligence. Dweck (2000) points out that, initially, only entity theory items were used because the original incremental theory items seemed too
appealing and drew an excessive amount of agreement. The original scale consisted of three items representing entity theory statements (e.g., “You have a certain amount of intelligence, and you really can’t do much to change it”), and respondents indicated their agreement with the statements using a six-point Likert scale (1=strongly disagree, 6=strongly agree). A higher score initially represented an entity view of intelligence, but later the items were recoded so that a higher score represented an incremental theory of intelligence (Deemer, 2004). Validation studies supported the use of the scale, and Cronbach’s Alpha values range from 0.94 to 0.98, indicating high internal consistency (Dweck, 2000). Furthermore, the test-retest reliability of the original version was reported as 0.80 (Deemer, 2004). More recently, incremental items were included, leading to the development of a six to eight-item scale (Dweck, 2000). The new scale includes both entity theory (e.g., “Your intelligence is something that you can’t change very much”) and incremental theory (e.g., “No matter who you are, you can change your intelligence a lot”) statements. The new incremental theory statements have strong negative correlations (between -0.69 and -0.86) with the original entity theory statements, indicating that disagreement with the entity items does represent agreement with the incremental items (Dweck, 2000; Levy, Stroessner, & Dweck, 1998). The incremental theory items are reverse coded and low scores represent entity theorists and high scores represent incremental theorists.

To illustrate the influence theories of intelligence have on learning goals, Bandura and Dweck (as cited in Dweck, 2000) measured fifth and sixth grade students’ theories of intelligence before asking them to choose among three tasks. The first two tasks offered performance goals (a task “easy enough so you won’t make mistakes” and a task “you are
good at but hard enough to show you are smart‖). The third task offered a learning goal (―hard, new, and different, but you might learn something new and useful‖). They found a significant relationship between students’ theories of intelligence and their goal choice. Students who held an entity theory of intelligence were more likely to select tasks associated with performance goals, and if they held an incremental view of intelligence, they were more likely to select tasks connected with learning goals (Dweck, 2000). Furthermore, Dweck and Leggett (1988) reported similar findings with eighth grade students. Over 80% of students with an entity theory of intelligence chose a task that presented a performance goal, while the majority of incremental theorists (over 60%) chose the learning goal task despite its challenge and risk. Again, the belief in fixed intelligence seemed to lead students towards performance goals, while a belief in malleable intelligence oriented students towards learning goals. More simply put, if an individual believes that intelligence can be developed, they are more likely to be motivated by learning. If an individual believes their intelligence is fixed, their motivation is fed by a desire to validate their performance rather than learning (Dweck, 2000).

Researchers also continue to examine how intelligence beliefs influence effort. Theories of intelligence often shape a student’s response to academic challenges and effort (Blackwell et al., 2007). An entity theory of intelligence encourages the measurement of ability and, when faced with challenging learning situations, can cause a learner to give up or withdraw. On the other hand, students with incremental beliefs are more likely to use effort to overcome difficulty (Blackwell et al., 2007). For example, Legget and Dweck (1986) measured eighth-graders theories of intelligence, goals, and
effort. After measuring the students’ theories of intelligence and goals, interviews were conducted to determine how effort relates to beliefs about intelligence. It was concluded that students holding entity beliefs were more likely to believe that exerting effort signifies low ability. In other words, if a student has to work hard at an academic task, it means they are not good at it. If a student is good at something, effort is not required. Students with incremental intelligence beliefs had exactly the opposite viewpoint. They described effort as a way an individual uses their ability and to reach their full potential (Leggett & Dweck, 1986). These results supported the claim that an individual’s beliefs about intelligence influence the effort they exert in educational settings. Additionally, in their longitudinal study, Blackwell et al. (2007) followed approximately 370 seventh graders during their transition from seventh to ninth grade. Their research confirmed that students who endorse an incremental theory of intelligence also have stronger learning goals, hold positive beliefs about effort, and are more likely to employ effort-based strategies in response to failure.

Implicit theories of intelligence also influence key components of motivation and self-regulation (Blackwell et al., 2007; Dweck, 2000; Dweck & Leggett, 1988). More specifically, incremental theorists tend to exhibit positive motivational beliefs and demonstrate mastery-oriented behaviors, while entity theorists may avoid challenging tasks and react negatively when difficulties in learning occur (Braten & Stromso, 2005). With this in mind, a student who endorses an incremental theory of intelligence could position himself or herself to be more successful in educational settings. In fact, in some cases, theories of intelligence actually predicted school achievement. Henderson and Dweck (1990) reported that students who endorse an incremental view of intelligence
earned significantly higher grades, when controlling for prior achievement. Additionally, Good, Aronson, and Inzlicht (2003) hypothesized that of views of intelligence would impact standardized test performance. A total of 138 seventh grade students participated in the study, and it was concluded that beliefs about intelligence did influence the student’s standardized test scores. Students who believed that intelligence was malleable outperformed those who did not on math and reading assessments (Good et al., 2003). The research presented by Good et al. (2003) supported the positive benefits of holding an incremental theory of intelligence. Dweck (2000) also supported the idea that achievement is influenced by an individual’s beliefs about intelligence. When students enter an academic setting with a belief in fixed intelligence, they are “set up for self-doubt, anxiety, and drops in achievement” (Dweck, 2000, p. 32). The incremental theory creates a desire for challenge and mastery. The benefits associated with an incremental theory clearly outweigh those associated with an entity theory.

As they describe the benefits associated with an incremental theory of intelligence, researchers have begun to explore the possibility of enhancing motivation to learn by modifying students’ beliefs about their intelligence. In 1992, Bergen influenced college students’ theories of intelligence by having students read two different articles presenting scientific research about the brain and learning (as cited in Dweck, 2000). Both articles described the abilities of a gifted 18-month old child. However, the entity theory article described the child’s abilities as a result of fixed, innate intelligence. The incremental theory article described the child’s abilities as a result of the surrounding challenging environment. Bergen concluded that the articles had an influence on students’ theories of intelligence and ultimately impacted their persistence when
confronted with challenge (Dweck, 2000). In a more extensive study, Blackwell et al. (2007) explored the effects of teaching students an incremental theory of intelligence. It was hypothesized that teaching students to think of intelligence as malleable should promote positive motivational behaviors and improve effort in the classroom. A total of 91 seventh-graders participated in the intervention study. The experimental group received information designed to facilitate an incremental theory of intelligence while the control group did not. After an eight-week period, it was determined that the experimental group showed a significantly greater change in their beliefs about intelligence based upon pre-test and post-test data. The findings presented by Blackwell et al. and others support the idea that teaching a malleable theory of intelligence can be successful in helping students change their beliefs about intelligence, which ultimately enhances motivation (Aronson et al., 2002; Good et al. 2003).

The majority of research examining implicit theories of intelligence has been connected with student’s beliefs and the impact on student achievement, motivation, and outcomes (Garcia-Cepero & McCoach, 2009). However, it is possible that a teacher’s implicit beliefs about intelligence impacts how they teach. Yet, there remains a much smaller body of research examining the relationship between teacher beliefs and their instructional practices (Deemer, 2004). According to Braten and Stromso (2005), the influence of beliefs on instruction is essentially unanswered. Therefore, the need for researchers to explore the relationship between teachers’ beliefs and their instructional approaches is vital (Clark, 1988; Gordon, Dembo, & Hocevar, 2007; Hofer, 2001; Munby, 1982). “The beliefs teachers hold influence their perceptions and judgments, which, in turn affect their behaviors in the classroom, or that understanding the belief
structure of teachers and teacher candidates is essential to improving their professional preparation and teaching practices” (Pajares, 1992, p. 307). Pajares’ statement continues to influence the research relating to teacher beliefs.

**Epistemological Beliefs.** The process of making sense of the world begins at a very young age, and this initial understanding has a powerful impact on an individual’s representation of concepts and information (Bransford, Brown, & Cocking, 2000). Because initial understanding plays a central role in the learning process, there is an increased interest in the role beliefs about knowledge and knowing play in the learning process. Known as personal epistemology, this area of study is “concerned with the origin, nature, limits, methods, and justification of human knowledge” (Hofer, 2002, p. 4). Research geared towards epistemological development and epistemological beliefs is an important area that many educational researchers and psychologists continue to pursue (Hofer, 2001; Hofer & Pintrich, 1997). Because beliefs about knowledge and knowing influence learning and can even enhance teaching effectiveness, Hofer points out that the study of personal epistemology as a construct with educational implications is at a critical point in time (Hofer, 2001).

Within the broad context of personal epistemology, reside an individual’s epistemological beliefs. Epistemological beliefs focus on the manner in which individuals come to know, their beliefs about knowing, and how those beliefs are a part of and influence cognitive processes (Hofer & Pintrich, 1997). These beliefs are activated as learners engage in learning and knowing. Hofer (2002) offers the following examples to illustrate how epistemological beliefs influence learning and knowing. “As we read the morning paper, we make judgments about the credibility of the claims in the
particular article. In our professional lives, we confront the learning of a new skill and make determination about their particular value” (Hofer, 2002, p. 3). In a more formal context, epistemological beliefs play an important role in most academic experiences. Hofer clarifies how personal epistemology relates to learning and education in general. “If epistemology is developmental and development is the aim of education, the goal of education is to foster epistemological development” (Hofer, 2001, p. 367). Furthermore, because epistemological thinking is a critical component of lifelong learning both in and outside of a classroom, epistemological beliefs impact the manner in which individuals “resolve competing knowledge claims, evaluate new information, and make fundamental decisions that affect their own lives and the lives of others” (Hofer, 2001, p. 354).

Much of the existing research on epistemological beliefs can be traced back to the seminal work of William Perry. Perry’s work began as documentation of undergraduate students’ college experiences at Harvard and Radcliffe (Perry, 1999). The Harvard Bureau of Study Counsel noticed that students dealt with academic relativism in a variety of ways. In fact, some students found “multiple frames of reference wholly unintelligible” (Perry, 1999, p. 4). The students’ variety in interpretation of academic experiences also led to an equally wide variation in how students acted upon the experiences. Through their observations, counselors concluded that the “escapability of relativism might well be a development of the twentieth century” (p. 5). The conclusion generated concern amongst the Harvard faculty because “the growing person’s response to pluralism in thought and values, and indeed his capacity to generate pluralism himself, are critical to the destiny of a democracy” (p. 7).
As a result, Perry began to explore how students responded differently to the diverse views of the university’s academic and social environments (Hofer & Pintrich, 1997). His longitudinal study included interviews with Harvard undergraduates to collect descriptive accounts of their experiences. Based upon the interviews, Perry outlined a scheme of intellectual and ethical development that included nine positions as an ongoing organization of meaning making (Hofer & Pintrich, 1997; Perry, 1999). The nine positions of Perry’s scheme are typically clustered into four sequential categories: (1) dualism, (2) multiplicity, (3) relativism, and (4) commitment within relativism (Hofer & Pintrich, 1997). The movement of students through the sequences of epistemological growth begins as individuals hold knowledge as being simple, dichotomous, certain, and handed down by authority. Perry noted that these beliefs are often characteristic of a first-year college student (Hofer, 2002). As epistemological beliefs develop and become more sophisticated, reasoning becomes more complex, relativistic and derived from reason, evaluation, and empirical evidence (Bendixen & Hartley, 2003; Schommer-Aikins & Easter, 2006). Perry emphasized that a dualistic view of knowledge was typically challenged and transformed over four years of college. Specifically, when students entered college, they tended to believe in simple, certain knowledge that is handed down by authority, yet as they reached their senior year, they believed in tentative, complex knowledge obtained through observations and reason (Hofer, 2002; Perry, 1999; Schommer-Aikins, 2002).

It was not until the 1990s that researchers began to further examine the idea of an epistemological belief system. Identifying epistemological beliefs was important, but more importantly, the researchers were driven to illustrate how epistemological beliefs
impact multiple aspects of learning (Schommer-Aikins, 2002). The early research supported the idea that belief in quick learning related to students’ grades, belief in simple knowledge related to students’ study strategies, and beliefs in simple and certain knowledge related to students’ ill-defined problem solving (Schommer-Aikins, 2002). Pajares (1992) also contributed to the evolution of epistemology. His work described epistemological beliefs as an important component of teachers’ instructional beliefs and practices.

As a result of the early research and William Perry’s work, Marlene Schommer (also referenced as Schommer-Aikins) proposed a multidimensional conception of epistemology composed of five dimensions. Schommer’s system includes beliefs about the nature of knowledge and learning, specifically the structure of knowledge (isolated bits to integrated concepts), the stability of knowledge (tentative to unchanging), the source of knowledge (handed down by authority to gained from observation and reason), the speed of learning (quick or gradual), and the ability to learn (fixed at birth to life-long improvement) (Schommer-Aikins, 2002; Schommer-Aikins & Easter, 2006). In Schommer’s scheme, an individual’s beliefs about knowledge and learning are more or less independent, and they may (or may not) develop simultaneously (Schommer-Aikins & Easter, 2006). Therefore, in order to gain a complete understanding of an individual’s personal epistemology, she supports examining each belief dimension (2006).

Schommer’s work also led to the development of a questionnaire designed to measure her proposed dimensions of epistemology. The Epistemological Beliefs Questionnaire (EBQ) was designed around the five dimensions: structure of knowledge, stability of knowledge, source of knowledge, control of knowledge, and speech of
knowledge acquisition (Hofer, 2001). The EBQ is a 63-item instrument in a five-point Likert-type format (1=strongly disagree to 5= strongly agree). The measurement of these distinct dimensions is based on a continuum from naïve to more advanced beliefs, and the questionnaire’s statements are identified from the naïve perspective. The dimensions include: (1) Certain Knowledge, (2) Simple Knowledge, (3) Quick Learning, (4) Fixed Ability, and (5) Omniscient Authority (Hofer, 2001; Hofer & Pintrich, 1997). Even though the original questionnaire was based around five factors, factor analysis of the EBQ has consistently yielded only four factors (Fixed Ability, Quick Learning, Simple Knowledge, and Certain Knowledge) (Hofer & Pintrich, 1997). The development of a paper-and-pencil instrument was an important development in the study of epistemology. As a result, researchers begun to further explore how epistemological beliefs impact thinking, learning, and problem solving (Hofer, 2001). The influence of epistemological beliefs on thinking, learning, and problem solving has critical educational implications because “in the classroom, students encounter new information and may approach the learning process quite differently depending upon how they view knowledge” (Hofer, 2002, p. 3). In fact, students’ beliefs about their own thinking and learning, knowledge construction, and how knowing occurs influences their reasoning, use of study strategies, and their cognitive processing of information (Hofer, 2002; Hammer & Elby, 2002).

Even though Schommer’s Epistemological Belief Questionnaire is the most widely used paper-and-pencil method measure of personal epistemology, it has its critics (DeBacker, Crowson, Beesley, Thoma, & Hestevold, 2008). Debacker et al. (2008) reported inconsistency of factors across samples and low internal consistency of scales. Therefore, researchers continue to explore alternative methods of determining one’s
epistemology (Hofer, 2001). Kitchener and King studied the epistemic assumptions that underlie reasoning and, as a result, proposed their Reflective Judgment Model. The method used to assess reflective judgment is the Reflective Judgment Interview, a one-hour, semi-structured discussion built around four ill-structured problems where participants stated and justified their point of view relating to the particular problems (Hofer, 2001; Hofer & Pintrich, 1997; King & Kitchener, 2001). Transcripts from the interviews were scored by trained, certified raters in a three-round process. The scores were divided into sections relating to the nature of knowledge and the nature of justification. Reliability coefficients across the four problems indicated an alpha level across studies of 0.77 (Hofer & Pintrich, 1997). Even so, the development and validation of paper-and-pencil measures of epistemology continues to be driven by interest in larger scale studies. In fact, when searching for large-scale, empirical studies that examine personal epistemology, Schommer’s Epistemological Belief Questionnaire and the Epistemic Belief Inventory (EBI), developed and validated by Schraw, Bendixen, and Dunkle, were the most commonly used or adapted measurement instruments (Bendixen & Hartley, 2003; Brownlee, Purdie, & Boulton-Lewis, 2001; Chai, Khine, & Teo, 2006; Chan, 2003; Dahl, Bals, & Turi, 2005; Kizilgunes, Tekkaya, & Sungur, 2009; Ravindran, Greene, & DeBacker, 2005; Schommer-Aikins & Easter, 2006).

With the development of instruments designed to measure epistemology, researchers can document how epistemology impacts students’ motivational approaches to learning. For example, Kizilgunes et al. (2009) examined how epistemological beliefs, achievement motivation, and learning approaches are related to achievement. Their work was influenced by previous empirical studies that examined how students’
epistemological beliefs influenced the selection of deep or surface learning approaches and the relationship between epistemological beliefs, goal orientation, and self-efficacy. Kizilgunes et al. (2009) proposed a path model assuming that students’ epistemological beliefs influence their achievement motivation and learning approaches. The results indicated that epistemological beliefs, achievement motivation, and choice of learning approaches were important determinants of students’ achievement (Kizilgunes et al., 2009). Additionally, Chan (2003) explored the relationship of epistemological beliefs and study approaches, including learning strategies, in a non-Western culture. Chan found that students who believed that ability is fixed and innate (a relatively unsophisticated belief) used surface learning approaches and strategies more frequently, while students who believed that learning requires effort were more likely to adopt deeper learning approaches (Chan, 2003). The relationship between beliefs about intelligence and learning strategies were later confirmed using structural equation modeling. The results of this particular study supported the claim that students’ epistemological beliefs are related to learning approaches, learning strategies, and motivation to learn.

A learner’s epistemological beliefs play a role in their level of cognitive engagement, and they also influence the type of achievement goals a learner sets. Achievement goals “refer to students’ self-reported motivations for completing tasks in specific achievement settings” (Ravindran et al., 2005, p. 222). Ravindran et al. examined achievement goals and epistemological beliefs as antecedents of predicting cognitive engagement. Specifically, their study examined the relationship among achievement goals, epistemological beliefs, cognitive engagement, and performance on a
complex learning task. Using a population of 101 pre-service teachers, they found that students who set performance achievement goals were more likely to believe in innate ability and simple knowledge. Mastery goals did not correlate with any epistemological belief variables. Furthermore, the null hypothesis of the regression analysis was rejected, indicating that performance goals and simple knowledge beliefs were predictors of shallow engagement (Ravindran et al., 2005). This study provides evidence of the relationship between epistemological beliefs and achievement goals, and the findings indicated that pre-service teachers’ naïve epistemological beliefs should be challenged because they influence meaningful engagement and achievement goals.

Paulsen and Feldman (1999) supported the claim that students’ epistemological beliefs impact additional motivational constructs. The results of their study indicated that epistemological beliefs are correlated with motivational constructs, including self-efficacy. Using Schommer’s framework of epistemological beliefs, three of the four dimensions were significantly correlated with four or more motivational constructs (intrinsic goal orientation, extrinsic goal orientation, task value, control of learning, self-efficacy, and test anxiety) (Paulsen & Feldman, 1999). The significant relationship between students’ epistemological beliefs and motivational constructs supports development as an important aspect of formal education. In fact, Paulsen and Feldman (1999) stated “teachers can enhance the motivation of their students to learn by promoting motivationally productive epistemological beliefs” (p. 22). In other words, helping students to recognize that knowledge is not necessarily simple, absolute, or certain, and promoting the concept that knowledge is complex and evolving can influence their motivation to learn (Paulsen & Feldman, 1999).
The previously cited examples provide evidence of the influence epistemological beliefs have upon multiple motivational constructs, yet a learner’s epistemological beliefs also impact the level at which they process information (Chan, 2003; Kizilgunes et al., 2009) and the type of goals that are set (Ravindran et al., 2005). Dahl, Bals, & Turi (2005) sought to determine if epistemological beliefs impact student’s use of learning strategies. Citing previous research that described the benefit of learning strategies, their study examined how epistemological beliefs impact academic performance. Using Schommer’s Epistemological Belief Questionnaire (EBQ) and the Motivated Strategies for Learning Questionnaire (MSLQ), Dahl et al. (2005) found significant correlations between the individuals’ beliefs and their reported use of learning strategies. Specifically, the more sophisticated an individuals’ beliefs are about the nature of knowledge and the ability to learn, the more likely they reported using learning strategies to support their academic performance (Dahl et al., 2005). The results indicated that individuals’ beliefs do have a significant relationship with the reported use of cognitive and metacognitive learning strategies. In fact, Dahl et al. (2005) reported, “epistemological beliefs may offer some insights into future studies of students’ actual use of learning strategies” (pp. 269-270).

Students’ epistemological beliefs influence their learning processes, and epistemological beliefs also influence how teachers approach teaching (Brownlee et al., 2001; Pajares, 1992). “After watching teachers for years as pupils in elementary and secondary schools and, subsequently, as students in college, (pre-service teachers) already think they know what they need in order to teach” (Barnes, 1989, p. 13). Pajares emphasized that a teacher’s beliefs ultimately impacts how they teach (Pajares, 1992).
Therefore, if pre-service teachers have an understanding of their belief structures, it could prove essential in improving their preparation and teaching practices. A limited amount of research exists that examines the impact teachers’ epistemological beliefs have on their motivational constructs and self-perceptions. However, previous researchers have found significant correlations between students’ epistemological beliefs and motivational constructs (Paulsen & Feldman, 1999).

Teacher preparation programs must build upon pre-service teachers’ epistemological beliefs when preparing future teachers. Brownlee et al. (2001) pointed out “there is growing evidence to suggest that it is important to consider pre-service teachers’ beliefs, in particular epistemological beliefs, in teacher education since such beliefs will influence performance in the classroom” (pp. 250-251). If such beliefs are not addressed within the teacher preparation program, pre-service teachers conceptions about teaching (accurate or inaccurate) may be so strong that they may be “impervious to change within teacher education program” (Munby, Russell, & Martin, 2001, p. 885). Additional researchers supported the claim of Munby et al. “If the quality of teaching is to be improved, prospective teachers need to reflect upon their personal beliefs about teaching and its contexts in relation to alternative models of practice” (Dart, Boulton-Lewis, Brownlee, & McCrindle, 1998, p. 295).

At the beginning of teacher preparation programs, pre-service teachers’ beliefs about knowledge and knowing must be examined because these beliefs influence how a person is likely to approach teaching in particular contexts (Brownlee et al., 2001). Unfortunately, pre-service teachers’ epistemological beliefs are often not addressed in teacher preparation programs, even though there is growing evidence that consideration
of those beliefs can influence performance and approaches in the classroom (Brownlee et al., 2001; Chan, 2003; Cronin-Jones, 1991; Luft & Roehrig, 2007; Pajares, 1992; Ravindran et al., 2005). Specifically, Maggioni and Parkinson (2008) pointed out that there is a relationship between a teacher’s personal epistemology and their tendency to adopt specific pedagogical practices. A teacher’s beliefs “characterize the way in which individuals look at the world in order to gain knowledge and have been found to influence teachers’ choice of pedagogical practices” (p. 447). Pre-service teachers’ beliefs influence their perception of the effectiveness of instructional strategies. If they believe a particular teaching method will not be effective or is not valid, it will not be implemented (Cronin-Jones, 1991).

All teachers hold beliefs about their work, their students, and their roles and responsibilities, yet a limited amount of information related to pre-service teachers’ epistemological beliefs has appeared in the literature (Pajares, 1992). Even though “findings suggest that beliefs of pre-service teachers play a pivotal role in their acquisition and interpretation of knowledge and subsequent teaching behavior and that unexplored entering beliefs may be responsible for the perpetuation of antiquated and ineffectual teaching practices,” the research related to the beliefs of pre-service teachers is relatively scarce (Pajares, 1992, p. 328). Teacher educators must identify the epistemological beliefs of pre-service teachers and challenge them to examine those beliefs, and perhaps even change them. However, because such studies require longitudinal designs, most research focuses on in-service teachers or the student teaching experience. Clearly, there is also need for research related to the epistemological beliefs of pre-service teachers.
While there is little debate that epistemological beliefs play a role in the teaching and learning process, questions still remain if epistemological beliefs can be changed. The various models of personal epistemology differ in how “implicitly or explicitly they consider the roles of learning, motivation, and affect” (Bendixen & Rule, 2004, p. 71). Therefore, invoking epistemological change may prove to be a slow and difficult task. The more a belief is connected with other beliefs, the less likely it is to be changed (Brownlee et al., 2001). Brownlee et al. (2001) pointed out that only a few studies have challenged individuals to explicitly reflect upon their epistemological beliefs as a method to facilitate change. In fact, “although there is some evidence of interventions focused on changing epistemological beliefs, it seems that this area is still relatively uncharted territory” (p. 252). In their study, Brownlee et al. (2001) examined how the epistemological beliefs of pre-service teachers changed as a result of an intervention program requiring explicit reflection upon their beliefs. Their study provided evidence that epistemological beliefs can become more sophisticated as a result of explicit reflection, and the results suggest that the change maybe have been facilitated by the intervention program (Brownlee et al., 2001).

**The Influence of Beliefs on Instructional Decision-Making.** In 1975, the National Institute of Education reported that teacher thinking should be a primary focus when examining the practice of teaching. “It is obvious that what teachers do is directed in no small measure by what they think…questions of the relation between thought and action become critical” (Borko & Shavelson, 1990, p. 312; Fang, 1996). Because teaching requires both thought and action, the relationship between the two is critical. It is assumed that teachers’ behavior is influenced by their thoughts and beliefs, and since
teachers (pre-service and in-service) hold a variety of beliefs about their students and the subjects they teach, these thoughts and beliefs ultimately influence a teacher’s practice (Fang, 1996; Hall & Smith, 2006). Therefore, to fully understand what influences in-service teachers’ decision-making and the teaching process, an examination of how teachers’ thoughts, beliefs, and decisions are translated into action is necessary (Borko & Shavelson, 1990).

In many cases, in-service and pre-service teachers have highly developed cognitive and metacognitive skills. For many pre-service and in-service teachers, these are natural skills because teachers consciously reflect upon their planning and teaching, assess the effectiveness of instruction, and make decisions regarding student understanding. Furthermore, if students are to become autonomous, strategic, and disciplined in the learning process, teachers should possess an understanding of their own thinking and how that translates into practice (Paris & Winograd, 1998). An exploration of teacher thinking can discover the “behaviors, skills, patterns, and strategies that lead to improved student learning and achievement” (Clark, 1988, p. 5). In fact, examining teaching from cognitive and metacognitive perspectives has significantly impacted the methods researchers use to study the interaction of knowledge, thought, and behaviors used while teaching (Borko & Shavelson, 1990; Hall & Smith, 2006).

When considering the influence teachers’ thoughts and beliefs have on decision-making, teacher decision-making is often examined from one of two perspectives: (1) instructional planning (pre-active decisions) or (2) interactive-decision making. During the instructional planning process teachers make pre-active decisions as they determine their course of action for carrying out instruction, which could include planning for
instruction throughout the school year, a specific grading term, a week, a day, or even a lesson. It is noted that almost all teachers engage in some type of instructional planning (Borko & Shavelson, 1990; Helterbran, 2008). Helterbran (2008) described the importance of instructional planning as the “baseline professional component of good teaching and an indicator of a teacher’s commitment to the instructional process” (p. 89). In addition, learning to plan effective lessons is often a major component within teacher preparation programs (Maynes, Julien-Schultz, & Dunn, 2010). During the instructional planning process, teachers select teaching methods and strategies in an attempt to help students learn. In fact, researchers identify planning as a “specific element of instruction that supports student learning” (Maynes et al., 2010, p. 125).

Hall and Smith (2006) reported that the teaching planning process reflects individuality and is highly personalized. With this in mind, one model of teachers’ planning processes is a model developed by Clark and Yinger (1979). Their three-part model reflects an individual’s approach to daily and weekly planning. It is noted that their model is closely related to previous descriptions of the problem-solving process (Clark & Yinger, 1979). In this model, the instructional planning process is described as cyclical and includes both cognitive and metacognitive attributes (Clark & Yinger, 1979). According to Clark and Yinger, the planning process begins as a problem-finding state. In other words, the teacher is faced task of selecting methods to teach a particular concept or topic. In this step, the teacher conceptualizes their plans based on a consideration of the lesson’s objectives, their own knowledge, and their own experiences and beliefs (Clark & Yinger, 1979). Selecting teaching methods is often challenging because problems vary in their nature and the manner in which they are presented (Jonassen,
The problem may be well-defined or ill-defined. Well-defined problems are those “for which there are absolutely correct and knowable situations,” and ill-defined problems are those “for which there are conflicting assumptions, evidence, and opinion which may lead to different solutions” (Schraw, Dunkle & Bendixen, 1995, p. 523).

The planning process continues as the teacher defines and represents the problem mentally. When defining a problem, the teacher (or problem solver) determines the scope (or complexity) and goals of the problem. This includes determining the number of issues or variables that are involved in the problem (Jonassen, 2000). This representation allows the teacher to select teaching methods/strategies and to begin organizing the currently held knowledge about the particular methods and strategies. Newell and Simon (1971) emphasized that problem solving takes place in the problem space. This includes both the activities required to construct the problem space and the activities required to solve the problem. Within the problem space, known information about a problem is organized mentally and provides the problem solver with a mental approach to solving the problem. Next, the teacher determines the mental and physical resources that are required for solving the problem. Finally, the instructional planning process persists as the teacher implements their plans, monitors their progress toward the learning objectives, and evaluates the activities used in the instructional process (Hall & Smith, 2006; Pretz et al., 2003).

Because instructional planning is viewed as a problem-solving process, it is necessary to examine what factors influence the decisions a teacher makes when planning. What teachers believe and think about prior to teaching shapes what they do in
the classroom (Hall & Smith, 2006). In fact, the teaching methods and strategies a teacher selects while planning is actually affected by many factors. The factors, which are often characterized as individual differences between teachers, include beliefs about students, the nature of the instructional task, personal characteristics, and school requirements (or constraints) (Borko & Shavelson, 1990; Fang, 1996; Munby, 1982). For many educators, one of the most important determinants of the instructional planning process is student ability. In other words, what the teacher perceives that a student can or cannot do influences how they teach. In addition to beliefs about their students, a teacher possesses individual characteristics that also influence the instructional planning process. If fact, previous researchers have stated that teachers’ conceptions of teaching, beliefs, and professional experience influences how they plan and, ultimately, teach (Borko & Shavelson, 1990; Fang, 1996; Hall & Smith, 2006; Mansour, 2009; Munby, 1982; Shavelson & Stern, 1981; Tickle, Brownlee, & Nailon, 2005).

Even though the importance of linking teachers’ thinking and beliefs to instructional decision making is not a new idea, the linkage continues to face its critics. For example, Rosso (1978) determined that the educational beliefs of teachers had little influence over the instructional decisions a teacher makes. However, Rosso acknowledged that the measure used to identify teacher beliefs might have failed to discriminate the beliefs relevant to this particular study (Munby, 1982; Rosso, 1978). In a more recent study, Wilcox-Herzog (2002) measured the beliefs of 47 early childhood educators in response to the lack of consensus regarding the belief-practice relationship for early childhood educators. Wilcox-Herzog suggested that there was not a relationship between teachers’ beliefs and their actions. Despite the findings, Wilcox-Herzog (2002)
stated “it is important to obtain a working knowledge of the thoughts and behaviors of teachers in various situations at various stages” (p. 101).

Proponents cite a large body of evidence that supports how teachers’ beliefs about teaching and learning influence their teaching practices, creating a strong interest in exploring teachers’ beliefs in order to clarify how they affect teaching practices (Ernest, 1988; Mansour, 2009). Pajares is identified as a strong advocate of the association between teachers’ beliefs and practice. He suggested there is “a strong relationship between teachers’ educational beliefs, their planning, instructional decisions, and classroom practices” (Pajares, 1992, p. 326). In fact, Parajes goes as far to claim that beliefs are even stronger predictors of behavior than knowledge (Pajares, 1992). With this in mind, Li, Chen, and Kulm (2009) substantiated Pajares’ claim, and emphasized the necessity of exploring teachers’ beliefs and thinking in relationship to lesson planning and the methods they employ while teaching.

The relationship between teachers’ beliefs and the influence of beliefs on teaching practices has many researchers intrigued. There is agreement that this topic needs attention, as it “gives insight into classroom events” (Munby, 1982, p. 201). More specifically, teachers’ implicit theories of intelligence and their impact on instructional decision-making are highlighted in the literature. In 2004, Deemer hypothesized that teachers’ beliefs would directly predict their instructional practices. Deemer measured teachers’ approaches to teaching and learning (mastery or performance approaches) and teachers’ theories of intelligence in an attempt to uncover how beliefs influence instructional practices. Among the 99 participants, there was a great variation in the teachers’ beliefs about intelligence, yet Deemer reported the variation did not account for
instructional practices teachers used in the classroom. Even so, she conceded the
findings might be a result of “the small sample size used in path analysis” (Deemer,
2004, p. 87). Garcia-Cepero & McCoach (2009) analyzed educators’ (K-12 educators
and teacher educators) implicit theories of intelligence and explored the impact theories
of intelligence have upon the identification of gifted students. Their findings were
similar to Deemer’s. There was no general trend for teachers or teacher educators to
view intelligence as fixed or malleable. However, a large standard deviation (SD=1.16)
indicated there was considerable variability among the participants’ beliefs about the
malleability of intelligence (Garcia-Cepero & McCoach, 2009). Their study suggested
that there is a relationship among the belief about intelligence and the identification of
gifted students. Most importantly, their research emphasized the critical need for
additional research relating to teacher’s implicit theories of intelligence. “More research
should be done to address if certain types of beliefs determine aspects of teaching
behavior such as educators planning, teaching, and assessment strategies” (Garcia-Cepero

Additionally, teachers’ epistemological beliefs have an influence on how they
teach. In fact, describing the epistemological beliefs of both in-service and pre-service
teachers is an important determinant of understanding a teacher’s practice. Maggioni and
Parkinson (2008) elaborated upon how teachers’ beliefs impact their pedagogy. In their
work, they noted that science teachers with more naïve epistemological beliefs tended to
demonstrate a “heavy reliance on memorization, focus on terminology, avoidance of
content perceived as potentially contradicting students’ religious beliefs, a classroom
discourse characterized by a routine constituted by teacher-initiated questions, student
responses, and scarce attention to integration of knowledge” (p. 450). According to Brownlee (2001), teachers with advanced epistemological beliefs tend to view teaching as a facilitation process and utilize active teaching methods. Additionally, researchers have noted that teachers with naïve epistemological beliefs and consider knowledge to be absolute are more likely to adopt a transmissive approach to teaching (Tickle, Brownlee, & Nailon, 2005).

Furthermore, teacher beliefs guide instructional decisions, influence classroom management, and serve as a frame of reference for interpreting what occurs within a classroom (Luft & Roehrig, 2007). Pajares (1992) emphasized the importance of understanding teacher beliefs. “Understanding the belief structure of teachers and teacher candidates is essential to improving their professional preparation and teaching practices” (p. 307). Ng, Nicholas, & Williams (2010) pointed out that to facilitate the development of pre-service teachers into critically reflective teachers, teacher educators should consider how pre-service teachers’ beliefs change during teacher preparation programs and during their beginning years of teaching. In fact, in order to promote change in epistemological beliefs, “it may be necessary to encourage students to reflect explicitly on their epistemological beliefs” (Brownlee et al., 2001, p. 251).

Even though this project examined only the pre-active decisions a teacher makes, the importance of interactive teaching decisions should be noted. In some cases, the most complex problems a teacher faces are during the interactive portion of a lesson (Borko & Shavelson, 1990). These decisions are much different than planning decisions because they are made in real-time with little (if any) time for reflection, reevaluation, or adjustment (Hall & Smith, 2006). Interactive teaching decisions are a daily function of
teaching. Clark and Peterson (1986) estimated that a teacher makes between 0.5 and 0.7 interactive decisions per minute, while Hall & Smith (2006) reported that teachers make instructional decisions every two minutes. Additionally, Clark (1988) reported that the greatest proportion of teachers’ interactive thoughts is about students, followed by instructional behaviors. With this in mind, teachers must possess an understanding of their thinking and how they utilize such thinking when making interactive decisions (Paris & Winograd, 1998). Shavelson and Stern (1981) reported that interactive decisions are influenced by the thoughts, judgments, and beliefs of teachers, and upon an examination of teaching behaviors, researchers must identify how thoughts, judgments, and beliefs are carried into action. Clearly, research that connects teacher beliefs with interactive decision-making can provide practitioners with insight to practices that will influence student learning (Munby, 1982).

**Summary**

This chapter presented the conceptual, theoretical, and empirical research related to the following areas: (1) implicit theories of intelligence, (2) epistemological beliefs, and (3) the influence of teachers’ beliefs on instructional decision-making. Driven by interest in student intelligence, intelligence theories are heavily researched. However, a smaller amount of research is devoted to implicit theories of intelligence. Implicit theories are the conceptions, ideas, or theories that reside in an individual’s mind, and implicit theories of intelligence are directly related to an individual’s belief about his or her own intelligence. The manner in which an individual views their own intelligence has important educational implications. Additionally, teachers’ implicit beliefs about intelligence impacts how they teach. Yet, a much smaller body of research has examined
the relationship between teacher beliefs and their teaching practices.

Epistemological beliefs focus on the manner in which individuals come to know and their beliefs about knowledge. Research that examines epistemological beliefs has illustrated that epistemological beliefs impact multiple aspects of learning. Specifically, students’ epistemological beliefs influence their learning processes, and teachers’ epistemological beliefs influences how they approach teaching. With this in mind, to fully understand what influences teachers’ decision-making and the teaching process, an examination of how teachers’ thoughts, beliefs, and decisions are translated into action is necessary. Previous researchers have supported the claim that teachers’ beliefs about teaching and learning influence their teaching practices. This has created a strong interest in exploring teachers’ beliefs in order to clarify how they affect teaching practices.
Chapter 3

Introduction

To this point, the researcher has provided an introduction to the research related to implicit theories of intelligence, epistemological beliefs, and their influence on teaching planning and decision-making. Chapter 1 included the problem statement and explained the need for research related to teacher beliefs, and it also contained the purpose of the study, the research questions, the researcher’s personal epistemology and definitions of key terms. Chapter 2 provided the conceptual framework for the study and presents a review of literature in the following areas: (1) implicit theories of intelligence, (2) epistemological beliefs, and (3) the influence of teachers’ beliefs on instructional decision-making. Chapter 3 describes the methodology of the study, and it provides details concerning the research design, data collection, and data analysis.

The Research Design

The intent of this study was to examine the role teachers’ beliefs play in making instructional decisions. The goal of the two-phase, sequential explanatory mixed methods study (Creswell & Plano-Clark, 2011; Ivankova, Creswell, & Stick, 2006) was to obtain quantitative results and then select participants for follow-up interviews to further clarify the results. In the first phase, quantitative research questions addressed the relationship between in-service teachers’ beliefs about intelligence and epistemological beliefs in relation to eight teaching methods the teachers might utilize in the classroom. In the second phase, qualitative semi-structured interviews (Creswell, 2007; Seidman, 2006) were conducted to explore how in-service teachers described the role their beliefs played when making planning decisions. Specifically, the following research questions were clearly outlined and guided the study:
1. What are the relationships between in-service teachers’ beliefs about intelligence and epistemological beliefs in relationship to the teaching methods they use?
   a. What is the relationship, if any, of in-service teachers’ beliefs about intelligence to their epistemological beliefs?
   b. How are in-service teachers’ beliefs about intelligence related to the teaching methods they use?
   c. How are in-service teachers’ epistemological beliefs related to the teaching methods they use?

2. How do in-service teachers describe their preference for the teaching methods they commonly use, their beliefs about intelligence, and their epistemological beliefs?

3. How do the descriptions of teaching method preferences, beliefs about intelligence, and epistemological beliefs align with the outcomes of a quantitative measurement within a systematically selected sample of in-service teachers?

Rationale for the Mixed Methods Design

The methods within quantitative and qualitative research paradigms provide researchers with many options when designing research methodology (Creswell & Plano-Clark, 2007). Both quantitative and qualitative research has advantages and disadvantages; however, when determining which method to employ, the research question(s) should drive the research methodology according to which method offers the best chance to obtain useful answers (Johnson & Onwuegbuzie, 2004; Johnson,
Onwuegbuzie, Turner, 2007; Mt. Collins & O’Cathain, 2009). In simpler terms, the purpose of the study should initiate the methodology used (Newman, Ridenour, Newman, & DeMarco, 2003).

There are some instances when one research approach (purely quantitative or purely qualitative) is inadequate for answering the research question (Creswell & Plano-Clark, 2007). In some cases, quantitative results might not provide explanations of outcomes, and therefore, qualitative data can be used to enrich, further interpret, and explain quantitative results. For example, Epler, Waknine, and Broyles (2010) conducted a case study examining the impact of cognitive load on the reflection of pre-service teachers. Quantitative methodology was used to examine the frequency with which pre-service teachers asked higher-order thinking questions when placed under higher or lower cognitive load, and qualitative methodology was used to provide further explanation of and enrich the quantitative results. In other instances, qualitative data might provide an adequate exploration of a problem, but quantitative data are needed to further understand the problem (Creswell & Plano-Clark, 2007). Cherubini (2008) used quantitative data to support the qualitative themes that emerged when determining the effect of student teaching on pre-service teachers’ beliefs about schools as communities of inquiry. Qualitative themes guided the quantitative methodology and the analysis of multiple comparisons based on age, gender, and divisional qualifications. These are just two examples that illustrate why one research approach may not be sufficient, and therefore, a mixed methods approach should be considered.

“Mixed methods research is defined as the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches,
concepts or language into a single study‖ (Johnson & Onwuegbuzie, 2004, p. 17). The central premise of a mixed methods approach is that neither quantitative nor qualitative methods are sufficient, and the use of both methodologies provides a better understanding of the research problem rather than using each approach individually (Creswell & Plano-Clark, 2007; Ivankova et al., 2006; Pole, 2007). Mixed methods research in a single study can help “obtain a fuller picture and a deeper understanding of a phenomenon” (Johnson et al., 2007, p. 119) and also allow for a more robust analysis (Ivankova et al., 2006). Mixed methods research is becoming increasingly articulated and is currently recognized as a third major research paradigm, along with quantitative and qualitative research paradigms (Creswell & Plano-Clark, 2007; Johnson & Onwuegbuzie, 2004; Johnson et al., 2007; Mt. Collins & O’Cathain, 2009).

The researcher’s personal epistemology directly influenced the selection of the mixed methods research design. Pragmatism is most commonly associated with mixed methods research and brings differing views related to epistemology and ontology (Creswell & Plano-Clark, 2007; Teddlie & Tashakkori, 2003). Pragmatism presents a very logical approach to research because it is problem centered, real world oriented, and uses a combination of methods and ideas that helps one address the research question or questions (Creswell & Plano-Clark, 2007; Johnson et al., 2007). The pragmatic viewpoint identifies the research question as more important than the method that underlies the methodology. In fact, “pragmatism provides investigators with a philosophical framework that embraces the integration of all methods (qualitative and quantitative methods) in order to come to a more comprehensive understanding of the
research problem and eventually obtain credible results” (Duemer & Zebidi, 2009, p. 166).

The Mixed Methods Design: Two-Phase, Sequential Explanatory Research Design

This study employed a two-phase, sequential explanatory mixed methods research design. The mixed methods sequential explanatory design consists of two distinct phases: quantitative followed by qualitative (Creswell & Plano-Clark, 2011; Ivankova et al., 2006). In this first phase, the researcher designs and implements a quantitative strand, collects and analyzes quantitative data and then uses the quantitative results to guide the qualitative strand. Specifically, the researcher uses quantitative data to develop and refine the qualitative research questions, and the data are also useful for purposeful sampling and data collection (Creswell & Plano-Clark, 2011). In the final step, the qualitative phase is implemented and qualitative data are collected and analyzed. This phase allows the researcher to explore participants’ views more in depth. The two-phase, sequential explanatory mixed methods design has both strengths and weaknesses. The two-phase nature of the design makes it very straightforward to implement, and the design lends itself to emergent approaches where the second phase is designed based upon what is learned from the first phase (Creswell & Plano-Clark, 2011; Ivankova et al., 2006). A noted weakness of this design includes the lengthy time required to implement the two phases, and Creswell and Plano-Clark (2011) described difficulties associated with securing institutional review board (IRB) approval.

The goal of this mixed methods study was to further explore and explain the relationship between teachers’ beliefs and instructional decision-making (Leech & Onwuegbuzie, 2010). In this sequential explanatory design, the data were collected over
two periods of time (Ivankova et al., 2006). The quantitative data were collected first and used to identify the relationship between in-service teachers’ beliefs about intelligence and their epistemological beliefs in relationship to teaching methods they utilize. This approach allowed the researcher to purposefully select individuals for an in-depth exploration of how teachers’ beliefs influence the teaching methods they use. Next, qualitative data were collected and related to the outcomes from the quantitative strand. Thus, the quantitative data and results provided a general picture of the research problem, while the qualitative data and its analysis further explained those statistical results by exploring the participants’ views more in depth. Figure 2 provides a visual model and timeline for the mixed methods sequential explanatory design procedure used in this study.
<table>
<thead>
<tr>
<th>Phase</th>
<th>Procedures</th>
<th>Timeline</th>
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| QUAN Data Collection       | - Theories of Intelligence Scale  
|                            | - Epistemic Belief Inventory  
|                            | - Teaching Practices Frequency | October 2010 – March 2011 |
| QUAN Data Analysis         | - Descriptive statistics  
|                            | - Pearson’s Correlation Coefficient  
|                            | - Canonical Correlation  
|                            | - One-Way ANOVA  
|                            | - Multiple Regression Analyses | February - March 2011 |
| Connecting QUAN and QUAL Phases | - Purposeful, systematic selection  
|                            | - Extreme cases matching theoretical assumptions  
|                            | - Demographic analysis  
|                            | - Maximum variation sampling | January 2011 |
| QUAL Data Collection       | - In-depth interviews | January- February 2011 |
| QUAL Data Analysis         | - Coding and thematic analysis  
|                            | - Constant comparative data analysis | February 2011 |
| QUAN → QUAL = Results      | - Interpretation and explanation of the quantitative and qualitative results | March 2011 |

*Figure 2. Visual model and timeline of the mixed methods sequential explanatory design study (Creswell & Plano-Clark, 2007; Ivankova et al., 2006).*
Protection of Human Subjects

Virginia Polytechnic Institute and State University Institutional Review Board (IRB) policies were followed throughout the study. Appendix A includes the IRB approval letter.

Quantitative Strand

The purpose of the quantitative strand was to identify the relationship between in-service teachers’ beliefs about intelligence and epistemological beliefs in relationship to the teaching methods they use.

Population and sample. The population for the quantitative strand included in-service Career and Technical Education (CTE) teachers located within the commonwealth of Virginia. Specifically, Agricultural Education, Business and Information Technology, Family and Consumer Sciences, and Marketing teachers were identified as potential participants (Virginia Department of Education, 2010b). These particular CTE disciplines were selected as they reflect the CTE disciplines within the teacher preparation program at the researcher’s university. The population included 3,111 teachers within the four CTE disciplines. According to Krejcie and Morgan (1970), an appropriate sample size for a population of 3,500 is 346. Using a stratified random sample, 497 participants were selected for the quantitative strand. Assuming a 70% response rate, the selection of 497 participants would generate an appropriate sample size. The use of a stratified random sample allowed the researcher to ensure that each CTE discipline was equally represented within the sample.

Pilot testing. A pilot test was conducted in the Fall 2010 with twenty-five in-service CTE teachers located in a midwestern state. Hittleman and Simon (2002) pointed
out that a pilot study allows researchers to identify potential problems within the data collection process. Specifically, a pilot study helps scrutinize data collection instruments and examines whether there is a need for modification of the instruments (Hittleman & Simon, 2002). In this particular study, the quantitative questionnaire was pilot tested to confirm the readability of the items and to identify methods to achieve a higher response rate. The pilot test included a letter requesting the teachers’ participation, the survey, and information regarding the purpose of the research and IRB protocol. The results of the pilot study were not published; however, the results were used to modify the data collection instrument and the items associated with the instrument.

Data collection. Often, researchers avoid using mail surveys because some believe that an adequate response rate cannot be achieved (Dillman, Smyth, & Christian, 2009). Even so, when designed correctly, mail surveys can produce data with appropriate response rates. When using a mail survey, Dillman et al. (2009) emphasized the importance of personalizing all contacts to establish a personal connection between the surveyor and the respondent. Furthermore, sending multiple contacts to potential respondents also increases response rates. It is often necessary to approach respondents through multiple methods and contacts to ensure a higher response rate. According to Olsen, Call, and Wygant (2005), the use of four follow-up contacts resulted in a 37 percent response rate in their survey of college undergraduates. While the impact of using multiple contacts has been explored, there remains little research that describes the optimal contact combinations to use (Dillman et al., 2009). Dillman et al. (2009) describe a system of five contacts, including a pre-notice letter, questionnaire mailing,
thank you postcard, replacement questionnaire, and a final contact via a different mode of delivery.

With this in mind, the researcher modified methods presented by Dillman et al. (2009) when implementing the quantitative strand of this study. The sample was first notified about the study through a pre-notice letter mailed via the United States Postal Service on October 18, 2010. The purpose of sending pre-notice letters was to inform the potential respondents that they would be asked to complete a questionnaire within the next several days. In some cases, sending pre-notice letters improves response rates by three to six percent (Dillman et al., 2009). Following the guidelines presented by Dillman et al. (2009), each letter was personalized. The letters were printed on university letterhead, used names instead of a pre-printed salutation, and included the researcher’s signature in blue ink. The letters also included an appeal for help and provided information regarding the purpose of the research study. An example of the pre-notice letter appears in Appendix B.

On October 27, 2010 the questionnaire mailing was sent individually to each member of the sample. In addition to the questionnaire, the questionnaire mailing included a detailed cover letter that introduced the questionnaire to potential respondents and emphasized why their participation was important. The letter also provided information regarding the confidentiality of their responses. The cover letter emphasized that all responses were voluntary and methods would be utilized to protect the participant’s anonymity. A business reply envelope was provided for the convenience of each participant. Completed and returned questionnaires served as implied consent for the participants. An example questionnaire mailing cover letter appears in Appendix C.
Thank-you postcards were mailed on November 15, 2010 to each member of the sample. Postcards often provide a “fresh” stimulus that is different from previous methods of contact (Dillman et al., 2009). The postcards expressed appreciation for responding and reiterated the importance of participating in the study. The postcards also urged participants to complete and return the questionnaire if it had not already been done. Finally, individuals that had not returned their questionnaire as of January 3, 2011 were mailed a replacement questionnaire. The replacement questionnaire indicated that the participant’s completed questionnaire had not been received and urged the participant to respond. An example of the postcard and the final appeal for participation appears in Appendices D and E. The combination of the above mentioned methods yielded an initial response rate of 45 percent (n=222). This represented 64% of the appropriate sample size. Because of the low initial response rate, the researcher used a second stratified random sample to select an additional 125 participants. The participants received a pre-notice e-mail on January 26, 2011, and the questionnaire mailing was sent on January 27, 2011. The pre-notice e-mail and questionnaire cover letter appear in Appendices F & G. As a result of the above-mentioned efforts, the overall response rate was 47 percent (n=292). The researcher acknowledged that a check for non-response bias did not occur. A method to determine if participants who responded to a questionnaire answered differently than those who did not, is calling non-respondents, collecting their responses verbally, and comparing the results. In this study, an independent sample t-test allowed the researcher to determine if means scores for early respondents and late respondents differed for the Theories of Intelligence Scale (TOI) and Epistemic Belief Inventory (EBI). The t-values were not significant, and it was
determined that early respondents’ mean scores were not significantly different than late respondents’ mean scores. An appropriate sample size was not reached (Krejcie & Morgan, 1970); however, it should be noted that the researcher collected 84% of the sample size needed.

**Instrumentation.** The quantitative questionnaire included three components. Dweck’s Implicit Theories of Intelligence Scale was used to measure the participants’ theory of intelligence, and the Epistemic Belief Inventory (EBI) was used to measure the participants’ epistemological beliefs. In addition, participants were asked to rate how often they use eight specific teaching strategies. Furthermore, demographic information was collected which included sex, years of teaching experience, primary CTE teaching discipline, and grade level taught. The demographic information also included the highest level of education completed, the type of teacher preparation program completed, and if the participants are a member of their state or national CTE professional organization. The questionnaire is found in Appendix H. A detailed description of each component of the quantitative questionnaire and their reported reliability and validity follows.

Dweck and Henderson (1989) developed the Implicit Theories of Intelligence Scale. Originally, the scale used only entity theory items to assess the nature of one’s beliefs about intelligence, and a higher score initially represented an entity view of intelligence. The items were later recoded so that a higher score represented an incremental theory of intelligence (Deemer, 2004). The most recent version of the scale includes both entity theory and incremental theory statements. The scale uses a six-point Likert scale (1=strongly agree, 6=strongly disagree). The incremental statements are
strongly correlated (between -0.69 and -0.86) with the original entity theory statements, indicating that disagreement with the entity items does represent agreement with the incremental items (Dweck, 2000; Levy, Stroessner, & Dweck, 1998). The incremental theory items are reverse coded; lower scores represent entity theorists and higher scores represent incremental theorists. Cronbach’s Alpha values range from 0.94 to 0.98, indicating high internal consistency (Dweck, 2000).

Schommer proposed five dimensions of epistemological beliefs that include beliefs pertaining to Certain Knowledge, Simple Knowledge, Omniscient Authority, Quick Learning, and Innate Ability (Schommer-Aikins, 2002; Schommer-Aikins & Easter, 2006). In response to criticisms of Schommer’s proposed dimensions and the Epistemological Belief Questionnaire (EBQ), Schraw, Bendixen, and Dunkle (2002) developed the Epistemic Belief Inventory (EBI) in response to the EBQ’s methodological problems (Schraw & Olafson, 2008). The EBI is a quantitative measure of epistemological beliefs, and this measure included 32 items using a five-point Likert type scale (1=strongly agree to 5= strongly disagree). The questionnaire is designed to measure beliefs according to five subscales: Certain Knowledge, Simple Knowledge, Quick Learning, Omniscient Authority, and Innate Ability (Schraw et al., 2002). Items used in the EBI were constructed based on the criteria for the five epistemic dimensions proposed by Schommer and consistently yields the five proposed factors (Schraw et al., 2002; Schraw & Olafson, 2008). Lower scores represent more naïve epistemological beliefs and higher scores represent more advanced epistemological beliefs. Reliability for the five subscales is reported between 0.58 and 0.71 (Schraw et al., 2002).
In addition to the two instruments, participants were asked to rate how often they use eight specific teaching strategies (or methods) through the use of a 5-point Likert type scale (1=never to 5=use a great deal). Often, descriptions of teaching strategies and methods are placed on a continuum ranging from what some call “teacher-centered” to “student-centered” (Schuh, 2004). This dichotomy is not intended to evaluate the effectiveness of teaching practices and methods, but it allows researchers to categorize the different types of teaching practices and methods. The eight teaching practices (demonstrations, experiments, group projects/assignments, independent assignments, lecture, role-play, small group/partner discussion, and teacher-led discussion) selected for these questions represent a variation among methods identified as teacher-centered or student-centered (Newcomb, McCracken, Warmbrod, & Whittington, 2004). Teacher-centered teaching practices (demonstrations, independent assignments, lecture, and teacher-led discussion) were reverse coded. Lower scores represent a more frequent use of teacher-centered teaching practices, and higher scores represent a more frequent use of student-centered teaching practices.

**Data analysis.** Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 17.0. A description of the quantitative participants (n=292) were included as part of the data analysis. In-service teachers were asked to identify their gender, years of teaching experience, primary CTE teaching discipline, and grade level taught. In addition, participants were asked to identify the highest level of education they had completed, the type of teacher preparation program they completed (traditional teacher preparation program or alternatively certified teacher), and if they are a member
of their state or national CTE professional organization. Frequencies and percentages were produced by SPSS for the demographic variables.

Research question one sought to identify the relationship between in-service teachers’ beliefs about intelligence, epistemological beliefs, and the teaching methods they commonly use. The mean, standard deviation, maximum/minimum scores for the Theories of Intelligence Scale and the Epistemic Belief Inventory are reported. In addition, participants also rated how often they used eight specific teaching practices and methods.

To determine the degree of the relationship between teachers’ theories of intelligence, epistemological beliefs, and teaching practices used, the Pearson product-moment correlation coefficient was used. The Pearson’s coefficient measures the degree of a relationship between two continuous variables (Coolidge, 2006). When the correlation value \( r \) is between +1.00 and +0.50, the variables are said to have a strong positive relationship, and a correlation value between -1.00 and -0.50 indicates a strong negative relationship. An \( r \)-value between -0.30 and +0.30 indicates a weak relationship between variables (Coolidge, 2006). The researcher established \textit{a priori} a minimum significance level of 0.05. According to Coolidge, this is the conventional minimum level of significance (2006).

In addition to Pearson’s coefficient, canonical correlation was used to further explain the influence of teachers’ beliefs about intelligence and epistemological beliefs upon their likelihood of using the ten teaching methods and strategies. The goal of a canonical correlation is to analyze the relationship between a set of independent variables and a set of dependent variables. In other words, canonical correlation is used for many-
to-many relationships. A canonical correlation allows the researcher to determine if and how the two sets of variables relate to each other (Tabachnick & Fidell, 2007). In this case, the independent variables are measures of teacher beliefs (beliefs about intelligence and epistemological beliefs) and the teaching practices (demonstrations, experiments, group projects/assignments, independent assignments, lecture, role-play, small group/partner discussion, and teacher-led discussion) function as the dependent variables. The variables were combined to produce a predicted value of independent variables that has the highest correlation with the predicted value of the dependent variables (Tabachnick & Fidell, 2007). The researcher established a priori a minimum significance level of 0.05.

Based upon the demographic variables of the quantitative strand, the researcher used analysis of variance (ANOVA) to determine if there were significant differences in the mean scores of the Implicit Theories of Intelligence Scale and Epistemic Belief Inventory based on CTE discipline, years taught, highest level of education completed, and the type of teacher preparation program completed. Again, the researcher established a priori a minimum significance level of 0.05. It should be noted that ANOVA is an omnibus test, and a significant $F$ value does not reveal which groups’ means are different from each other (Coolidge, 2006). A significant ANOVA simply reveals if there is at least one mean different from another.

The researcher conducted a forced-entry regression to determine the influence the Theories of Intelligence Scale (TOI), Epistemic Belief Inventory (EBI), and selected demographic variables (CTE discipline, years taught, highest level of education completed, and type of teacher preparation program completed) have on teaching
practices. This type of regression is also known as simultaneous regression because the independent variables are entered into the regression equation at the same time (Keith, 2006). This method allows the researcher to determine the extent of the influence of the variables on the dependent variable (in this case, teaching practices). Using the statistically significant predictors of teaching practices as determined by the forced-entry regression analysis, the researcher conducted a stepwise regression to determine which variables were the strongest predictors of teaching practices. In stepwise regression, the predictor variables are entered one at a time in sequential order. The computer uses the independent variables’ correlations with the outcome variable to determine the order the variables are entered into the equation (Keith, 2006). In other words, the first variable entered is the variable with the largest correlation to the dependent variable. Next, the semipartial correlation is calculated for the remaining variables, and the variable with the largest semipartial correlation is entered next. This continues until the maximum number of steps is reached (Keith, 2006). The researcher established a priori a minimum significance level of 0.05.

**Qualitative Strand**

In the second phase, in-depth interviews were conducted to help explore how teachers’ beliefs influence the teaching methods they use. In-depth interviews allow participants to describe the meaning of a particular phenomenon as they have experienced it (Creswell, 2007).

**Participant Selection.** Within a sequential explanatory mixed methods design, individuals participating in the qualitative strand should also have participated in the initial, quantitative strand (Creswell & Plano-Clark, 2011). Because the qualitative
strand describes the quantitative results, only individuals that contributed to the quantitative strand are suited to participate in the qualitative follow-up. Creswell and Plano-Clark (2011) pointed out that within this research design, the qualitative strand includes a much smaller number of participants than the quantitative strand. The intent is not to merge or compare data, so unequal sample sizes is not an issue.

In this study, participants were asked at the conclusion of the quantitative survey if they would be interested in participating in an in-depth interview to explore how teachers’ beliefs influence teaching decisions. The participants were notified that the interview would last between 45-60 minutes, and that if they were selected, they would be contacted via e-mail to schedule the interview. Seventy participants indicated they would be interested in participating in the qualitative strand of the study. Next, the qualitative strand participants were systematically chosen using the quantitative data in order to best understand the phenomenon being explored (Onwuegbuzie & Collins, 2007).

In order to select individuals best able to explain how beliefs influence teaching methods, the researcher chose to follow-up with extreme cases that matched the theoretical assumptions of the quantitative strand. In other words, in-service teachers that were identified as holding an incremental theory of intelligence, advanced epistemological beliefs, and that use mainly student-centered teaching methods were considered as potential interview participants. Furthermore, in-service teachers with entity theories of intelligence, naïve epistemological beliefs, and that use mainly teacher-centered methods were also considered as interview participants. In order to systematically and purposefully select the qualitative participants, the researcher
identified the maximum and minimum values for each component of the questionnaire based upon the questionnaires that had been returned from the quantitative strand participants. Participants whose responses placed them in the 30th percentile or lower for all three areas were identified as potential qualitative strand participants. Seven participants met these criteria and were identified as eligible. In addition, participants whose responses placed them in the 60th percentile or above for all three areas were also identified as potential qualitative strand participants. Based upon this, an additional 11 participants were eligible for participation. The 18 participants were contacted to participate in the follow-up interview, and nine agreed to participate.

**Preliminary Work.** The *a priori* propositions proposed in Table 1 assisted the researcher in the planning and development of the interview guide. Propositions are hypotheses that relate categories in a study. Propositions shape data collection and suggest why a certain cause influences the central phenomenon and, in turn, provide the researcher with relevant analytical strategies (Creswell, 2007; Yin, 2009). Table 1 explains how the researcher’s propositions are correlated with supporting literature and reflected in the interview questions.
Table 1

*a Priori Propositions*

<table>
<thead>
<tr>
<th>Proposition</th>
<th>Supporting Literature</th>
<th>Research Question</th>
<th>Interview Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individuals’ beliefs about intelligence play a key role in multiple learning contexts.</td>
<td>Beliefs influence a variety of cognitive processes and, ultimately, learning (Muis &amp; Foy, 2010). Students’ beliefs affect motivation, self-efficacy, and even classroom achievement (Leondari &amp; Gialamas, 2002). Additionally, students’ beliefs about intelligence influence the learning goals they set, the amount of effort they exert, and the frequency of self-regulatory and motivational strategies used during problem solving (Blackwell et al., 2007; Dweck, 2000; Dweck &amp; Molden, 2005; Leggett &amp; Dweck, 1986). Teachers also hold a variety of implicit beliefs, and these beliefs affect “perception, interpretation, and judgment” and impact the judgments and actions teachers make every day (Clark, 1988, p. 7). A teacher’s belief about intelligence even influences their planning, teaching, and the type of assessment strategies they use (Deemer, 2004; Garcia-Cepero &amp; McCoach, 2009). Examining teachers’ beliefs provides insight into teachers’ classroom practices and pedagogy (Kagan, 1992; Muis &amp; Foy, 2010).</td>
<td>1. What are the relationships between in-service teachers’ beliefs about intelligence and epistemological beliefs in relationship to the teaching methods they use?</td>
<td>How do you define intelligence?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Do you believe that intelligence can be developed? How?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1b. How are teachers’ beliefs about intelligence related to the teaching methods they commonly use?</td>
<td>If you heard a student say, “There are some things I just can’t learn,” how would you respond?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. How do in-service teachers describe their preference for the teaching methods they commonly use, their beliefs about intelligence, and their epistemological beliefs?</td>
<td>How do your beliefs about students’ intelligence influence how you teach?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Do you believe that a student’s intelligence can change as a result of school? What leads you to that? How do you communicate those beliefs to your students?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>How do those beliefs influence your teaching methods?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When planning a lesson, how do you take into consideration the varying ability levels of each student?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>How do you plan differently based upon the ability of a particular class?</td>
</tr>
</tbody>
</table>
Table 1

*a Priori Propositions Continued*

<table>
<thead>
<tr>
<th>Proposition</th>
<th>Supporting Literature</th>
<th>Research Question</th>
<th>Interview Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individuals hold different beliefs about the nature of knowledge and knowing. These beliefs, known as epistemological beliefs also influence teachers’ pedagogical approaches to teaching.</td>
<td>Individuals possess beliefs about knowledge and knowing. Known as epistemological beliefs, these beliefs relate to how individuals come to know, and because these beliefs are activated during learning, they also influence cognitive processing (Hofer &amp; Pintrich, 1997). Epistemological beliefs include beliefs about the structure of knowledge, the stability of knowledge, the source of knowledge, the speed of learning, and the ability to learn (Schommer-Aikins, 2002). A student’s epistemological beliefs influence motivational constructs, the depth in which they process information, the type of learning goals set, and their use of learning strategies (Chan, 2003; Dahl et al., 2005; Kizilgunes et al., 2009; Ravindran et al., 2005). Furthermore, a teacher’s epistemological beliefs influence how they approach teaching (Brownlee et al., 2001; Pajares, 1992). Specifically, research supports the claim that there is a significant relationship between a teacher’s epistemological beliefs and their tendency to adopt specific pedagogical practices (Chan, 2003; Maggioni &amp; Parksion, 2008; Pajares, 1992; Luft &amp; Roehrig, 2007).</td>
<td>1. What are the relationships between in-service teachers’ beliefs about intelligence and epistemological beliefs in relationship to the teaching methods they use? 1c. How are teachers’ epistemological beliefs related to the teaching methods they commonly use?</td>
<td>In your opinion, how does learning occur? How do students come to “know” something? What is an example of that from your classroom? Do you believe your content is connected to other subjects? Which is most important for learning: the process of learning or the final product? Please explain</td>
</tr>
</tbody>
</table>
**Pilot Testing.** The interview guide was pilot tested with two in-service Career and Technical Education teachers, one of whom also participated in the quantitative pilot study. The pilot test for the interview took place approximately four weeks before the first scheduled interview. As a result of the pilot test, the researcher was able to make changes to the interview protocol based upon suggestions from the pilot study participants. The suggestions included changes in the order of the questions asked, clarifying the wording of questions, and the addition of questions to best understand the phenomenon. The researcher submitted an amendment to the research protocol based upon the suggestions from the qualitative pilot study participants, and the Institutional Review Board approved the requested changes.

**Data Collection.** Data within the qualitative strand were collected using in-depth, semi-structured interviews. The purpose of in-depth interviews is to understand the lived experience of other people and the meaning they make of that experience (Seidman, 2006). Because the researcher used mainly open-ended questions with the intent of building upon and exploring the participants’ responses to those questions, the interviews were also semi-structured. By using semi-structured interviews, the researcher was able to use probes to further explore the research questions, and this allowed comparisons to be made across interviews (Bernard & Ryan, 2010). The researcher interviewed nine participants who were systematically selected using the criteria described earlier. The consent form for the qualitative strand participants appears in Appendix I. The interview protocol was developed using the propositions and supporting literature from the a priori table. The interview guide can be found in Appendix J. The interview questions were designed as open-ended questions (Seidman, 2006), where
participants were able to respond to the questions by reconstructing their own experiences in relationship to the phenomenon. Participants were able to share their own perceptions and experiences as they described the role their beliefs play when selecting teaching methods and how their thinking influences interactive decision-making. The interview protocol was designed for a 60-minute timeframe and all interviews were audio-recorded. Seidman (2006) explains that the use of audio recordings allows the researcher to reliably transcribe spoken words into written text. After transcribing each interview, the researcher provided the participants with the written transcript of their interview, allowing participants to check the accuracy of the researcher’s account. As described earlier, the pilot test of the qualitative interview questions allowed the researcher to make changes to the initial interview guide based upon the feedback of the pilot study participants.

**Data Analysis.** The purpose of the qualitative strand was to explore how teachers’ beliefs influence the teaching methods they use and how teachers articulate their thinking processes when making interactive teaching decisions. Data analysis began when the researcher transcribed the audio-recorded interviews verbatim. During the transcription process, the researcher created memos based upon reactions and interpretations of the data. This provided documentation of the researcher’s thought processes while analyzing the data.

With the amount of text generated by in-depth interviews, the researcher used constant comparative data analysis. In the constant comparative method, each incident in the data is compared with other incidents for similarities and differences, thus generating as many categories of analysis as possible (Corbin & Strauss, 2008; Creswell, 2007).
Coding was completed in two cycles. In the first cycle, InVivo Coding was used. InVivo coding refers to the creation of codes by using a word or short phrase from the qualitative data itself (Saldana, 2009). In the majority of instances, codes generated in the first cycle were originated by the participants or from the literature (Constas, 1992). Next, a second round of coding was completed in order to “reorganize, reconfigure, and to eventually develop a smaller and more select list of broader categories” (Saldana, 2009, p. 149). In the second round of coding, focused coding was used. Focus coding allowed the researcher to develop the most salient categories by comparing the newly constructed codes across other participants’ data to assess comparability and transferability (Saldana, 2009).

After the coding was completed, the researcher compared similarly coded data to identify each possible dimension of a category and the relation of a category to other categories and themes (Corbin & Strauss, 2008; Glaser, 1965). This identified different aspects of the same phenomenon and provides elaboration and variation. By using the constant comparative approach, the researcher was able to “saturate” the categories – looking for instances that represent the category until the new data does not provide additional insight to the category (Creswell, 2007). Atlas.ti © software was used to store, code, and categorize the transcripts and qualitative data for analysis. Themes were derived from the coded and categorized data (Saldana, 2009).

Trustworthiness

Within qualitative research, the researcher must look to themselves and to the participants to address issues with reliability and validity (Creswell, 2007). In the 1980s, Guba and Lincoln substituted the terms reliability and validity with the concept of
“trustworthiness” which contains four aspects: (1) credibility, (2) transferability, (3) dependability, and (4) confirmability (Creswell, 2007; Morse, Barrett, Mayan, Olson, & Spiers, 2002). Essentially, trustworthiness relates to how well a study does what it is designed to do (Merriam, 1995). Because qualitative research assumes that realities are constructed and constantly changing, concerns with internal and external validity must be addressed. In this particular study, the researcher used the following methods to establish trustworthiness.

**Clarifying Researcher Bias.** A statement of assumptions and biases allows the researcher to share their insight into how the data were interpreted. Additionally, reflexivity during data collection and analysis is an important consideration within the qualitative strand. In an attempt to acknowledge his biases and experiences, the researcher notes that he has experience as a Career and Technical Education (CTE) teacher, and he has worked closely with both in-service and pre-service CTE teachers. Furthermore, the researcher believes that intelligence is a malleable trait, and that student-centered teaching methods promote deeper level learning and increased student engagement. The researcher also possesses advanced epistemological beliefs. A personal audio journal was utilized during qualitative data collection to help the researcher develop an awareness of possible biases towards the phenomenon, and the journal was also utilized during data analysis. In addition, the researcher debriefed with his graduate committee chair, providing an external check of how biases were influencing data analysis.

**Member Checking.** Member checking involves the researcher soliciting the participants’ views of the credibility of the findings and interpretations (Creswell, 2007;
Merriam, 1995). With member checks, the researcher takes data collected and the tentative interpretations back to the participants for confirmation of the analysis’ plausibility. In this study, each qualitative strand participant examined the transcripts generated from the semi-structured interviews to determine the accuracy and credibility of the account.

**Generalizability.** The use of rich and thick descriptions within the findings of the qualitative data helped to ensure confirmability and transferability. By using detailed descriptions of the phenomenon, the researcher was able to enable readers to determine if the findings are transferable because of similar characteristics (Creswell, 2007). The findings of this study are influenced by the use of rich descriptions and authentic participant quotes. Furthermore, generalizability was strengthened through the use of multiple cases that represent a variation of the phenomenon. This allows the results to be applied to a greater range of similar situations (Merriam, 1995).

**Integration of Quantitative and Qualitative Data: The Mixing Approach**

Integration refers to the stage or stages in the research process where the mixing of the quantitative and qualitative data occurs (Creswell & Plano-Clark, 2011; Ivankova et al., 2006). In this study, the data were connected during the intermediate stage of the research when qualitative participants were determined from the data collected during the quantitative strand. The second connecting point occurred after qualitative data collection and analysis to determine if the descriptions of teaching method used, beliefs about intelligence, and epistemological beliefs aligned with the outcomes of the quantitative measurement for the qualitative strand participants. The second connecting
point served as a foundation for the larger interpretation discussed in the findings section of the study.

**Validity Within Mixed Methods Design Research.** According to Creswell and Plano-Clark (2011), because mixed methods research involves both quantitative and qualitative strands of data, the researcher must ensure that specific threats to validity are discussed for both strands. Validity in mixed methods research refers to the strategies that address potential issues in data collection, analysis, and interpretation that might compromise the connection of the data strands and the conclusions drawn from the study (Creswell & Plano-Clark, 2011). In this particular study, the researcher identified the following threats to validity: (1) Using inappropriate sample sizes for the qualitative and quantitative data collection, (2) selecting inadequate participants for the follow-up that cannot explain significant results, (3) choosing weak quantitative results to follow up qualitatively, and (4) comparing the two data sets when they are intended to build rather than merge (Creswell & Plano-Clark, 2011, p. 242). The following strategies were utilized to minimize the threats to validity: (1) The researcher used a large sample for the quantitative strand (292 participants) and a small sample for the qualitative strand (nine participants), (2) the researcher used only individuals that had completed the quantitative strand for the qualitative strand, (3) the qualitative strand participants were systematically selected based upon matching theoretical assumptions, and (4) the quantitative and qualitative data were interpreted to answer the mixed methods research question (Creswell & Plano-Clark, 2011).
Summary

This chapter described the rationale for a two-phase, sequential explanatory mixed methods research design and methodology for examining the role teachers’ beliefs play in making instructional decisions. The quantitative and qualitative methodologies were explained, including information regarding the population and samples, pilot studies, and data collection and analysis procedures. Procedures utilized to ensure the reliability and validity of the quantitative and qualitative data were also discussed. In addition, this chapter described the mixed methods data analysis procedures and described strategies used to minimize threats to validity. Chapter 4 will present the findings for the quantitative strand, the qualitative strand, and the mixed methods research question.
Chapter 4

Findings

The intent of this study was to examine the role teachers’ beliefs play in making instructional decisions. In this two-phase, sequential explanatory mixed methods study, quantitative data were used to select participants for follow-up interviews to further explain the results. In the first phase, quantitative research questions addressed the relationship between in-service teachers’ beliefs about intelligence and epistemological beliefs in relation to student-centered and teacher-centered teaching methods. In the second phase, semi-structured interviews were conducted to explore how in-service teachers describe the role their beliefs play when making planning decisions.

Specifically, the following research questions were clearly outlined and guided the study:

1. What are the relationships between in-service teachers’ beliefs about intelligence and epistemological beliefs in relationship to the teaching methods they use?
   a. What is the relationship, if any, of in-service teachers’ beliefs about intelligence to their epistemological beliefs?
   b. How are in-service teachers’ beliefs about intelligence related to the teaching methods they use?
   c. How are in-service teachers’ epistemological beliefs related to the teaching methods they use?

2. How do in-service teachers describe their beliefs about intelligence, epistemological beliefs and how those beliefs influence how they teach?

3. How do the descriptions of teaching method preferences, beliefs about intelligence, and epistemological beliefs align with the outcomes of a
quantitative measurement within a systematically selected sample of in-service teachers?

This chapter reports the findings of the above research questions. A description of the participants for the quantitative and qualitative phases precedes the findings for the quantitative strand and the qualitative strand. Research question one identified the relationship between in-service teachers’ beliefs about intelligence and epistemological beliefs in relationship to student-centered and teacher-centered teaching methods. The question was addressed by collecting data using Dweck’s Implicit Theories of Intelligence Scale, the Epistemic Belief Inventory (EBI), and the self-reported frequency of using eight teaching methods and strategies that represented a variation of teacher-centered or learner-centered teaching methods (demonstrations, experiments, group projects/assignments, independent assignments, lecture, role-play, small group/partner discussion, and teacher-led discussion). The data generated from the questionnaire reflects an overall picture of the samples’ beliefs about intelligence, epistemological beliefs, and teaching practices used.

Research question two allowed the researcher to categorize how teachers’ beliefs influence the teaching methods they commonly use. To address this question, the researcher conducted in-depth interviews with systematically selected participants. The interviews were transcribed verbatim and analyzed using the constant comparative method. This generated multiple categories of analysis and by comparing it with similarly coded data, the researcher was able to identify the central themes relating to the research question. Research question three was addressed by comparing the quantitative findings obtained in research question one with the findings of research question two.
Quantitative Strand Findings

Participants. Within the quantitative strand, 292 questionnaires were returned. The average age of the quantitative strand participants was 46.07 (n=289; SD=11.36) years of age with a minimum of 23 years of age and a maximum of 72 years of age. For years of teaching experience, the mean was 15.67 years (n=290). The standard deviation was 10.37 years, and the minimum was one year and the maximum was 40 years. Eighty-four percent of the quantitative strand participants were female, and approximately 44 percent identified their primary CTE discipline as Business and Information Technology. The quantitative strand included 210 high school teachers, 68 middle school teachers, and 14 teachers that teach both middle and high school. Of the quantitative strand participants, 141 hold a Bachelor’s degree and 146 hold a Master’s degree. Approximately 67 percent completed a traditional teacher preparation program, while 32 percent were alternatively certified. A more detailed description of the quantitative strand participants is provided in Table 2.
Table 2

Description of Quantitative Strand Participants (n=292)$^a$

<table>
<thead>
<tr>
<th>Variable</th>
<th>$n$</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>48</td>
<td>16.4</td>
</tr>
<tr>
<td>Female</td>
<td>244</td>
<td>83.6</td>
</tr>
<tr>
<td>Years of Teaching Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3 years</td>
<td>25</td>
<td>8.6</td>
</tr>
<tr>
<td>4-6 years</td>
<td>51</td>
<td>17.5</td>
</tr>
<tr>
<td>7-13 years</td>
<td>68</td>
<td>23.3</td>
</tr>
<tr>
<td>14-23 years</td>
<td>71</td>
<td>24.3</td>
</tr>
<tr>
<td>24 or more years</td>
<td>75</td>
<td>25.7</td>
</tr>
<tr>
<td>Primary CTE Discipline$^b$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agricultural Education</td>
<td>34</td>
<td>10.9</td>
</tr>
<tr>
<td>Business &amp; Information Technology</td>
<td>129</td>
<td>41.3</td>
</tr>
<tr>
<td>Family &amp; Consumer Sciences</td>
<td>97</td>
<td>31.0</td>
</tr>
<tr>
<td>Marketing Education</td>
<td>44</td>
<td>14.1</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>2.6</td>
</tr>
<tr>
<td>Grade Levels Currently Teaching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle School</td>
<td>68</td>
<td>23.3</td>
</tr>
<tr>
<td>High School</td>
<td>210</td>
<td>71.9</td>
</tr>
<tr>
<td>Both Middle School &amp; High School</td>
<td>14</td>
<td>4.8</td>
</tr>
<tr>
<td>Highest Level of Education Completed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelor’s Degree</td>
<td>141</td>
<td>48.3</td>
</tr>
<tr>
<td>Master’s Degree</td>
<td>146</td>
<td>50.0</td>
</tr>
<tr>
<td>Doctoral Degree</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>Type of Teacher Preparation Program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional Program</td>
<td>196</td>
<td>67.1</td>
</tr>
<tr>
<td>Alternatively Certified</td>
<td>93</td>
<td>31.8</td>
</tr>
<tr>
<td>CTE Professional Organization Member</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>165</td>
<td>56.5</td>
</tr>
<tr>
<td>No</td>
<td>125</td>
<td>42.8</td>
</tr>
</tbody>
</table>

Note. $^a$Complete demographic data were not collected from all participants. $^b$ Twenty participants indicated more than one primary CTE discipline.

Quantitative data collection occurred between October 2010 and March 2011.

Using the mean scores for the Theories of Intelligence Scale (TOI) and Epistemic Belief Inventory (EBI), the researcher conducted an independent sample $t$-test to determine if means scores for early respondents (first fifty questionnaires returned) and late respondents (last fifty questionnaires returned) were significantly different. For the TOI,
the t-value is 0.07 and is not significant (p=0.947). For the EBI, the t-value is 0.50 and is not significant (p=0.62). This indicates that the mean TOI and EBI score for early respondents is not significantly different than the mean TOI and EBI score for late respondents. In addition, prior to conducting further statistical analysis, the researcher examined the assumption of normally distributed data for the teaching practices scores, TOI Scale, and the EBI. Skewness values, kurtosis values, and histograms for the three components of the questionnaire were examined, and it was determined that the data were normally distributed.

Table 3 provides the mean scores, standard deviations, minimum and maximum values for the teaching practices scores, Theories of Intelligence (TOI) scale, and the Epistemic Belief Inventory (EBI). The scores for the teaching practices questions have a range between 8-40. The mean (n=290) was 19.84, and the standard deviation was 2.97. The minimum score was ten, and the maximum score was 27. Higher teaching practice scores indicate a preference for student-centered teaching methods. For the TOI Scale, the scores can range between eight and 48. The mean (n=284) was 37.26, and the standard deviation was 7.15. Participants with higher TOI scores are classified as incremental theorists and lower scores represent entity theorists (Dweck, 2000). The minimum value was 16, and the maximum score was 48. For the EBI, the mean (n=267) was 108.99, and the standard deviation was 7.82. The minimum score was 76, and the maximum score was 130. Higher EBI scores represent a participant with advanced epistemological beliefs, and lower scores indicate a participant with naïve epistemological beliefs (Schommer-Aikins, 2002; Schommer-Aikins & Easter, 2006; Schraw, Bendixen, & Dunkle, 2002).
Table 3

Means, Standard Deviations, Minimums, and Maximums for the Teaching Practices Scale, Theories of Intelligence Scale, and Epistemic Belief Inventory

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching Practices Scale</td>
<td>290</td>
<td>19.84</td>
<td>2.97</td>
<td>10</td>
<td>27</td>
</tr>
<tr>
<td>Theories of Intelligence Scale</td>
<td>284</td>
<td>37.26</td>
<td>7.15</td>
<td>16</td>
<td>48</td>
</tr>
<tr>
<td>Epistemic Belief Inventory</td>
<td>267</td>
<td>108.99</td>
<td>7.82</td>
<td>76</td>
<td>130</td>
</tr>
</tbody>
</table>

Note. a The Teaching Practices scores can range between 8-40. b The Theories of Intelligence Scale scores can range between 8-48. c The Epistemic Belief Inventory scores can range between 32-160. d Missing data were excluded.

Research Question 1: What are the relationships between in-service teachers’ beliefs about intelligence and epistemological beliefs in relationship to the teaching methods they use?

The Pearson product-moment correlation coefficient was used to determine if there was a statistically significant relationship between in-service teachers’ beliefs about intelligence and epistemological beliefs in relationship to the teaching methods they use. Correlations were conducted to determine if there were significant relationships between the teaching practices scores, the Theories of Intelligence Scale, and Epistemic Belief Inventory. The correlation coefficient shows a weak, positive, but statistically significant relationship between the teaching practices scores and the Epistemic Belief Inventory (r=0.20, p<0.01). In addition, there was a weak, positive significant relationship between the Theories of Intelligence Scale and the Epistemic Belief Inventory (r=0.23, p<0.01).

Table 4 provides a summary of the correlation coefficients for the teaching practices scores, Theories of Intelligence Scale, and the Epistemic Belief Inventory.
Table 4

*Correlation Matrix for Teaching Practices scores, Theories of Intelligence Scale and Epistemic Belief Inventory*

<table>
<thead>
<tr>
<th></th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Teaching Practices</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Theories of Intelligence Scale</td>
<td>-0.03</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3. Epistemic Belief Inventory</td>
<td>0.20**</td>
<td>0.23**</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note.* *p*<0.05; **p*<0.01

**Research Question 1a: What is the relationship, if any, of in-service teachers’ beliefs about intelligence to their epistemological beliefs?**

Correlations were conducted to determine if there were significant relationships between the Theories of Intelligence Scale and Epistemic Belief Inventory. As described previously, the resulting correlation coefficient shows a significant positive, weak relationship between the Theories of Intelligence Scale and Epistemic Beliefs Inventory. As a result, the Pearson product moment was also used to determine the relationship between Theories of Intelligence Scale and the five constructs of the Epistemic Belief Inventory. Of the five constructs of the Epistemic Belief Inventory, two had statistically significant relationships with the Theories of Intelligence scale. “Innate Ability” had a moderate, positive relationship (*r*=0.45, *p*<0.01) with the Theories of Intelligence Scale. This means participants with a higher score on the Theories of Intelligence Scale (i.e. incremental theorists) will have a higher score for the Innate Ability construct of the Epistemic Belief Inventory (advanced beliefs). “Quick Learning” had a weak, positive relationship (*r*=0.15, *p*<0.05). For the remaining relationships, the researcher failed to reject the null hypothesis indicating there were not significant relationships between the Theories of Intelligence Scale and the remaining constructs (Simple Knowledge, Certain Knowledge and Omniscient Authority) of the Epistemic Belief Inventory. Table 5
provides a summary of the Pearson product-moment correlations for the Theories of Intelligence Scale and the Epistemic Belief Inventory constructs.

Table 5

Correlation Matrix for Theories of Intelligence Scale and Epistemic Belief Inventory Constructs

<table>
<thead>
<tr>
<th></th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Theories of Intelligence Scale</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Epistemic Belief Inventory: Simple Knowledge</td>
<td>0.05</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Epistemic Belief Inventory: Certain Knowledge</td>
<td>0.05</td>
<td>0.17**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Epistemic Belief Inventory: Innate Ability</td>
<td>0.45**</td>
<td>0.21**</td>
<td>0.11</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Epistemic Belief Inventory: Omniscient Authority</td>
<td>-0.08</td>
<td>0.16**</td>
<td>0.21**</td>
<td>0.04</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>6. Epistemic Belief Inventory: Quick Learning</td>
<td>0.15*</td>
<td>0.29**</td>
<td>0.16**</td>
<td>0.37**</td>
<td>0.01</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. *p<0.05; **p<0.01

Research Question 1b: How are in-service teachers’ beliefs about intelligence related to the teaching methods they use?

Research Question 1c: How are in-service teachers’ epistemological beliefs related to the teaching methods they use?

In addition, correlations were used to determine the relationship between the Theories of Intelligence Scale, the Epistemic Belief Inventory, and the eight teaching methods the teachers’ might utilize in the classroom (demonstrations, experiments, group projects/assignments, independent assignments, lecture, role-play, small group/partner discussion, and teacher-led discussion). The correlations show a statistically significant relationship between the Theories of Intelligence Scale and two of the eight teaching methods. There is a negative, weak relationship between the Theories of Intelligence Scale and Practice 1, “demonstrations” \((r=-0.19, p<0.01)\). In other words, the more frequently the participants indicated they used demonstrations in their classrooms, their
Theories of Intelligence Scale score decreased. There was also a weak, positive relationship between the Theories of Intelligence Scale and Practice 2, “experiments” ($r=0.15, p<0.05$). The more likely teachers indicate they utilize experiments in their classrooms, their Theories of Intelligence Scale score increased. The Epistemic Belief Inventory had a statistically significant relationship with two teaching methods. There was a weak, positive relationship between the Epistemic Belief Inventory and Practice 5, “lecture” ($r=0.20, p<0.01$). In this case, the more frequently teachers indicated they use lecture, their Epistemic Belief Inventory scores increased. There was also a weak, positive relationship between the Epistemic Belief Inventory and Practice 7, “small group/partner discussion” ($r=0.15, p<0.05$). In other words, as Epistemic Belief Inventory scores increased, the teachers indicated more frequently using small group/partner discussion as a teaching practice. Table 6 illustrates the individual correlations between the teaching practices and the Theories of Intelligence scale and the Epistemic Belief Inventory.
Table 6

Correlations Between Teaching Practices and the Theories of Intelligence (TOI) Scale and Epistemic Belief Inventory (EBI).

<table>
<thead>
<tr>
<th>Teaching Practice</th>
<th>TOI</th>
<th>EBI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrations</td>
<td>0.19**</td>
<td>0.09</td>
</tr>
<tr>
<td>Experiments</td>
<td>0.15*</td>
<td>0.12</td>
</tr>
<tr>
<td>Group Projects/Assignments</td>
<td>0.01</td>
<td>0.08</td>
</tr>
<tr>
<td>Independent Assignments</td>
<td>-0.10</td>
<td>0.03</td>
</tr>
<tr>
<td>Lecture</td>
<td>-0.05</td>
<td>0.20**</td>
</tr>
<tr>
<td>Role-Play</td>
<td>0.05</td>
<td>0.00</td>
</tr>
<tr>
<td>Small Group/Partner Discussion</td>
<td>-0.02</td>
<td>0.15*</td>
</tr>
<tr>
<td>Teacher Led Discussion</td>
<td>-0.05</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Note. *p<0.05; **p<0.01

A canonical correlation analysis was conducted using the Theories of Intelligence Scale and Epistemic Belief Inventory as predictors of the eight teaching practices (demonstrations, experiments, group projects/assignments, independent assignments, lecture, role-play, small group/partner discussion, and teacher-led discussion). This allowed the researcher to consider the simultaneous relationship of all the variables at once. Overall, the full model was significant (Wilks $\lambda = 0.85, F(16, 502) = 02.75, p<0.01$). Wilks $\lambda$ represents the variance not explained by the model, $1 - \lambda$ provides the variance explained by the full model (Rinn, 2009). Therefore, the full model explained approximately 15% of the variance shared between the two variable sets. Meanwhile, the tests of dimensionality for the canonical correlation analysis, as shown in Table 7, indicate that one canonical dimension is statistically significant. Results of the canonical
correlation analysis yielded a squared canonical correlation ($R_C^2$) of 0.12 for Dimension One.

Table 7

Tests of Canonical Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>$R_C$</th>
<th>$R_C^2$</th>
<th>$F$</th>
<th>df1</th>
<th>df2</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.34</td>
<td>0.12</td>
<td>2.75</td>
<td>16.00</td>
<td>502.00</td>
<td>0.00**</td>
</tr>
<tr>
<td>2</td>
<td>0.21</td>
<td>0.04</td>
<td>1.68</td>
<td>7.00</td>
<td>252.00</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Note. *p<0.05; **p<0.01

The meanings of the canonical variates are interpreted via the structure coefficients. An examination of the structure coefficients in Table 8 illustrate that the criterion synthetic variable for the first canonical dimension was primarily defined by Practice 1 ($r_s = -0.69$), Practice 5 ($r_s = -0.50$), and Practice 7 ($r_s = -0.57$). Specifically, approximately 44% of the variance in Practice 1 was shared with the canonical variate, 28% of the variance in Practice 5 was shared with the canonical variate, and 14% of the variance in Practice 7 was shared with the canonical variate. Regarding the predictor variables, both the Theories of Intelligence Scale (TOI) and Epistemic Belief Inventory (EBI) contributed to the predictor canonical variate. The shared variance with the predictor variate was 53% (EBI) and 25% (TOI), respectively. Because the structure coefficient for EBI was negative, it was negatively related to Practice 1 (demonstrations), Practice 5 (lecture) and Practice 7 (small group/partner discussion). This indicates that higher scores on the EBI were associated less frequent use of those particular teaching practices.
Table 8

Canonical Solution for Theories of Intelligence Scale and Epistemic Belief Inventory Predicting Teaching Practices 1-8.

<table>
<thead>
<tr>
<th>Dimension 1</th>
<th>Coef(\text{a})</th>
<th>(r_s)(\text{b})</th>
<th>(r_s^2) (%)(\text{c})</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOI</td>
<td>0.70</td>
<td>0.50</td>
<td>0.25</td>
</tr>
<tr>
<td>EBI</td>
<td>-0.89</td>
<td>-0.73</td>
<td>0.53</td>
</tr>
<tr>
<td>RC(\text{2d})</td>
<td></td>
<td></td>
<td>0.12</td>
</tr>
<tr>
<td>Practice 1</td>
<td>-0.69</td>
<td>-0.66</td>
<td>0.44</td>
</tr>
<tr>
<td>Practice 2</td>
<td>-0.05</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Practice 3</td>
<td>-0.08</td>
<td>-0.18</td>
<td>0.03</td>
</tr>
<tr>
<td>Practice 4</td>
<td>-0.11</td>
<td>-0.25</td>
<td>0.06</td>
</tr>
<tr>
<td>Practice 5</td>
<td>-0.50</td>
<td>-0.53</td>
<td>0.28</td>
</tr>
<tr>
<td>Practice 6</td>
<td>0.24</td>
<td>0.09</td>
<td>0.01</td>
</tr>
<tr>
<td>Practice 7</td>
<td>-0.57</td>
<td>-0.38</td>
<td>0.14</td>
</tr>
<tr>
<td>Practice 8</td>
<td>-0.04</td>
<td>-0.16</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Note. \(\text{a}\)Standardized Canonical Coefficient. \(\text{b}\)Structure Coefficient. \(\text{c}\)Squared Structure Coefficient. \(\text{d}\)Squared Canonical Correlation Coefficient

Analysis of variance (ANOVA) was utilized to determine if there were significant differences in the mean scores of the Theories of Intelligence Scale and Epistemic Belief Inventory based on CTE discipline, years taught, highest level of education completed, and the type of teacher preparation program completed. Based upon the participants CTE disciplines, a one-way ANOVA revealed there were not significant differences in the mean scores of the Theories of Intelligence Scale \([F(4, 279) = 1.03, p = 0.39]\) or in the mean scores of the Epistemic Belief Inventory \([F(4, 262) = 1.72, p = 0.15]\). Table 9 provides a summary of the one-way ANOVA based on CTE teaching discipline.
Table 9

*Summary of One-Way ANOVA Based on CTE Teaching Discipline*

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theories of Intelligence Scale</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>210.28</td>
<td>4</td>
<td>52.57</td>
<td>1.03</td>
</tr>
<tr>
<td>Within Groups</td>
<td>14270.92</td>
<td>279</td>
<td>51.15</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>14481.20</td>
<td>282</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Epistemic Belief Inventory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>415.47</td>
<td>4</td>
<td>103.87</td>
<td>1.72</td>
</tr>
<tr>
<td>Within Groups</td>
<td>15840.47</td>
<td>262</td>
<td>60.46</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16255.94</td>
<td>266</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* *p*<0.05; **p<0.01

The participants’ years of teaching experience ranged from one year to 40 years. Using quartiles, four categories were created. They include: (1) 1-6 years of experience, (2) 7-13 years of experience, (3) 14-23 years of experience, and (4) 24 years or more of experience. The researcher chose to split the 1-6 years of experience into two separate categories (1-3 years; 4-6 years) for a total of five categories. A one-way ANOVA revealed there were not a significant difference in the mean scores of the Theories of Intelligence Scale, \(F(4,277) = 0.55, p = 0.70\) based upon years taught. Additionally, there was not a significant difference in the mean scores of the Epistemic Belief Inventory based upon years taught, \(F(4, 261) = 2.39, p = 0.05\). Table 10 provides a summary of the one-way ANOVA based on years of teaching experience.
In addition, a one-way ANOVA was used to determine if there were differences in the mean scores of the Theories of Intelligence Scale and Epistemic Belief Inventory based upon the highest level of education the participants had completed (Bachelor’s degree, Master’s degree, or Doctoral degree). For both the Theories of Intelligence Scale \(F(2, 281) = 1.48, p = 0.21\) and the Epistemic Belief Inventory \(F(2, 264) = 0.43, p = 0.65\), there were not statistically significant differences in mean scores based upon the highest level of education completed. Table 11 provides a summary of the one-way ANOVA based on the highest level of education completed.

### Table 11

**Summary of One-Way ANOVA Based on Highest Level of Education Completed**

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theories of Intelligence Scale</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>150.98</td>
<td>2</td>
<td>75.49</td>
<td>1.48</td>
</tr>
<tr>
<td>Within Groups</td>
<td>14330.21</td>
<td>281</td>
<td>51.00</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>14481.19</td>
<td>283</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Epistemic Belief Inventory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>52.63</td>
<td>2</td>
<td>26.32</td>
<td>0.43</td>
</tr>
<tr>
<td>Within Groups</td>
<td>16203.31</td>
<td>264</td>
<td>61.38</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16255.94</td>
<td>266</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* *p*<0.05; **p*<0.01
Finally, a one-way ANOVA was used to identify differences in mean scores of the Theories of Intelligence Scale and Epistemic Belief Inventory based upon the type of teacher preparation program completed. The ANOVA analysis revealed there were not significant differences in the mean scores based upon the type of teacher preparation program completed (traditional teacher preparation program or alternatively certified teacher) for both the Theories of Intelligence Scale \[ F(1, 279) = 0.89, p = 0.35 \] and the Epistemic Belief Inventory \[ F(1, 262) = 0.48, p = 0.49 \]. Table 12 provides a summary of the one-way ANOVA based on the type of teacher preparation program completed.

Table 12

Summary of One-Way ANOVA Based on Type of Teacher Preparation Program Completed

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theories of Intelligence Scale</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>45.51</td>
<td>1</td>
<td>45.51</td>
<td>0.89</td>
</tr>
<tr>
<td>Within Groups</td>
<td>14201.52</td>
<td>279</td>
<td>50.90</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>14247.03</td>
<td>280</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Epistemic Belief Inventory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>29.48</td>
<td>1</td>
<td>29.48</td>
<td>0.48</td>
</tr>
<tr>
<td>Within Groups</td>
<td>16204.38</td>
<td>262</td>
<td>61.85</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16233.86</td>
<td>263</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. *p<0.05; **p<0.01*

To further understand the influence the Theories of Intelligence Scale (TOI), Epistemic Belief Inventory (EBI), and selected demographic variables (years taught, CTE discipline, highest level of education completed, and type of teacher preparation program completed) have on teaching practices, the researcher conducted a forced-entry regression to determine the amount of variance explained by the model. Because this regression analysis included continuous variables (TOI, EBI, and years taught) and categorical variables (CTE discipline, highest level of education completed, and type of
teacher preparation program), the researcher used dummy variables for the categorical variables. Two variables, highest level of education and type of teacher preparation program, were assigned values of “1” for membership and values of “0” for non-membership. The initial coding for the level of education variable (Bachelor’s degree=1, Master’s degree=2) was recoded as Bachelor’s degree = 1 (membership) and Master’s Degree = 0 (non-membership). The initial coding for type of teacher preparation program (Traditional teacher preparation program=1, alternatively certified teacher=2) was recoded as traditional program =1 (membership) and alternative certification = 0 (non-membership). Finally, CTE discipline was also coded into a series of dummy variables with “Other” serving as the reference variable.

The ANOVA table shows that the regression analysis is statistically significant $F (9, 245) = 7.38, p<0.01$. It can be determined that when taken together, the Theories of Intelligence Scale, Epistemic Belief Inventory, CTE discipline, years taught, highest level of education completed, and type of teacher preparation program explained 18.4% of the variance in teaching practices. Table 13 provides the ANOVA for the regression equation. Table 14 provides the results of the forced-regression analysis of the predictors of teaching practices. Epistemic Belief Inventory and level of education completed predicted an increase in teaching practices scores. Years taught and CTE Discipline: Business and Information Technology predicted a decrease in teaching practices scores.
Table 13

ANOVA for the Regression Equation

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>461.86</td>
<td>9</td>
<td>51.32</td>
<td>7.38**</td>
</tr>
<tr>
<td>Residual</td>
<td>1704.62</td>
<td>245</td>
<td>6.96</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2166.47</td>
<td>254</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. *p<0.05; **p<0.01

Table 14

Forced-Entry Regression Analysis of Predictors of Teaching Practices

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)a</td>
<td>16.22</td>
<td>2.65</td>
<td>6.13</td>
<td>0.00**</td>
<td></td>
</tr>
<tr>
<td>TOI</td>
<td>-0.03</td>
<td>0.02</td>
<td>-0.07</td>
<td>-1.21</td>
<td>0.23</td>
</tr>
<tr>
<td>EBI</td>
<td>0.06</td>
<td>0.02</td>
<td>0.16</td>
<td>2.73</td>
<td>0.01**a</td>
</tr>
<tr>
<td>CTE Discipline: AE*c</td>
<td>-2.05</td>
<td>1.28</td>
<td>-0.23</td>
<td>-1.61</td>
<td>0.11</td>
</tr>
<tr>
<td>CTE Discipline: BIT*d</td>
<td>-2.78</td>
<td>1.21</td>
<td>-0.47</td>
<td>-2.30</td>
<td>0.02*</td>
</tr>
<tr>
<td>CTE Discipline: FCS*e</td>
<td>-0.36</td>
<td>1.22</td>
<td>-0.06</td>
<td>-0.30</td>
<td>0.77</td>
</tr>
<tr>
<td>CTE Discipline: ME*f</td>
<td>-0.44</td>
<td>1.30</td>
<td>-0.05</td>
<td>-0.34</td>
<td>0.74</td>
</tr>
<tr>
<td>Years Taught</td>
<td>-0.38</td>
<td>0.18</td>
<td>-0.13</td>
<td>-2.11</td>
<td>0.04*</td>
</tr>
<tr>
<td>Highest Education</td>
<td>0.67</td>
<td>0.34</td>
<td>0.12</td>
<td>2.00</td>
<td>0.05*b</td>
</tr>
<tr>
<td>Teacher Prep</td>
<td>0.38</td>
<td>0.41</td>
<td>0.06</td>
<td>0.95</td>
<td>0.35</td>
</tr>
</tbody>
</table>

*Note. *p<0.05; **p<0.01. aDependent Variable: Teaching Practices. bDependent Variable: Teaching Practices. cAgricultural Education teachers. dBusiness and Information Technology teachers. eFamily and Consumer Sciences teachers. fMarketing Education teachers.

Based upon the statistically significant predictors of teaching practices as determined by the forced-entry regression analysis, the researcher conducted a step-wise regression to determine which variables (Epistemic Belief Inventory, CTE discipline: Business and Information Technology, years taught, and highest level of education...
completed) were the strongest predictors of teaching practices. CTE discipline: Business and Information Technology was found to be the best predictor of teaching practices with the first model explaining 11 percent of the variance. There was a significant change in $R^2$ for the second and third models. In the second model, the addition of the Epistemic Belief Inventory led to a significant increase in the amount of variance explained ($\Delta R^2 = 0.03, F = 8.77, p < 0.01$). In the third model, the addition of years taught led to a significant increase in the amount of variance explained ($\Delta R^2 = 0.02, F = 5.58, p < 0.05$). Table 15 provides a summary of the stepwise regression analysis.
Table 15

*Stepwise Regression Analysis of Predictors of Teaching Practices*

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*Note.* $^p<0.05$; **$p<0.01$. $^a$Dependent Variable: Teaching practices score

**Qualitative Strand Findings**

**Participants.** The qualitative strand included nine participants systematically and purposefully selected from the results of the quantitative strand. “Mrs. Daniels” is a high school Agricultural Education teacher, and she has been teaching for 8 years. “Ms. Neil” teaches middle and high school Business and Information Technology courses. She is in her 20th year of teaching. “Mrs. Newman” teaches Family and Consumer Science courses at the high school level, and she has 40 years of experience. “Mrs. Niles” has
been teaching for 27 years. Her primary CTE discipline is Business and Information Technology at the high school level. “Mrs. Oliver” teaches middle school Family and Consumer Science, and she has been teaching for 13 years. “Ms. Oster” teaches high school Business and Information Technology classes, and she has been teaching for the past six years. “Mrs. Thomas” also teaches high school Agricultural Education courses, and she is in her 14th year of teaching. “Ms. Turner” is a first year Marketing teacher at the high school level. “Mrs. Zook” has taught Business and Information Technology for the eleven years. She teaches at the high school level. Of the qualitative strand participants, six have Master’s degrees, and four participants (Mrs. Newman, Mrs. Oliver, Ms. Oster, and Mrs. Zook) were alternatively certified.

**Research Question 2:** How do in-service teachers describe their beliefs about intelligence, epistemological beliefs and how those beliefs influence how they teach?

**Findings.** Upon a thematic analysis, six themes emerged from the data, and the themes are used as a framework for organizing the findings. The six themes include:

1. Teachers use a variety of teaching strategies and methods that reflect both student-centered and teacher-centered approaches.
2. Teachers possess differing beliefs regarding the ability of all students to improve their intelligence and learning.
3. Teachers believe that the content they teach supplements other academic disciplines by tapping into students' interests and offering real-life application of content.
4. The process of learning and the final product are both important and should be emphasized.
5. Students obtain knowledge from a variety of sources.
6. The speed of learning is dependent upon the individual learner.

The themes are discussed separately. However, they are not experienced independently of one another, but rather holistically.

**Theme: Teachers use a variety of teaching strategies and methods that reflect both student-centered and teacher-centered approaches.**

When asked about strategies and methods they employ while teaching, the participants indicated using a variety of teaching strategies and methods. The participants described student-centered teaching methods they frequently use, but several teachers noted that they have not always adopted the student-centered mentality. “You go from standing in front of the classroom and lecturing, and I did that for a little bit, and you realize that you’re not getting to the students,” said Mrs. Oliver. Mrs. Newman recalled a similar experience. “Well, for me, when I first started teaching, it was more just lecture. I’ll lecture then you go do it,” she said. Mrs. Niles described similar feelings. “I think I was a rigid teacher when I first started teaching. Probably for the first – maybe six or seven years,” she said. Their reasons for changing from teacher-centered to student-centered occurred for different reasons. In some cases, the teachers described their displeasure with lecture, a teaching strategy commonly identified as teacher-centered. “I don’t like to lecture. It’s not fun for anybody,” said Mrs. Newman. She elaborated. “They don’t listen. I think they are lectured out. Even using the overhead and things like that, they’ve got too much of it.” Mrs. Zook expressed similar feelings. “I don’t like traditional teaching, so for me, I don’t want to lecture for an hour or an hour and a half.” Mrs. Oliver also shared why she uses lecture sparingly:
You take a professor who stands up and lectures the entire time, and those kids who can’t process that information; you’re losing them. You can see it in their eyes and body language. I was like, ‘Oh, I am not so effective here.’ I mean I still have to give notes every so often, but I try to make it as quick and painless as possible.

The participants described the types of student-centered methods they use while teaching. Specifically mentioned were project-based instruction, hands-on activities, class discussions, peer teaching, collaborative groups, and the use of higher order questioning. There were multiple instances where project-based instruction was acknowledged. Ms. Turner described a project she implemented in her Computer Programming class. “They actually had to create a video game. They had to play their video game in front of the class,” she recalled. She went on to describe how the use of a project allowed her to determine if her students had mastered the material. “If I could see that their video game is working properly, then – and they could tell me exactly what is going on, ‘Oh, this is my loop. This is the object changing poses.’ I can tell they’ve conquered the material,” she said. Ms. Oster also mentioned a project her students were currently completing in a Business and Information Technology class. “Right now, we are doing a virtual simulation where the kids are building a sim. It’s kind of like Sim City, and they have to get an apartment, get a job, and do various things as far as personal finance,” she explained.

The participants also specified how they use hands-on activities in their classes. “We have the kids doing interactive stuff or filling out packets or researching,” said Mrs. Newman. Ms. Neil also illustrated her preference for using hands-on activities. “We do
a lot of board work. They go up and do a lot of board work. We draw cartoons. I even bring out crayons and colored paper. There’s always one to two activities that we do per chapter,” she said. Mrs. Daniels described the types of hands-on activities she is able to include in her Agricultural Education classes. “…they are in the shop or in the greenhouse or I take them to the Chesapeake Bay or go to the arboretum.” In fact, Mrs. Thomas even stated that students often choose to take her Agricultural Education classes because of their hands-on nature. “They want to come out here because they know they will have a lot of hands-on, they know they will be outside,” she said. Mrs. Newman also described the hands-on nature of her Family and Consumer Science classes:

In our classes especially, it’s a walk-around class. They aren’t stuck to their chairs all day. They have to have some activity. I want it to be fun. I want them to know that being in the kitchen or in the other class – I also teach fashion.

That’s total hands-on activities. We do a little bit of lecture in there, but the rest of it’s hands-on.

In addition to adopting a hands-on approach to teaching, the teachers also include discussions and higher-level questioning techniques into their classes. “I guess one of my biggest tools that I do use is class discussion. I love that. It’s not me standing up there lecturing, but everybody is talking back and forth,” described Ms. Neil. In fact, Ms. Neil even described her class as “roundtable discussion” in which students can share ideas back and forth. Ms. Oster identified questioning as a method she uses in her classroom to promote higher-level thinking. “I try – any question I ask, I try and make it upper level because I don’t want kids just regurgitating information back to me. I want them to know it and be able to talk about it.” Mrs. Thomas also uses higher-level questioning in her
Agricultural Education classroom. “I can ask, ‘If my plants are looking kind of purple, what is it? If I’m putting in a whole bunch of tomatoes, what kind of fertilizer would I want to use?’”

Peer teaching and working in collaborative groups was also frequently mentioned as common teaching practices. “I don’t expect them to sit quietly and fill in the paper. There is a lot of chatter back and forth. I think that way they are exchanging information and – it’s teamwork,” recalled Mrs. Newman. Ms. Turner also indicated her preference for group work and using strategies such as “think-pair-share.” She described how her students work in collaborative groups when reading a current event:

I’ll break it up into four sections, hand it out to a group and then one person will read one section and one person will read another section. They’ll have to discuss the main points, what types of questions did they have hanging from actually reading the article. Then, they will discuss as a group their main points and figure out what the whole article is about.

Peer teaching was also encouraged in the participants’ classes. Mrs. Oliver used an example from her middle school Family and Consumer Science class. “At no time should I see three students who are capable of measuring the flour doing it while my other child is sitting there watching. ‘No, no, no, no! Get her in there! Show her how to do it!’”

Mrs. Newman also described how she uses peer-to-peer teaching as a form of mentoring. “I have one student that can’t read very well at all. So, I have him working with another person as a mentor. Mentoring seems to work in the classes,” she added. Mrs. Zook encourages peer teaching and highlighted that students are often evaluated on their ability to teach the material to others:
It is not cheating in my class when you look at your partner or friend and say ‘Hey, I can’t get this to work. Show me what you did.’ That’s how I actually measure a lot of what they know. The competencies – the way you rate them is ‘can teach others.’ I know you know something when someone else says, ‘Show me how you did it’ and you get up and you can show them. There is no better measure for me.

Furthermore, the teachers indicated that their students ultimately play a large role in determining the content and pace of the material being taught. Mrs. Oliver recounted a conversation she had with her Family and Consumer Science students:

They said to me ‘What are we doing next?’ I said, ‘I don’t know. What do you want to do?’ They were like, ‘What do you mean?’ ‘You design the lesson plan.’ I had four girls who developed a lesson plan on making Christmas cookies for the entire staff at [school name]. To me, that was student-driven.

Mrs. Niles also described allowing students to have input on the order material was taught. “Okay, these are the three things we need to study. What do you want to do first?’ I would let them lead it.” Mrs. Newman’s noted that her students often dictate the pace at which she teaches. “…they are going to dictate how things go. I might have such and such planned, but it might not work out that way because they are missing something else that we have to backtrack for.” Ms. Turner sought input on what her students enjoy. “I’ll ask my kids ‘What do you like to do in class? What do you not like to do in the class?’”

In addition to describing student-centered teaching methods, the participants stressed the importance of providing individualized assessment strategies. “I don’t think
we should grade all students the same,” said Mrs. Niles. Mrs. Oliver also expressed differentiating assessment methods for her Family and Consumer Science students. “Just because this kid couldn’t read and summarize doesn’t mean that he can’t learn about it. Maybe watching a video or asking him, ‘This is your appliance. What do you know about it?’” Other participants described the different assessment strategies they utilize. “I don’t believe that fill-in-the-blank, multiple-choice tests are all that effective. I use them occasionally, but I like to use other kinds of assessments,” said Ms. Oster. She specified further: “It’s more of a – like for instance, in this simulation, they have to print out their bank statement for me showing me that they have paid bills, showing me that they understood those concepts.” Ms. Turner also indicated an individualized approach to assessments:

I still use formal assessments, especially in my Marketing class, but I’m also project based too. So even if they can’t remember the definition of customer service, if they can do a role-play in front of the class demonstrating customer service; then I know they know what it is.

The use of technology is a teaching strategy that was frequently mentioned. The teachers felt that technology was a tool they could use to engage students in the learning process. “I have found that the more I use technology, the more I can engage my kids,” said Ms. Oster. Even though she is not completely comfortable with technology, Mrs. Newman has taken advantage of professional development opportunities designed to help her with technology integration. “I just finished taking one of the on-line classes on integrating the computer into the classroom. They were really happy that I took that one. That’s where we learned how to blog.” The teachers reported a wide variety of
technology used in their classrooms. Computers were most readily identified as a type of technology the participants used while teaching. “I use computers a lot. In all of my classes – my law class, my economics class, my management class – whatever I’m teaching,” said Ms. Neil. Ms. Oster also indicated that she used computers frequently in her classes. “I have 25 computers, desk top computers, in my class, and every child can have a computer. I use a lot of technology, as much as I possibly can,” she said. In addition to the use of computers, the participants described other types of technology they utilize. Mrs. Oliver explained:

I’ve been teaching them Wikispaces where they can collaborate. They are just finishing up their projects on cooking methods, small appliances, and they are researching it. They put everything into a wiki over the holiday. Now they have created glogs, instead of a blog, using Glogster, and an interactive slideshow using VoiceThreads. It is amazing.

Mrs. Oliver also described how technology allows her students to work at their own pace. After teaching a sewing lesson in her Family and Consumer Science class, she used a videotaped demonstration to reinforce the sewing process. “We videotaped each step. We put the videos on the computer, and we brought the sewing machines over. The kids logged on, and they watched the step and then they did it.”

Another student-centered characteristic that was mentioned was the importance of differentiated instruction based on ability. It was noted that the teachers have a wide range of ability levels in their classes. “I have everything…kids that are autistic…kids who are probably ADHD,” said Mrs. Thomas. Ms. Turner also described having a range of ability levels in her classes. “…it’s difficult to be a teacher because you have students
that are in IB/AP [International Baccalaureate/Advanced Placement] classes that are really bright students. You also have students with IEPs [Individualized Education Plans] that are on the lower scale,” she remarked. Ms. Neil also called attention to the varying ability levels of her students. “You have from Governor’s School down to quite a few special ed., but inclusive – all the way down to that level.” Because of the varying ability levels in their classes, the teachers felt it was important to offer each student what they needed in order to learn. “I try to come at it that every kid is capable of something, and I try to find that something and give them an opportunity to do it,” expressed Mrs. Daniels. Mrs. Niles pointed out that, because students have differing ability levels, teachers cannot teach each student in the same manner. “You can’t always teach the same thing, the same way,” she said. Mrs. Oliver specified similar feelings. “I can’t teach the same way to every kid. I can’t have a coined lesson and expect every child to learn. I’m going to have to look at the individual child and determine what they can do to benefit.” Ms. Turner offered the following as an example to illustrate how she differentiates when creating assessments:

What I’ve decided is that I have different tracks. So when we were doing the Alice software final project, I had a rubric…the higher track students had to complete everything in the rubric. The lower tract, mainly students with IEPs or those that didn’t catch on as quickly, only had to do like ¾ of the rubric.

In some cases, the participants felt it was necessary not only to individualize lesson plans for students with lower ability levels, but also to challenge students with higher ability levels. Ms. Oster described one instance she encountered during her career:
One year I had a kid in my class who was just so far advanced, and he was so bored. I said, ‘Well, I tell you what. You be my assistant teacher.’ He would zip through his work, and then he would go around – and the kids learned to depend upon him. If they needed assistance, and I was busy, they could call on him.

Additionally, the participants articulated how they differentiated instruction for a particular class. When questioned about their approach to teaching the same class more than once during the school day, the teachers reported the individual nature of each class. “Maybe period two you taught it one way, but period three it will go over their heads so you have to back up a step,” recalled Mrs. Niles. Ms. Turner described a similar situation. “My second period, is slower at finishing things. My sixth period are balls of energy. ‘We’re finished, Ms. Turner! What can we do next?’ I plan additional assignments for them to make sure they reach higher levels of thinking.” Ms. Oster also described how she modifies her lessons based upon the class:

My first block, which is the same as my seventh block, I do totally different things with them. I tweak my lessons depending upon the class and how they learn. If they are kinesthetic learners, then I get them up, get them in groups, get them walking about the room and talking to other people. If they are quiet and like to sit and take notes, then I do that with them. A lot of my lesson planning – my plans are the same, but I present them differently in each class.

While a variety of student-centered teaching methods were described, the participants also indicated the use of teacher-centered methods as well. The teacher-centered methods that were most frequently mentioned included lecture, demonstrations, and teacher-led discussion in which the students took notes. Ms. Turner acknowledged
that she uses some direct instruction in her classes, but she mixes it with student-centered methods. “I do a little bit of direct instruction. I like to do the direct lecture to teach them material, but then after that, I like to let them work with partners or groups to get a feel of it,” she said. Ms. Oster adopted a similar approach, stating that her class periods include “about 15-20 minutes of direct instruction.” Ms. Neil indicated that there are some instances where a teacher has to lecture. “I would never do straight lecture, but there are some things that you have to lecture. I mean you simply can’t get around it. They have to – so I use some lecture,” she remarked. Several participants indicated that their students are encouraged to take notes during lectures. “We do some kind of notes. [Guided notes] helps them to know what type of notes they have to have,” explained Mrs. Thomas. Mrs. Daniels also mentioned the use of notes and student notebooks in her Agricultural Education classes. “In Ecology, we might move into some more structured learning, like maybe some notes,” she said. Mrs. Daniels also pointed out that she tries to make lecture and notes more engaging. “We do notes sometimes, but notes just aren’t me talking. I usually give them something visual to look at when we take notes,” she stated.

In addition to lecture, the participants shared that they frequently use demonstrations as a teaching strategy, but often as a precursor to guided practice. “I’ll bring it in [the classroom] to show them what needs to be done, and then we’ll go out [to the lab] to do it,” recalled Mrs. Thomas. Mrs. Niles indicated that she uses a similar approach in her Business and Information Technology classes. “I always thought the best way was to demonstrate, do a class assignment together. Whether it be a spreadsheet or a computer programming language, complete it together, and then the kids show me they
know could produce their own,” she said. Mrs. Daniels also indicated she frequently uses demonstrations followed by guided practice. “I like to show them “how to” – I like to demonstrate things to them. Then I like to let them do what I’m demonstrating.” In addition, Mrs. Thomas indicated that she uses assessment methods more closely aligned with teacher-centered teaching methods. “The way I tend to test is a lot of multiple choice, just because of the kids I get,” said Mrs. Thomas. In fact, Mrs. Thomas felt her choice of assessment methods was directly related to the ability level of her students. “…I don’t want to do a test. I could give a test, but everyone would fail, so it’s pointless,” she explained.

Mrs. Thomas indicated that her choice of using teacher-centered methods is a direct result of the students in her classroom and their behavior. “I’ve tried [student-centered instruction], and it didn’t work,” she said. “The methods I use are pretty much minimal and somewhat highly controlled teacher-led classroom work. The methods I choose are ones that will help me maintain control,” she added. She described an instance when she observed another teacher using student-centered methods and indicated that the particular strategy would not work in her classroom:

We don’t do a lot of things in the classroom where things could get out of control quickly. I was in a math classroom before break. She was able to put a scenario on the board and break her kids into groups to discuss it to figure out the answer. I could never do that with the type of kids I get out here.

**Theme:** Teachers possess differing beliefs regarding the ability of all students to improve their intelligence and learning.
The participants expressed that they believed that every student has the ability to learn, while also acknowledging that learning occurs differently for every student. “I think everybody can learn anything. I have a kid with severe autism that should be in the special education program that’s in my Web Design, and he is creating websites,” stated Ms. Turner. Other participants echoed the same sentiments. Ms. Neil recalled a conversation with one of her students regarding that student’s frustration in learning a difficult subject:

I said, ‘If you can learn that, you can learn – you can learn that because you wanted to…there isn’t anything you can’t learn. You have to want to do it. It’s very easy for you to sit back and think you’re dumb. The dumb part of that is saying that you’re dumb and you can’t get this.’

To illustrate their beliefs that all students can learn, many participants described their interactions with special education students. Because she believes that all students can learn, Mrs. Oliver expressed her concern with Individualized Education Plans (IEPs). “I probably shouldn’t say this, but I don’t look at my IEPs. If I start to read through those IEPs before those kids walk into my classroom, I’m judging them by their IEP.”

Coupled with their belief that all students can learn, participants indicated that they believed that students learn differently. “You really have to figure out in your classroom, who is what kind of learner. That’s hard. They don’t come with a label,” said Mrs. Newman. Because students learn differently, Mrs. Newman described how that influences how she teaches Family and Consumer Sciences:

After you figure out what type of learner they are and why they aren’t doing something, why they aren’t turning in something, figure out another way to do it.
If they have to draw a picture, draw a picture. Like today…they had to draw an ad. Some were better than others, but they all got the point across. They all understand what a carbohydrate is.

Mrs. Niles also elaborated upon the different ways her students learn. “You learn by your experiences. You learn by repetition. You learn by what you glean from an activity, your perceptions, and then you learn by reading and factual material.” Mrs. Thomas also felt that students learn differently, and she used herself as an example of how people learn differently. “There are multiple ways to learn things. Being a special education teacher, you learn different ways to help kids remember things they need to know. I’m learning disabled myself, so there are different strategies that I’ve used to help keep myself organized, to help remember things.”

To further illustrate that anyone can learn anything, the teachers pointed out that even the teacher could learn new things. “You know, I’m not always sure that I’m saying it right or doing it right. I hope that I can learn everyday and increase my knowledge,” said Mrs. Oliver. Ms. Oster expressed similar feelings:

I don’t look at myself as being the ‘grand poobah’ of technology or business classes. I know what I know, but there is a lot I don’t know. I learn from [the students] as well – they think it’s really cool that they can teach a teacher something.

Mrs. Newman also suggested that teaching is a two-way street in her Family and Consumer Science classroom. “I’ll help you with the brown sugar if you help me with this PowerPoint. So when we are exchanging what we don’t know, they are catching on.”
Even though it was expressed that all students can learn, the participants emphasized that students have to take some responsibility for their own learning. Ms. Neil described:

I am a firm believer that it should be – the responsibility for learning should be on the student. That’s not the teacher’s responsibility. My responsibility is to teach in any way that I can to get the message across. I am to teach. That’s my responsibility, but it’s the student’s responsibility to learn it.

Mrs. Zook expressed similar feelings. “There is going to come a point when I’m not standing and saying get back to work. I can’t make you work. I can’t make you put your hands on the keyboard and do one thing.” Mrs. Daniels went as far as to say that a student’s work ethic supersedes their intelligence. “I think that all kids are capable, but I think that a lot of kids are lazy. I see kids that are very capable, but I think that a lot of times they are really lazy about embracing their capabilities,” she said. Mrs. Zook added, “I see a lot of kids that just waste their time – who I know, book wise, are super intelligent.”

Aligning with their beliefs that everyone has the ability to learn, participants expressed their belief about the malleable nature of intelligence. More specifically, participants indicated that all students are intelligent at some level. Mrs. Niles expressed her excitement about her students at the start of the school year. “I love September because you think, ‘Oh, this is going to be a great year. They are all smart!’” Just as learning occurs differently for each student, the teachers also acknowledged that students are intelligent in different ways. They described many different types of intelligence yet still felt that all students possessed some type of intelligence. “There are all kinds of
intelligence….saying that one person is more intelligent than another person is totally perspective. It’s where you are or what you have done,” said Ms. Neil. Mrs. Daniels articulated similar beliefs. “I think that all kids are intelligent in their own way. I think they all have abilities.” She elaborated further. “I don’t really see any dumb kids. I use the word ‘smart’ and ‘dumb’ instead of ‘intelligent’ or ‘not intelligent.’ I think that all kids are smart, and I tell them that all the time.” Mrs. Oliver spoke passionately about a particular student and her efforts to help him learn:

It’s just like with [student’s name] saying he can’t do it. He can, and I’ve already been to somebody today to say we need to be helping this student. I’m not going to let him fail. He’s not going to fail in my class…because he’s a smart kid.

With that in mind, the teachers also expressed that intelligence can change. “I think that, you know, we all are sponges to start with, and so the more material we are given, we soak up. It can happen,” said Mrs. Newman. Mrs. Oliver agreed. “I think that you can honestly be as smart as you want,” she stated.

Additionally, the participants described how their beliefs about intelligence influence how they teach. “I think you have to seek knowledge every single day. I think that kids have to think about something every single day. A lot of my warm-ups are reflection…they have to think outside the box, and I think that’s how we keep kids sharp,” said Ms. Oster. Mrs. Newman expressed similar feelings and used an example from her Family and Consumer Science classroom:

My goal is to have them be more intelligent in both classes. I will especially address nutrition. They need to be more intelligent in the kitchen. They need to know that microwaving a Hot Pocket versus making a healthy sandwich – which
is better for you in the long run? In my case, definitely, I want to develop that intelligence.

The participants also mentioned that to help students improve their intelligence, the smallest successes should be acknowledged. Ms. Neil explained:

I think that sometimes you just verbally have to tell kids. A pat – everybody loves a pat on the back. How hard is it to say good job? It’s a whole lot easier to show your disappointment, I guess. Sometimes we just take it for granted, even though those kids who always do well – we shouldn’t take that for granted. We should tell them they did a great job.

Even though most described intelligence as malleable, there were participants that hinted that intelligence is a fixed trait. Several participants described intelligence as being something “innate.” Ms. Turner said, “I believe that we are born with innate abilities – you know, sensories, being able to touch, see and feel, and you just start building on to your knowledge.” Additionally, Mrs. Oliver added, “I honestly believe that at some point, we are born with a certain amount of ability.” Mrs. Zook expressed similar feelings about students possessing an innate ability, but indicated conflicting feelings about exactly what is innate in a student:

Is there something innate? What is it that drives you internally that doesn’t drive the kid that has it a little bit better? Or even the kid that has it really good? What drives you? For me, I sometimes wonder ‘Is it intelligence or is just something intrinsic to you that everybody else just doesn’t find?’

When asked if she felt that school could improve a student’s intelligence, Mrs. Thomas expressed feelings that it could not. “I don’t think I would get kids long enough [to
change it],” she said. In her particular case, she indicated that she teaches few students classified as “book smart.” “There is intelligence like being able to do really well on a test, which I get very few of those kids because they tend to be in the more academic classes.” Furthermore, participants suggested that there are concepts that some students will just not be able to learn. When recalling a particular subject that students struggled with, Mrs. Thomas said, “I realized that, maybe this is something that this group isn’t going to get.” Mrs. Oliver and Mrs. Zook expressed similar feelings. “Some kids can’t always give you that finished product,” stated Mrs. Oliver. Mrs. Zook agreed. “…obviously, knowing when they come in, they are probably are not going to be able to perform.”

**Theme: Teachers believe that the content they teach supplements other academic disciplines by tapping into students' interests and offering real-life application of content.**

The participants indicated the complex nature and connectedness of their particular disciplines in relation to core academic disciplines. In fact, the teachers noted the cross-curricular nature of their particular content and described their effort to help students see that connection. “I’m always trying to show them, and I tell them that it’s really not about what you do in class. I’m trying to show them things they can use in other classes,” said Mrs. Zook. Mrs. Daniels expressed similar feelings. “I think that’s why a lot of kids can relate to it because it’s – it connects to their other classes, it connects to real life,” she said. Mrs. Niles also stated that teachers must show their students how the content is explicitly connected with other academic subjects. Ms. Neil agreed:
It should be stressed, and I know the other teachers here do the same thing. A history teacher said, ‘You have [student] in class? Their hand went straight up when I started to talk’ – [they said], ‘We just learned that. I know all about that from business law.’ Kids have a tendency to think ‘Once I go out that door, I don’t have to think about this class anymore.’ It’s up to the teachers to stress the fact that this is overall learning.

All participants pointed out that their particular CTE discipline was connected with a variety of subjects. Specifically, science, math, and English were identified most commonly as subjects connected with CTE content. Mrs. Oliver used an example from her class to illustrate how science is connected with Family and Consumer Sciences:

…you start to tell them that the baking soda and baking powder is interacting with the flour and creating gluten – you can get into big terms. That’s chemistry. And if you didn’t do the portions right, it’s not going to work. It’s just like being in the science lab, and you’ve got this test tube, and you’re trying to make something work and it’s not working.

Ms. Oster described her students’ reactions when she included science concepts in her Microsoft Excel lesson. “…they would be like ‘Oh! I’m killing two birds with one stone and learning how to do it, and it’s going to be applied in my science class,’” her students remarked. In addition to science, the participants felt their particular content emphasized math concepts. “For instance, in my Intro to Ag class, we spend a lot of time on bill of materials which involves a lot of math. It’s real life stuff. It’s about math and money management…,” said Mrs. Daniels of her Agricultural Education courses. Participants also noted the importance of using the correct academic language and described their
efforts in utilizing correct math terminology. “…when I demonstrate on the Promethean board how to pin, I use terms like perpendicular and parallel, and I ask them ‘Who can tell me what perpendicular means?’ I make them bring those terms out,” said Mrs. Oliver of her Family and Consumer Science classes. In addition to science and math, English was also identified as a subject closely connected with CTE content. “My content is connected with English. I work very closely with the English teachers. I’m teaching them how to write letters and do brochures, and that totally [is connected],” said Ms. Oster. Ms. Turner offered the following example when asked if her content is connected with other subjects:

The other day in Marketing…we are reading an article on Build-A-Bear. They read the article, and they were like, ‘Ms. Turner. Why are we reading in Marketing? This is so stupid.’ I said, ‘Think about it. This article relates to you being a customer, it relates to history, it relates to your English class because your reading, you’re picking out definitions.’

In addition to science, math, and English, the participants pointed out that the classes they teach are connected with history, philosophy, psychology, health, and physical education.

Even though the cross-curricular nature of the CTE courses was described, Mrs. Zook indicated it was sometimes connected out of necessity. “We have had to [connect with other curriculums] out of necessity, and I think this came down when the certification testing started, and the state said to us they were going to tie it to Perkins funding,” she said. She described her frustration with that necessity:

Before all this testing came along it was ‘Try to get as many SOLs [Standards of Learning] into your course.’ I went to the history teachers and said, ‘Give me a
list of the things, areas that might be on there that I can have kids do a PowerPoint on.’ It always had to be MY idea.

As a result, she mentioned that she is less likely to include cross-curricular references. “Let’s just say that if somebody came to me and asked me to do it, and I had time, I would. But I can tell you that I’ve left it alone.”

In addition to the cross-curricular nature of their subject, the participants pointed out that their content becomes more meaningful when it is connected with their students’ interests. “…like finance…relate it to something that interests them,” said Mrs. Niles.

Ms. Turner indicated that she is continually using her students’ interests to make her Marketing courses more meaningful. “I’ve noticed that in my Sports Marketing class, if we read anything about the NFL or any sports or entertainment thing, they want to read it. They are all about it,” she said. She elaborated further about the importance of connecting her content with her students’ interests:

It’s just a matter of connecting with that student on an individual basis and connecting it to something they are interested in. Most of the time when you hear web design, students are like, ‘Oh. That sounds pretty boring.’ But if they get to create web pages on bands – [student’s name] is really into programs for students with disabilities, so he created a website for that. It’s awesome! I think you just have to relate it to the student and what they are interested in.

Along with the cross-curricular nature of their CTE disciplines, the participants emphasized that their content is connected to aspects of their students’ lives outside of the classroom. It was noted that many students automatically question why they will need to know particular subjects. “You hear teenagers say, ‘I’m never going to need this again.
Why do I have to study this?’ They have to know why, you know? Simple algebra – you use it everyday of your life, but they don’t get that,” said Mrs. Niles. Because of the real-life nature of CTE content, students seemed less likely to question the relevance because the teachers stressed the applicability beyond the classroom. “You’re having a party…this recipe serves six. How many times are you going to have to – are you going to double it, triple it? You have to make enough for 40 people,” Mrs. Newman said. Ms. Turner provided a similar example. “These kids need to know how to build a resume. They need to know how to build a cover letter. They need to know how to interview,” she said. Mrs. Thomas also indicated that she shared the connectedness of her content with her students’ lives. “…all the time I’m talking ‘Someday you will own a house. Someday you will have a yard.’” In addition, the teachers noted their desire for their students to apply what they learn in different contexts. “I would rather they be able to build and have something they can use when they leave our doors because CTE is about preparing them for the future,” said Mrs. Niles. Ms. Oster articulated similar feelings regarding her Business and Information Technology classes:

I think that knowledge occurs when they’ve taken that fact or concept and put it inside of them, and then they can take it out and use it in other contexts. For instance, asymmetrical and symmetrical balance – I love it when a kid later on in the year says, ‘Ms. Oster. It tried to set this up symmetrically, but I think it looks better when it’s asymmetrical.’ Holy cow! They know it! They got it!

**Theme:** The process of learning and the final product are both important and should be emphasized.
A range of beliefs was described regarding the importance of the learning process and the final product. In some instances, participants indicated that the learning process was most important for them and their students. Ms. Turner explained her beliefs regarding the learning process versus the final product. “I think the process [is most important] because if the process is not clear, then you’re not going to have that final product of learning,” she said. Ms. Neil expressed similar feelings. “If all we have is the end result, and that getting to that end result is the ultimate, then we miss out on so much more that we could be doing,” she stated. She elaborated:

It’s like the kids are going simply from Point A to Point B, and when they get to Point B, it’s to Point C. All the stuff that is in between is just a labored way to get there instead of actually learning stuff that they can use. Somehow, we have to get them to realize the learning process is the goal. To learn the information, that is actually the reward instead of the A on the test.

Mrs. Oliver used a personal example to illustrate how focusing on only the final product can impact a student’s excitement and desire. She described a situation when her daughter brought home an apron she had made in her sewing class. “‘What did you get on this?’ ‘I got an A!’ ‘You’ve got to be kidding me?’ I started to point out what was wrong, and the tears – I just stopped. What did I just do? I ruined it for her.”

Additionally, Mrs. Daniels felt that as a CTE teacher and advisor for a Career and Technical Student Organization (CTSO), she is able to promote the learning process over the final product. “I think that maybe we have an advantage as [CTSO] advisors to show them that the process is just as important. We might not always win, but the process is sometimes more important than the outcome of the contest,” she said.
While some participants suggested that the process of learning was most important, others noted that the final product equally as important. “The product [is most important]. It doesn’t matter how I do it, it matters how they do it, and what they are getting out of it. In the end, that they get it,” expressed Mrs. Newman. “We care about can you follow the directions here and can you end up with that end product,” said Mrs. Zook. Ms. Turner noted many students are final product focused. “I think that a lot of kids nowadays, that’s what they are focused on. It’s sad because there is so much pressure. So much is on that grade. If they don’t get a good grade, ‘Can I do extra credit?’”

Several participants expressed concern that standardized testing is forcing teachers and students to focus only on the final product. “I think we are teaching kids how to take tests and not how to be intelligent,” said Mrs. Daniels. When asked which is most important, the process of learning or the final product, Mrs. Thomas agreed with Mrs. Daniels. “Well in America and in Virginia, it’s the final product. Can you pass the SOL?” Ms. Neil offered similar concerns regarding the message being sent with the emphasis placed on standardized tests:

I have a terrible feeling that we are training an entire generation of young people to think of only the end result, not how you get there, but if you pass the test. I think we are doing them a disservice. The outcome is – regardless of what you’ve learned to get to that point. The learning itself isn’t being stressed enough. It’s did you pass the SOLs?

While some indicated either the process or final product were most important, it was also mentioned that the process and final product go hand-in-hand. “They are both
important…I guess you have to have a good process to get a good product,” stated Mrs. Daniels. “Some kids can’t always give you that finished product. If you can get them to give you that finished product, I think it’s worthwhile. They feel a huge sense of accomplishment,” said Mrs. Oliver. Ms. Oster said, “I think the process affects the final product. If the process isn’t very good, then your final product isn’t [going to be good].”

**Theme: Students obtain knowledge from a variety of sources.**

The participants described their differing beliefs regarding the sources of students’ knowledge. It was articulated that students obtain knowledge from a variety of sources, but in some cases, the participants expressed that the teacher was the ultimate source of knowledge and information. In fact, when questioned about how she would react if the accuracy of what she was teaching were challenged, Mrs. Thomas offered the following example. “I did have a student say that what I was teaching was wrong, but it wasn’t. I pulled out the book and showed them,” she said. She elaborated:

He just thought that he knew better because he lived on a farm. He thought that he knew everything…that type of kid. I’m like, ‘How many degrees do I have?’

He was like, ‘Well, I live on farm.’ I’m like, ‘Well…’

Participants acknowledged that for some teachers, authority is important. “I can almost attest to the fact that there are teachers that would stand there and try to argue with you until you went home and worked the problem and came back,” stated Mrs. Zook. Ms. Neil even went as far to say teachers are perhaps naturally egotistical. “I think most teachers are a little egotistical. If you’re going to stand in front of students and share your brilliance, there is a little bit of you that says, ‘I know what I’m doing,’” said Ms. Neil. Even so, she also acknowledged her concern with adopting that mindset:
I think the worst thing that a teacher could ever do is to try to be omnipotent – where they are little demigods and they know everything. A student can smell that a mile away, and they are going to shoot you down so fast. Your wisest move is to say, ‘You know, I don’t know that, but I will know it for you by tomorrow.’

When asked if a student has ever challenged them on the accuracy of what they were teaching, the participants indicated that students do, in fact, challenge them. However, that challenge was often welcomed. “Bring it on! I would encourage that,” said Mrs. Niles. Mrs. Newman described a similar feeling. “They do! Look it up! I don’t care. I’ve been wrong about stuff before. I don’t get defensive, and I almost like it because it gives them an opportunity to look something up,” she said. In fact, some participants felt that when a student challenges them, it indicates that the student is thinking deeply about the concept being taught. Ms. Oster explained:

I like to be challenged. I like them – because that says to me that they are listening to what I’m saying and thinking ‘I don’t think that’s right.’ They are using their brains. They aren’t just sitting there like little robots and repeating the information back like a parrot. They are thinking.

Mrs. Daniels described similar feelings. “I think it’s great for kids to challenge you. It means they are thinking about what you are saying to them…”

The participants also described their approaches to handling students that questioned the accuracy of the information being taught. Mrs. Niles recounted a situation from her Computer Programming class. ‘‘Okay. This is a stump Niles.’ I couldn’t get it. ‘Gosh, I can’t figure this out.’ I’d turn it back to them. ‘Bonus points because Niles can’t
get it. I have no idea what is going on here.’” Ms. Turner’s approach was similar in her Marketing classes. “I say, ‘[student’s name], if you want to find more information, give it to me for extra credit. Go research and then you can say it to the class, and I’ll give you extra credit for it.’” Mrs. Oliver pointed out that, for her, the challenge was a reminder to remain current. “I think it’s a note-to-self. Are we current? Am I teaching what is most accurate? Do I need to refresh myself?”

The participants also acknowledged that one source of students’ knowledge is the knowledge they already have. Mrs. Neil explained:

I believe that – one thing about knowledge is that I think that all learning comes from previous knowledge. I think that you have to approach it that way and build on that. There has to be – I like to use the analogy of a hat-rack. You have to have something there, and then you can just hang stuff on it.

Ms. Turner articulated similar beliefs. “…you have to figure out what they already know and build on that knowledge. I’m definitely into getting that prior knowledge and building upon that,” she said. Furthermore, the participants felt it was important to honor students’ previous knowledge and use it as a foundation for the concepts they were teaching. Mrs. Oliver explained:

As educators, we can only lay the foundations and hopefully [the students] will start to build their own thought processes. I think we lay those foundations and – I’m not here to tell kids that what their parents teach them is right or wrong. I just hope that I can give them an alternative that sticks in their minds, and later thinks, ‘Maybe that might work.’
The participants indicated their students also could gain knowledge from their peers. Specifically, peer-to-peer teaching was identified as an important feature of the participants’ classrooms. “I think that students can learn a lot from their peers. They can learn a lot from each other,” expressed Ms. Turner. She continued, “My belief is that we learn a lot from each other, especially in [county’s name] county. So I think it’s really important that the students can teach each other.” Others felt that, in some instances, the students actually learn better from their peers as opposed to the teacher. “I think kids oftentimes listen to other kids better than they listen to me,” said Mrs. Daniels. Ms. Neil expressed similar feelings. “They are able to share more on a student level. Sometimes a student can communicate better with a student. I communicate with the student, the student communicates with another student. That’s a chain of learning,” she said.

When questioned about how they view their role in the classroom, participants offered a range of descriptions. Most commonly, the teachers viewed themselves as a facilitator, coach, or trainer. Ms. Turner explained:

I like the word facilitator, actually. I don’t like to use instructor. I like to facilitate because, like I said, we do a lot of group work. You just have to make sure – you go around the room and make sure that everybody is on the same track; everybody is working towards the same goal.

Ms. Oster also indicated a preference for being viewed as a facilitator. “I’m just the facilitator. I am just like the cheerleader, and yes, I give them information. But I like them to discover a lot of things on their own,” she said. “We are teachers, but we are also trainers. We train people how to think,” said Ms. Neil. Mrs. Newman also expressed that she facilitates knowledge acquisition. “My job is really more of a facilitator – just
guiding, showing them where to go,” she said. Mrs. Zook offered an example to illustrate how she facilitates learning in her Business and Information Technology classroom:

I was facilitating more yesterday in the Economics and Personal Finance course. They were working on this project and they all needed me about the economics. They had already gotten their information, ‘Can you show me again about this Excel thing?’ I was running from place to place. There were little groups, and I sit there with each little group, whatever they needed was what I did.

**Theme: The speed of learning is dependent upon the individual learner.**

When questioned about the speed at which learning occurs, the participants indicated that they felt it varied based upon their students. “It could take some kids ten times trying something, and they still might not get it. It might take a kid doing it once, and he get is and excels at it,” said Mrs. Oliver. Mrs. Newman also expressed that learning occurs at different speeds. “[The speed of learning] is so individual. Again, some kids catch on right away to measurement and some don’t. Everybody is different.” Ms. Oster articulated her beliefs that the speed of learning is dependent upon the student. “That depends on the person. I know that I am really swift and can pick up on things fast, but I have kids that you have to let them mull it over. I learn things quickly, but not everybody does,” she said. Mrs. Daniels also indicated that the speed of learning varies on the person. “It depends on the person really. I think it all depends on the kid,” she said. Ms. Turner agreed. “I don’t think there should be a limit on how fast students should learn. Everyone is at their own pace. You can’t force it,” she said. To further
illustrate that students learn at different speeds, Ms. Oster used her grandson as an example:

My grandson is six, and he’s in the first grade. [His teacher] has decided that he’s not doing his work fast enough so she has put a timer on him. [Son’s name] went in and said, ‘Oh no. You’re not going to time him. He might be slow because he doesn’t understand, but he’s not slow because he’s talking or being disruptive.’ That’s something I take a lot of issues with. If a child is not getting something, then I’m not going to say, ‘Well, you should have gotten it by now.’ I’m not gonna do that. We will find another way for them to understand the material.

In addition to speaking more generally about the speed at which learning should occur, several participants offered examples to illustrate that students learn at different speeds. “They can do the Excel spreadsheet, but it takes one kid 30 minutes, and they are trying, and another kid 10 [minutes],” said Mrs. Niles of her Business and Information Technology students. “Maybe I have to ask three or four times before it sinks in, and maybe you’ll have to ask three or four times ‘How do I measure brown sugar?’ That’s okay. Eventually you will get it,” said Mrs. Newman. In addition, the participants also described how the speed at which learning occurs ultimately influences their approach to planning and assessment. Mrs. Oliver described using technology to support her Family and Consumer Science students as they work at different speeds:

We put the videotapes on the folder, brought all of our sewing machines over, and we put them next to a computer. The kids logged on and watched the step, and then they did it. They could rewind it and watch it again and do it. It made it so
much easier, but they may have to watch it ten times. But guess what? They got it.

Mrs. Oliver described how assessments should reflect that students learn at different speeds. “We assess how much they know and where they are. I think that’s why we have to be careful that when I’m assessing one child – I can’t assess them compared to another.” Mrs. Niles also indicated that the speed of learning varies by class, which ultimately influences how she teaches. She said:

I don’t think it’s fair to the class that is “slower” per se, for whatever reason, to rush them through it. My philosophy has always been what they learn well, as opposed to running through the curriculum. What good is it if you’ve covered ten things in ten minutes, and they can only retain two?

Mrs. Oliver reported similar feelings. “You’re never going to have a class of twenty students who learn at the same speed…that is a perfect world. I think we have to be patient that it takes a little bit longer,” she said.

Interestingly, the participants hinted that standardized testing influences the rate at which some teachers have to teach. Specifically, the participants described the pressures associated with standardized testing. Ms. Neil explained:

I think the SOLs have made a lot of teachers too rigid. On one hand, you’re being told ‘Be flexible. If they don’t learn this, go back and re-teach it.’ Another is ‘No. We’ve got to be at Point B by this day.’ I think we are sending mixed signals to the teachers and in that way, we are sending mixed signals to the students.

Others echoed the same feelings. Ms. Turner indicated that SOL testing forces teachers to adopt the mentality that “we’ve got to get through this.” Mrs. Niles supported that
statement as she described how the Advanced Placement (AP) teachers in her school reacted to missing school days last year because of snow. “I think the hardest teachers that were hit with all the snow were the AP teachers. Those test dates don’t change, and the material is monumental they have to cover. They were stressed.” It was noted that, because their disciplines do not have standardized testing, CTE teachers are afforded the flexibility to focus on student learning. “If they bomb the test…then I’ll back up, and when we go over the test, I’ll spend another day. I have that luxury because I don’t have an SOL. I will spend another day going over that,” explained Ms. Neil. Mrs. Daniels said, “I think that for CTE, since we don’t have SOLs, I don’t panic about it. Maybe if I was an English teacher, and we had SOLs, it would matter more.” Even so, Ms. Turner emphasized that pressure of standardized tests should not completely determine the pacing of content. “I even told another teacher, ‘If you get through 2/3 of the material really well, they are gonna pass the SOL.’ But if you try to teach 100 percent of the material, and they kind of know it, they may not do well.”

Mixed Methods Findings

Research Question 3: How do the descriptions of teaching method preferences, beliefs about intelligence, and epistemological beliefs align with the outcomes of a quantitative measurement within a systematically selected sample of in-service teachers?

Research question three sought to determine how the preferences for student-centered or teacher-centered teaching methods, beliefs about intelligence, and epistemological beliefs align with the outcomes of a quantitative questionnaire within the systematically selected sample. In order to combine the quantitative and qualitative data, the researcher compared the data collected from the qualitative strand participants to their
scores on the quantitative questionnaire. Table 16 includes the qualitative strand’s mean scores for the teaching practices scale, the Theories of Intelligence Scale, and the Epistemic Belief Inventory.

Table 16

<table>
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<tr>
<th>Participant</th>
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<th>Epistemic Belief Inventory</th>
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Note. A pseudonym was used to protect the identity of the qualitative strand participants. High Participants responses placed them in the 60th percentile or above for all three areas. Low Participants responses placed them in the 30th percentile or below for all three areas. The Teaching Practices scores can range between 8-40. The Theories of Intelligence Scale scores can range between 8-48. The Epistemic Belief Inventory scores can range between 32-160.

High Participants

Qualitative strand participants that were designated as “high participants” scored in the 60th percentile or above for each of the three components on the questionnaire (teaching practices, the theories of intelligence, and epistemic beliefs). These participants are identified as incremental theorists, possess advanced epistemological beliefs, and indicated a preference for student-centered teaching methods (Dweck, 2000; Hofer, 2001; Schommer-Aikins, 2002; Schraw, Bendixen, and Dunkle, 1995). Previous researchers have indicated that incremental theorists regard intelligence as a trait that can be
improved and cultivated (Dweck, 2000). In addition, individuals with advanced epistemological beliefs believe that knowledge is composed of integrated concepts that are gained from a variety of sources. Learning is viewed as something that occurs gradually, and those with advanced beliefs indicate that the ability to learn is something that everyone possesses (Schommer-Aikins, 2002; Schommer-Aikins & Easter, 2006).

Beliefs Regarding Intelligence and Epistemological Beliefs. The high participants described their beliefs that all students were capable of learning and becoming more intelligent. Mrs. Oliver, who had the maximum score on the Theories of Intelligence Scale, articulated her beliefs that all students can become more intelligent and provided the following example:

I think that you can honestly be as smart as you want to be. Even the Down Syndrome kids learn everyday. I fought to have a child who was mentally challenged in my class. They have her in an inclusion classroom with other kids, and she was just sitting there. I said, ‘Why can’t she be in my classroom?’ So they brought her in.

Mrs. Newman, who also had the maximum score on the Theories of Intelligence Scale, expressed that anyone can learn anything. “I think, you know, we are all sponges to start with, and so the more material we are given, we soak up. It can happen,” she said. Ms. Neil articulated similar beliefs. “…the brain can be taught. They brain can be taught to absorb information, how it’s absorbed – there is all kinds of study skills that you can do, there’s exercises you can do to improve the brain,” she remarked. Ms. Oster indicated that she continually tells her students that they can learn anything. When asked how she would respond if a student said they were unable to learn a particular concept, she said
she would tell them that they could in fact learn the concept. “I would tell them they need to rethink that, because everybody can learn anything that they want to,” she said. Mrs. Newman used a similar approach and offered herself as an example that anyone can learn anything:

> Everything can be learned, even to different degrees. Using my own experience and telling them ‘Look. I hate the computer. It is not my friend, but every time I sit down, and I ask for help, I learn what I’m missing. And maybe I have to ask three or four times before it sinks in…that’s okay. Eventually, you will get it.’

In addition, the high participants indicated that the courses they teach are integrated with other disciplines. In fact, when asked if her content was connected with other academic subjects, Ms. Neil expressed that her content was connected with “*everything.*” Mrs. Newman also indicated that the classes she teaches are connected with a variety of academic disciplines and students’ career choices as well. “My classes are connected to just about anything you want to do. I mean consumerism, math, science, phys ed. It’s all connected,” she said. Of the qualitative strand participants, Ms. Oster had the highest score on the Epistemic Belief Inventory. She indicated that her content is connected with English and science, and she described how she integrates science content into her business class. “When I taught computer applications, I taught Excel. I worked closely with the science teachers because they were asking their kids to put things into graphs and columns, and they didn’t know how.”

Furthermore, the high participants articulated that their students obtain knowledge from many sources, as opposed to a singular authority figure. The participants acknowledge that student often learn from each other. “Teaching happens naturally.
Students do it naturally. It’s just amazing,” said Mrs. Oliver. Ms. Oster also indicated that knowledge is gained from multiple sources. “I’m teaching them, but they are learning by doing, and by doing, they are talking to each other. That’s okay.” Additionally, the teachers mentioned that the teacher is not always correct. “I always say, ‘I’m not an expert.’ I hope that I can learn everyday and increase my knowledge but things change everyday,” remarked Mrs. Oliver. “I’ve been wrong about things before. I don’t get defensive, and I almost like it because it gives them an opportunity to look something up,” added Mrs. Newman.

Finally, when questioned about the speed at which learning should occur, the high participants pointed out that the speed of learning is dependent upon the combination of the learner and the material being learned. Ms. Neil explained:

Some students are going to pick up things, right now. They are just going to know. You are going to make one little example, and they’ll go ‘Oh! The light bulb just went off!’ Other students – it totally depends on their mindset, where they are.

Mrs. Oliver suggested similar beliefs. “It could take some kids ten times trying something,” she said. Mrs. Newman also suggested that the speed of learning varies by student and the concept being taught. “Some kids catch on right away to measurement and some don’t,” she recalled. Ms. Oster again used a personal example to illustrate her feelings. “I learn things very quickly, but not everybody is like me. A good teacher will recognize that and never make a child feel like they have to learn in a certain period of time,” she declared.
Even though the high participants expressed beliefs aligning with incremental theorists and those possessing advanced epistemological beliefs, there were instances when their descriptions did not align with their responses on the quantitative questionnaire. For example, Mrs. Oliver indicated that, in some cases, some students are not able to produce the final product. “…sometimes the final product isn’t always going to be there. Some kids can’t always give you the final product,” she said. Mrs. Newman also indicated that some students are not capable of completing a learning task. “I do have some students that are less able to do things, and then I have students who are just not doing it,” she stated. In addition, Ms. Neil expressed concern with using peer teaching in her classroom. “These kids aren’t teachers, and you can’t expect them to be. I don’t think that ever works…” she indicated.

**Description of Teaching Methods.** In accordance with the scores of their quantitative questionnaires, the high participants described their preference for student-centered teaching methods. Mrs. Oliver, who indicated frequent use of student-centered teaching methods on the questionnaire, described her classroom as a student-driven classroom:

I wish you could have been here last block. I had two boys sitting in my office, and they were doing a VoiceThread, so we had it as the sound studio. I had students over there working on computers. I had the laptops in case we needed an extra computer. I’m sitting here trying to figure out YouTube videos because I have a flip video camera, so I’m trying to brainstorm. There’s a lot going on. In that instance, it’s very student-driven.
The high participants indicated that they incorporate student-centered teaching methods into their classes. Those methods included using projects, hands-on activities, and collaborative discussions. Ms. Neil recounted her use of active, student-centered learning strategies. “[I use] lots of hands-on activities, group activity, large group activity, small group activity, partners – especially in my Economics class. I use lots of activities – up and moving around activities,” she said. Ms. Oster indicated a similar approach. “I’m more of a hands-on, let’s do it teacher. In this simulation, they have to print their bank statements showing me they have paid bills, showing me that they understand those concepts. So, I do a lot of hands-on teaching,” she explained. Mrs. Newman indicated that she uses student-centered methods because of the hands-on nature of her classes. “We’re the only ones that can give them the true experience in the kitchen, and we need to do that. We are redoing our curriculum to include more hands-on labs,” she said. Mrs. Oliver described how she uses collaborative teaching methods, which promotes a student-centered learning experience. “I’ve been teaching them Wikispaces where they can collaborate together. They can do their research anytime, whenever they want, as long as they fall in the parameters of getting the wiki together,” she stated.

It should also be noted there were a few instances where high participants reported the use of teacher-centered teaching methods. Both Ms. Oster and Ms. Neil reported the use of lecture in their classes. Even though they mentioned using lecture, it was described as a very small part of their class period. “My classes are 90-minutes long, so there is about 15-20 minutes of [direct] instruction,” said Ms. Oster.
Low Participants

The qualitative strand participants that are designated as “low participants” scored in the 30th percentile or below for each of the three components on the questionnaire (teaching practices, the theories of intelligence, and epistemic beliefs). These participants are classified as entity theorists, possess naïve epistemological beliefs and indicate a preference for using teacher-centered teaching methods (Dweck, 2000; Hofer, 2001; Schommer-Aikins, 2002; Schraw, Bendixen, and Dunkle, 1995). Previous researchers have indicated that entity theorists regard intelligence as a fixed, unchanging trait (Dweck, 2000). Furthermore, naïve epistemological beliefs have been reported to reflect the isolated nature of knowledge. Additionally, individuals that possess naïve epistemological beliefs often express the belief that knowledge is handed down from authority, indicate that learning should occur quickly or not at all, and point out that the ability to learn is fixed at birth (Schommer-Aikins, 2002; Schommer-Aikins & Easter, 2006).

Beliefs Regarding Intelligence and Epistemological Beliefs. In several cases, the low participants hinted at the fixed nature of intelligence and even reported that intelligence was something that could not completely be changed. When questioned if she thought intelligence could be developed, Mrs. Thomas (lowest Theories of Intelligence Scale score of qualitative strand participants) said, “I don’t think I could get those kids long enough.” She also indicated that school could “not completely” change a student’s intelligence. Mrs. Niles also pointed out that not all students are smart. She said she tries to think of her students as smart, but she remarked, “Truthfully, they aren’t all smart.” Mrs. Niles also stated that some students lack ability on certain subjects. “Not every kid has that logical ability to write computer programs. I always found out by
December who was a programmer and who wasn’t. Some kids can’t think logically,” she said. Ms. Turner indicated that some students would not be able to improve their intelligence, but attributed it to their work ethic and desire. She explained:

There’s kids that are struggling that want help, and then there are kids that are struggling that don’t want to learn. They’re just – they’ve just shut off, you know? So I think those students, no, their intelligence isn’t increasing, but the ones who are struggling and actually want to do well, that their intelligence will increase.

The low participants also described beliefs that align more closely with naïve epistemological beliefs. When questioned about students challenging the accuracy of the content she is teaching, Mrs. Thomas referred to her college degrees as an indication that she was correct. “I’m like, ‘How many degrees do I have?’” Additionally, Ms. Turner expressed that students who learn quickly are more intelligent than students that learn things more slowly. She offered the following example:

Intelligence to me is defined as how quick you grasp something and how much information you grasp from a concept. So if I’m teaching how to do a loop in Computer Programming, there is going to be a kid that gets it really quick and has figured out how to loop in five minutes. Then I’m going to have a kid who it could take possibly two weeks to figure it out. There are two different types of intelligence there. So I think if you have a high intelligence, you would obviously be that quick learner.

Finally, Mrs. Zook described the somewhat isolated nature of her content. She pointed out that other academic disciplines would like for her content to be more integrated than
it actually is. “I think the other subjects would like for it to be connected more than it is,” she said.

Even as the low participants described their naïve beliefs, they also offered contradictory descriptions more closely aligned with individuals possessing advanced beliefs. Mrs. Niles recalled a time when her epistemological beliefs were challenged:

I had a class in graduate school, but there were two or three nights that he covered how do you know what you know. Somebody told you the Earth was round, certain people act a certain way because your grandmother told you, and you know that’s what happened. So how do you know what you know is the truth? It was a fascinating class to me because it made me think in a whole different way in relationships. You know, my husband thinks a certain way because that’s what his beliefs are, that’s his truth. That truth might not be my truth. And so now you have 30 kids in the room that have another set of beliefs. How do they come to know what they know?

The low participants elaborated upon their beliefs regarding intelligence. In fact, the low participants indicated that intelligence could be improved. Mrs. Thomas said, “We can always learn.” Mrs. Niles expressed similar beliefs. “I think everybody is born with a certain amount of intelligence, but that it can be expanded and enhanced by opportunity,” she explained. Contrary to their Theories of Intelligence scale scores, Ms. Turner and Mrs. Zook also suggested that anyone could become more intelligent. “I think everybody can learn anything,” said Ms. Turner. Mrs. Daniels added, “I definitely think [students] can cultivate their ability.”
Additionally, the low participants described their beliefs that their content is integrated with other academic disciplines. Mrs. Thomas provided a specific example of content she teaches that is connected with biology. “In your biology class, you guys studied about’ – when we do osmosis and fertilizers,” she said. Ms. Turner also indicated she was able to integrate her content with other subjects. “We were talking about Sunchips – a lot of customers are complaining about those crinkly, bio-degradable bags. So Sunchips is going back to their original design; then we’d talk about the environment. We are relating science to my class,” she explained. When asked if her subject is connected with other subjects, Mrs. Daniels said, “Yes! Absolutely!”

In addition, the low participants suggested that students obtain knowledge from a variety of sources as opposed to a singular authority. Specifically, Ms. Turner indicated that students learn a great deal from each other. “My belief is that we learn from each other, especially in [county’s name]. So I think it’s really important that students can teach each other,” she said. The participants also indicated that their students do challenge them, and they acknowledged that they make mistakes. “I make mistakes, and especially in CTE – I learned early on that you can’t keep up with technology. If a kid found something on the Internet, ‘Hey there is another way to do this!’ ‘Oh really? Show me! Perfect!’” she explained.

The low participants also expressed their beliefs that learning occurs at different speeds for different students. When questioned about her beliefs regarding the speed of learning, Mrs. Thomas said, “[learning] definitely does not occur the first time around.” Ms. Turner also expressed a concern for identifying the speech at which learning should occur. “See, I don’t think there should be a time frame on that. That actually bothers
me,” she said. Mrs. Niles reported similar concerns. “Some things take practice, practice, practice – some [students] might get lost at step three and some get lost at step twelve.” Both Mrs. Daniels and Mrs. Niles described how their beliefs about the speed of learning influences how they teach. “My philosophy has always been what they learn well as opposed to running through the curriculum. What good is it if you’ve covered ten things in ten minutes, and they can only retain two?” wondered Mrs. Niles. Mrs. Daniels added, “I think a lot of teachers zoom through material way too fast. They cover way too much material in a short period of time, but I think that you have to take your time.”

**Description of Teaching Methods.** The low participants indicated they utilize teacher-centered teaching methods in their classes. They mentioned using lecture, demonstrations, and teacher-led discussion in which the students took notes. Mrs. Thomas indicated that she often demonstrates the material as part of a lecture. “I showed them on the board, you know, how the seed germinates. I showed them about the cotyledons, how they form,” she said. She also indicated teacher-centered teaching methods that lead to a formal assessment. “You need to take these notes and take the quiz later,” she stated. In fact, when asked if her approach to teaching was more teacher-centered or student-centered, she said, “Probably more teacher-centered.” In addition, Mrs. Niles recounted using methods classified as teacher-centered. “I would try to talk and explain. I would talk my way through. It was more or less out of the book, but they weren’t reading it,” she said. Ms. Turner also mentioned that she uses lecture and direct instruction in her classes; however, it is often utilized with student-centered methods. “I do a little bit of direct instruction, a lot of group work, a lot of think-pair-share, and I definitely do individual work too.” Mrs. Daniels explained how she uses teacher-led
discussions in her classes. “I like to have discussions with them, and I like to – I wouldn’t really say labs. I like to show them how to do something and then let them do it by themselves,” she said. Finally, Mrs. Zook indicated that she uses direct instruction when teaching beginning concepts:

I will spend a lot of time in the beginning courses – like Design Multimedia Web Technology course, I will spend some of the time trying to knock out some of the things that are on the competencies – covering what I need to cover before we get into the meat and potatoes of the subject.

Even though the low participants described teacher-centered teaching methods, they also indicated that they frequently use student-centered teaching methods. Similar to the high participants, the low participants indicated the use of projects, hands-on activities, and collaborative discussions. Ms. Turner offered the following explanation of her approach to a lesson:

I’ll go into teaching a concept – like for branding, what a logo is, what a slogan is – teach them that. Then they have to go maybe with a partner and create their own logo and slogan, so it’ll be an activity after they learn a concept.

Mrs. Thomas also indicated that she includes projects into her classes. “When I do get to the insects – like we are doing weeds now – when we get to the insects, I’m going to have them do the research and do PowerPoints,” she said. The low participants also indicated their preference for including collaborative group work into their classes. “I like to let them work with partners or groups to get a feel of it. I do a lot of group work where they share ideas,” said Ms. Turner. Furthermore, Mrs. Daniels indicated she does not like to assign individual bookwork. “I cannot – I do not like to give kids bookwork. I think
when you make a kid open a book and just assign them problems from the book, that is [a bad thing],” she reported. Mrs. Zook pointed out that because her classes are performance-based, she does not lecture for extended periods at a time. In fact, she offered the following example for how she taught the concepts related to world population:

We used National Geographic on-line. They’ve had a whole wonderful thing that was done – I don’t know how I ran across it – about world population. We looked at the videos that were out there. There was one called ‘Party for Seven Billion.’ We watched that video. We actually read – it was like a 14-page article that talked about what will happen in a few years when the population reaches this level. Then we moved from that into GDP. Now, I’ve got them doing a project.

Summary

The intent of this study was to examine the role teachers’ beliefs play in making instructional decisions, and this chapter reported the findings. The quantitative research questions addressed the relationship between in-service teachers’ beliefs about intelligence and epistemological beliefs in relation to student-centered and teacher-centered teaching methods. Correlations indicated statistically significant relationships between the teaching practices scores and the Epistemic Belief Inventory and the Theories of Intelligence Scale and the Epistemic Belief Inventory. Correlations also indicated a significant relationship between the Theories of Intelligence Scale and two teaching practices, and there was also a significant relationship between the Epistemic Belief Inventory and two teaching practices. A one-way ANOVA was used to identify if there were significant differences in the mean scores of the Theories of Intelligence Scale
and Epistemic Belief Inventory based on CTE discipline, years taught, highest level of education completed, and the type of teacher preparation program completed. Based upon the ANOVA analyses, and it was concluded there were no significant differences on the means scores of the Theories of Intelligence scale and the Epistemic Belief Inventory based upon the selected demographic variables. Finally, a regression analysis indicated that teaching discipline, epistemological beliefs, and years of teaching experience significantly predict the teaching practices in-service teachers’ select.

The qualitative strand included nine participants systematically selected from the results of the quantitative data. The qualitative strand allowed the participants to describe the role their beliefs play when making planning decisions. Six themes emerged from the qualitative data. The quantitative and qualitative data were connected when qualitative participants were selected from the data collected during the quantitative strand, and the second connecting point occurred to determine if the descriptions of teaching method used, beliefs about intelligence, and epistemological beliefs aligned with the outcomes of the quantitative questionnaire. The mixed methods findings offer inconsistencies regarding the teaching practices of teachers with advanced beliefs and teachers with naïve beliefs. Both groups indicated utilizing student-centered and teacher-centered methods, and both offered examples that indicated conflicting beliefs when compared to the quantitative findings.
Chapter 5

Overview

The intent of this study was to examine the role teachers’ beliefs play in making instructional decisions. This two-phase, sequential explanatory mixed methods study used quantitative results to select interview participants in order to clarify the quantitative results. In the first phase, quantitative research questions addressed the relationship between in-service teachers’ beliefs about intelligence and epistemological beliefs in relation to eight teaching practices (demonstrations, experiments, group projects/assignments, independent assignments, lecture, role-play, small group/partner discussion, and teacher-led discussion). In the second phase, qualitative semi-structured interviews explored in-service teachers’ descriptions of their beliefs and how their beliefs are related to the teaching practices they use. The data were connected when qualitative participants were identified from the data collected during the quantitative strand. A second connecting point occurred after qualitative data collection and analysis, and this connecting point serves as a foundation for the larger interpretation discussed in this chapter.

Three research questions guided this study. Research question one was quantitative in nature and included three sub-questions. The data were collected through a quantitative questionnaire, and the data were analyzed using SPSS. Quantitative data analysis allowed the researcher to determine the relationships between in-service teachers’ beliefs about intelligence, epistemological beliefs, and the teaching practices they use.

The quantitative questionnaire consisted of three components. The first component was the Theories of Intelligence scale (TOI) (Dweck, 2000; Dweck &
Henderson, 1989). The TOI scale is used to assess the nature of one’s beliefs about intelligence. Lower scores represent entity theorists and higher scores represent incremental theorists (Dweck, 2000). The second component of the questionnaire was the Epistemic Belief Inventory (EBI) (Schraw, Bendixen, & Dunkle, 2002). The EBI is a quantitative measure of epistemological beliefs is designed to measure beliefs according to five subscales. The subscales include: (1) Certain Knowledge, (2) Simple Knowledge, (3) Quick Learning, (4) Omniscient Authority, and (5) Innate Ability (Schraw et al., 2002). Lower scores represent more naïve epistemological beliefs and higher scores represent more advanced epistemological beliefs. In the final questionnaire component, participants were asked to rate how often they use eight specific teaching strategies. The teaching practices selected (demonstrations, experiments, group projects/assignments, independent assignments, lecture, role-play, small group/partner discussion, and teacher-led discussion) represent a variation among teacher-centered or student-centered teaching methods (Newcomb, McCracken, Warmbrod, & Whittington, 2004). Teacher-centered methods were reverse coded, and a total score was calculated. Higher scores represented a more frequent use of the student-centered teaching methods that were offered.

Research question two was qualitative in nature. Data were collected from participants systematically selected from the results of the quantitative data. In the qualitative strand, the researcher conducted semi-structured interviews with the nine participants. Data were analyzed using constant comparative data analysis, and six themes emerged from the analysis. The themes and associated quotations provide further insight into the role in-service teachers’ beliefs about intelligence and epistemological beliefs influence how they teach. The third, and final, research question allowed the
researcher to connect the quantitative and qualitative findings. This question was used to determine if the descriptions of teaching method used, beliefs about intelligence, and epistemological beliefs aligned with the outcomes of the quantitative questionnaire.

Specifically, the following research questions were clearly outlined and guided the study:

1. What are the relationships between in-service teachers’ beliefs about intelligence and epistemological beliefs in relationship to the teaching methods they use?
   a. What is the relationship, if any, of in-service teachers’ beliefs about intelligence to their epistemological beliefs?
   b. How are in-service teachers’ beliefs about intelligence related to the teaching methods they use?
   c. How are in-service teachers’ epistemological beliefs related to the teaching methods they use?

2. How do in-service teachers describe their preference for the teaching methods they commonly use, their beliefs about intelligence, and their epistemological beliefs?

3. How do the descriptions of teaching method preferences, beliefs about intelligence, and epistemological beliefs align with the outcomes of a quantitative measurement within a systematically selected sample of in-service teachers?
Population and Sample

The population included in-service Agricultural Education teachers, Business and Information Technology teachers, Family and Consumer Sciences teachers, and Marketing teachers located within the commonwealth of Virginia. Using a stratified random sample, 497 participants were initially selected for the quantitative strand. The researcher employed a system of four contacts to collect the quantitative data (Dillman, Smyth, & Christian, 2009). Based upon a low initial response rate, an additional 125 participants were selected using a second stratified random sample. The abovementioned methods yielded 292 participants within the quantitative strand.

The qualitative strand participants were systematically and purposefully selected using the quantitative data. In order to select individuals best able to explain how beliefs influence teaching methods, the researcher followed-up with extreme cases that matched the theoretical assumptions of the quantitative strand. Specifically, participants whose responses placed them in the 30th percentile or lower for all three areas on the questionnaire (Theories of Intelligence scale, Epistemic Belief Inventory, and frequency of teaching practices) were identified as potential qualitative strand participants. In addition, participants whose responses placed them in the 60th percentile or above for all three areas were also identified as potential qualitative strand participants. A total of 18 participants (seven “low” participants and eleven “high” participants) were contacted to participate in the qualitative strand, and nine agreed to participate. The researcher concedes that a limitation of this particular study relates to the selection of the qualitative strand participants. The researcher chose to follow-up with extreme cases within the quantitative strand. Selecting non-extreme qualitative participants could enhance the
overall findings of the study and provide a deeper description of the phenomenon being explored within the qualitative strand.

**Conclusions and Discussion**

The quantitative, qualitative, and mixed methods findings inform the conclusions and discussion drawn from this study. Even though the data were collected and analyzed separately, each informed and supported each other. The remaining portion of this chapter blends the three data types to provide a holistic presentation of the data while offering implications for practice and future research.

The correlations between the Theories of Intelligence scale (TOI) and Epistemic Belief Inventory (EBI) showed two statistically significant relationships. The findings highlight the statistically significant relationship between the TOI scale and the EBI. The weak, positive relationship indicates that TOI scores and EBI scores parallel each other. In other words, higher TOI scores (incremental theorists) reflect higher EBI scores (advanced epistemological beliefs) and visa versa. This relationship was initially considered in the original conceptual framework (Figure 1), and Figure 3 offers a visual model of the relationship between beliefs about intelligence and beliefs about knowing and learning.

![Figure 3. Diagram illustrating the relationship between beliefs about intelligence and beliefs about knowing and learning](image)
In this case, the statistically significant relationship between the Theories of Intelligence (TOI) scale and the Epistemic Belief Inventory (EBI) suggests that dimensions of epistemology (as measured by the EBI) are connected with an individual’s beliefs about intelligence. Even though there remains disagreement regarding the relationship between beliefs about learning and beliefs about knowledge (Hofer & Pintrich, 1997), Braten & Stromo (2005) suggested “beliefs about knowledge and knowing should be considered central components of epistemological beliefs” (p. 559). Furthermore, this significant relationship substantiates the work of previous researchers. Even though Hofer and Pintrich (1997) stated that beliefs about intelligence and beliefs about knowing are distinct entities, others have pointed out that these beliefs are not conceptually separate. “The two kinds of beliefs are probably intimately tied to each other, and both have been found to be related to several important aspects of learning” (Braten & Stromo, 2005, p. 540; Schommer-Aikins, 2002). Because a significant relationship exists between teachers’ beliefs about intelligence and their beliefs about knowing, it is important to further clarify the relationship and how each type of belief affects teaching practices (Luft & Roehrig, 2007).

As stated previously, the Pearson product-moment correlation coefficient indicated a statistically significant relationship between the Theories of Intelligence Scale (TOI) and the Epistemic Belief Inventory (EBI). As a result, the researcher conducted further analysis to determine the relationship between the TOI scale and the five constructs of the EBI (Certain Knowledge, Simple Knowledge, Quick Learning, Omniscient Authority, and Innate Ability). The analysis indicated two statistically significant relationships between the TOI scale and the constructs of the EBI. There was
a moderate, positive relationship between the TOI scale and the Innate Ability construct. Similarly, a weak, positive relationship existed between the TOI scale and the construct of Quick Learning. The remaining constructs of the EBI did not have a significant relationship with the TOI scale.

The researcher attributes the relationships between the Theories of Intelligence scale and the two constructs of the Epistemic Belief Inventory (Quick Learning and Innate Ability) to the similar nature of the TOI scale and the Quick Learning and Innate Ability constructs. The TOI scale assesses beliefs about the malleability of intelligence and addresses a significant question: Can intelligence be changed or is intelligence unchangeable (Dweck, 2000)? With that in mind, the EBI’s Innate Ability construct examines beliefs relating to the ability to learn, which ranges from fixed at birth to improvable over time (Duell, 2001; Schommer-Aikins, 2002). This construct closely related with the purpose of the Theories of Intelligence Scale. In fact, Hofer & Pintrich (1997) go so far as to state that this construct is a “concept borrowed from Dweck and Leggett” (p. 106). In this particular study, data analysis revealed that incremental theorists have more advanced beliefs regarding individuals’ ability to learn. This supports Dweck’s (2000) conceptualization that incremental theorists belief that intelligence can be increased, improved, or changed over time.

Furthermore, the Quick Learning construct examines an individuals beliefs about the speed at which learning should occur, ranging from quick to occurring gradually over time, in other words an “all-or-none” approach (Duell, 2001; Schommer-Aikins, 2002; Schommer-Aikins & Easter, 2006). The complementary relationship revealed in this study indicates that incremental theorists have a tendency to possess advanced beliefs
regarding the speed of learning. Conversely, entity theorists expressed naïve beliefs regarding how quickly learning should occur. These findings also align with the work of previous researchers. In accordance with their beliefs about intelligence, Braten & Stromo (2005) reported that students who believe in the fixed nature of intelligence are more likely to believe that learning occurs quickly or not at all.

In addition, the relationship between beliefs about intelligence and epistemological beliefs to eight particular teaching practices were also examined. A weak, positive relationship existed between the Epistemic Belief Inventory and the overall teaching practices score. In other words, participants with more advanced epistemological beliefs indicated a tendency to use student-centered teaching practices more frequently, and participants with more naïve epistemological beliefs indicated a tendency to use teacher-centered teaching practices more frequently. This finding helps clarify the influence teachers’ epistemological beliefs have on their approach to teaching.

Maggioni & Parkinson (2008) reported that few studies simultaneously consider teachers’ epistemological beliefs along with teaching practices used. However, their work highlights the relationship between teaching practices and epistemological beliefs. They point out that teachers with naïve beliefs often adopt a transmissive approach to teaching, relying upon rigid, teacher-centered practices, while teachers with advanced epistemological beliefs are more likely to approach teaching and learning from a constructivist perspective (Maggioni & Parkinson, 2008). These teachers tend to share authority with their students, emphasize the formulation of questions over simply answering questions, and view themselves as a facilitator of knowledge. In accordance with previous researchers’ findings (Brownlee, 2001; Maggioni & Parkinson, 2008; Muis
& Foy, 2010; Tsai, 2006; Tickle, Brownlee, & Nailon, 2005), the findings presented in this study indicate that in-service teachers with advanced epistemological beliefs are more likely to adopt teaching practices that match student-centered methods.

The qualitative data supported the quantitative findings, and support the claim that beliefs about intelligence and epistemological may influence teaching practices (Figure 4). For example, Mrs. Oliver had the highest scores on all three constructs of the quantitative questionnaire, and she offered multiple examples of her student-centered classroom. She frequently referenced her belief that all students can learn, and she described how that influenced her teaching, how she assesses her students, and the manner in which she differentiates instruction. Mrs. Oliver also offered descriptions that support the quantitative findings that indicate she possesses advanced epistemological beliefs. She shared that her content, Family and Consumer Sciences, was connected with a variety of academic disciplines and built upon her students’ previous knowledge. Mrs. Oliver also pointed out that, in her classroom, the teacher does not simply hand down knowledge. The creation of knowledge is a shared undertaking between herself and her students. Finally, Mrs. Oliver acknowledged that learning does not always occur quickly, and the speed at which learning occurs is dependent upon the individual learner. While she described primarily student-centered teaching practices, Mrs. Oliver did mention that she also uses teacher-centered methods. She reported using lecture and demonstrations; however, those particular strategies were used minimally, often as a precursor to project-based or group-based instruction.
Conversely, Mrs. Thomas’ quantitative results placed her in the 30th percentile or below for each of the three components on the questionnaire. In several instances, her description of her beliefs related to intelligence, knowing, and learning supported the results gathered from her quantitative questionnaire. Specifically, when asked if her approach to teaching was student-centered or teacher-centered, Mrs. Thomas stated she uses a teacher-centered approach in her classroom. She described instances that illustrate her belief that student-centered methods do not work in her classroom, and she expressed that teacher-centered methods provided her with the most control. She described her frequent use of lecture and demonstration, and, again, cited the control both practices provide her. Even though her quantitative results and portions of her qualitative description aligned, there were instances where Mrs. Thomas described advanced beliefs and using student-centered teaching practices. Mrs. Thomas articulated her beliefs regarding differentiation, and she expressed her beliefs that learning occurs gradually. She also expressed her belief that any student can learn anything, and she mentioned sharing that belief with her students frequently.
In addition, the researcher conducted additional quantitative analyses to supplement the correlation analyses and qualitative data. A one-way analysis of variance (ANOVA) was used to determine if there were statistically significant differences in in-service teachers’ beliefs based upon four demographic variables. Specifically, the researcher compared the mean scores for the Theories of Intelligence scale and Epistemic Belief Inventory based upon years of teaching experience, CTE discipline (Agricultural Education, Business and Information Technology, Family and Consumer Sciences, or Marketing Education), highest level of education completed (Bachelor’s degree or Master’s degree), and the type of teacher preparation program completed (traditional teacher preparation program or alternative certification). In particular, years of teaching experience and highest level of education completed were selected as key demographic variables based upon previous research that examined differences in beliefs based upon age, experience, and level of education.

The one-way ANOVA revealed there were no statistically significant differences on the mean scores of the Theories of Intelligence scale and Epistemic Belief Inventory based upon CTE discipline (Agricultural Education, Business and Information Technology, Family and Consumer Sciences, or Marketing Education). Even though there was not a statistically significant difference based upon teaching discipline, the literature relating to the domain-generality versus domain-specificity of beliefs provides contradictory findings. In accordance with this particular finding, previous researchers have expressed that beliefs do not vary across academic domain (Braten & Stromso, 2005; Fives & Buehl, 2010; Hofer & Pintrich, 1997). Conversely, others indicate that beliefs vary with field of study. Despite these differences, several researchers “hold that
domain-generality versus domain-specificity is not a question of either-or,” instead suggesting that belief can have general and specific characteristics (Braten & Stromso, 2005, p. 545).

Furthermore, the researcher initially anticipated significant differences in the beliefs of in-service teachers based upon the highest level of education completed. The findings indicate there were not statistically significant differences on the mean scores of the Theories of Intelligence scale and Epistemic Belief Inventory based upon the levels of education completed. The researcher attributes this to the age, education, and experiences of the participants. Hofer & Pintrich (1997) emphasize a positive relationship between age, education and the development of beliefs, and this concept is supported by the work of William Perry. According to Perry, when students enter college, they possess a naïve repertoire of beliefs. Specifically, students tend to believe in simple and certain knowledge that is handed down from authority. However, as students advance through their education, their beliefs have shifted towards a complex view of knowledge that is obtained through their own active participation and reasoning (Hofer, 2002; Perry, 1999; Schommer-Aikins, 2002). More simply put, as the students advanced through their respective degree programs, their age and educational backgrounds fostered the development of advanced epistemological beliefs. For example, in Perry’s original study, students exhibited higher stages of thinking in each subsequent year, from freshman to senior year (Hofer, 2001). Hofer (2001) also reports that epistemological level and educational background are positively correlated. These two examples support this study’s findings that significant differences do not exist on the means score of the Theories of Intelligence scale and Epistemic Belief Inventory based upon participants.
holding either a Bachelor’s degree or Master’s degree. Had the study also included pre-service teachers, a difference may have existed between pre-service teachers’ and in-service teachers’ beliefs about intelligence and their epistemological beliefs.

Statistically significant differences did not exist on the mean scores of the Theories of Intelligence scale and Epistemic Belief Inventory based upon the type of teacher preparation program completed (traditional teacher preparation program or alternative certification). The term “alternative certification” relates to individuals that have completed an alternative route to teacher licensure as opposed to the traditional post-secondary teacher preparation program (Zeichner, 2001). In many cases, individuals completing alternative certification programs are older and possess a variety of work experiences. For example, in a study examining individuals’ motivation for completing an alternative teacher certification program, the majority of students were between 22-30 years of age (Salyer, 2003). The participants in this study expressed they felt that their “practical, real-world knowledge” influences their teaching behaviors and effectiveness (Salyer, 2003, p. 24). These practical experiences can promote the development of advanced beliefs, which in most cases is transferred into the classroom practices. In this study, four participants of the qualitative strand were alternatively certified, and of the four, three scored the highest on the quantitative questionnaire. These particular individuals described that their previous work experiences have influenced their approach to teaching and the beliefs they possess. For them, previous work and life experiences have advanced their beliefs about intelligence, beliefs about knowing, and beliefs about learning, and those beliefs ultimately influence how they teach. With this in mind,
additional research connecting the type of teacher education program with teacher beliefs should be conducted (Savasci-Acikalin, 2009).

Significant differences did not exist on the means score of the Theories of Intelligence scale or Epistemic Belief Inventory based upon years taught. In an attempt to substantiate this finding, the researcher noted a lack of empirical evidence related to in-service teachers’ beliefs and teaching practices. Chai, Khine, & Teo (2006) stated that studies which examine the influence beliefs have in an educational context generally focus on students’ beliefs. Furthermore, in the limited amount of research that is specifically devoted to teachers’ beliefs, the majority focuses on the beliefs of pre-service and beginning teachers (Savasci-Acikalin, 2009). With that in mind, previous researchers have indicated that pre-service teachers possess a range of beliefs. Yet as they gain more experiences, those beliefs are often challenged. Fives & Buehl (2010) offer a teaching knowledge belief framework, and they reported that teaching knowledge and beliefs relating to teaching are formed through observational experiences, vicarious experiences, and enactive experiences. This suggests that, as pre-service teachers gain experience, those experiences challenge their currently held beliefs and their approaches to teaching. Even so, additional research with pre-service teachers should be conducted. Longitudinal studies conducted from the beginning of teacher preparation programs would help shed light on how beliefs change over time and how that change influences teaching practices (Savasci-Acikalin, 2009).

The forced-entry regression analysis revealed the statistically significant predictors of teaching practices in this study. The overall regression model was statistically significant with Theories of Intelligence scale, Epistemic Belief Inventory,
CTE discipline, years of teaching experience, highest level of education completed, and type of teacher preparation program explaining 18.4% of the variance in teaching practices. A second, stepwise regression analysis revealed CTE discipline: Business and Information Technology was the best predictor of teaching practices (explaining approximately 11% of the variance), followed by the Epistemic Belief Inventory, and years of teaching experience. The Epistemic Belief Inventory influenced teaching practices score positively, while CTE discipline: Business and Information Technology and years of teaching experience predicted a decrease in teaching practices score. It is not surprising that teaching discipline (or context) provided the greatest explanation in the variance of teaching practices. The inherent nature of disciplines is reflected in how they are taught (Braten & Stromso, 2005). As a result, the researcher modified the original conceptual framework to encompass the influence teaching discipline has on instructional practices (Figure 5). With that in mind, caution should be exercised when trying to relate teaching strategies to particular disciplines and contexts. This is further explained as part of the recommendations for future research based upon this study.
The qualitative findings illustrate the variety of teaching strategies and methods that in-service CTE teachers use in their classroom. The strategies reflect both student-centered and teacher-centered teaching practices. The teachers indicated using multiple student-centered teaching methods including project-based instruction, hands-on activities, class discussions, peer teaching, collaborative groups, and the use of higher order questioning. The teachers also reported using teaching practices identified as teacher-centered including lecture, demonstrations, and teacher-led discussions. Finally, the teachers also indicated the frequent use of technology and expressed their beliefs regarding differentiation of instruction based upon ability.

In regards to the participants’ beliefs about intelligence, differing beliefs were described regarding the ability of all students to improve their intelligence and learn. In most cases, the teachers articulated their beliefs that anyone can learn anything, and they
recounted teaching methods that align with that belief. Additionally, the participants indicated that intelligence was a malleable trait, and they pointed out that even the teacher could still learn new things. While most participants expressed beliefs regarding the malleable nature of intelligence, there were participants who hinted that intelligence is a fixed trait, and they shared examples how that belief influences how they teach and assess students.

When articulating their epistemological beliefs, the teachers reported the connectedness of their content. Specifically, they felt that their content was connected with a variety of academic disciplines, especially science, math, and English. In addition to their content being connected with other subjects, the teachers pointed out that, because their content is connected with the students’ interests, it becomes more meaningful and relevant. Furthermore, the teachers shared their beliefs that both the process of learning as well as the final product is important. In some cases, the participants described how they shared that belief with their students. On the other hand, others expressed that the final product is an indication of student mastery. No matter if the teacher believed the process or the final product was most important, both sides mentioned that standardized testing emphasizes the final product. The participants also offered varying beliefs regarding the source of students’ knowledge, and they expressed that the speed of learning is dependent upon the individual learner.

Finally, the mixed methods findings offer inconsistencies regarding the teaching practices of teachers with advanced beliefs and teachers with naïve beliefs. Both groups indicated utilizing student-centered and teacher-centered methods, and both offered examples that indicated conflicting beliefs when compared to the quantitative findings.
The inconsistencies show that the relationship between beliefs and teaching practices can vary across a group of in-service teachers. Therefore, caution should be exercised regarding the generalizability of these findings. It should be noted that the sample used in this study is limited (Career and Technical Education teachers only), and that findings are based upon a self-reported questionnaire and interviews. It is also important to note that the qualitative strand participants did not validate the themes that emerged from the individual interviews. The use of focus groups would allow the qualitative strand participants to discuss their attitudes towards the themes in order to improve the quality of the data. To further verify the data, the researcher recommends additional research that collects data through participant observations and documents analysis.

**Implications for Practice**

The intent of this study was to examine the role teachers’ beliefs play in making instructional decisions. The findings presented support the work of previous researchers, which illustrate that in-service teachers hold a variety of beliefs. Specifically, in-service teachers possess beliefs regarding intelligence, knowing, and learning, and this study illustrated that these beliefs may influence how a teacher teaches. With this in mind, it is important to understand how beliefs are formed, and, if needed, how beliefs can be changed. The cognitive psychology literature is populated with information that holds practical use within teacher preparation programs, and it is imperative that teacher educators recognize that beliefs often serve as the best indicator of the decisions that pre-service and in-service teachers will make in and out of the classroom.

Because beliefs about teaching are often established by the time pre-service teachers enter college, teacher educators must consider what pre-service teachers think
they already know about teaching and learning. The teaching practices of and the interactions with former teachers may have directly impacted pre-service teachers' beliefs about teaching, learning, and knowing. Furthermore, after spending years as students, pre-service teachers often think they already know what they need in order to teach. Therefore, addressing pre-service teachers’ conceptions (and in many cases, misconceptions) about teaching will facilitate their learning about quality teaching. In other words, the prior knowledge of pre-service teachers should be considered. This carries important implications. If teacher educators wish to have a significant impact on pre-service teachers’ beliefs about teaching, they must consider the currently held knowledge base (Anderson, 1989a). Learning is a function of many factors, and one such factor is the current level of skill and knowledge of the learner (Bransford, 1979). To challenge those currently held beliefs, teacher educators must “understand existing conceptions and create learning experiences that will allow students to either accommodate or restructure their knowledge frameworks for new learning” (Meyer, 2004, pp. 971-972). However, this creates several questions for teacher educators to consider. First, what beliefs should be considered within a teacher preparation program? Ultimately, who determines what the “correct” beliefs are? And finally, can a teacher preparation program affect deep cognitive change in a limited amount of time?

Attempting to modify one’s beliefs is an arduous process. Even so, because researchers have illustrated the importance epistemological beliefs and beliefs about intelligence play within a classroom, the naïve beliefs of pre-service and in-service teachers should be challenged. To promote conceptual change in pre-service and in-service teachers, teacher educators and school administrators first must identify the
beliefs being held. The use of quantitative, self-report questionnaires has proven to be a reliable method for identifying teachers’ beliefs, and qualitative methodology can also be used (e.g. case studies, semi-structured interviews, observations) effectively. If pre-service or in-service teachers possess naïve beliefs about intelligence, knowing, or learning, they should be offered opportunities to become aware of those beliefs. These individuals should be encouraged to explicitly discuss their beliefs, how their beliefs were formed, how their beliefs might impact their teaching, and, if needed, examples should be provided that challenge their beliefs. These educational interventions may affect teachers’ beliefs, and they can also translate into changes in pedagogical practices (Brownlee, Purdie, & Boulten-Lewis, 2001; Maggioni & Parkinson, 2008).

It is important to note that, in order for pre-service and in-service teachers to perceive alternative beliefs as credible, they have to be presented with evidence that challenges their currently held beliefs. For example, teachers with an entity theory of intelligence must be explicitly taught that intelligence can be improved and cultivated. Dweck (2000) reports that theories of intelligence can be manipulated. With that in mind, interventions must provide mechanisms for challenging the belief of entity theorists. Similarly, naïve epistemological beliefs can also be challenged through explicit reflection and through an environment that endorses advanced beliefs. Teacher preparation programs and in-service teacher professional development should emphasize reflective thinking rather than encouraging a passive reception of knowledge from authority figures (Cheng, Chan, Tang, & Cheng, 2009). Furthermore, King and Kitchener (2002) describe methods that can promote epistemological development. The methods include promoting discussion about controversial and ill-defined issues, creating
opportunities for pre-service teachers to analyze others’ point of view, giving frequent feedback, and teaching strategies that are used for gathering and evaluating data.

Finally, clinical experiences can also provide opportunities for pre-service teachers to challenge previously held beliefs. These experiences can include early observations in schools and classrooms to working one-on-one with students in a tutoring context, co-planning and co-teaching with the clinical faculty, to teaching independently. Even so, the experiences alone are not enough. Teacher educators should emphasize reflection on these experiences to facilitate the development of advanced beliefs. One method that promotes reflection is the use of learning journals. A learning journal would allow the pre-service teacher to reflect on their experiences and how those experiences align (or do not align) with their beliefs (Cooper, 2006). A learning journal would increase the value of clinical experiences, and it would help promote the experiences as a method for changing the beliefs of pre-service teachers.

**Recommendations for Future Research**

Pre-service and in-service teachers hold beliefs about their students, the subjects they teach, and their responsibilities as a teacher, and these beliefs may influence how a teacher teaches (Fang, 1996). Even though empirical evidence has shown that a teacher’s beliefs can be changed, there are inconsistencies within the literature regarding the conceptual change of a teacher’s beliefs. With that in mind, additional research is needed to determine if (and at what level) teachers’ beliefs can be modified.

Specifically, metacognition plays an important role in the conceptual change process (Murphy & Mason, 2006). Metacognition includes second order cognitions, thoughts about thoughts, and knowledge of cognition and the regulation of cognition
Metacognition helps individuals reflect upon their own thinking and enables individuals to manage their cognitive skills, and it promotes the use problem solving skills and critical thinking skills as decisions are made (Hartman, 1998; Joseph, 2009; Metallidou, 2008; Schraw, 1998). In regards to the change process, teachers must be able to think about their beliefs rather than merely thinking with their beliefs. With this in mind, it is necessary to examine metacognitive knowledge and metacognitive processes in an effort to change teachers’ beliefs. Simply put, metacognition “forces reflection” (Assessing and Developing Metacognitive Skills, 2009, p. 6). Within an educational context, it can be hypothesized that teachers with greater metacognitive awareness are more likely to experience a conceptual change of their beliefs. Unfortunately, there is a limited amount of research examining the relationship between teacher beliefs and metacognitive processes. Can greater metacognitive awareness influence an individual to change their beliefs? If metacognitive awareness can influence a change of beliefs, the researcher anticipates that metacognitive interventions would facilitate the development of advanced epistemological beliefs. By explicitly reflecting upon their epistemological beliefs, the intervention participants “may develop higher order beliefs, which are typically more convertible because they are consciously held” (Brownlee et al., 2001, p. 251).

Schommer (1994) points out that the focus of epistemological interventions should not focus on changing beliefs from a dualist view into a relative view, but they should help participants see that critical interpretation of multiple realities is sometimes necessary.

Because the beliefs held by teachers play an important role in how they teach, it is also necessary to clarify the role that the teaching discipline (or context) plays with the
pedagogical decisions a teacher makes. Or perhaps, the better question lies within teachers’ beliefs about their content. Do teachers’ conceptions (or misconceptions) about their content influence the teaching methods they use? For example, in this particular study, Business and Information Technology teachers indicated using experiments less frequently. In fact, several Business and Information Technology teachers wrote on their quantitative questionnaire that experiments were not applicable to their particular content. Is that statement accurate? Is it impossible to include experiments in a Business and Information Technology classroom? Or is that a belief that the teacher holds regarding their content? This example creates additional questions: Do teachers’ beliefs about their content ultimately play a larger role in their selection of teaching methods, as opposed to their beliefs about their students?

With this in mind, the researcher recommends confirmatory longitudinal research using a single school as a case study to determine the influence teachers’ beliefs have on teaching practices. Previously, a large body of research examining the influence teacher beliefs on teaching practices has relied upon self-reported data (Savascki-Acikalin, 2009). The use of observations, document analysis of lesson plans, and in-depth interviews within a single school would allow the researcher to offer additional conclusions connecting teacher beliefs with teaching practices. Furthermore, the case study methodology would allow the researcher to retain the meaningful characteristics of real-life events and place emphasis on the contextual conditions that are applicable within the study (Yin, 2009). Finally, the use of a single school would clarify the contextual differences of teacher beliefs and how those beliefs influence teaching practices.
Summary

This study examined how in-service teachers’ beliefs about intelligence and their epistemological beliefs influence their teaching practices. Using a sample of in-service Career and Technical Education teachers located within the commonwealth of Virginia, the researcher employed a two-phase, sequential explanatory mixed methods study. The quantitative strand allowed the researcher to identify the relationships between in-service teachers’ beliefs about intelligence and epistemological beliefs and the relationship to the teaching methods they use. Furthermore, using a systematically selected sample matching the theoretical assumptions, semi-structured interviews were conducted to further clarify the role in-service teachers’ beliefs play when making planning decisions. Finally, the data were connected when qualitative participants were determined from the quantitative data, and they were also connected after qualitative data collection and analysis to determine if the descriptions of teaching method used, beliefs about intelligence, and epistemological beliefs aligned with the outcomes of the quantitative questionnaire.

The findings indicate a relationship between teacher’s beliefs about intelligence and their epistemological beliefs. Furthermore, this research supports the claim that teachers’ beliefs about intelligence and epistemological beliefs may influence their teaching practices. While the direct relationship between teacher beliefs and teaching practices cannot be pinpointed through this research, the evidence indicates there is a relationship between the two. The researcher acknowledges that teachers possess a variety of beliefs, and no matter the nature of the belief, a teachers’ beliefs do in fact influence how teachers view their students and, ultimately, how they teach.
That being said, this study provided recommendations for both practice and future research. The researcher recommends that teacher educators attempt to identify the beliefs pre-service teachers hold as they begin their teacher preparation program. By doing so, currently held misconceptions about education can be examined and discussed. If modifications of beliefs are needed, it is recommended that pre-service (or in-service) teachers have the opportunity to participate in interventions, reflective thinking, and discussions in an attempt to modify their beliefs. The researcher also provides recommendations for future research relating to metacognitive awareness and further clarifying the role teaching discipline and beliefs play in instructional decision-making. Finally, the researcher suggests a longitudinal, mixed methods case study utilizing observations, document analysis, and in-depth interviews within a single school to offer additional explanations in connecting teacher beliefs and teaching practices.

In classrooms across America, teachers are charged with creating meaningful learning experiences for their students. Long gone are behaviorist conceptions of learning, and in their place resides the conception that learners are active seekers and processors of knowledge. Even though educational research offers many examples that student-centered instruction allows students to be active learners, many teachers still embrace a teacher-centered mentality. One is left to wonder what it might take for all teachers to create student-centered classroom that thrives upon student inquiry and construction of knowledge. Perhaps, understanding teachers’ belief can answer that question. Pajares (1992) points out “the beliefs of teachers and teacher candidates can inform educational practices in ways that prevailing research agendas have not and cannot” (p. 329). The study of beliefs and their influence on teaching is critical. Pajares
(1992) labeled the construct of teacher beliefs “messy.” Nevertheless, teacher beliefs must become an important component of educational inquiry.
References


Appendix A
IRB Approval Letter

MEMORANDUM

DATE: October 18, 2010

TO: Thomas W. Broyles, Cory Eppler, Donna Moore, Gary E. Skaggs

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires June 13, 2011)

PROTOCOL TITLE: The Relationship Between Implicit Theories of Intelligence, Epistemological Beliefs, and the Teaching Practices of In-service Teachers: A Mixed Methods Study

IRB NUMBER: 10-813

Effective October 18, 2010, the Virginia Tech IRB Administrator, Carmen T. Green, approved the new protocol for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at http://www.rib.vt.edu/pages/responsibilities.htm (please review before the commencement of your research).

PROTOCOL INFORMATION:
Approved as: Expedited, under 45 CFR 46.110 category(ies) 6, 7
Protocol Approval Date: 10/18/2010
Protocol Expiration Date: 10/17/2011
Continuing Review Due Date*: 10/2/2011

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:
Per federally regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals / work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.
Appendix B
Pre-Notice Letter

October 25, 2010

Mr. John Teacher
School High School
123 Address St.
City, VA 12345

Dear Mr. Teacher:

I am writing to ask for your help with an important study being conducted by Virginia Tech and the Department of Agricultural and Extension Education. I am interested in learning more about the role a teacher’s beliefs play as they make instructional decisions. Specifically, this research will examine how teachers' beliefs influence their instructional decisions.

The significance of this study is substantial; therefore, your participation is very important! The results will help the teaching profession and provide teacher educators with information they can use to prepare future Career and Technical Education teachers. Participation is entirely voluntary and your responses will be kept confidential.

I would like to do everything to make it easy for you to participate in this study. I am writing in advance because many times people like to know ahead of time that they will be asked to fill out a survey. Within the next week, you will receive a letter that contains a survey to complete as part of this study. When you receive your survey, I hope that you will take 10-15 minutes to complete it. This study will only be successful with the help of generous teachers like you!

Many thanks,

Mr. Cory Epler
Graduate Research Assistant
October 25, 2010

Mr. John Teacher
School High School
123 Address St.
City, VA 12345

Dear Mr. Teacher:

Last week you should have received a letter requesting your help with an important study being conducted by Virginia Tech and the Department of Agricultural and Extension Education. This study will explore the role teachers’ beliefs play when making instructional decisions. Specifically, I am interested in examining how Career and Technical Education (CTE) teachers’ beliefs influence their instructional decisions. The best way I can learn about this is to ask CTE teachers to share their thoughts and opinions. You have been randomly selected to participate in this study.

This mailing includes the survey that I hope you will complete. The questions on this survey should take less than 10 minutes to complete, and your responses are voluntary and will be kept confidential. This study has been reviewed and approved by Virginia Tech’s Institutional Review Board (IRB), and if you have questions about your rights as a participant, you may contact the IRB office at (540) 231-4991. If you have questions regarding this survey, please do not hesitate to contact me at cepier@vt.edu or (540) 231-7244. By taking a few minutes to share your thoughts, you will be helping me out a great deal!

I appreciate your time and consideration in completing the survey. For your convenience, I have enclosed a business reply envelope for you to return your completed survey. This study will only be successful with the help of generous teachers like you!

Many thanks,

Mr. Cory Epler
Graduate Research Assistant

Enclosures
Appendix D

Postcard mailing

Within the past two weeks, you should have received a letter requesting your help with an important study being conducted by Virginia Tech and the Department of Agronomic and Extension Education. This study will explore the role teachers’ beliefs play when making instructional decisions. The significance of this study is substantial; therefore, your participation is very important.

If you have completed and returned the survey, please accept my sincere thanks! The success of this study is dependent upon your generous help like yours. If you have not completed the survey, I hope you will take a few minutes of your time to do so. It is especially grateful for your help with this important study.

If you did not receive a survey or if it was misplaced, please do not hesitate to contact

Cory Spier
Graduate Research Assistant

Within the past two weeks, you should have received a letter requesting your help with an important study being conducted by Virginia Tech and the Department of Agronomic and Extension Education. This study will explore the role teachers’ beliefs play when making instructional decisions. The significance of this study is substantial; therefore, your participation is very important.

If you have completed and returned the survey, please accept my sincere thanks! The success of this study is dependent upon your generous help like yours. If you have not completed the survey, I hope you will take a few minutes of your time to do so. It is especially grateful for your help with this important study.

If you did not receive a survey or if it was misplaced, please do not hesitate to contact

Cory Spier
Graduate Research Assistant
Appendix E
Replacement Questionnaire Cover Letter

January 3, 2011

Mr. John Teacher
School High School
123 Address St.
City, VA 12345

Dear Mr. Teacher,

In late October, I sent a request asking for your help with an important research study examining Career and Technical Education (CTE) teachers’ beliefs and how such beliefs influence CTE teachers’ teaching practices. As part of the initial mailing, a survey was included, and to the best of my knowledge, the survey has not yet been returned.

I am writing again because the significance of this study is substantial; therefore, your participation is very important! It is imperative that we hear from current CTE teachers in order so the results can be used to better understand how CTE teachers make instructional decisions, and the results will also be assist teacher educators as they prepare future CTE teachers. I hope you will complete and return the survey soon. As mentioned before, the survey should take only 5-10 minutes to complete. Your responses are voluntary, and they will be kept confidential. This study has been reviewed and approved by Virginia Tech’s Institutional Review Board (IRB), and if you have questions about your rights as a participant, you may contact the IRB office at (540) 231-4991. If you have questions regarding this survey, please do not hesitate to contact me at cepier@vt.edu or (540) 231-7244.

I appreciate your time and consideration in completing the survey. For your convenience, I have enclosed a business reply envelope for you to return your completed survey. Again, this study will only be successful with the help of generous teachers like yourself.

Many thanks,

Mr. Cory Epler
Graduate Research Assistant
Appendix F
Second Stratified Sample’s Pre-Notice Email

Good afternoon! You have been identified as a potential participant in a research project being conducted by Virginia Tech and the Department of Agricultural and Extension Education. The purpose of this research project is to examine how Career and Technical Education (CTE) teachers’ beliefs influence their instructional decisions. The significance of this study is substantial; therefore, your participation is very important!

I am writing in advance to let you know that next week, you will receive a mailing that contains a survey to complete as part of this study. The questions on the survey should take only 5-10 minutes to complete, and your responses will be kept confidential. When you receive the survey, I hope that you will consider completing and returning the survey! For your convenience, I will enclose a business reply envelope for you to return your completed survey.

It is imperative that we hear from current CTE teachers so the results can be used to better understand how CTE teachers make instructional decisions. The results will also assist teacher educators as they prepare future CTE teachers. The success of this project is dependent upon the help of generous teachers like yourself!

Thank you in advance!

Cory Epler
Appendix G
Second Stratified Sample’s Cover Letter

Virginia Tech
College of Agriculture and Life Sciences

January 28, 2011

Mr. John Teacher
School High School
123 Address St.
City, VA 12345

Dear Mr. Teacher:

You have been identified as a potential participant in a research project I am conducting through Virginia Tech and the Department of Agricultural and Extension Education. The purpose of this project is to examine how Career and Technical Education (CTE) teachers’ beliefs influence their instructional decisions. The significance of this study is substantial; therefore, your participation is very important! I hope to hear from current CTE teachers so we can better understand how CTE teachers make instructional decisions. The results will also assist teacher educators as they prepare future CTE teachers.

This mailing includes the survey that I hope you will complete. The questions on the survey should take only 5-10 minutes to complete, and your responses will be kept confidential. This study has been reviewed and approved by Virginia Tech’s Institutional Review Board (IRB), and if you have questions about your rights as a participant, you may contact the IRB office at (540) 231-4991. If you have questions regarding this survey, please do not hesitate to contact me at cepler@vt.edu or (540) 231-7424.

I appreciate your time and consideration in completing the survey. For your convenience, I have enclosed a business reply envelope for you to return your completed survey. The success of this project is dependent upon the help of generous teachers like yourself!

Many thanks,

Mr. Cory Epier
Graduate Research Assistant

Enclosures
Appendix H
Teacher Beliefs Questionnaire

**Part 1:** For each of the teaching practices/strategies listed below, please indicate how often you use them during a typical lesson by circling your response.

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Occasionally</th>
<th>Moderately</th>
<th>A Great Deal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Demonstrations: Demonstrations are used to teach students how to do certain tasks, and they usually include explanations and illustrations.</td>
<td>N</td>
<td>R</td>
<td>O</td>
<td>M</td>
<td>G</td>
</tr>
<tr>
<td>2. Experiments: In an experiment, the students perform a test to examine a hypothesis for an objective or problem.</td>
<td>N</td>
<td>R</td>
<td>O</td>
<td>M</td>
<td>G</td>
</tr>
<tr>
<td>3. Group Projects/Assignments: With this method, groups of students work together to complete projects or assignments.</td>
<td>N</td>
<td>R</td>
<td>O</td>
<td>M</td>
<td>G</td>
</tr>
<tr>
<td>4. Independent Assignments: This includes in-class or out-of-class assignments that students complete individually.</td>
<td>N</td>
<td>R</td>
<td>O</td>
<td>M</td>
<td>G</td>
</tr>
<tr>
<td>5. Lecture: In a lecture, the teacher disseminates factual information. Often, a lecture includes the use of visual aids (e.g., PowerPoint presentation, overhead transparencies, etc.)</td>
<td>N</td>
<td>R</td>
<td>O</td>
<td>M</td>
<td>G</td>
</tr>
<tr>
<td>6. Role-Play: Role-play involves having students play or portray a given role. The playing of and analysis of the role provides the information for what is being taught.</td>
<td>N</td>
<td>R</td>
<td>O</td>
<td>M</td>
<td>G</td>
</tr>
<tr>
<td>7. Small Group/Partner Discussion: Individual students (or groups) are asked to discuss a given topic or question in order to come up with their own opinions.</td>
<td>N</td>
<td>R</td>
<td>O</td>
<td>M</td>
<td>G</td>
</tr>
<tr>
<td>8. Teacher Led Discussion: The teacher poses questions to the class and the students offer answers.</td>
<td>N</td>
<td>R</td>
<td>O</td>
<td>M</td>
<td>G</td>
</tr>
</tbody>
</table>

**Part 2:** Please indicate the extent to which you agree or disagree with each of the following statements. Circle your response.

<table>
<thead>
<tr>
<th>SA=</th>
<th>Strongly Agree</th>
<th>A=</th>
<th>Agree</th>
<th>MA=</th>
<th>Mostly Agree</th>
<th>MD=</th>
<th>Mostly Disagree</th>
<th>D=</th>
<th>Disagree</th>
<th>SD=</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>You have a certain amount of intelligence, and you really can't do much to change it.</td>
<td>SA</td>
<td>A</td>
<td>MA</td>
<td>MD</td>
<td>D</td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Your intelligence is something about you that you can't change very much.</td>
<td>SA</td>
<td>A</td>
<td>MA</td>
<td>MD</td>
<td>D</td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>No matter who you are, you can significantly change your intelligence level.</td>
<td>SA</td>
<td>A</td>
<td>MA</td>
<td>MD</td>
<td>D</td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>To be honest, you can't really change how intelligent you are.</td>
<td>SA</td>
<td>A</td>
<td>MA</td>
<td>MD</td>
<td>D</td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>You can always substantially change how intelligent you are.</td>
<td>SA</td>
<td>A</td>
<td>MA</td>
<td>MD</td>
<td>D</td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>You can learn new things, but you really can't change your basic intelligence.</td>
<td>SA</td>
<td>A</td>
<td>MA</td>
<td>MD</td>
<td>D</td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>No matter how much intelligence you have, you can always change it quite a bit.</td>
<td>SA</td>
<td>A</td>
<td>MA</td>
<td>MD</td>
<td>D</td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>You can change even your basic intelligence level considerably.</td>
<td>SA</td>
<td>A</td>
<td>MA</td>
<td>MD</td>
<td>D</td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Teacher Beliefs Questionnaire - Page 2

**Part 3: Indicate how strongly you agree or disagree with the following statements. Please circle your response.**

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree (SA)</th>
<th>Agree (A)</th>
<th>Neutral (N)</th>
<th>Disagree (D)</th>
<th>Strongly Disagree (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>It bothers me when teachers don't tell students the answers to complicated problems.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>2.</td>
<td>Truth means different things to different people.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>3.</td>
<td>Students who learn things quickly are the most successful.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>4.</td>
<td>People should always obey the law.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>5.</td>
<td>Some people will never be smart no matter how hard they work.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>6.</td>
<td>Absolute moral truth does not exist.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>7.</td>
<td>Parents should teach their children all there is to know about life.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>8.</td>
<td>Really smart students don't have to work as hard to do well in school.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>9.</td>
<td>If a person tries too hard to understand a problem, they will most likely end up being confused.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>10.</td>
<td>Too many theories just complicate things.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>11.</td>
<td>The best ideas are often the most simple.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>12.</td>
<td>People can't do too much about how smart they are.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>13.</td>
<td>Teachers should focus on facts instead of theories.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>14.</td>
<td>I like teachers who present several competing theories and let their students decide which is best.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>15.</td>
<td>How well you do in school depends on how smart you are.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>16.</td>
<td>If you don't learn something quickly, you won't ever learn it.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>17.</td>
<td>Some people just have a knack for learning and others don't.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>18.</td>
<td>Things are simpler than most teachers would have you believe.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>19.</td>
<td>If two people are arguing about something, at least one of them must be wrong.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>20.</td>
<td>Children should be allowed to question their parents' authority.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>21.</td>
<td>If you haven't understood a chapter the first time through, going back over it won't help.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>22.</td>
<td>Science is easy to understand because it contains so many facts.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>23.</td>
<td>The moral rules I live by apply to everyone.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>24.</td>
<td>The more you know about a topic, the more there is to know.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>25.</td>
<td>What is true today will be true tomorrow.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>26.</td>
<td>Smart people are born that way.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>27.</td>
<td>When someone in authority tells me what to do, I usually do it.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>28.</td>
<td>People who question authority are troublemakers.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>29.</td>
<td>Working on a problem with no quick solution is a waste of time.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>30.</td>
<td>You can study something for years and still not really understand it.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>31.</td>
<td>Sometimes there are no right answers to life's big problems.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
<tr>
<td>32.</td>
<td>Some people are born with special gifts and talents.</td>
<td></td>
<td>A</td>
<td>N</td>
<td>D</td>
</tr>
</tbody>
</table>
Teacher Beliefs Questionnaire - Page 3

**Part 4: Please answer the following demographic questions.**

1. **What is your sex?**
   - [ ] Male
   - [ ] Female

2. **What is your age?**
   - ___________ years

3. **How many years have you taught (including the current year)?**
   - ___________ years

4. **Which best describes your primary CTE discipline? Select all that apply.**
   - [ ] Agricultural Education
   - [ ] Business and Information Technology
   - [ ] Family and Consumer Sciences
   - [ ] Marketing Education
   - [ ] Other (please specify: ________________)

5. **Which best describes the grade level(s) you currently teach? Select all that apply.**
   - [ ] 6th
   - [ ] 7th
   - [ ] 8th
   - [ ] 9th
   - [ ] 10th
   - [ ] 11th
   - [ ] 12th

6. **What is the highest level of education you have completed?**
   - [ ] Bachelor’s Degree
   - [ ] Master’s Degree
   - [ ] Doctoral Degree

7. **Which best describes the type of teacher preparation program you completed?**
   - [ ] Traditional teacher preparation program
   - [ ] Alternatively certified teacher

8. **Are you a member of your state or national CTE professional organization?**
   - [ ] Yes
   - [ ] No

In addition to this survey, we will be conducting interviews to explore how teachers’ beliefs and thinking influences the decisions they make while teaching. *Would you be interested in participating in an interview regarding this topic?* The interview would last approximately 45-60 minutes. Answering “yes” is not a final commitment at this point. We simply want to know who might be willing to do so.

   - [ ] Yes
   - [ ] No

**If yes, please provide your email address to schedule an interview:** ______________________________

*Please return using the provided business reply mail envelope or send to:*

Ag and Extension Education  
Virginia Tech  
2270 Lott-Reaves Hall (6342), PO Box 850  
Blacksburg, VA 24063-8559
Appendix I

Qualitative Strand Participant’s Consent Form

Virginia Polytechnic Institute and State University

Informed Consent for Participants in Research Projects Involving Human Subjects

Project Title: The Relationship Between Implicit Theories of Intelligence, Epistemological Beliefs, and the Instructional Practices of In-service Teachers: A Mixed Methods Study

Investigators: Mr. Cory Epler, Graduate Research Assistant, Virginia Tech
Dr. Thomas Broyles, Assistant Professor, Virginia Tech
Dr. Donna Moore, Assistant Professor, Virginia Tech
Dr. Terry Wildman, Professor, Virginia Tech
Dr. Gary Skaggs, Professor, Virginia Tech

I. Purpose of the Research

The intent of this study is to examine the role teachers’ beliefs play in making instructional decisions. This two-phase, explanatory mixed methods study will obtain quantitative results from a sample and then select participants for follow-up interviews to further explain the results. In the first phase, quantitative research questions will address the relationship between in-service teachers’ beliefs about intelligence and their epistemological beliefs in relation to the pedagogical decisions they make. In the second phase, qualitative semi-structured interviews will be conducted to explore how in-service teachers’ beliefs influence their instructional practices.

II. Procedures

Your participation in the above-mentioned interviews will involve sharing with the interviewer your experiences. The interview will last between 60-90 minutes and it will take place at a location of your convenience. You may withdraw at any time.

III. Risks

This study has been reviewed and approved by the Virginia Tech Institutional Review Board. Individual answers and identities of the participants will be protected all times. This research involves no more than minimal risk.

IV. Benefits

There are no known benefits to participants. The data collected from participants during this research will be developed into one or more papers for publication in academic journals or for presentation at professional conferences. The results of the study will help explain how teachers’ beliefs play a role in their selection of teaching strategies and methods.

V. Extent of Anonymity and Confidentiality

Your identity, and that of any individuals you mention, will be kept confidential at all times and will be known only to your interviewer. The above-mentioned interviews will be audio recorded and later transcribed by a member of the research team. When transcribing the interview recordings, pseudonyms (i.e., false names) will be used for my name and for the names of any other people you mention. These pseudonyms will also be used in preparing all written reports of the research. Any details in the interview recordings that could identify you, or anyone who you mention, will also be altered during the transcription process. After the transcribing is complete, the interview recordings will be stored in locked offices used by the research team. The audio recordings will be destroyed after the analysis is complete, but the transcriptions will be stored indefinitely.

It is possible that the Institutional Review Board (IRB) at Virginia Tech will view this study’s collected data for auditing purposes. The IRB is responsible for overseeing the protection of human subjects who are involved in research.

Virginia Tech Institutional Review Board; Project No. 13-813
Approved October 18, 2010 to October 17, 2011
VI. Compensation

You will receive no compensation for participating in this study.

VII. Freedom to Withdraw

You participation in this research is entirely voluntary and your refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. Similarly, you are free to withdraw from this research at any time. If you choose to withdraw from the research, any information about you and any data not already analyzed will be destroyed. You are free to choose to not answer any question.

VIII. Participant's Responsibilities

As a participant you are responsible for completing one interview that should last between 60-90 minutes.

IX. Participant's Permission

I voluntarily agree to participate in this research. I have read and understand the Informed Consent and the conditions of this research. I have also had all of my questions answered. I hereby acknowledge the above and give my voluntary consent:

<table>
<thead>
<tr>
<th>Signature of Participant</th>
<th>Printed Name of Participant</th>
<th>Date</th>
</tr>
</thead>
</table>

If I have any questions about this research or how it is conducted, my rights as a participant, or whom to contact in the event of a research-related injury to me, I can contact:

Dr. Thomas Broyles, Assistant Professor
540.231.8188
tbroyles@vt.edu

Mr. Cory Epler, Graduate Research Assistant
540.231.7422
cepler@vt.edu

Mr. David Moore, Virginia Tech Institutional Review
540.231.4099
moored@vt.edu
Appendix J
Interview Guide

Interview Guide
Follow-up questions will be asked as needed.

My first questions relate to the methods or strategies you choose to use when teaching.

1. What types of teaching methods are you most comfortable with? Why?

2. What type of teaching methods are you least comfortable with? Why?

3. Two common terms used in education are “student-centered” or “teacher-centered.” If you were to place yourself on a continuum between student-centered and teacher-centered, where would you fall? Why?

4. How do you promote higher-level learning as you teach?

I am also interested in hearing more about your beliefs regarding intelligence. The term “intelligence” has many meanings, so feel free to use your own definition of intelligence as a basis for these questions:

5. How do you define intelligence?

6. Do you believe that intelligence can be developed?
   a. [If yes] How can intelligence be developed?
   b. [If no] What makes you believe that it cannot be developed?

7. If you heard a student say, “There are some things I just can’t learn,” how would you respond?

8. How do your beliefs about students’ intelligence influence how you teach?

9. Do you believe that a student’s intelligence can change as a result of school? What leads you to that?
   a. How do you communicate those beliefs to your students?
   b. How do those beliefs influence your teaching methods?

10. When planning a lesson, how do you take into consideration the varying ability levels of each student?

11. How do you plan differently based upon the ability of a particular class?

Let’s shift our thinking...we’ve been talking about your beliefs about intelligence, but let’s talk a bit more generally about your beliefs about learning and knowing.

12. In your opinion, how does learning occur?

13. How do students come to “know” something?
   a. What is an example of that from your classroom?
14. Do you believe the content you teach is connected to other subjects?
   a. [If yes] How do you share that with your students?

15. In your opinion, which is most important for learning: the process of learning or the final product? Please explain.

16. What do you see as your role as the teacher/facilitator of knowledge?
   a. How is this reflected through the teaching methods you employ?

17. How would you respond if a student challenged the accuracy of information you were teaching them?

18. How quickly should student learn? Please give an example from your classroom to illustrate this.

19. How comfortable are you with your students teaching each other?
   a. [If comfortable] How would you respond if someone saw your students teaching each other and commented, “The teacher should be the one teaching”?