PRE-SERVICE TEACHERS’ EPISTEMIC THINKING IN AN INQUIRY-BASED EARLY CHILDHOOD LABORATORY SCHOOL: AN EXPLORATORY CASE STUDY

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ABSTRACT

At the intersection of scholarly literature on education psychology and early childhood education, documentation of pre-service teachers (PSTs) epistemic thinking can serve to clarify and guide how instructional practice is interpreted. This exploratory case study fills a critical gap in the field of epistemology by providing a profile of PSTs beliefs contextualized in a laboratory school supportive of inquiry-based methods for teaching and learning. Using qualitative content analysis, data compiled from interviews and observations of teaching were analyzed from a convenience sample of eight PSTs located in a Midwestern university. Analysis on the individual level, and across the data, revealed the epistemic patterns of thinking deduced from the theoretical work of Hofer (1999) and Kuhn (2001) as articulated in a hybrid model by Feucht (2011). A survey of epistemic beliefs that pre-service teachers could reflect upon in the laboratory school setting is presented alongside key implications for practice. Key findings suggest PSTs demonstrated the capacity to reflect upon a variety of beliefs, with sources of authority for receiving knowledge being witnessed as having an influence on interpretation of practice. Teacher candidates uniquely espoused the value of learning from experience to make judgements about instructional practice; however, participants generally justified practice from subjective positions as opposed to coupling their reflective capacities with evidenced-based theory. Therefore, triangulation revealed an overall pattern of epistemic thinking where six individuals were recognized as having beliefs reflective of a multiplistic nature. In addition, one PST evidenced evaluativistic tendencies, while another’s beliefs could not be verified, signifying a period of transition regarding epistemological development was occurring.
Keywords: teacher development; personal epistemology; inquiry-based methods; laboratory school
This work is dedicated to all those who act on the belief that children are a pillar of community. We all benefit from the respect in your voice and potential in your eyes.
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Chapter 1: Introduction

Prologue

Having served in various elementary school teaching assignments in private schools and international schools in the United States, Sarajevo, Japan, and Copenhagen, I was able to gain first-hand knowledge of how curricula can be interpreted differently by instructors, students, and stakeholders in education. Over the course of a decade, core ideas found in this dissertation were developed, in part, through dialogue with families about their own child’s schooling experience, through reflection on the philosophy of education operating in each of the respective schools employed, through student’s responses to different modes of instruction, and in dialogue alongside fellow teachers in domestic and international schools about inquiry-based and traditional methods of instruction. These conversations helped me to begin to understand how personal ways of knowing, influenced by experience, are deeply ingrained in implicit forms of knowing (Polanyi, 1966; Hofer, 2008). Further, working in a variety of cultures with a diversity of beliefs about knowledge have taught me to be mindful of knowledge claims, how they operate in our speech and thoughts, and how they are contained in curricula.

At the onset of this study, I was consulting at a laboratory school for teacher training found in a university setting. This teacher induction program supports inquiry-based methods, as well as constructivist principles for learning through an experiential teaching assignment provided through an undergraduate course for early childhood educators. In my work with preservice teachers, it has been observed that teachers new to innovative pedagogical practices often face tensions when negotiating understanding of curriculum, and realized that they may have difficulty processing their training because
of their beliefs about knowledge. Research supports that teachers with advanced ways of knowing are able to engage in critical thought (Kuhn, 1999), which has been advocated for excellence in induction programs throughout the United States (NCATE, 2010). How personal beliefs about knowledge support or hinder the interpretation and development of a student-led curriculum has not yet been explored. Therefore, this study fills a gap in the literature by taking the first step of documenting the beliefs about knowledge that PSTs espouse and enact in a setting that is supportive of constructivist learning principles and inquiry-based methods of instruction. Identification of the knowledge beliefs of teachers can inform how receptive one would be to certain pedagogical practices. Educators who develop teacher induction program curricula will benefit by being aware of, and attend to, the knowledge beliefs that are articulated and enacted upon by PSTs.

**Background Information and Defining Knowledge Beliefs**

How a person has been taught and the views of knowledge presented through instruction by others (e.g., teachers, parents, peers, society) are suggested to have an impact on how individuals gain understanding and develop preferences for certain learning engagements (e.g., passive or active strategies) (Feucht, 2010, 2011). The impact of experience and worldview influence two aspects of cognition, namely “how individuals come to know” and “the theories and beliefs they hold about knowing” (Hofer & Pintrich, 1997, p. 88). Beliefs about the “nature of knowledge and knowing” (Hofer, 2004, p. 46) are commonly referenced to describe an array of terms concerned with identifying the knowledge beliefs a person can be said to hold (Yadav, Herron, & Samarakunegavan, 2011; Chinn, Buckland, & Samarakunegavan, 2011). Briell, Verschaffel, and Clarebout (2011) have noted terms such as *epistemic beliefs*, *epistemic
cognition, epistemic reasoning, epistemological beliefs, epistemological understanding, epistemological stance, epistemological perspectives and ways of knowing as a few of the most common variations. What Hofer & Pintrich (1997) describe as epistemological theories have been popularly recognized in educational psychology under the encompassing term of personal epistemology (Hofer, 2001). These beliefs are said to act in a manner that can influence a variety of behaviors (Hofer, 2001), and act as a filter, of sorts, “to understand learning in a range of educational contexts” (Brownlee, Walker, Lennox, Exley & Pearce, 2009, p. 1). A key concept in this study is the personal epistemology of pre-service teachers, specifically how they understand knowledge and how it is expressed in their practice. These beliefs are often held unconsciously, but can be revealed through conversation and can be found to function in practice (Kagan, 1992; Hofer & Pintrich, 1997; Hofer, 2001).

Different beliefs about knowledge have demonstrated a relationship to conceptions of teaching and learning, such as constructivist, as well as traditional views on curriculum (Chan & Elliot, 2006, 2011). For example, the social constructivist curriculum is supported by a view that knowledge is subjective and socially constructed by each learner. Alternatively, a curriculum that is guided by traditional ideals is grounded by the belief that knowledge is objective and certain and can be transmitted by the sharing of facts and acquired through modes such as memorization (Chan, 2011). Therefore, certain worldviews and certain ways of knowing favor certain forms of curricula (Schraw & Olafson, 2002). These ideas are recognized in cognitive psychology and education psychology as “curricular epistemology” (Feucht, 2010, p. 77). The theories supporting various curricula designs contain “values and norms” that are an
expression of beliefs about knowledge (Feucht, 2010, p. 75). Therefore, it is critical for educators and students to gain awareness of the role of epistemic thinking and epistemic representations that can be found in teaching and planning to teach (Feucht, 2010).

The field of personal epistemology has been recognized as a rapidly growing areas of education research over the past 25 years (Chinn, Buckland, & Samarapungavan, 2011). Although the early development of this body of research was focused on student learning, studies on individual teacher’s epistemology have advanced the field over the past two decades (Brownlee, Purdie & Boulton-Lewis, 2001; Schraw & Olafson, 2002). A popular conception of epistemic beliefs is that they are comprised of the individual beliefs that make up the construct of personal epistemology (Hofer, 2001). These beliefs have been found to be present when individuals engage in certain types of thinking, reasoning, and learning (Kuhn, 1999; Hofer, 2001). Additional studies have revealed that epistemic beliefs have been suggested to have an influence on a teacher's decision making (Brownlee, 2001), critical thinking (Kardash & Howell, 2000; Schommer-Aikins, 2002), problem solving (Kuhn & Weinstock, 2002), argumentation (Kuhn, 1999), and thought development (Hofer, 2001) and ultimately the environment and the learning that students will engage (Hofer, 2004; Feucht, 2010). These beliefs have been shown to influence learning about certain “approaches to learning and learning outcomes” (Brownlee, Schraw & Berthelsen, 2011, p. 9). In this dissertation, the terms epistemic beliefs and personal epistemology will be used interchangeably in congruency with the logic found in this study’s theoretical framework (Feucht, 2011). This conceptual lens is outlined following the problem statement, purpose and research questions.
Statement of the Problem

Teacher educators and teacher induction programs increasingly support constructivist principles to address the learning needs of students (Brownlee et al., 2011a). There are a variety of definitions for constructivist ideals, but a common thread found through these is an understanding that through social collaboration a learner actively develops new knowledge and ideas through connections to previously held schema (Tynjälä, 1999). Despite the enthusiasm toward constructivist notions of learning in teacher training programs over the past thirty years (Jones & Carter, 2007), progress has not been gained in supporting educators in making more than a surface level change (Windschitl, 2002). Skott (2015) suggested change might look like pre-service teachers (PSTs) adopting the language used during their induction period and applying it to their previous experiences with schooling. The reasons practitioners have not made greater gains in understanding constructivism are much more complex. Windschitl (2002) suggested reasons for the lack of progress can be attributed to pedagogical, political, conceptual, and cultural considerations. Epistemologists contend a key factor in advancement of learning outcomes in pedagogical science can be considered through research on the epistemic conditions found operating in a classroom space (Kuhn, 1999; Hofer, 2001; Feucht, 2011). Following this line of reasoning, educators and teacher induction program curricula will benefit by being sensitive toward, and attend to, the knowledge beliefs that are present and the ones being support by those PSTs who first approach constructivist methods.

One mode of learning that supports the view that knowledge is constructed is through inquiry-based methods (Short & Burke, 1996). Teaching through inquiry can be
defined in a variety of ways, but at its foundation is the impetus of learning being provoked through student interest and student questions (Short & Burke, 1996). These methods are based on assumptions about the process of developing knowledge. Inquiry, as a method of learning, begins when a question of particular concern is developed from a real-life situation and answered through observation, investigation, analysis, and the development of a possible course of action (Marx, Blumenfeld, Krajcik, & Soloway, 1997). This technique is derived from the work of scientists, which “gives us an exact and concrete exhibition of the path which intelligence takes when working most efficiently, under most favorable conditions” (Dewey, 1903, p. 200). It is likely that PSTs, attending a program that supports inquiry-based methods and the assumptions these are developed upon, will experience the same challenge to their deeply held beliefs about teaching and learning that have been documented upon entrance to a teacher induction program (Britzman, 2003).

Traditional forms of teacher education (i.e., models that transmit knowledge from teacher to learner or teacher-centered) have been called to question their methods for over 100 years (Dewey, 1903). Mandl, Gruber, and Renkl (as cited by Tynjälä, 1999) “noted that traditional forms of university instruction settings impart inert knowledge which is not easily transferred into complex problems of working life” (p. 358). Tynjälä (1999) asserted that expertise was necessary in society, however the dominant forms of pedagogy found in traditional models of education “produce consumers of expertise” (p. 358). On the contrary to the model provided in schooling, Tynjälä posited that experts work in real environments through collaboration and the sharing of ideas in pursuit of common objectives. Dewey (1903) first suggested this sentiment when articulating the
reasoning of a democratic form of education is to have an individual apply their knowledge to a problem; a by-product of this effort may lead to the transformation of ideas and the situation.

Education in a democratic society requires teachers to support students in development of the cognitive resources necessary to engage in civic duties and political participation (Dewey, 1903; Kuhn, 2003). A governing principle for education in U.S. society is to develop the capacity for an individual to make autonomous decisions (Dewey, 1903; Kelly, 1999; Tabak & Weinstock, 2011). This is based on the reasoning that democratic principles support an individual in society as having ultimate control over the decisions that influence the course and trajectory of life. Toward achievement of these ends, the nature of expertise that we expect of professionals must be considered if educators can encourage their students to connect what is happening in school to the wider society (Tynjälä, 1999).

Kuhn (2003) argued that for individuals to achieve a level of expertise, then schooling should focus on the inherent worth of “intellectual engagement” (p. 20). Kuhn (1999) suggested this could be done through consideration of how one knows something and how this knowledge can be useful for “critical thinking” and developing the skills of “argument” (p. 21). This critical perspective challenges who owns knowledge in a society and how this knowledge should be useful for citizens in a democracy.

How a pre-service teacher (PST) can reflect upon learning and teaching within a given theory of education will be determined, in part, by his or her beliefs (Chan, 2011). While teacher decision-making is motivated by an entire belief system (Fitzgibbons, 1981), how a person thinks about “the nature of knowledge and processes of knowing” is
argued to be a key component of this system (Hofer and Pintrich, 1997, p.117).

Improving teaching and learning through reflection on personal epistemologies has of late been correlated with supporting improvement in teacher education programs (Kang, 2008; Brownlee et al., 2011a).

**What is missing?** In the field of epistemology, in-depth qualitative classroom-level research is largely missing from the record (Feucht, 2010) as most studies are based on survey data (Levin, 2015). In recent years, early childhood teachers’ epistemic thinking has received empirical attention, however, this area of research is not yet as robust as the treatment that has been given to personal epistemology and learning. An area of study that can benefit from introspection is found in a practicum setting which serves as a bridge between in-service practice and the more traditional model of professional learning in the university classroom. There has been no research, to date, that documents the personal epistemology of PSTs in the laboratory school setting for teacher education.

**Why is this research missing?** There are few opportunities for researchers to study the epistemic beliefs of PSTs in the laboratory school context that supports inquiry-based methods. Policy, cultural, and pragmatic explanations exist for why the teacher practicum or student teaching experience in which PSTs gain situated understanding of practice are in traditional public-school settings for teaching and learning (Windschitl, 2002). Curriculum in traditional models of schooling focus on outcomes based on standards that are often content related. In these settings, pedagogical decision making is under scrutiny for evidence-based student learning outcomes in order to support market-based solutions to the problems of education (Duncan, 2009). This development is argued
to be to the detriment of education and educators who embracing a notion of uncertainty in learning (Britzman, 2015). Due to the volume of research that draws from assumptions about schooling improvement driven through a concern for efficiency in delivering content knowledge, the empirical record lacks research about PSTs beliefs in a classroom climate that is nurtured to support innovative pedagogical practices.

The research-based evidence that is required to measure these outcomes suggest a contributing factor in why there is a temporal concern for this study. This stems from policy reform initiatives that demonstrate the potential to threaten the current function of the laboratory school in serving pre-service teachers’ learning about innovative methods of pedagogical practice. The movement in curriculum development and design for a centralized authority to guarantee access to learning by ensuring basic standards is evidenced worldwide (Ladwig, 2010). Regarding this effort, in the United States, the reach of policy to reform schooling has recently extended to teacher development at the university level (Fenwick, Edwards & Sawchuk, 2011). Although the strengthening of standards is a laudable goal, the mechanisms of policy to enact change may have the tacit effect of continuing the unilateral development of standardizing the processes of teacher pedagogy and student learning in a manner, argued as consistent to a historically privileged epistemic view toward objectivism in western society (Guba & Lincoln, 2005; Roth & Roychaudry, 1994). An influential publication titled, *Studying Teacher Education: The Report of the AERA Panel on Research and Teacher Education* (2005) supports this claim. A suggestion made by Craig (2010) contends that this report provides a narrow selection of research that excludes findings from the international community on the efficacy of teacher training in schooling reform and further narrows the criteria for
research in education. Critics contend schooling motivated by an objectivist view has led to the disfranchisement of students and has contributed to the lack of influence by teachers in the curriculum (Gore & Morrison, 2001).

**What will help fix it?** A step toward reconciling the opposing forces of government policy for research and focus on a standard set of delineated and proscribed content, with those who endorse progressive ideals in curriculum development and teacher training, can be approached through meaningful reflection and support of critical thinking through the development of epistemic beliefs. As Hofer (2001) has noted, if the goal of education is development then epistemological thinking is an important influence toward this result. Given the severe challenges noted in the research record for teachers to implement a deliberate and thoughtful form of constructivist practice (Windschitl, 2002), alongside the call for improved teaching training (Feiman-Nemser, 2012), then research on epistemic beliefs in a laboratory setting for teacher training is useful. To contribute toward these outcomes, an important research effort would be to explore and document how epistemic thinking is present in an inquiry-based early childhood laboratory school. Documenting the espoused and enacted beliefs can provide a more nuanced understanding of the practicum experience as it concerns the individual and contextual learning needs for novice teacher training. Given that beliefs influence behavior (Skott, 2015; Hofer, 1999; Kuhn, 2001), knowing and understanding epistemic beliefs can demonstrate how receptive one would be to innovative pedagogical practices. Because of this call it is important for research to document PSTs epistemic beliefs so they may be considered in relation to instructional methods.

**Purpose Statement**
The intent of this inquiry was to document the epistemic beliefs that are most salient for PSTs in a setting for teacher training that supports inquiry-based methods and constructivist practice due to a dearth of information on the situated nature of epistemic beliefs. An integrated model for understanding the dimensional (Hofer, 2001) and developmental aspects (Kuhn, 1999) of personal epistemology was useful to explore: (1) PSTs espoused beliefs about the nature of knowledge and knowing, and (2) PSTs enacted beliefs about the nature of knowledge and knowing as found in instructional practice in an inquiry-based laboratory school classroom for early childhood education. A description of these beliefs allowed for consideration of the connection/disconnect between epistemic beliefs, instructional aims, and actual practice.

A case study utilizing a framework for understanding PSTs personal epistemology is a valuable strategy to document beliefs about instructional practice (Feucht, 2010). Documenting epistemic beliefs in the context of the laboratory school offers a tool for teacher educators to gain a more nuanced understanding of the difficulties and tensions a PST may experience when developing practical knowledge in situated field experiences.

This research did not directly seek to support epistemic development, improved learning outcomes, or make personal epistemology explicitly known to PSTs. Rather, this exploratory case study was useful in gaining an epistemic snapshot of the beliefs that are evident in a laboratory setting for Early Childhood Education (ECE). Research on teacher beliefs has not answered what epistemic beliefs pre-service teachers espouse and enact when engaged in learning and teaching in relation to a laboratory school’s teacher preparation learning experience. As articulated above, the laboratory school environment provides a unique and important role in offering an epistemic climate conducive for
developing teacher candidates' knowledge about personal epistemology in relation to innovative practice.

Further, exploration of PSTs’ espoused and enacted beliefs in the context of a laboratory school for teaching and learning was useful for reporting how epistemic beliefs might influence teacher training. Specifically, it helped determine which epistemic beliefs are manifest in practice for PSTs who are new to, or engaged at some level, in student-centered inquiry-based methods for teaching and learning. Understanding PSTs epistemic beliefs offer an opportunity for those who work with prospective teachers to better understand the cognitive processes in which PSTs use to make decisions about curriculum, instruction, and assessment in an ECE laboratory school setting.

**Positionality Statement**

This inquiry has developed through what Lincoln and Guba (2000) describe as “reflexivity” or “the process of reflecting crucially on the self as researcher” (p. 183). Reason (1988) termed this “critical subjectivity” and pointed out that a researcher can “raise” experience “to the consciousness and use is as part of the inquiry process” (p. 12). Therefore, the intellectual curiosity that first budded through my experiences teaching, observations about how individuals in different cultures experience schooling, and how I made meaning of how students and teachers come to actualize their practice, has transformed into the important concepts found in this dissertation’s conceptual frame. Key traits of these prior experiences can be found permeated in this dissertation in two distinct ways: (1) the epistemic beliefs that developing teachers can articulate in a vision of teaching (enacted) and, (2) the epistemic nature of beliefs that may be evidenced in practice (enacted).
Case study is a methodology especially suited for learning about the context in which a phenomenon is present (Lin, 2004). Therefore, the contextual nature of this research, as well as qualitative research in general, must acknowledge the shared influence between the researcher and participants as this reflective relationship influences the results found in any given study (Alvesson & Skolberg, 2000). To do this, critical issues in recognizing researcher positionality will be addressed through self-reflection as articulated below.

This research took place at a college of education within a medium-sized, Midwestern university. I serve in two positions within this setting. The first role is as an instructor outside of the College of Education. This position is not related to the nature of this study, nor will I examine the beliefs of any students in my charge. The second role that pertains to this study has been through my engagement in volunteer consulting work with a faculty member in the Department of Professional Teacher Instruction (pseudonym). This department houses the laboratory school, which provides the context for this inquiry. This role is locally recognized as a ‘pedagogue’ in the service of teacher candidates’ learning about inquiry-based practice. The role of the pedagogue can be likened to that of a consultant or co-creator of knowledge, who listens, observes, and asks probing questions to help a learner develop an understanding of experience (Rinaldi, 2005). In the modern era, this term was made popular through schools that developed as early childhood centers of learning at and near Reggio Emilia, Italy, following the Second World War. The principles of teaching and learning enacted in Reggio Emilia have been recast in many types of schools in Western society. One facility in the United States that supports Reggio Emilia inspired principles for teaching and learning of the
focus of this study. At this facility for teacher training, I have collaborated alongside a faculty instructor in a university level teacher preparation course. This work has occurred over three semesters in the past two years. I last engaged in this role in the spring of 2016. Through this experience, I have become uniquely positioned as an insider/outsider as I collaborated alongside the mentor-teacher and PSTs at periodic intervals throughout their situated learning experience (i.e., positionality of setting; Anderson & Herr, 1999; Cochran-Smith & Zeichner, 2005). In this manner, I have developed trust amongst staff and students in the ECE program. However, I had not yet made the acquaintance of any potential participants in this study until the data collection period had commenced.

Fives (2011) calls for research to support teacher induction programs “to address the epistemological perspectives of both their students and the theories advocated” (p. 125). Fives’ call resonates with my personal background and how I am positioned to conduct interviews centered on constructs of personal epistemology. This expertise has been developed through a firm understanding of the educational context that is studied and knowledge of prevailing views on epistemic perspectives. My understanding of a teacher’s personal epistemology has been developed through this dissertation and application of this knowledge through my own teaching. These experiences have been gained through working alongside PSTs in the laboratory school, writing curriculum, and teaching through various curriculum designs from teacher-directed to learner-centered inquiry-based methods.

As noted in the prologue, my experience working in private and public schools on three continents have helped me to recognize a diversity of ways of knowing and beliefs about knowledge that support critical thinking about knowledge claims, how they operate
in our speech and thoughts, and how they are present and influence instructional practice. My teaching experience further encompassed a focus on the development of conceptual understandings for curriculum development and inquiry-based methodologies, for both teaching and learning. My views on how teachers and students learn were augmented through a careful review of literature in the fields of social science and philosophy, as well as practitioner accounts of personal beliefs. My background was further influenced by having spent several weeks each summer in my early life on the Rosebud Sioux Tribe, in south central South Dakota, and learning from personal narratives about my mother’s compulsory attendance in a series of Indian Boarding Schools from first through twelfth grade. The stories my mother ‘lived by’ helped to inform my understanding of the concept of personhood and how a researcher and educator must be mindful of their positioning to avoid unintentional negative consequences. Much has since been written concerning the social and cultural impact of these boarding schools on Native Americans. For a representative account, see Adams (1995) and Szasz (1974).

As a component of my positionality, negotiation of entry into the research site must be addressed. My entry into the laboratory school began after being elicited to volunteer at the Early Childhood Education Center at XXXX University by a faculty member. As previously mentioned, the center supports the use of pedagogues to gain outside perspective. My participation was negotiated alongside the aforementioned instructor who also serves in the role of mentor teacher, coordinator of the laboratory school, and organizes a situated learning course at the ECE. This project has been welcomed as an extension of a policy at the contemporary laboratory school for ECE to support teacher research (McBride et al., 2012).
Summary of Research Questions

The following research questions provided the focus for an exploratory qualitative study. This inquiry helped to elucidate the variables of a phenomenon on which little pragmatic research and knowledge is available in a situated context (university laboratory school) that supports learner-centered practice and inquiry-based methods for teaching and learning. The answer to the questions below will provide an epistemic snapshot of one unique context for teaching and learning that will contribute to understanding the beliefs that are evident by PSTs utilizing an epistemic framework that allows for interpretation of dimensional (Hofer, 2001) and developmental understanding (Kuhn, 1999).

Research Questions

1. What are PSTs’ epistemic beliefs about instruction in an inquiry-based laboratory school?
   a. What are PSTs’ espoused epistemic beliefs about the dimensions of knowledge and knowing in the inquiry-based laboratory school (i.e., structure, stability, source, and justification)?
   b. What are PSTs’ espoused developmental levels of epistemic understanding about instruction in an inquiry-based laboratory school (i.e., absolutist, multiplist, evaluativist)?
   c. What are PSTs’ enacted developmental levels of epistemic understanding about instruction in an inquiry-based laboratory school (i.e., absolutist, multiplist, evaluativist)?
Discussion for Research Questions. The above questions were crafted alongside the language of this study’s theoretical framework (Feucht, 2011). Primary research question numbered (1) was answered by collecting data about the epistemic beliefs a PST may draw from and are evident in practice in the context of a laboratory school. This required an analysis of data triangulated from sub-questions lettered (a), (b), and (c). Each sub-question was analyzed using an aspect of the Integrated framework of epistemic beliefs and epistemic development (see Table 1).

Definitions of Terms

There are many theoretical constructs and definitions for personal epistemology, therefore the terms found below will help to clarify the personal epistemology framework that follows. This framework will serve as a working definition of personal epistemology applied consistently throughout this study.

Theoretical definition of personal epistemology. The field of epistemology can gain clarity in the research record through a clear use of operational definitions (Hofer & Pintrich, 2001; Chinn, Buckland, & Samarapungavan, 2011). This is also the case for social constructivist views about learning (Windschitl, 2002). In the absence of agreed upon terms, the following philosophy laden terms are based on a review of literature that clarifies the use of each term in this study’s conceptual framework.

Personal Epistemology. The study of an individual’s beliefs about the nature of knowledge and the process of knowing (Hofer and Pintrich, 1997). These beliefs are studied in relation to “learning, teaching, critical thinking and intellectual-ethical development across different school subjects, academic domains, and everyday life (Feucht, 2011, p. 228).
**Epistemic beliefs.** This term refers to an individual’s beliefs about the nature of knowledge and knowing. These beliefs contain fine-grained knowledge sources: stability of knowledge, structure of knowledge, sources of knowledge, and justification of knowledge (Hofer, 2001). In this study, *epistemic beliefs* will denote the same meaning as *personal epistemology* when referring to an individual. The reciprocal nature between these terms is a position adopted by Feucht (2011), who recognized these two terms as the most referenced in the field. Usage of the term *epistemic* has been argued as more appropriate than using *epistemological beliefs*, as the latter denotes general beliefs about the field of epistemology (Hofer & Bendixen, 2012).

**Personal Epistemology Framework.** This study’s framework will include a model of personal epistemology that has integrated dimensional aspects (Hofer, 2001) and developmental thinking (Kuhn, 1999) as a guiding feature of the theoretical frame, working definition of personal epistemology, and research questions (see Table 1: *Personal Epistemology Framework*). It will function as a heuristic resource to support analysis of the data collected to form an “epistemic pattern” that is useful to provide “a more nuanced perspective of personal epistemology” (Feucht, 2011, p. 229). In this dissertation, personal epistemology will be used as an umbrella term to reference a hybrid model conceptualizing personal epistemology through two seminal theories: dimensional theories (Hofer, 2001) and developmental beliefs (Kuhn, 1999). The integration of this model was developed by Feucht and Bendixen (2008).

**Social Constructivism.** Humans construct reality through the experiences interpreted by cultural values to influences their worldview. An assumption of this method of learning is that humans can better seek interpretations of knowledge than
seeking objective knowledge. The ontology of constructivism considers meaning to be fluid (Fox, 2008). In other words, knowledge is seen as relative or uncertain and can change as new information is presented and interpreted by the individual through social interactions. This research adopts Richardson and Placier's (2001), as well as Windschitl’s (2002) related definition, that “constructivism is a theory of learning”, rather than “a theory of teaching” (p. 138). The nuance being that one does not teach a constructivist pedagogy. Rather, a teacher can provide learning engagements that allow for the student to construct their own personal meaning. This does not limit the teacher in direct transmission of information to the student if the pupil has an existing basis of knowledge to allow this piece of information to be negotiated on the cognitive level to develop a new understanding.

_Laboratory School_. McBride, Groves, Barbour, Horm, Stremmel, Lash, et al. (2012) articulated the mission of the contemporary laboratory school as facilitating and supporting teaching, research, and community engagement in the context of supporting the development of young children within a campus-based setting.

**Theoretical Framework**

This study’s purpose and problem statement required a conceptual frame that can explore the espoused and enacted epistemic beliefs of pre-service teachers (PSTs) in an inquiry-based laboratory school. To do so, this research benefited from the use of two theories that support the understanding of personal epistemology (Hofer, 2001; Kuhn, 1999). Research on teachers’ personal epistemologies served as the guiding framework for a qualitative exploratory study useful for examining how certain beliefs about the nature of knowledge and the process of knowing can support or be misaligned with pre-
service teachers’ espoused beliefs when engaged in small-group investigations with children. Within an integrated dimensional and developmental model of personal epistemology termed, *Personal Epistemology Framework (Integrated Framework of Epistemic Dimensions and Epistemic Development)* (see Table 1), the pedagogical implications of learning in a field placement that advocates for inquiry-based methods for teaching and learning for teacher education can be explored.

**Dimensional View of Knowledge and Knowing**

A prominent construct useful to understand students’ and teachers’ personal epistemology refers to specific dimensions of knowledge. As noted in the introduction, Hofer and Pintrich (1997) termed these constructs *Epistemological Theories*. These theories were developed from philosophical tenets and themes found across epistemological studies (Feucht & Bendixen, 2011). This study drew from the language and explanation offered by Hofer (2001). Hofer explained that beliefs can be expressed along four dimensions of knowledge and knowing. These four empirically defined categories are noted as: (1) certainty, (2) simplicity, (3) source and (4) justification. Each is explained below as it is expressed alongside a continuum that is reflective of objective, subjective, and objective as well as subjective positions.

Table 1

*Personal Epistemology Framework (Integrated Framework of Epistemic Dimensions and Epistemic Development)*

<table>
<thead>
<tr>
<th>Epistemic Understanding of Developmental Levels (Kuhn, 1999)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolutism</td>
</tr>
</tbody>
</table>
Table 1 offers a visual of the conceptual frame which is useful for the collection and sorting of empirical data. The integrated framework of epistemic belief (Hofer, 2001) and epistemic understanding of developmental levels (Kuhn, 1999) was articulated by Feucht (2010/2011). Adapted from “The epistemic underpinnings of Mrs. M’s Reading Lesson”, by F. Feucht, in J. Brownlee, G. Schraw & D. Berthelsen (Eds.), *Personal Epistemology and Teacher Education* (p. 230), 2011, New York, NY: Routledge. Copyright [2016] by Routledge. Reprinted with permission.

Hofer (2004) explained each stage of this theory in the following manner:

**Certainty of knowledge.** The degree to which one views knowledge as certain is an aspect of personal epistemology across multiple schemes. The continuum of development has been described as moving from a fixed to a more fluid view

<table>
<thead>
<tr>
<th>Epistemic Belief Dimensions (Hofer, 2001)</th>
<th>(Objective view of knowledge)</th>
<th>Relativistic views)</th>
<th>(Objective &amp; Subjective views)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature Dimension: What knowledge is thought to be</td>
<td>The Certainty/ Stability of Knowledge is…</td>
<td>certain or fixed and not changing</td>
<td>uncertain and changing</td>
</tr>
<tr>
<td></td>
<td>The Structure of Knowledge …</td>
<td>is simple and based on facts</td>
<td>are facts that might be connected with other opinions</td>
</tr>
<tr>
<td>Process Dimension: How one comes to know something</td>
<td>The Source of Knowledge is…</td>
<td>credibly derived from external sources other than self</td>
<td>credibly derived from internal sources</td>
</tr>
<tr>
<td></td>
<td>Knowledge is Justified by…</td>
<td>truth based on authority</td>
<td>not evaluated against outside criteria</td>
</tr>
</tbody>
</table>
a progression that absolute truth exists with certainty to the position that knowledge is tentative and evolving. (Hofer, 2004, p. 131)

**Simplicity of knowledge.** At lower levels, knowledge is viewed as discrete, knowable facts, and at higher levels, individuals see knowledge as relative, contingent, and contextual. (Hofer, 2004, p. 131)

**Justification of knowledge.** This dimension involves how individuals justify what they know and how they evaluate their own knowledge and that of others. Individuals may justify beliefs through observation or authority or on the basis of what feels right, or though the evaluation of evidence, expertise and authority, and the assessment and integration of the views of experts (King & Kitchner, 1994). (Hofer, 2004, p. 131)

**Source of knowledge.** An aspect of the nature of knowing, this dimension refers to the locus of knowledge, perceived as originating outside the self and residing in external authority (from whom it may be transmitted), or, on the other extreme, as actively constructed by individuals in interaction with the environment and others (Baxter Magolda, 1992; Belenky, Clinchy, Tarule & Goldberg, 1986). (Hofer, 2004, p. 131)

The first two categories are known as the nature dimension, or what knowledge is thought to be; the latter two categories are known as the process dimension, or the nature of “how individuals come to know” something (Hofer & Pintrich, p. 88). Each dimension can be considered in terms of a sliding developmental scale. Development is considered stage-like, related to expertise rather than related to age or gender (Hofer & Pintrich,
1997). This means the dimensions do not function as stage-like, as offered in Piaget’s theory of child development, but rather a certain dimension can be developed according to the level of knowledge a person has about a particular subject or area of knowledge. Feucht (2011) referred to this developmental understanding as “fluid” (p. 10). In other words, once an individual experiences a “theory-like” shift in understanding of a dimension he or she will most likely not return to their former understanding (Hofer, 2001, p. 367). Feucht and Bendixen (2011) pointed out that Hofer’s (2001) combined developmental and dimensional perspective allows researchers to recognize what aspect of a person’s knowledge (i.e. dimension) might change given a certain intervention to support development. Hofer (2001) pointed out this theory-like view might be related to context. This contextual element to personal epistemology will be a salient point in this study as the literature review will later unpack the concept of epistemic climate (Feucht, 2010).

Hofer (2001) delineated each dimension, noted above, as a binary (i.e., knowledge is certain or tentative; knowledge is justified from authority or what feels right; knowledge is simple and received or complex and constructed; and knowledge is justified based on facts or evaluated based on specific criteria). These categories have been empirically verified to function on a continuum from naïve views to more sophisticated views of knowledge (Hofer, 2001). Knowledge categorized under the certainty dimension can exist between absolute or debatable positions. The absolute side of the spectrum identifies beliefs that are objective in nature and therefore considered naïve (Hofer, 2001). Conversely, as an individual’s beliefs reflect a more subjective nature they can be useful for more evaluative thinking, dependent on interpretation and weighing of
evidence. These beliefs are known as sophisticated (Hofer, 2001). The beliefs that are found to be more sophisticated have been noted to contribute to the development of expertise (Hofer, 2001). These four dimensions of knowledge and knowing are often referenced using the term epistemic beliefs, which identify fine-grained aspects of an individual’s cognitive (personal epistemology) belief system.

**Epistemic Beliefs.** Perry’s (1970) early work, published under the title, *Forms of Intellectual and Ethical Development in the College Years: A Scheme*, was developed from research on students at Harvard in the 1960s. This work set the stage for a field of related epistemic theories to follow (as cited in Hofer, 2001). A popular developmental perspective that supports many of his findings can be found in Kuhn’s (1999) research. This model was developed across children, adolescents and adults to explain the various stages of understanding of knowledge (Kuhn, Cheney, & Weinstock, 2000). Kuhn (2000) suggested this model can be useful to understand differences in cognitive “performance” (p. 5). As this latter model is utilized in this study’s framework it is expounded upon here.

A defining feature of Kuhn’s (1999) model is that at advanced stages of development individual’s beliefs about knowledge and knowing must be justified and based on critical reasoning. Kuhn (2003) explained it was important to articulate a theory of epistemological understanding that can demonstrate there is a reason for knowledge and “a point for arguing” (p. 21). Kuhn (2001) reasoned that a student can be intrinsically motivated to develop epistemic understanding. In turn, this development would “inform intellectual values” (Kuhn, 2001, p. 6). Kuhn (2001) suggested these values stimulate an individual to take action. This call questions assumptions about what it means to be
educated in Western society from an individualistic effort to a society based effort that is fundamentally democratic in nature. Therefore, this model articulates that “the purpose” of schooling is to develop critical thinking as revealed through argumentative reasoning (Kuhn, 2003, p.16). Kuhn (1999) pointed out that this value-based component functions at an increased level in stages. Each phase operates on a continuum that articulates an individual’s understanding of knowledge can mature from a strict objective orientation and evolve to a subjective orientation. Then in its most mature form, an objective dimension is reintegrated with a subjective position allowing for a sophisticated evaluation of information and justification of knowledge. She found that epistemological understanding, a term unique to this model, could be considered through developmental levels delineated in a logical progression from realist to evaluativist views of the nature of knowledge. In between these two poles an individual can hold absolutist views or multiplist views. Each of the aforementioned stages of development are detailed below. It is important to note each stage is experienced sequentially, but this development is not necessarily based on age. Each level reflects an age that is typical for development, however a level of expertise is a more accurate defining hallmark for each stage.

**Realist.** This initial stage is applicable to children’s epistemological understanding. The sequence begins with pre-school aged children holding realist views where knowledge is “copied from external reality” (Felton & Kuhn, as cited in Kuhn, 1999, p. 104). Kuhn referred to this as the “pre-absolutist” stage and by construct it is not included in studies that are concerned with the beliefs of university students, teachers, and PSTs. Kuhn (2000) explained this was the only stage that did not correlate with Hofer’s (2001) dimensional view of epistemology. Therefore, it is not included in the hybrid model presented in this
study’s definition of epistemology.

**Absolutist.** Along this developmental continuum, *absolutist* views are suggested to occur amongst children and subsequent development beyond is found generally in the adolescent period, but contingent on individual and contextual factors. Individuals who hold *absolutist* views find that authority figures disseminate knowledge and there is no “basis” for questioning this knowledge (p. 105). These individuals find that people hold a variety of opinions, including experts, therefore the reasoning supports that no one opinion is wrong. Therefore, “all opinions are equally right” (Kuhn, 1999, p. 22). Teachers who hold absolutist views “perceive” instructional practice as the act of “transferring knowledge from the teacher as experts to students as naïve learners” (Feucht, 2010, p. 66). Tsai (as cited in Feucht, 2010) have labeled these as traditional teacher beliefs.

**Multiplist.** *Multiplist* views of knowledge are developed through an individual’s cognitive efforts, but seen as uncertain. The multiplist stage can recognize knowledge as constructed by the individual. This approach mirrors a relativist view that reality is subjective and that everyone is “equally right” or “equally wrong” and therefore, requires no further inquiry (Kuhn, 1999, p. 105). Kuhn (1999) has pointed out that many individuals maintain multiplist beliefs “for life” (p. 22). Even though this is a middle stage, Kuhn (1999) pointed out that these individuals have “no basis” for evaluating “the strength of an argument” (p. 22). This developmental level is recognized in teachers who support students to construct their own understanding of the curriculum (Feucht, 2010). These individuals often eschew expert knowledge given their understanding of all knowledge as “subjective and tentative” (Feucht, 2010, p. 67).

**Evaluativist.** Those who mature beyond the multiplist stage recognize knowledge
claims are worthy of evaluation, and based on evidence as discerned through critical thinking. This stage is the culminating stage in Kuhn’s model, termed *evaluativism*. Kuhn recognized both subjective and objective knowledge sources being useful for debate. Kuhn (2001) pointed out in clear language why this final stage where knowledge is justified is only accomplished by the individual who can accept some notion of relativism in argumentative reasoning:

> If facts can be ascertained with certainty and are readily available to anyone who seeks them, as the absolutist understands, or, alternatively, if any claim is as valid as any other, as the multiplist understands, there is no point in expending the intellectual effort that the justification and debate of claims entails.

(Kuhn, 2001, p. 5)

In other words, there is no significant reason to engage in dialogue and discussion for an individual believes a fact is indisputable.

Feucht (2010) suggested the evaluativist teacher will support her students to engage in knowledge construction through a shared collaborative approach. Feucht went on to explain, “Because these teachers perceive content knowledge as context-dependent and tentative, they complement curricula with multiple, additional sources” (p. 67). It stands to reason that the prospective teacher who is willing to support her own students to question, evaluate, and make judgements about knowledge is also willing to consider debates about effective instructional practice as well.

*Integration of two models.* The integration of the dimensional and developmental models was first developed by Bendixen and Haerle (2005), and developed further by Feucht and Bendixen (2008). This model was utilized by Feucht (2011) and further tested
by Ziegler (2014). The dimensional perspective (Hofer, 2001) and developmental understanding (Kuhn, 1999) have been articulated as a 12-cell matrix by Feucht (2010). This model answers the call by Yadav, Herron, and Samarapungavan (2011) for “more robust, nuanced and diverse measures” that serve to “rethink the dimensions/constructs of personal epistemology” (p. 34). Kuhn et al. (2000) first pointed out how the theory of epistemological understanding have a natural alignment with Hofer and Pintrich’s (1997) dimensional view of knowledge. The authors noted at the time they wished to “better understand the dimensions and how they connect” (Kuhn et al., 2000, p. 310). Feucht’s was able to overlay frames to define how each dimension (Hofer, 2001) can be articulated alongside precise levels of developmental understanding (Kuhn, 1999). This model is an integrated framework of epistemic dimensions and epistemic development and referenced it as the “12-cell matrix” (Feucht, 2011, p. 230). For the sake of this inquiry this has been termed the Personal Epistemology Framework (PEM). The integration of frameworks for measuring the construct of epistemology is common in the literature (Brownlee, 2001; Major, 2011; Cam, Sulun, Topcu, & Guven, 2015) and is a product of the fluid nature and understanding of the construct of knowledge and knowing. Hofer’s (2001) review of the field of epistemology recognized the benefits that can be gained from the type of framework integration found in the PEM model (see Table 1).

*Implications for use of personal epistemology framework.* In this study, the four dimensions of knowledge and knowing (e.g., *structure, stability, source, and justification*) as they are integrated and articulated alongside the three developmental levels (e.g., absolutism, multiplicity, and evaluativism) of epistemic understanding were utilized to frame the research, contextualize the interview questions, and inform the
analysis. This model also contributed to the selection of literature to be reviewed to support the reader in understanding the role of personal epistemology as PSTs engage in teaching.

**Theoretical Framework Conclusion**

A theoretical framework for personal epistemology is useful to document the fine-grained messages that are articulated about PSTs knowledge and knowing, and manifest in a context-specific situation. A developmental model of epistemic understanding integrated with research proven dimensional aspects of knowledge can serve as a heuristic to document PSTs beliefs while engaged in a teacher induction program that supports inquiry for learning and instruction. Utilizing a hybrid model, provided by the theoretical work of Hofer (2001) and Kuhn (1999), provided a nuanced understanding of PSTs personal epistemology that contributed to understanding PSTs epistemic thinking in a laboratory school for teacher training (see Table 1).

**Content and Organization for the Remainder of the Study**

Chapter 1 provided an overview of the study by describing the statement and significance of the problem, key terms, definitions and sources and a summary of research questions. This was followed by a synthesis of key variables in this project’s theoretical frame. Chapter 2 reviews literature relevant to understanding the vocabulary and prevailing perspectives on how the concept of epistemology. This chapter also reviews literature necessary to understand the epistemic beliefs of PST in relation to teaching and learning, as well as the role of the laboratory school in developing PSTs personal epistemology. Chapter 3 describes the research methodology and design used for collecting data from the participants. Chapter 4 shares an analysis and description of
the research data. Chapter 5 relates the findings to the theoretical framework and literature reviewed, as well as a discussion of the study’s implications and pertinent areas for future research.

Chapter 2: Review of the Literature

This chapter synthesized the literature that is necessary to understand teacher beliefs and teacher epistemic beliefs as it related to this study’s problem statement. To be able to explore PSTs espoused and enacted beliefs in the laboratory environment, it is essential to understand the nuance found in the abundance of conceptual models utilized
to articulate the concept of personal epistemology. The purpose of this chapter is to synthesize four related bodies of knowledge that consider the role of beliefs for teacher education (noted in parts 1-4 below). The constructs found in this review were deliberately chosen as conceptual resources to illuminate certain viewpoints about PST and teacher beliefs necessary to inform this study’s theoretical frame. The review further helped to situate this research topic within the boundaries of the existing literature.

Toward this effort, this literature review was guided by the following themes to build a foundation, in terms of previous work, for important ideas found in the problem statement:

**Part 1:** Defining Teacher Beliefs

**Part 2:** Review of Epistemological Models

**Part 3:** PSTs Epistemic Beliefs about Learning and Teaching

**Part 4:** Laboratory Schools and their Potential for Epistemic Development

It was beyond the scope of this review to define all aspects related to empirical research on teacher beliefs and personal epistemology. Therefore, the review was narrowed to a representative sample of relevant research in each field of study specific to the topics noted above.

**Standards of Criteria for Literature Coverage**

Literature was mined through a database search of journals, articles, books and dissertations through Primo software, which organizes Scholar OneSearch. Key descriptors (e.g., personal epistemology, teacher education, pre-service teacher beliefs, instructional design, knowledge development, constructivist, behaviorist, and situativist beliefs) were used to collect peer-edited research on the above literature review themes,
alongside a respective search of references from seminal authors on personal epistemology. New articles found on the topic were referenced until saturation was reached in terms of relevance. Seminal theorists (i.e., Feucht & Elby) on personal epistemology were contacted regarding soon to be published work pertinent to the topic and an expert in the field (i.e., Ziegler) was contacted about sources for additional information.

Inclusion of literature in the review required each journal article, dissertation or book to contain each of the following criteria:

1. The study must be written in English
2. Each will report on primary or original scholarship.
3. A piece of scholarship must report results from one of the following variables:
   a. The study addressed the role of beliefs or personal epistemology in teacher/PST learning.
   b. It tested or utilized epistemological thinking of teachers/PSTs.
   c. It considered the value or effect of contextual learning for teachers/pre-service teachers with emphasis on the concept of laboratory schools for teacher training.
   d. The study considered research on teacher and pre-service teacher’s beliefs and any relationship with instructional methods/conceptions of learning.

It must be noted, due to the limited nature of information on PSTs epistemic beliefs and pedagogical decision-making, analogous topics in related fields were included regarding pre-service teacher/candidate teacher beliefs, teacher thinking and knowledge development concerning the notion of personal epistemology.

Eight criteria, as noted by Bruce (2001), were utilized to restrict the literature to a
purposive sample. The eight criteria were referenced for the initial collection of material. The information in brackets following each criterion indicates how it was interpreted for use in this literature review:

- topicality (area of concern)
- comprehensiveness (available and significant)
- breadth (analogous topics in related fields)
- exclusion (selective)
- relevance (psychological view: how each report fit into the researcher’s scheme)
- currency (current knowledge in a field)
- availability (physically and locally available through digital and university sources)
- authority (critically accessed as making a valuable contribution).

After selecting research based on topicality and comprehensiveness in the collection of information, the foci shifted to the following four criteria: breadth, relevance, currency and authority. These concepts were demonstrated to be useful in making connections and developing meaning across the area of concern (Bruce, 2001). The four criteria noted above offer a subjective orientation of knowledge as opposed to an objective view (Bruce, 2001). A subjective view allowed for the review of literature to be synthesized and formed into a constructed argument, as opposed to a reporting of the literature as a collection of absolute facts.

**Part 1: Defining Teacher Beliefs**

**Overview**

Teacher beliefs have a long and storied history for use in education. The most prominent lines of inquiry can be found in the area of teacher efficacy (Bandura, 2002;
Pajares, 1992) and teacher epistemic beliefs (Perry, 1970; Schommer, 1990; Hofer & Pintrich, 1997). Common threads found throughout research on teacher beliefs is in the difficulty of gaining a unified construct of epistemology, as well as agreement on methods for measuring teacher beliefs (Skott, 2015; Pajares, 1992). Regardless of the challenges, it is suggested that learning about the nature and effect of teacher beliefs is an important development toward the goal of sustainable education reform (Woolfolk-Hoy, Davis, & Pape, 2006). Further, reflection on beliefs allows a teacher to become a capable decision maker about issues related to curriculum planning and instruction (Skott, 2015). Also, it has been suggested that individuals are more likely to enact practices based on beliefs rather than enact practices based on specific knowledge about a content area or knowledge about an instructional strategy (Pajares, 1992).

Problems of research on teacher beliefs. In regard to teacher development, Holt-Reynolds (1992) suggested that teacher development programs may not be changing teacher’s beliefs. The authors hypothesized that new teachers may simply be adopting the language of their pre-service programs “to explain and act on their initially held perspectives” (as cited in Fives & Beuhl, 2010, p. 504). This has been largely due to the difficulty of sifting beliefs from knowledge and personal practice (Pajares, 1992). The disparity between beliefs and practice have also been attributed to the contextual elements that are necessary to enact certain beliefs (Hofer, 2002; Hammer & Elby, 2002). Regardless, a gap has been acknowledged in research between PSTs and teacher’s espoused and enacted beliefs, where what teachers profess about beliefs is not often reflected in situated practice (Fives & Buehl, 2010, 2012).
Espoused and Enacted Beliefs. Research has considered PSTs’, as well as in-service teachers’, ability to reflect on espoused and enacted beliefs. In general, teachers espoused and enacted beliefs are not always in alignment (Buehl & Beck, 2015; Olafson & Schraw, 2010; Schraw & Olafson, 2002; Hofer, 2002). The advantage of alignment is an increased ability to recognize the specific area of development that may be of personal benefit to improve pedagogical practice. Maggioni and Parkinson (2008) suggested, “well calibrated teachers know what they do and do not know and can therefore seek knowledge in areas that need improvement” (p. 454). The importance of metacognition has been argued as critical to support teacher’s to “make reasonable judgements” (Hofer, 2001, p. 354). Understanding PSTs epistemic beliefs can help researchers and teacher educators to better understand the cognitive processes in which PSTs use to make decisions about curriculum, instruction, and assessment (Fives, 2011; Feucht, 2011).

Several researchers have considered how research should consider the problem between espoused and enacted beliefs. Stipek, Given, Salmon and MacGyver (2001) argued that the gap between espoused and enacted beliefs should not be the focus of attention, rather how to ameliorate the disjunction between the two. The authors stated, “It is clear that beliefs and practices are linked, and emphasis in teacher professional development on either one without considering the other is likely to fail” (p. 225). Fives and Beuhl (2012) addressed the gap between stated belief and the beliefs found in practice as not so much an issue of the link between student’s learning objectives and a teacher’s beliefs lacking causation, but suggested the focus should be on the “degree of congruence or incongruence between beliefs and practice” (p. 481). The authors proposed that the disparity between a belief and practice might be attributed to internal factors that
unduly influence views such as personal values. Fives and Beuhl (2012) also noted the impact of certain external conditions, such as, school philosophy and its effect on how beliefs are enacted.

**The Problems of Definition.** Skott (2015) reviewed literature related to commonalities in the field of teachers’ beliefs from its development in 1980s to the present; a body of research that parallels the development in popularity for constructivist practice for learning. The field consists of “teachers’ thinking about meta-issues such as what knowledge is in a certain domain, how students become proficient in that domain, and what teachers may do to facilitate the development of such proficiency” (Skott, 2015, p. 13). Skott aimed to clearly delineate prominent theoretical frameworks and key concepts to frame the reasoning and challenges of the field, as well as uncover indicators for future directions for research. Skott reported that the inability of researchers to agree on a concept for defining beliefs leads to problems of method. In the absence of a common definition for teacher beliefs, Skott identified four common themes found in research: beliefs describe mental constructs; beliefs have a binary nature; beliefs have a time-related and contextual element; and beliefs tend to influence teachers and teaching. Each of these themes are expounded upon below.

**Beliefs Describe Mental Constructs.** Skott summarized the findings of Pajares (1992), Richardson (1996, 2003), and Schoenfeld (1998) to state, “beliefs are generally used to describe individual mental constructs, which are subjectively true for the person in question” (Skott, 2015, p. 18). This means that beliefs are held as true by individuals but they might find that other ideas have a justification for being valid. Therefore, the
individual’s ideas are not set in stone, but they have an internal logic where they are justified as being useful to that individual.

**Beliefs have a Binary Nature.** According to Skott (2015), referencing the work of Abelson (1979), Gill and Hardin (2015), Nespor (1987) and Pajares (1992), the second construct about the universality of research on defining a belief is that “there are cognitive as well as affective aspects to beliefs, or at least beliefs and affective issues are viewed as inextricably linked, even if considered distinct” (p. 18). This seemingly contradictory idea simply points out that the cognitive and affective aspects of a human mind are linked when expressing a vision of what is true. The affective aspect is argued to solidify the cognitive aspect. Therefore, one is necessary for the other (Skott, 2015). Skott pointed out that a belief can be thought of in terms of a vision that may seek or hope for an ideal quality about the world that may not yet exist.

**Beliefs have a Time-Related and Contextual Element.** Skott paraphrased the findings of Borko and Putnam (1996), Calderhead (1996) Cooney, Shealy, and Arvold (1998), Gill, Ashton, and Algina (2004), Kagan (1992), Lloyd, (2005), Mansour (2009), and Richardson (2003) to point out that beliefs can be considered related to the time and context in which they have first developed. Skott (2015) stated, “beliefs are generally considered temporally and contextually stable reifications that are likely to change only as a result of substantial engagement in relevant social practices” (p. 18). This means that they do not change in degree or kind without an intervention through collaborative social exchange. The mediation of a belief can occur inside or outside of teaching practice (Skott, 2015).
Beliefs Tend to Influence Teachers and Instructional Practice. Skott (2015) found that “beliefs are expected to significantly influence the ways in which teachers interpret and engage with the problems of practice” (p. 19). The impact of beliefs is correlated to a pedagogical technique or thought about instructional practice that functions as a definitive indicator of practice. This construct highlights the fact that targeting teacher beliefs is a productive means for education reform.

Skott (2015) synthesized the four assumptions noted above concerning the construct of a teacher belief into a definition to support this field of scholarship: “The term is used to designate individual, subjectively true, value-laden mental constructs that are the relatively stable results of substantial social experiences and that have significant impact on one’s interpretations of and contributions to classroom practice” (p. 19).

A notable influence in the shifting and shaping of perspectives are found in the elements of schooling; these consist of the context and the social collaboration that occur within spaces for learning and teaching, alongside moral and emotional factors that each individual possess. Only after a perspective has been demonstrated can it said to become a cognitive unit popularly recognized under the term ‘belief’. This definition reveals that educators and researchers should guard against consideration of belief development from an acquisitionist or transmission point of view as it is communicated from one source to another.

Domain Specific and Domain General Beliefs

Dependent on the research question and population of the inquiry, the construct of epistemology can be considered as domain-general or domain-specific (Hofer & Pintrich, 1997). Domain knowledge has been defined by Alexander (1992) “broadly as knowledge
in a particular field of study” (as cited in Hofer & Pintrich, p. 125). How epistemic theories function within or independent of a domain is a question that has long been debated in the field.

Domains have been defined in a variety of ways. Most studies in the field consider the domain-specific nature of personal epistemology through the lens of a single subject area such as science or mathematics (Hofer and Pintrich, 1997). However, there is precedent in the early work of personal epistemology by Perry (1970) to have a more broadened view of the term “domain” to include “academic, extracurricular, interpersonal, vocational, and religious” as well (as cited in Hofer & Pintrich, p.125). An expanded approach to how “domain” is conceptualized has more recently been noted in the field to include “content knowledge and teacher knowledge” (Feucht & Bendixen, 2010, p. 22).

The field of epistemology has questioned whether an individual begins to stereotype the types of knowledge and knowing that are situated independently in certain domains of knowledge or do certain types of knowledge views operate generally across domains. The domain-independent or domain-general nature of personal epistemology has long remained an open question in the field. However, researchers in the field are increasingly exploring issues of how an individual reflects on knowledge within topics in a domain. As an example, Mason, Pluchino, and Ariasi (2014) considered how readers approach knowledge about science found on websites. As a natural expansion of the specificity of knowledge gained in the field, the definition of domain has also extended to how the domain nature of beliefs may work in concert (Feucht & Bendixen, 2010).
Ultimately, these questions consider how personal epistemology functions in teaching and learning.

Yadav, Herron, and Samarapungavan (2011) suggested that attention to the social conditions of learning is critical when studying the contextual variations in PSTs personal epistemology. The authors suggested that many studies on PSTs epistemology have considered how these function in a general manner, meaning they operate like a theory that can be useful for understanding teaching and learning in any situation. Rather, the authors advocate for assessing personal epistemology in very specific subject areas (i.e., domain-specific) to understand the corresponding learning conditions that may influence these beliefs. They concluded that assessing PSTs epistemic beliefs using the same set of metrics that are aimed at understanding epistemology across all modes of teaching and learning (e.g., domain-general) may not reveal “a more nuanced way” of understanding beliefs at “different levels of granularity” (Yadav et al., 2011, p. 34). The grain level is in reference to the analysis stage and can reveal certain aspects or dimensions of knowledge and knowing are more or less prevalent in different situations (Yadav et al., 2011).

Schraw (2013) pointed out that there is a strong empirical basis for recognition that the level of sophistication of epistemic beliefs grows in correspondence with the level of expertise within a certain domain. The most widely cited of these finding is by Kuhn (1991) who demonstrated that the level of expertise in one domain may not necessarily transfer across different domains. Therefore, it appears that the developmental nature of beliefs that Kuhn (1999) conceptualized have a domain-specific nature.

**Advanced Epistemic Beliefs.** Information on PSTs personal epistemology is useful when teacher educators look to support the advancement of PSTs toward, what
researchers have termed, *sophisticated* (Kienheus et al., 2010; Hammer & Elby, 2002; Hofer, 2001) views of knowledge and knowing. The beliefs that are found to be more *sophisticated* or *evaluativist perspectives* (Kuhn, 1999) have been noted to contribute to the development of expertise by PSTs who “facilitate the learning process” through constructivist perspectives (Yadav, et al., 2011, p. 30), critical reflection about practice (Fives, Lacatena, & Gerard, 2015), and the development of student’s reasoning skills as it is correlated with learning (Hofer & Pintrich, 1997). Sophisticated views about knowledge and knowing are considered an advanced form of epistemic thinking and have been categorized as “contextual, complex, and constructed” (Maggioni & Parkinson, 2008, p. 455). Based on an assumption in Western education on philosophy that relativism allows for more complexity in thinking (Goldberger, as cited in Brownlee et al., 2001), this does not mean a evaluativist thinker cannot hold absolute beliefs. Rather, an individual would have constructed an understanding of truth to be determined as absolute through reasoning and evaluation (Brownlee et al., 2001). Therefore, sophisticated beliefs are a recognition of how knowledge is found to be or how the process of knowing is gained. For example, if knowledge is recognized as contextual there is an understanding that it can change depending on the situation (Hofer, 2001; Hammer & Elby, 2002). If knowledge is recognized as complex, then there is an understanding that there might be a multitude of perspectives to consider and evaluate (Kuhn, 1999). Complexity cannot be transmitted or transferred to another individual without a great deal of effort and practice. This is also true if the process of knowing something is viewed as constructed (Belenky et al., 1986). In this case, any learning engagement must account for prior learning (Windschitl, 2002). Sophisticated forms of
knowing have been correlated with advanced levels of education (King & Kitchner, 1994).

**Naïve beliefs.** In contrast, *naïve or absolutist* epistemic beliefs have been related to PSTs that believe the students have a passive manner of receiving information from authority, as well as support teacher-centered instruction (Brownlee, 2004). An individual who considers beliefs as absolute do not need to engage in debate. These less sophisticated beliefs have been correlated with a teacher’s lack of concern for student’s learning preferences, as well as a lack of diversity in instructional strategies chosen (Stuck, as cited in Brownlee et al., 2001). Naïve views about knowledge and knowing are considered in terms of “certain, simple, and transferable” (Maggioni & Parkinson, p. 455). Certain, simple and transferable beliefs are attributes that reveal an absolute view of knowledge or naïve and unsophisticated views (Kuhn, 1999), and have been recognized as beliefs that prevent the achievement of quality learning outcomes (Muis, 2004). For example, in the domain of science, teachers with less sophisticated beliefs focused on traditional classroom practices and assessment strategies (Tsai, 2002).

Hammer and Elby (2001) contest that beliefs develop from naïve to sophisticated conceptions. The authors make the argument that “correctness” and “productivity” of an epistemic belief should be the criterion for elementary students who learn about science (p. 554). Hammer and Elby (2001) assert it is not productive for these students to consider scientific facts as relative or uncertain, but more geared toward “discovering objective truths”. Further, they point out that in certain scientific contexts knowledge can be seen as tentative, such as, in the example of considering theories that are up for debate (i.e., dinosaur extinction) as opposed to theories that are not debatable (i.e., flat-earth
theory) (Hammer & Elby, 2001). The authors also argue that an “absolute authority” is not a sophisticated view nor is a “blanket distrust of authority” a useful framework for considering productive learning in science (Hammer & Elby, 2001, p. 560). A simplified rendering of their solution is for students to engage in the evaluation of information and for researchers to conduct interviews. Evaluation of information justifies the ends for teachers who wish to teach introductory scientific ideas. Interviews can target context and therefore, interview questions can be posed about certain situations that might differ between “well-established” pieces of knowledge and “cutting edge” ideas about knowledge (Hammer & Elby, 2001, p. 561). Hofer (2004) recognized Hammer and Elby’s concern for the contextual variation found within knowledge communities and learning environments. Hofer (2004) further suggested research was necessary to consider the “socio-cultural context” that influences the beliefs of teachers and PSTs (p. 133).

**Implications for the Present Study.** This literature review sifts out a definition of belief that will guard against a quick labeling of a pedagogical technique or thought about instructional practice as having a stable nature that is a definitive indicator of practice. The difficulty in pinpointing a belief as a definitive influence on decision-making in the classroom is due to an unclear demarcation line between a belief and knowledge (Connelly & Clandinin, 2013). Therefore, it is important to consider the primary means of evidence to support claims on the efficacy of teacher beliefs have been drawn from surveys, interviews, and written evidence. Schraw (2013) noted how diaries, journals, and videos are underutilized in research on teacher beliefs. The author warned against “context stripping” by omitting one or more of the above forms of qualitative
evidence (Schraw, 2013, p. 13). Therefore, it is appropriate for this study to engage participants in interview as well as collect video of PSTs enacted practice in its methodology.

This study attends to three of the four assumptions that Skott (2015) uses to synthesize a definition for a belief. In this review, the author’s construct that recognizes the temporal, contextual description of a belief as a cognitive unit that is recognized as having an influence on practice is followed in this study. However, Skott’s assumption that relates to the affective nature of beliefs will not be tested in this study. The general definition of a teacher belief provided by Skott (2015) will later be juxtaposed against Feucht’s (2010) definition of epistemic climate. Even though the field of teacher beliefs finds itself embroiled in debates about method and definition, this study can sidestep many of these issues by focusing on how beliefs are dependent on contextual factors. This is opposed to the assumption that an individual’s beliefs are the sole mediators of action regardless of the milieu in which these views are expressed.

**Part 2: Review of Epistemological Models**

**Overview**

Perry (1970) initiated the task of defining personal epistemology. Since the publication of his seminal research the field has developed into a variety of positions based on multiple constructs (Hofer, 2004). This review is narrowed to four models that are useful for understanding perspectives on personal epistemology that have been recognized and tested in a variety of research. The first considers the construct of knowledge and knowing following a developmental arc that focus on skills of reasoning (Kuhn, 1999). The second model concerns personal epistemology functioning as a general theory with
domain-specific theories (Hofer, 2001). Third, the construct is explained “as a system of more or less independent beliefs” expressed as dimensions (Schommer, 1994, p. 300). Fourth, personal epistemology has increasingly been considered in research in terms of contextually related frames or resources for understanding knowledge (Hammer & Elby, 2002).

This section of the literature review is not exhaustive of each key theorist in the field, but has been delimited to offer a broad overview for each of the major viewpoints concerning personal epistemology that is useful for understanding the empirical findings that are later referenced. As the reader considers these four models, he or she will be provided a basis for understanding how researchers and educators working with the concepts of personal epistemology can benefit from examining various assumptions and perspectives. An additional objective of this section is to make clear how one or an “integration” of constructs of personal epistemology can be useful for elucidating understanding of particular research questions dependent on the goals and purpose of the research (Hofer, 2001, p. 377).

Beliefs have a developmental nature. The field of personal epistemology began in the “mid 1950s” through phenomenological studies of a longitudinal nature (as cited in Hofer & Pintrich, 1997, p. 89). Perry (1970) began studying the trajectory of understanding of knowledge by university students to determine how education plays a role in the development of personal epistemology. In the initial period of college, Perry found that students held beliefs about knowledge as “simple, “certain,” and transmitted by “authority” (as cited in Schommer-Aikens, Bird & Bakken, 2010, p. 31). Perry classified these individuals as holding “dualistic” views (as cited in Hofer & Pintrich,
From this dualist stage, Perry (1970) suggested that an individual’s meaning making of the college experience tends to mature into a position termed “multiplicity” (as cited in Hofer & Pintrich, p. 91). In this stage, a person holds a subjective view of knowledge. As the students in this study approached the end of their college experience, just before the conferral of an undergraduate degree, Perry recognized that beliefs tended to evolve to recognize knowledge as “complex” and “tentative” and based on “reason and evidence” (as cited in Schommer-Aikens et al., 2010, p. 31). These attributes are ascribed to an individual who begins to use knowledge to reason. Perry classified this skill development into two related stages termed: “relativism” and a “commitment within relativism” (as cited in Hofer & Pintrich, 1997, p. 91). These final categories take a more subjective view of knowledge that allow for making evaluated judgements where the individual makes their own meaning. This meaning is “relative, contingent and contextual” (Hofer & Pintrich, 1997, p. 91). Once this meaning has been made, the individual begins to think about and develop commitments to “values, careers, relationships” (p. 91). The category of a commitment that is built into Perry’s (1970) concept of relativism is where an individual demonstrates their values through their actions. However, individuals in Perry’s study were not found to gain this level of development during the college experience.

Taken together, this model and others like it have come to be known as a developmental progression, developmental perspective, or developmental model. The views of knowledge that students were found to hold throughout their undergraduate experience serve as a foundation for understanding that the construct of personal
epistemology can be expressed by qualitatively defined “stages, positions, or levels” (Greene, Torney-Purta, Azevedo, & Robertson, 2010, p. 235). This developmental perspective has become a long-standing tradition in the construct of epistemology.

The developmental perspective which has inspired other influential theorists will be mentioned here, in brief, to demonstrate the lasting nature of Perry’s (1970) findings and the directions in which his work has advanced. Baxter Magolda’s (1992) *Epistemological Reflection* model considers how learners’ assumptions about knowledge are “gender related rather than dictated by gender” and influence learning in the university classroom (Baxter Magolda, 2004, p. 36). Belenky, Clinchy, Goldberger and Tarule (1986) studied *Women’s Way of Knowing* to demonstrate how the developmental levels influence an individual’s view of knowledge. King and Kitchener (1994) use the term *reflective thinking* to articulate a developmental sequence in their theory of *Reflective Justice*. Kuhn (1999) utilized developmental positions to articulate the stages of reasoning as individuals develop an argument in the model of *Epistemological Understanding*. Lastly, Hofer (2001) has also drawn similarities across the work of each of these developmental thinkers to develop her *Epistemological Theories* and move the field forward in the tradition of Perry’s work.

The developmental perspective provided by Perry (1970) is not without its critics. Moore (1994) suggested that it remains to be determined if a “developmental trajectory” is a natural explanation of acquiring knowledge “or is more an artifact of the socialization process in the values of Western liberal arts education” (as cited in Hofer & Pintrich, 1997, p. 93). This is an important point for a researcher to be mindful of when considering potentially dangerous cultural assumptions. From an alternative perspective,
Wang and Tanase (2010) challenged the view that beliefs are gained in a developmental sequence. The authors suggested that Perry’s explanations do not account for the contextual nature of teacher education programs and classrooms. These spaces, the curricular resources, and the people within them (i.e., peers and teachers) may present epistemic beliefs or epistemic messages that are in concert or in opposition to PSTs beliefs. As previously noted, this congruency/lack of congruency is argued to play a role in the shaping of PSTs beliefs.

**Epistemological understanding.** As written above, similarities can be drawn between Perry’s (1970) framework and Kuhn’s (1999) model (see Table 2: *The Developmental Nature of Epistemic Beliefs – Stage Similarities*), with the latter including judgement and critical thinking in advanced stages of epistemological understanding. As this model was explained in detail in this study’s theoretical frame it will only be reviewed in brief here in order to draw parallels across epistemological theories.

A defining feature of Kuhn’s (1999) model is that knowledge must be justified. Therefore, Kuhn’s stages articulate an individual understanding can mature from an objective to a subjective orientation that allows for evaluation of information and the justification of knowledge. She found that *epistemological understanding* could be considered through developmental levels delineated in a logical progression from realist to *evaluativist* views of the nature of knowledge. In between these two poles an individual can hold *absolutist views* or *multiplist views*.

*Table 2*

*The Developmental Nature of Epistemic Beliefs – Stage Similarities*
<table>
<thead>
<tr>
<th>Epistemic Model</th>
<th>Dualism</th>
<th>Multiplicity</th>
<th>Relativism</th>
<th>Commitment within relativism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developmental Positions as Gained through Increased Education Levels (Perry, 1970)</td>
<td>Dualistic views between right and wrong. Absolutist. Knowledge is discerned from authority.</td>
<td>Similar to dualistic thinking with recognition of diversity and uncertainty. Authorities may disagree on a truth that is knowable.</td>
<td>Contextual relativist. The individual creates meaning. Realize need to choose commitments to values, career, relationships and personal identity.</td>
<td>Focus on ethics (responsibility, engagement, acting on the development of commitments)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Developmental Levels of Epistemic Understanding (Kuhn, 1999)</th>
<th>Absolutism</th>
<th>Multiplism</th>
<th>Evaluativism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assertions are facts. Reality is knowable. Knowledge is certain and from an external source. Critical thought is useful for evaluating assertions to reality.</td>
<td>Assertions are opinions. Reality is not knowable. Knowledge is uncertain and socially constructed. Critical thought is irrelevant.</td>
<td>Assertions are judgements. Reality is not knowable. Knowledge is uncertain and socially constructed. Critical thinking is necessary to make evaluative judgements.</td>
<td></td>
</tr>
</tbody>
</table>

*Note. Table 2 offers a visual of Perry’s (1970) developmental stages as they may be influenced through increased education levels (as cited in Hofer & Pintrich, 1997, p. 91). This is presented alongside Kuhn’s (1999) research on the development of epistemic understanding toward making evaluated judgements. Stage similarities across developmental levels are represented horizontally and have been adapted from Hofer and Pintrich (1997).*  

**Knowledge beliefs acting as theory.** Hofer’s model also was detailed in this study’s theoretical frame. However, given that Hofer’s (2001, 2004) dimensional model is a commonly referenced in the field of epistemology (as cited in Schraw,
Olafson, & VanderVeldt, 2010), its complexity can be explored with additional treatment. Therefore, Hofer’s dimensional model will be explained alongside the influence of other theorists’ work here whom have advanced the understanding of personal epistemology.

As previously explained, Hofer’s (2001, 2004) *Epistemological Theories* were developed for understanding the theories that teachers hold about the nature of knowledge and knowing. These epistemological theories have been described as functioning as “theory-like” (Bendixen & Feucht, 2010, p.10). This allows for a study of beliefs that are malleable, but also allows for study into the dimensions of how beliefs are influenced. Acknowledging Hofer’s (2001) conceptualization of epistemological beliefs functioning as theory alongside multiple dimensions, Mason (2010) articulated:

This means that individuals’ views are not to be seen as a collection of independent ideas, but rather as a coherent integration of compatible perspectives at both the domain-general and domain-specific levels. It is supposed that an individual may hold a theory about knowledge in general as well as theories about knowledge in domains such as math or history. (p. 264)

To offer an example, Hofer and Pintrich’s (1997) four *epistemological theories* function in the mind of an individual. These academic theories that share commonalities with conceptual change theory. Conceptual change theory emanates from cognitive/developmental psychology and finds that knowledge acquisition begins in early childhood with the individual attempting to develop a coherent system of beliefs for understanding the world (Miller, 2011). Piaget (as cited in Miller, 2011)
explained this phenomenon in young children as he stated, “children construct new knowledge by taking their knowledge from a lower level to a higher one and reorganizing it at this higher level” (p. 87). This understanding of knowledge acquisition using a framework is said to begin in a naïve manner, and develops more sophisticated ideas as knowledge acquisition matures. A coherent framework for understanding a phenomenon is useful to the individual, however, as an individual gains new knowledge, the cognitive structure of a belief can be thought of using the metaphor of a tipping point where the concept shifts to a new position. This new position or conceptual change will then provide a belief or set of beliefs that allow interpretation of a situation or event in a new manner. Regardless, conceptual change theory is supportive of Hofer and Pintrich’s understanding of epistemology.

Hofer and Pintrich’s (1997) explanation has two categories: nature of knowledge and the nature of knowing. The knowledge dimensions refer to the dimensions of certainty and simplicity of knowledge. The knowing dimension refer to the source and justification of knowledge. These can be understood in terms of dimensions of the process of knowing something. It focuses on four interrelated dimensions (i.e., structure, stability, source, and justification) that, more or less, follow a stage-like progression that can be thought of in terms of a developmental pattern as articulated above. However, a theory-like view differs from Perry’s (1970) model by not being centered on how education influences beliefs, but rather how advanced educational attainment is supportive of a more sophisticated understanding of knowledge (Hofer, 2001). However, it can be differentiated in the sense that the progression may not occur in a linear manner and across all of the stages unilaterally,
much like Piaget’s (as cited in Miller, 2011) developmental model, but rather a belief may be recognized as less/more sophisticated if that individual has a lesser/greater depth of learning in a certain area of expertise.

Hofer’s (2001) offered her own critique of this model. She found that the simplicity of knowledge dimension located in theory could not be empirically validated. Rather, a dimension related to the attainment of truth was found (Hofer, 2001). This manner in receiving knowledge was articulated when experts could discern a level of veracity as he/she gained a certain competency while engaged in a certain domain of knowledge (e.g., math, science).

Knowledge beliefs having a dimensional nature. Schommer (1990) popularized an alternative perspective, in contrast to the theory-like developmental pattern articulated above, considering epistemology with independent belief dimensions. Currently publishing under the name, Schommer-Aikens (2002, 2004), her epistemological framework is comprised of five beliefs dimensions that share a likeness to what Hofer (2004) suggests are the three “core” theories (i.e., certainty of knowledge, structure of knowledge, and source of knowing), however Schommer-Aiken’s model includes two additional dimensions (i.e., learning ability and speed of knowledge acquisition) (p. 131). Schommer-Aikens (1990, 1994) hypothesized that knowledge could be understood across five dimensions (i.e., simplicity, certainty, sources, learning, and effort). Each dimension allows for recognition of an individual’s beliefs to occupy a position on a continuum ranging from less sophisticated to more sophisticated views of knowledge. Schommer’s theory articulates how different beliefs about knowledge can be considered as static or “an accumulation of facts” to recognizing knowledge as “highly interrelated concepts”
(Hofer, 2000, p. 381). The five dimensions below have been paraphrased from Schommer-Aikens (2004):

*Simplicity of knowledge* seeks to understand if an individual holds a belief that knowledge is simple or integrated.

*Stability of knowledge* determines if knowledge is certain and unchanging or uncertain and changing.

*Source of knowledge* considers if knowing is external vs. internal; objective vs. subjective; passive or active.

*Speed of learning* asks how quickly does learning happen, if at all.

*Ability to learn* targets beliefs about success as it is measured through effort and aptitude.

Each belief that is plotted using this multi-dimensional model can be placed on a continuum from naïve to sophisticated views of knowledge, however this differs from other models by supporting a view that beliefs are independent. Contrary to the developmental perspective, an individual might hold multiple beliefs within any given dimension. This is true regardless if these beliefs are consistent. Brownlee et al. (2011a) offered the following example to articulate this point: “For example, it is possible for an individual to think that knowledge is certain and unchanging (attainability of truth) and yet also believe that knowledge is integrated (structure of knowledge) and constructed (knowledge construction)” (p. 479). Schommer-Aikens (2004) conceptualized this system in order to sort out the field where different beliefs (e.g., beliefs about authority, learning ability, the speed of learning, the justification of knowledge and belief about intelligence) were focused on by a variety of researchers (Dweck & Bempechat; Schoenfeld; Kitchner...
Hofer (2004) argued that two dimensions in Schommer’s model, speed of learning and ability to learn, cannot be supported empirically as an epistemological construct, but rather, these function as beliefs about learning. However, Fives et al. (2015) review of the field supports beliefs about learning as epistemologically related and therefore important for inclusion. Ultimately, this disagreement suggests that conceptual clarity on defining a belief is on-going (Skott, 2015). Schommer-Aikens (2004) defended the inclusion of learning beliefs through reasoning that an Embedded Systemic Model, inspired by Bronfenbrenner’s (1979) Ecological Systems Theory of Human Development suggested that personal beliefs are influenced by systemic processes and cannot be isolated from the context in which they occur. Therefore, Schommer-Aikens (2004) concluded that beliefs about learning are not easily separated from beliefs about knowledge.

**Knowledge beliefs as resource/framing.** Hammer and Elby (2002) argued that a contextually dependent resource/framing model of personal epistemology has merit for helping an individual understand the nature of knowing and for helping interpret what is useful to understand a learning engagement. A resource model is useful for both learners and teachers. Hammer and Elby (2001) refer to “epistemological resources” as the “cognitive building blocks from which students construct their epistemological views” (p. 564). The metaphor of ‘framing’ can be productive for understanding what a student or teacher can find useful for learning in specific situational and cultural contexts (Hammer and Elby, 2002; Feucht, 2008). This theory termed, Epistemological Resources and Frames, questions the assumption that a learner’s beliefs develop from naïve conceptions of knowledge (e.g., King & Kitchner, 2002) to more sophisticated forms, as previously
noted in Schommer’s framework (Hammer & Elby, 2001). Therefore, knowledge as an epistemological resource has diminished empirical appeal for supporting conceptual shift in ideas through pre and post measurement research designs. The draw of this framework is found in its user-friendly terms to support teachers to be cognizant of the messages contained within their beliefs and what they send to students. In other words, what cognitive resources “novice teachers can learn to recognize” (Hammer & Elby, 2010, p. 416). Hammer and Elby’s (2002) fine-grained resources can be recognized and activated through metacognition in the following four categories:

(1) Nature and sources of knowledge (e.g., knowledge as propagated stuff, knowledge as free creation, and knowledge as fabricated stuff); (2) Epistemological activities (e.g., accumulation, formation, and checking); (3) Epistemological forms (e.g., stories, rules, facts, and games); and (4) Epistemological stances (e.g., acceptance, understanding, and puzzlement). (Bendixen & Feucht, 2011, p. 12).

Hammer and Elby’s classification system as noted above attempts to reference epistemic thinking patterns in the context of learning. The types of resources used by a learner or teacher can make these often implicitly held cognitive resources useful for explicit reflection. The system of resources above is suggested as a tool for the teacher or learner to understand a learning engagement from a knowledge point of view.

The epistemological resources framework does not use constructs that confer a notion of stability that is associated with having a belief (Hammer & Elby, 2002). Rather, Hammer and Elby (2002) reason that a cognitive resource cannot be termed a belief until it is demonstrated across different contexts. Hammer and Elby (2002) suggest a belief is
not to be ascribed to an individual by a researcher, but rather “development and change consists of the co-activation and stabilization of epistemological resources the student already possesses” (p. 11). Alternatively stated, an individual already possesses a network of beliefs to draw from and to inform decision making. The act of making these implicit beliefs explicitly known support an individual to recognize how certain frames are more productive for learning. Hammer and Elby (2002) refer to this as “cueing” a belief (p. 11). The implication is that one cues something that already exists “dependent on how a student understands the task” (Hammer & Elby, 2002, p. 11). In the resource model, the researcher does not measure a shift in epistemic beliefs of development along a continuum, but the learner can discern how effectively he or she can engage in the “redeployment of an old ‘belief’” for the purposes of their work (Hammer & Elby, 2002, italics original, p. 10). Using the same resource repeatedly can insure that cognitive framing is supportive in developing stability of that frame. Therefore, once showcased in a variety of setting, this resource can then be termed a belief.

This view represents a shift in thinking about personal epistemology. The question is not so much shifting “developmental position to another but rather supporting students to find the most appropriate resource for the learning task” (Stahl, as cited in Luna et al., 2011, p. 322). Concerning pedagogy, Russ and Luna (2013) said this framing is “a moment to moment understanding of what is going on with respect to knowledge and learning in the classroom, [which] drives much of teacher practice” (as cited in Luna et al., 2011, p. 322). This contextual and temporal dimension lends itself to meta-cognitive aspects of epistemic thinking. In other words, the resource perspective requires
individuals to reflect in the moment about what is occurring concerning knowledge and the processes of developing knowledge (Hammer & Elby, 2003).

This theory was developed for use in domain-specific areas of inquiry. This means that it is helpful for describing, predicting and explaining teachers’ interventions and student’s response to these within an area of specific knowledge content (i.e., physics, mathematics). Elby (2009) suggest the field of epistemology has engaged in a rush to judgment by defining personal epistemology as views about knowledge and knowing before all the facts were in about how beliefs develop and function. Elby furthered Schommer-Aikens’ point that the definition of epistemology should include views about learning. Elby (2009) calls for further empirical work to help define this boundary. This call has been taken up in through connecting conceptions of learning to personal epistemologies (Schommer-Aikens, 2004; Chan, 2011).

A question was posed to Elby (2015) concerning this study not exclusively targeting one subject-specific area for teaching and learning. Elby suggested: In the absence of a curriculum that does not engage in a particular area of content knowledge, cognitive framing would be useful for making beliefs explicit with respect toward knowledge and learning. Elby stated, “interventions could help teachers become more thoughtful about the epistemological messages they are sending, and research could document this increased thoughtfulness” (personal communication, March 21, 2015). The resources/framing perspective also is geared to consider the framing/message that classroom students convey. Elby pointed out “it would also be interesting to take the classroom interactions as the unit of analysis, but given the context—teacher professional development—a focus on the teachers’ framing will be valuable” (personal
communication, March 21, 2015). This perspective is useful when considering the concept of epistemic climate that will be articulated in the following section.

**Implications for the present study.** Several themes were found in this review of frameworks. The first is that there are many competing definitions and constructs of personal epistemology. These constructs have a multi-dimensional nature and are often found to be compatible as they reveal different aspects of an individual’s belief system as they are enacted through different experiences. Secondly, there are general dimensions of epistemology to include: the nature and justification of truth, the source of knowledge as being derived from authority or be developed autonomously, and the role of critical thinking and reasoning in epistemic development. It has been suggested that utilizing an epistemological framework that has been tested can be useful for the field to gain clarity (Schraw, 2013). Use of the PEM model as provided through the work of Kuhn (1999) and Hofer (2001) will fit this criterion (see Table 1).

The four key theoretical developments discussed in the field of personal epistemology above present differences in perspective on how knowledge can be understood and useful for research. As the teacher education program supporting this study concerns an inquiry orientated Reggio Emilia approach recast for teacher training, the use of a multiple framework construct for understanding personal epistemology has value.

The value of Hammer and Elby’s model is found in its use of language that is approachable for the novice teacher. Schommer-Aikens et al. (2011) pointed out that the importance of avoiding “lofty language” to support the field of epistemic beliefs, however the nature of the dissertation process does not lend itself to participatory
methods useful for working alongside teachers to introduce the language that Hammer
and Elby provide. Further, an intervention would be more appropriate for the use of a
resource model.

Schommer-Aikens model has merit as well, however the critique by Hofer about
the inclusion of learning dimensions will be heeded following the advice of Pajares’
(2002) and Skott (2015) that the field can benefit from clarifying the blurred line that
differentiates a belief and knowledge. Therefore, Kuhn’s developmental perspective
alongside Hofer’s dimensions can provide a way forward that can support the efforts of
epistemologists to clarify the developmental positions and dimensional aspects of beliefs
about knowledge and knowing that are most salient in the laboratory school setting.
Recognition of contextualized aspects to personal epistemology that Hammer and Elby
(2002) noted as critical in understanding epistemology, can be gained through use of the
PEM model (Feucht, 2011). This latter point will be expanded upon in this review under
the subheading of epistemic climate.

Part 3: Preservice Teachers Epistemic Beliefs About Teaching and Learning

Overview. White (2000) and Brownlee (2001) were early advocates for
advancing the view that the development of personal epistemological is a promising goal
for teacher preparation. As the field of epistemology has advanced, it has established a
strong correlation between personal epistemologies and student learning (Brownlee et al.,
2011a). More recently, the field has shifted attention to research on personal
epistemology and teaching, to include the role of epistemic thinking and meta-cognition
in teacher education (Spray et al., 2009; Muis & Franco, 2009; Kienhues et al., 2010).
Brownlee et al. (2011a) found that more remains known about how these beliefs relate to
teaching and teacher education, but found support for the view that epistemic beliefs influence practice. Likewise, Fives and Buehl (2012) and Schommer-Aikens (2004) suggested that beliefs are indicators of action, and by understanding beliefs one can understand how an individual will teach.

A developing body of empirical evidence demonstrates that a teacher’s personal epistemology is influenced in two ways. The first is how contextual factors influence beliefs in teaching and learning environments. The second theme found relates to how epistemologies interact with learning and instruction in a variety of ways. Each of these findings will be explored in the paragraphs below.

**Contextual influences.** Many theories and findings on the context of personal epistemology relate to the context in which a person is learning. Hofer (2004) suggested that personal epistemologies must be looked at “not as a decontextualized set of beliefs, but as an activated, situated aspect of cognition that influence knowledge conduction processes” (p. 132). Hammer and Elby (2002) articulated this concept as fine-grained epistemological resources that are reflected upon through the act of metacognition. As previously mentioned, contextualized epistemologies have been targeted by researchers in domain-specific areas of academic study (Tsai, 2002). Concerning student learning and learning about teaching, researchers have pointed out that this engagement with epistemology typically occurs as an individual works through dilemmas (Tillema, 2011; Hofer, 2001; Kuhn, 1999). Teaching is the act of making decisions and solving problems. Most of the problems of teaching can be defined as ill-structured. Jonassen (1997) defined ill-structured problems as problems that are found that have multiple solutions. The individual must evaluate multiple perspectives to seek a solution. Voss and Post (as
cited in Jonassen, 1997) have argued that solving these problems is dependent on the knowledge beliefs of the individual. The authors found that sophisticated epistemic beliefs are useful for teachers tasked with solving ill-structured problems.

An additional contextual influence of personal epistemology is expressed through each academic domain. Hofer (2004) has suggested that it might be the case that specific domains of knowledge also benefit from certain views of knowledge. Related, Tsai (2002) found that knowledge views were closely aligned in a single subject domain. Using the example of science, Tsai (2002) pointed out that “teaching science, learning science and the nature of science are interrelated” (p. 780). In a separate domain, such as history, the same individual may hold a different set of beliefs about knowledge in what has been termed *nested epistemologies* (Tsai, 2002). Due to the complex nature of beliefs, Tsai (2002) noted that *nesting* does not infer a correlation to how science is taught, but a relationship was found between aligned beliefs and classroom teaching experience.

**PSTs Beliefs about Learning.** Brownlee (2001) considered “the nature of learning in teacher education” (p. 284). This qualitative study sought the epistemic beliefs of 29 students in a university graduate diploma program aimed at Australian primary school teacher preparation. Each participant held an undergraduate degree from one of a variety of fields. The reasoning for this variety of participants was to understand any individual differences in epistemology. Brownlee found that participants could be categorized on a continuum from *Received Absolute Truths* (REC) to being able to *Construct Reasoned Truths* (CON). Most participants (n = 17) could be said to occupy the middle position where “some truths are constructed and reasoned, while other truths
are absolute and received” (p. 287). Eleven participants were said to have the most sophisticated views (CON).

Brownlee (2001) advocates for teacher education programs to support belief development toward relativistic positions on knowledge that allow for multiple ways of knowing. In a separate study, Brownlee et al. (2001) described a “relativistic” orientation as being valued in certain societies and offered the example of its growing prominence in the United States. Likewise, in Australian primary education a student considering a variety of perspectives on knowledge is a “desirable” viewpoint in curricula (Brownlee, 2001, p. 288). This orientation as a goal allows for a developmental understanding of knowledge and the role of critical thinking. In a democratic society, critical thinking is a quality that is prized for individual to possess to aid the proper functioning of government. However critical thought is not necessary if all opinions can be recognized as correct (Kuhn, 1999). Therefore, it benefits a learner to engage in efforts to mature epistemologically to recognize certain views as more desirable based on determinations about the credibility and justification of certain information. This action requires critical thought. A developmental perspective on epistemology benefits from pedagogical techniques that support a subjective orientation as well as a subjective and objective orientation about knowledge. A pedagogy supportive of these perspectives can be found in constructivist principles for teaching and learning (Fosnot, 1996).

Brownlee, Walker, Lennox, Exley & Pearce (2009) interviewed 35 first-year early childhood, primary teacher candidates, as well as students enrolled in a creative writing course, to discern the relationship between personal epistemology and teaching and learning. Each student was enrolled in a bachelor’s program in a prominent university in
Australia. The authors utilized an established framework for understanding epistemological development using Kuhn and Weinstock’s (2002) categories of absolutism, multiplicity, and evaluativism. This developmental perspective supplemented with constructs about epistemology articulated by Hammer (2003). This frame assisted the content analysis of the semi-structured interviews. The authors found, in all three groups, that there was a correlation between epistemic beliefs and beliefs about learning. The authors pointed out that this has implications on the design of teacher education courses.

Spray et al. (2013) also call for teacher education to support epistemic development through supplementing course content with explicit reflection on meta-cognitive skills. Through consideration of first year preservice education students, the authors focused their inquiry on the awareness of epistemic thinking. This is opposed to seeking dimensional aspects of epistemic beliefs. Therefore, self-report tools in the form of a written journal were useful for this case-study. The authors found that successful students oftentimes would resort to a less than complex strategy, but success was dependent on the ability to be aware of the difference. Naïve learning strategies were found to be an absolute belief in facts about knowledge and memorization as a technique to gain these, while sophisticated strategies consist of evaluation of concepts. The authors deduced that it is important for teacher educators to model the processes of learning to help sort naïve strategies into sophisticated ones. This conclusion was drawn from research by Muis and Franco (2009) that epistemology develops in relation to knowledge development and this can be the reason that “first year students” rely on “rehearsal learning strategies” for performance (as cited in Spray et al., 2013, p. 52).
Fives et al. (2015) review on epistemological beliefs pointed out that Chan’s (2011) study was a prototypical example of research on teachers’ beliefs about learning. Chan (2011) used an established epistemic framework by Biggs and Moore (1993) to support their prediction that PSTs “conceptions of learning” are related to epistemological beliefs. Chan (2011) related Biggs and Moore’s (1993) conceptions as either qualitative (e.g., learning for developing meaning) or quantitative (e.g., learning as memorizing) (p. 88). Qualitative conceptions are related to constructivist views where a student may hold a belief that “learning is understanding” (p. 105). This approach has been noted as supportive of critical thinking (Muis, 2004) and improved learning outcomes (Brownlee et al., 2009; Spray et al., 2013). In contrast, quantitative conceptions have been related to acquisitionist views on learning where students are “likely to adopt a rote memory approach” (Chan & Elliot, 2011, p. 105). This type of approach has been noted to be a hindrance on learning (Muis, 2004). Chan’s (2011) quantitative study, conducted in Hong Kong, measured the learning beliefs of 231 preservice teacher candidates through questionnaires. The author found that teacher education programs would be best served by utilizing reflective thinking, constructivist practices, and autonomous decision making alongside supporting teachers to recognize their epistemological beliefs (Chan, 2011).

**PSTs beliefs about teaching.** White (2000) described the personal epistemology of PSTs as they engaged in decision making when faced with a problematic situation in the classroom. The situations they were presented were modeled following the aforementioned ill-problem scenarios described by Kuhn (1999). The 20 study participants, mostly female, from a range of university designations (freshman-senior)
analyzed case-studies from first-year teachers as they engaged in a university course for teacher training. Those with naïve epistemologies were linked with an understanding of classroom dilemmas and solutions that were “simple” and relied on personal experience to solve a problem (White, 2000, p. 291). While those PSTs with sophisticated beliefs were able to recognize complexity in the problem and utilized multiple perspectives to form a conclusion. White (2000) noted that PSTs experienced a slight epistemic shift using a dimensional perspective. She suggested that PSTs beliefs did not move in a linear stage like fashion through dimension. However, she did posit that beliefs had an internal consistency, much like that described by Tsai’s (2002) nested epistemologies.

Interestingly, White hypothesized that the certainty of knowledge for PSTs was a concept in which they, most likely, had been familiar with throughout their formative educational experience. White (2000) found that the PSTs faced a tension when trying to reconcile “the lack of absolute certainty” when dealing with “non-factual knowledge” (p. 302). The author felt that PSTs experienced difficulties in being able to make reasoned judgements when there is not one definitive way to solve an ill-structured problem in practice, given most participants felt these types of decisions were subject to opinion (White, 2000).

Chai and Khine (2008), associate professors at Singapore and Australian universities, reflected upon the reforms in Singapore education systems that require changes for teacher education preparation. These changes are to recognize the new demands of a knowledge-based economy (Chai & Khine, 2008). Since 1997, these changes have brought constructivist and student-centered practice, which require teachers to “view knowledge claims as uncertain and knowing as a process of constructing personally meaningful understanding” (Chai & Khine, 2008, p. 288). Cohen (1988) is
referenced as a source that pointed to the need for PST readiness for constructivist teaching (as cited in Chai & Khine, 2008). The authors of this study found that the pre-service teachers’ \((N=877)\) beliefs about knowledge and knowing and beliefs about instructional practice can be useful to develop a profile to understand a teacher’s readiness for teaching in a constructivist manner. The authors agree with Sinatra and Kardash (2004) that more complex assessments are needed to measure beliefs. Research that accounts for espoused beliefs on self-reported data and the gap between actual practice has been noted as an area for future studies.

Patchen and Crawford (2011) approached understanding of teacher’s **epistemological orientation** in hopes of ameliorating the gap between espoused and enacted beliefs through the study of teacher metaphors. Using metaphors supports a researcher’s ability to uncover unconscious assumptions. Drawing from the Belenky et al. (1986) model for understanding *Women’s Ways of Knowing*, the authors studied 28 in-service teachers engaged in Master’s program studying teacher education. The first level of analysis of student’s metaphors revealed Belenky et al.’s orientation of teachers as constructed knowers who support constructivist viewpoints. However, secondary analysis revealed teachers tended to revert to an “acquisitionist mode” that is reflective of Belenky’s received view or knowledge (Belenky et al., 2006, p. 293). The reasons for this were pragmatic, as teachers noted pressures to conform to curricular requirements. This suggests that the context for learning can help support or hinder existing beliefs. The authors pointed out that this finding casts suspicion on Sfard’s (1998) claim that, “education is moving from the more traditional acquisition-based models of teaching and

**Teacher education programs and development of epistemic thinking.**

Research on PSTs’ personal epistemology has been developed and influenced by research from university scholars in Australia. These studies have taken place over a decade centered on various facets of ECE preservice teacher’s epistemic beliefs. Brownlee, Petriwskyj, Thorpe, Stacey and Gibson’s (2011) study was the culminating step of a three-phase research project that was initiated by Brownlee, Purdie and Boulton-Lewis (2001).

In phase 1, Brownlee et al. (2001) found that beliefs can change across a year-long engagement on reflection based on a university psychology course. These researchers suggested PSTs have the capacity to develop sophisticated epistemic beliefs within their teacher training initiation. This mixed methods study of 29 PSTs revealed that those students who participated in reflective journaling about epistemic beliefs could demonstrate a dimensional shift in beliefs as compared to a control group who did not explicitly reflect on epistemology. This mixed method study utilized Schommer-Aikens’ (1990) epistemological belief questionnaire and semi-structure interviews. Both were conducted as pre and post measurements. The intervention was written reflective statements about student personal epistemology. The authors found this supported change of PSTs epistemic beliefs.

Phase 2 of this project was conducted by Stacey, Brownlee, Thorpe, and Reeves (2005). These researchers considered belief changes through a semester long course that considered research methods. During phase 2, students demonstrated an increased level
of sophistication in their epistemic thinking as it concerned Schommer’s dimension concerned with a belief that learning is supported by innate ability as opposed to ability gained through effort. Stacey et al.’s (2005) study participants demonstrated that effort was supportive of growth rather than reliance on learning abilities that are held innately. Epistemologists have argued that beliefs about these abilities fall outside of a strict interpretation of epistemology concerned with beliefs about knowledge and knowing (Hofer & Pintrich, 1997).

Phase 3 considered the integration of curriculum concerning certain dimension of knowledge through a mixed method study focusing namely on the structure of knowledge. This study used qualitative data from field journals and open-ended questions. Additionally, quantitative data was useful for measuring change using an Epistemological Beliefs Survey (EBS). This project considered epistemological beliefs as characteristics that are stable over many contexts (e.g., domain-general). These generic characteristics are studied as an aspect of social construction (as cited in Hofer, 2004), rather than stages, alongside a paradigm of epistemic development. The authors found that modeling personal epistemologies across collaborative practice, through four introductory courses in an early childhood teaching program, while engaged in explicit reflection was useful in supporting teacher candidates to develop more sophisticated views of knowledge. The reader will recall, the dimension that considers the structure of knowledge, expressed by Schommer, and found in Brownlee et al. (2011a) study can also be found in Hofer’s (2001) framework. The authors noted a “sophistication of epistemological” thinking was greatly enhanced and confirmed a more nuanced understanding amongst study participants that knowledge is connected and integrated
(Brownlee et al., 2011a, p. 481). Therefore, Brownlee et al. (2011a) concluded that development of personal epistemology was a promising direction for teacher preparation.

Despite evidence of the usefulness of epistemology for learning, as well as learning about teaching, it is not yet widespread practice to link personal epistemology to curricular goals in teacher education programs. Hofer (2001) first made this suggestion as she stated, despite the conceptual clarity and “evidence of its importance” it often “is not typically part of a teacher preparation curriculum” (p. 354). Brownlee et al. (2011a) reiterated Hofer’s (2001) point, sharing that the use of personal epistemology in teacher education is a developing concept.

**Epistemic climate.** Research suggests certain knowledge beliefs are activated dependent on the learning engagements and the knowledge demands found in particular environments (Feucht, 2008; Baxter Magolda, 2004; Hammer & Elby, 2002). Feucht’s comprehensive literature review on the epistemic underpinnings of instruction in elementary education helped to conceptualize the *Educational Model of Personal Epistemology* (EMPE) to explain the concept of *epistemic climate* (see Figure 1). The term is defined as the reciprocal nature of epistemic beliefs among “epistemic factors (e.g., math problems and news commentary) and processes (e.g., problem-solving and school education) that interact and influence a person’s epistemology” (Feucht, 2010, p. 57). These beliefs can be expressed in the form of messages about knowledge being sent and received amongst the various actors and resources in a learning environment. *Epistemic messages* refer to the “knowledge representations” expressed by the curricula and curricular resources, personal knowledge beliefs of instructors, and embedded in the instructions they offer to students. These messages contain fine-grained knowledge
sources (i.e., Hofer’s (2001) dimensions: stability of knowledge, structure of knowledge, sources of knowledge, and justification of knowledge). This influence also can be found in operation in a teacher’s instructional practice. An example can be illustrated through the epistemic messages embedded in curriculum. These messages also are conveyed through environmental factors (i.e., instructional materials) to influence personal epistemology. The notion of epistemic instruction is concerned with the messages of an epistemic nature being sent through educational materials and teachers. Feucht (2010) explained the approach by which a teacher presents certain course content can send a message about the expectations of a lesson or project. For example, a teacher can establish the level of choice for a learning engagement within a wide or narrow set of boundaries. At other times, the teacher-influenced options appear open-ended, but in actuality presents an engagement that narrow parameters. This can be present in both materials and messages offered. In this scenario, the teacher may reduce opportunities for creative and critical thinking by the learner.

Figure 1 *Educational Model of Personal Epistemology*
Figure 1. This figure can be explained as follows: The bi-directional nature of the solid black lines indicates the reciprocal influence shared between epistemic messages sent and received through instruction, the learner and knowledge representations. The dotted lines in the middle of triangle indicate that the teacher’s personal epistemology influences each of the epistemic factors noted on the model that make up the concept of epistemic climate. The solid black lines and the dotted lines, taken together, showcase the reciprocal nature of all four concepts illustrated on the model. From “Epistemic climate in elementary” by F. Feucht, in L. Bendixen & F. Feucht (Eds.), Personal Epistemology in the Classroom (p. 59), 2010, New York, Cambridge University Press. Copyright [2016] by Cambridge University Press. Reprinted with permission.

Feucht (2011) theorized that his conceptualization of an EMPE model for understanding personal epistemology does not recognize a stage-like development (e.g., Perry, 1970; Kuhn, 1999; Hofer, 2001). This is due to the influence of the classroom climate which is found to be unique dependent on the beliefs about knowledge held by the students, teacher and knowledge representations in the classroom (Feucht, 2011). The concept of epistemic climate can serve to function as a way of thinking about the contextual factors that influence, and allow or disallow, our beliefs to become a reality. In this manner, the notion of epistemic climate operates tacitly in Hammer and Elby’s (2002) resource model for understanding personal epistemology (Feucht, 2010). Following Hammer and Elby’s construct (as cited in Feucht, 2010) “epistemic climates can differ according to the subject-specific content knowledge to be learned” (p. 84). Therefore, the climate will vary according to the subject taught and the knowledge beliefs of the students and teachers. Feucht (2010) offers the example of a history class considering knowledge as “uncertain and subjective” and a science classroom offering knowledge as “certain and objective” (p. 84).

Implications for Research. Research on the contextual nature of beliefs recognizes the need to engage in research in the context in which practice occurs. Skott
(2015) pointed out, in a meta-analysis of teacher research on beliefs, when a researcher is conceptualizing a study in order to understand teacher belief, it is necessary to consider the binary of the individual and the environment, as opposed to studying individual beliefs in isolation from the environment in which the belief is expressed. Skott (2015) stated, “This shift entails changing the unit of analysis from individuals’ beliefs, and acknowledging the significance of context, and focusing on some understanding of person-in-practice” (p. 26.) In other words, a more effective technique to understand beliefs would be to study the individual in an authentic environment as opposed to reliance on survey instruments and decontextualized research strategies. Skott advocated for some form of participatory research for this to be accomplished, however the nature of dissertation process will prevent this from occurring. Therefore, a case study will provide a pragmatic method of inquiry as it allows for understanding a phenomenon in the context in which it occurs.

Skott’s (2015) general definition of a teacher belief is constructed in a manner to allow a theoretical space for Feucht’s (2015) concept of epistemic climate. As stated previously, Skott (2015) pointed out that beliefs are a product of the “results of substantial social experiences” and “have significant impact on one’s interpretations of and contributions to classroom practice” (p.19). Skott’s notion of “significant impact” can be found in when teachers engage in working through classroom dilemmas, critical thinking, and engagement in decision making (p. 19). Each of these has been demonstrated in research on epistemology as useful in supporting sophisticated beliefs (Kuhn, 1999; Tillema, 2011).
The “social experiences” that Skott referenced are outlined in the EMPE model where the underpinnings of pedagogy and curriculum design contain assumptions in operation that directly refer to knowledge and reality when expressed through knowledge representations and instruction (Feucht, 2010). These assumptions also can be manifest in personal epistemology (Feucht, 2010). It will be necessary for this study to clarify how epistemic beliefs, in particular, function in how teaching and learning are understood and interpreted by novice practitioners. Therefore, in this study, enacted beliefs about learning and teaching practice will be documented as they are demonstrated in the framing of instructional thinking through interviews. To ascertain beliefs that are evident in practice, this study considered teacher’s personal epistemology as found in video of instructional practice as a secondary source of data. Feucht (2010) noted that not all aspects of the EMPE model are often documented in a single study, nor has the model been empirically tested, and this is not the goal of this inquiry. Rather, the model was utilized as a guiding lens to develop interview questions that target epistemic messages found in situated practice. Consequently, it is reasonable and practical for the concept of the learner’s epistemology (i.e., children), as outlined on the EMPE model, to not be sought due to the implications of research on this sensitive population.

Part 4: Laboratory Schools, Policy Challenges, Epistemic Development

Laboratory Schools Defined

McBride, Groves, Barbour, Horm, Stremmel, et al. (2012) articulated the mission of the contemporary laboratory school as “child development laboratories” (p. 158). The authors stated,
Child development laboratories are defined as campus-based units that provide part-day or full-day early childhood programming for young children while at the same time addressing one or more of the missions associated with an academic program, including research, teacher training, or outreach and dissemination. (McBride et al., 2012, p. 155)

This concept recognizes the laboratory school as instrumental in the development of knowledge for informing social and educational policy, all the while offering a service to teachers, researchers, families and communities. An assumption underpinning this definition is that the research that is conducted in a laboratory ultimately supports the child. McBride et al., pointed out the laboratory school can take a variety of forms. These include all types of centers for higher education (e.g., community college to doctoral programs) and advanced learning (e.g., professional development and technical schools).

**Importance and value.** The university laboratory has historically been important in the development of scientific understanding of child development (Barbour & Elicker, 2012). The early part of the 20th century witnessed the proliferation of almost a dozen *Child Welfare Research Institutes*. The unique value of these first laboratory schools was centered on a concern for raising a child in modern society and supporting research to influence policy on the social development of children and families (Barbour & Elicker, 2012). This research informed both child rearing and pedagogical practice (Barbour & Elicker, 2012).

John Dewey, arguably the most influential educational scholar of the modern era, whose educational thinking can be found supported in many philosophies and schooling models today, developed one of the first laboratory schools (Knoll, 2014). Dewey’s
ideals were first enacted in the *University Primary School* (1896-1904), later termed, *The Laboratory School of the University of Chicago* (Knoll, 2014). Dewey’s philosophy was unique in that it placed the child and his or her experiences at the center of learning engagements (Knoll, 2014). This philosophy, now termed a *child-centered* form of learning, as opposed to *teacher-centered* methods of instruction, can be found in models of early childhood education today.

One such approach that reflects Dewey’s vision of early childhood education can be found in the municipal schools of Reggio Emilia, Italy (Gandini, 1993). These schools are developed through close observation and documentation of children’s interests, development, and thinking by their teachers (i.e., pedagogues). Children’s inquiries guide the learning experience as grounded in Dewey’s philosophy. The efficacy of reflection on practice requires recognition of its value toward personal and professional growth. This concept has become widely recognized as *reflective practice* and has taken a prominent role in teacher training (Boucenna & Charlier, 2013). As such, a pillar of the Reggio Emilia philosophy that is embodied in the laboratory setting is the placement of high value on critical reflection, especially gained through dialogue (Gandini, 1993). Therefore, the use of a reflective theoretical perspective in this inquiry is appropriate as a design feature on ontological, epistemology, and methodological grounds.

From a separate starting point, the physical environment of the modern laboratory is particularly suited for research. It is purposefully built with observation rooms and audio and visual recording equipment (Clawson, 2013). McBride et al. (2012) noted the advantages for research through the recording of classroom interactions and discussion. A call for video recording of practice has been made for research to gain a nuanced
assessment of personal epistemology as well (Brownlee et al., 2011a). The laboratory school teacher is unique in that she is often conceived of in terms of a teacher-researcher. McBride et al. (2012), define this role in the following manner: “Teacher research is practice-focused inquiry in which teachers, students, and often children engage collaboratively in systematic and intentional inquiry into problems of meaning” (McBride et al., 2012, p. 158). This is a salient point in that settings that support engagement in reflective practice, inquiry-based learning, and critical thinking through dialogue are supportive of sophisticated/epistemic development. Nearly a century after the first laboratory schools opened, their contemporary counterparts can serve to support understanding PSTs development of teaching and learning through the unique experiential learning engagements offered (McBride and Barbour, 2003).

**Policy Challenges to Innovative Forms of Pedagogy**

The laboratory school provides a setting for teacher learning that shares similarities and differences with alternative modes for in-service practicum teaching assignment. This is typically termed a field-based placement where a student teacher is assigned to a general classroom in a private or public-school setting alongside the classroom teacher. The similarities of the lab school and the classroom setting found in a traditional teaching practicum assignment are in providing an authentic setting for teaching and learning. This point has been highlighted as a strength in the design of learning about the complexities of teaching (Loughran, Korthagen, & Russell, 2013; Darling-Hammond, 2006). In this section, literature on the challenges to implementing a constructivist form of practice and the potential for the laboratory school to develop evaluativistic thinking will be offered.
Public policy has been referenced as a constant pressure on reform minded educators that work against implementing a form of social-constructivist theory (Windschitl, 2002). However, the urgency of documenting and proving the worth of epistemic beliefs for use in teacher education through the laboratory school environment is reaching a critical juncture with the rapid onset and subsequent removal of the U.S. Department of Education’s regulations toward reform of teacher preparation at over 20,000 teacher-preparation programs in the United States (Sawchuck, 2014). Changing regulations that once sought to improve accreditation models to hold universities accountable for program outcomes, such as employment rates are in constant flux with each U.S. Presidential administration (Iasevoli, 2017). Critics contend regulations on teacher education programs will be problematic because of the contextual and conditional nature of schools where program graduates will find employment (Weingarten, as cited Sawchuck, 2014). Others see regulations as an important move to repurpose the accountability movement in the United States for using student test scores to rate teacher preparation programs, along with the problematic implications that are documented using value added measures (Pringle, as cited in Sawchuck, 2014). These developments may suggest that the teacher educators who guide PSTs, no matter the setting, might be under pressure to conform to traditional practices that are enacted in schooling models in the larger society (Grossman, 2005).

The Potential of Evaluativistic Thinking in a Laboratory School

The nature of a laboratory course sequence for teacher training lends itself to the benefits noted in a situated learning experience or an experiential learning engagement (Lave & Wegner, 1991). This learning experience is embedded in an authentic social
context, opposed to learning about pedagogy and child development through university classroom based experiences such as reading and discussion. Further, conducting research in this context answers the call from epistemologists to engage in authentic teaching and learning environments (Feucht, 2010).

The academic setting of a laboratory school is unique in that it allows teacher candidates to engage in social constructivist pedagogical practices (i.e., inquiry-based methods, autonomy supportive case studies, reflective engagements) that have been documented to be supportive in the development of increasingly sophisticated beliefs about knowledge and knowing (Kang, 2008; Schraw, 2011; Tabak & Weinstock, 2011). Further, the laboratory that frames the boundaries for this case supports student teachers learning about the benefits of a negotiated curriculum (i.e., student-centered inquiry as curriculum), as well as Reggio Emilia inspired elements. These experiences challenge the assumptions about teaching and learning that are often held by the PSTs and teacher educators about what pedagogical practice should resemble in schools (Oliver & Oesterreich, 2013). This site also was selected based on research that illustrates that the type of experiences in teacher education programs affect personal epistemology (Joram & Gabriele, as cited in Schraw, 2013). It has been suggested in the literature that beliefs have the capacity to develop within academic domains, and developed in relation to “the relative sophistication” of the content studied (Schraw, 2013, p. 13). Learning about inquiry-based methods has been argued as a complex form of pedagogical content that not only requires a depth of understanding but a depth in sophistication concerning epistemic beliefs (Patchen & Crawford, 2011). Sophisticated beliefs have been found in individuals who engage in critical thinking (Hofer, 2001; Kuhn, 1999), autonomous
decision making (Weinstock & Roth, 2011), and useful for practicing teachers to support
democratic ideals in education (Brownlee, Scholes, Walker & Johansson, 2016).

**Literature Discussion and Contribution**

There is a robust research tradition to draw literature from for understanding the
importance of beliefs about knowledge and knowing as it relates to learning as well as
how epistemologies relate to teaching in general. Further, the above studies contribute to
a body of evidence that suggests that beliefs influence the learning of PSTs in teacher
programs. Additionally, these studies contribute to the importance of how the
development of evaluativistic personal epistemologies are supportive of curricular goals
in teacher education programs and constructivist views of knowledge as well as the role
of the teacher as a facilitator in the classroom.

According to this review of literature, the reader can understand the valuable role
that the laboratory school environment has in the development of PSTs epistemic beliefs,
and improved learning outcomes for prospective teachers in innovative methods of
instruction. This review suggests a critical gap in the field of epistemology through lack
of documentation of PSTs epistemic beliefs in a laboratory school environment.

This research will support the development of a profile of PSTs’ knowledge
beliefs. This profile will be useful for teacher educators to understand a sample of pre-
service teacher’s knowledge beliefs as they are contextually expressed in a laboratory-
learning environment that supports inquiry methods for teaching and learning. This
information can be useful for the academic community, including researchers and teacher
educators, who work alongside teacher candidates in situated practice. This profile can be
useful to learn from and recognize how epistemic thinking by teacher candidates in early childhood education may inform and interpret practice.
Chapter 3: Research Design

This chapter provides an overview of the research design. It first presents the research paradigm and then proceeds to outline the methodology of the study. As such, the exploratory case study approach and tradition is described. The plan for data collection methods and procedures, as well as analysis and interpretation of the data follows. It concludes by addressing the safeguards to privacy and the care taken to ensure the ethical treatment of participants in this study.

Purpose of the Study

The intent of this case study was to explore and document (a) what epistemic beliefs PSTs can call to attention, (b) and what epistemic beliefs do PSTs enact in situated practice. These beliefs were contextualized within an early childhood laboratory school associated with inquiry-based methods for teacher education.

Research Questions

The research questions for this study are as follows:

1. What are PSTs’ epistemic beliefs about instruction in an inquiry-based laboratory school?
   a. What are PSTs’ espoused epistemic beliefs about the dimensions of knowledge and knowing about instruction in the inquiry-based laboratory school (i.e., structure, stability, source, and justification)?
   b. What are PSTs’ espoused developmental levels of epistemic understanding about instruction in an inquiry-based laboratory school (i.e., absolutist, multiplist, evaluativist)?
c. What are PSTs’ *enacted* developmental levels of epistemic understanding about instruction in an inquiry-based laboratory school (i.e., *absolutist, multiplicist, evaluativist*)?

**Research Paradigm**

This study is interpretivist in nature as it seeks contextual understanding of a phenomenon and recognizes that knowledge is gained through social constructions of reality (Creswell, 2009). The research questions in this study require assessment of an individual’s personal epistemology reflective of what an individual believes (e.g., the content of beliefs) which is better served by a combination of inductive and deductive method of analysis using an established theory as a lens to illuminate beliefs. This is true regardless of the fact the framework for understanding personal epistemology that I have chosen to situate and analyze the data (e.g., Hofer, 2001; Kuhn, 1999) allows for conceptualizing beliefs as socially constructed and context bound. Despite this fact, this study is not focused on how PSTs make meaning (e.g., the structure of meaning making) which would benefit from a phenomenological or grounded theory approach that would primarily rely on inductive analysis of the data to allow new perspectives to emerge. Rather, in this study an inductive approach will be useful for keeping an open-mind toward the data and considering any gaps that this study finds in the analysis based on empirical material. This is important to note, as Alvesson and Skoldberg (2000) highlighted, the fact that what is deemed truth in empirically verified research should be subject to scrutiny upon presentation of new evidence for the reason that:

Limited aspects of a phenomenon lend themselves to being illuminated in a particular study. Interpretations of the phenomenon thus require much more than a
body of well-defined empirical material which rarely addresses social context as well as meaning/consciousness on an individual level. (p. 134)

In other words, the context that surrounds a study forms a boundary of sorts that will determine what may or may not be found using a certain conceptual lens.

Given the nature of the dissertation timeline and through efforts to gain construct validity, the linear organization of a technical rational design is necessary where the methods and theory are decided at the onset of the study. In this study, a process that favors exploration over use of an a priori hypothesis is sought. Therefore, an interpretivist/constructivist perspective is more appropriate to address this study’s research questions, rather than a conceptual preference for a critical perspective through participatory methods as a guiding paradigm. This conceptual lens recognizes the value of teachers’ developing their own understandings of practice through personal practical knowledge (Connelly & Clandinin, 1996/2013). As a researcher, I remain mindful of the nature of an interpretivist stance that the study’s methodology requires.

Qualitative design is useful in social science research for providing a systematic way to examine, interpret, and explain the conscious experience of individuals (Ponterotto, 2005), while quantitative research has been established in the natural sciences for collecting quantifiable information to establish cause and effect or to describe and explain a relationship (Creswell, 2009). Qualitative and quantitative methods for research design have been argued on epistemological (e.g., what is the nature of knowledge to the knower and what is to be found?) and ontological (e.g., what is the nature of reality?) grounds as not occupying contradictory positions, but rather each providing a separate logic for knowledge development (Guba & Lincoln, 2005). As such,
each paradigm has been recognized to have distinct value and resultant limitations. This section will illustrate how the research design required for this study is fundamentally qualitative in nature, while the validity for data collection and analysis of this project will be strengthened, in part, by utilizing commonalities from the two major paradigms. Therefore, this research will benefit from the long-recognized ability of quantitative design to lend scientific rigor in the collection and analysis phase of qualitative work (Jick, 1979). The constructivist/transformative perspectives of the researcher will be noted alongside their practical application in this study.

Different ontologies are suited for different methodologies (Burrell & Morgan, 1979). This research calls for an emic (insider) perspective (Ponterotto, 2005) to gain data from participants’ thinking and reflection. Qualitative research is useful for gaining a deeper understanding of a phenomenon being studied from an emic perspective.

Documenting the epistemic beliefs that PSTs can call to attention in the laboratory school can enrich understanding of how the initial teaching experience, and the ability to learn about teaching are supported or hindered when engaged in constructivist methods.

Applying a qualitative method is appropriate for documenting how epistemic thinking influences how a teacher approaches instruction, because discerning the experience of another’s reality is not suitable through reflection on experimental methods where manipulation of variables is utilized in controlled settings to determine causal processes. Rather a constructivist perspective is necessary to acknowledge, “reality is constructed in the mind of the individual” (Hansen, 2004, p. 129). This perspective allows for recognition that reality may be experienced differently for each individual as it is constructed through experience, culture, and context (Hofer, 2008). Therefore, this
epistemological and ontological position is useful for allowing for interpretive possibilities (Alvesson & Skoldberg, 2000). A constructivist design is particularly suited to document beliefs that are expressed through language and found in natural occurring settings that have been not manipulated by the researcher (Maxwell, 2005).

A quantitative approach would not be expedient in gaining the story of research participants. For example, an analysis that would seek to statistically enumerate traits that can be noted in a teacher candidate’s experience would not fulfill this study’s purpose to determine what epistemic beliefs a PST espouses and enacts. Rather, this will require nuance by the researcher to draw out and unpack a participant’s words and actions. Further, if neuroscience allowed researchers to gain knowledge of the cognitive process that occurs biologically in the formation of beliefs, this method would be deficient as the perception of the conscious experience is influenced by subjective factors (i.e., culture, teacher training, peer influence) that only may be revealed through language about experience. An empirical study will allow the research community to understand the kinds of knowledge beliefs that can be articulated and are evident in practice. This combination of data will produce findings objectivist in nature necessary to make productive use of data gained on the subjective experience of individuals.

Collection of empirically justified data can be supported through the adoption of qualitative content analysis to allow for certain shared constructs from quantitative research (Kohlbacher, 2006), thus strengthening the logic of the design, but remaining fundamentally qualitative in nature. Content analysis is a method for handling recorded data. An oft quoted rationale by Mayring (2000) has noted its use in preserving “the advantages of the quantitative content analysis” through “improved qualitative-
interpretive steps of analysis” (p. 50). This is accomplished through use of a theory-guided approach to text analysis by support of a category system. The logic of this approach will be further clarified in the research approach and design phase of this study.

**Research Approach and Tradition**

Case study was used as a research strategy useful for developing perspective into aspects that occur in a specific context (Merriam, 2008). Therefore, the context specific nature of personal epistemology is especially suited for use of the case study method (Hammer & Elby, 2002; Feucht, 2010). The term *case* is an analogy for the delineated boundaries that frame the collection and analysis of data for understanding an aspect or aspects of a contextual phenomenon (Yin, 2009). The developing nature of case study design makes an agreed upon definition elusive, with Stake (2008) defining case study through an “interest in individual cases, not by the methods of inquiry used” (pp. 236–237). While Yin (2009) shifted the focus on case study design to the nature of the circumstances in which the research method is to be used, as well as placing an importance on itemizing the data collection methods.

In the absence of a unified definition, a broad agreement can be made on the basic function of a 'case' is in defining a unit or “bounded system” that will simply determine what will be studied (Stake, 2005, p. 120). The boundaries of a qualitative case study may be an individual(s) or institution(s) and “the contextual features that form a relationship between the two” (Hood, 2009, p. 68). There are many practical considerations that determine the scope and methods necessary to answer a particular set of research questions. This section will illustrate how case study supports these questions and the conceptual needs that underpin this study. This section concludes with an
operational definition provided by Yin (2009) necessary to demonstrate a rigorous plan and support the development of a credible case report.

Elements of an exploratory case study design utilizing qualitative content analysis (Mayring, 2000/2014) emerged as appropriate resources for this study in serving both pragmatic, as well as methodological concerns. The epistemological choice of the sponsoring university’s Professional Studies department allows for an objectivist view or constructivist view of the researcher to accurately comprehend the researched; therefore, the choice was a pragmatic one. From a methodological standpoint, a case study will support a constructivist perspective for the project design, data collection, and the analysis of the data as guided by the research questions (Yin, 2009).

Duff (2008) clarified the role of using case study research alongside teachers and students, specifically in the field of linguistics. Duff (2008) stated that the case can be centered on the “behaviors or attributes of individual learners” (p. 34). These cases can be selected on the bases of certain characteristics such as “psychological, linguistic, institutional, sociocultural, or biological” factors (Duff, 2008, p. 34). In contrast, Stake’s (1995) earlier work pointed out how the individual can be a case, but the individuals’ practice “probably lacks the specificity, the boundedness to be a case” (p. 444). This inquiry acknowledges the importance Stake (1995) places on seeking a “specificity of engagement” in practice through consideration of both “psychological” (PST beliefs) and “sociocultural” (ECE laboratory school) aspects (p. 444).

Case study is conceptualized as a research strategy that allows for a pluralism of methods, as the design is not prescribed (Yin, 2009). Therefore, elements of an exploratory and descriptive elements can be linked in a compatible and complementary
manner (Yin, 2009). The nature of the method requires enormous amounts of data to be collected (Eisenhardt, 2002); therefore, it is important for the novice researcher to prove the data was collected and analyzed in a manner necessary to establish credible findings (Yin, 2009). The use of an outside theory (e.g., personal epistemology) to filter data collection and analysis can serve this purpose (Yin, 2009). However, this view is at odds with an exploratory case method and is more fitting for use in a descriptive approach where a “reference theory” is utilized to filter the data collection and analysis (Scholz & Tietje, 2002, p. 12). Alternatively stated, this study will not be descriptive in the sense it will be theoretical, but it will be guided by a theoretical framework before any data has been collected (Merriam, 2008, p. 38). Rather, the driving factor in case study method, and qualitative research (Maxwell, 2005), is a recognition that each unique set of research questions, and unique research problem and context (Maxwell, 2005), require their own unique design (Yin, 2009). In this project, the research questions are framed as “what” questions and, therefore, provide “a justifiable rationale” for exploratory research (Yin, 2009, p. 9). Further, the nature of the intervention does not have a single set of possible outcomes and, therefore, is exploratory in nature (Yin, 2009).

The act of clarifying the case in question required a determination if a single case or multiple case study was necessary. This project required data collection from one research site, however the participants were engaged in teaching and learning in multiple classrooms within an Early Childhood Education facility. Given that it has been noted in the scholarly literature as productive for use of a multiple case analysis if epistemic beliefs are to be considered across classrooms (Feucht, 2010), further consideration was necessary to determine the best design. A conclusion was reached based on reflection on
the intent of this study to explore the beliefs that are salient at the research site. Secondly, the nature of this study’s primary research question required the primary unit of analysis to be at the group level. Therefore, a single case design was appropriate.

The definition of a case also required determining if a holistic or embedded nature is appropriate (Yin, 2009). The scope of data collected in a holistic view of phenomenon is narrowed to single units of information. In contrast, an embedded design seeks multiple resources for data using at least two units (i.e., main units and sub-units) (Yin, 2009). This case was bounded by time, location, and the personal epistemology of PSTs found in three unique classroom environments situated in one laboratory school. As the primary research question concerned a holistic analysis across PSTs beliefs, it was not necessary to treat each classroom as a separate embedded case. Therefore, results are first reported at the individual level to answer this study’s sub-questions and analyzed holistically across the participant level to answer the primary research question. The main unit in this design was the overall epistemic beliefs that are made evident by PSTs in one laboratory school course. In the absence of a comparison group this case study presents a single holistic case study.

Kohlbacher (2006) has noted the use of qualitative content analysis (QCA) as useful in case study design to manage the data collection and analysis. This design allows researcher subjectivity to be checked through use of “well-defined” concepts that will serve to “comprehend the research participant’s psychology” (Ratner, 2002, p. 1). In this manner, the meaning units (i.e., words chosen to draw out meaning) developed and itemized in the study’s design protocol helped to empirically ground interpretation of the data (i.e., deductive) with an established theory (Hofer, 2001; Kuhn, 1999).
The case study definition necessary for this research is provided by Lin (2009) as an empirical study that allows for: (a) an investigation of a phenomenon within the context it occurs, (b) for data collection and analysis from multiple sources to be filtered through existing theory, and for (c) data to be gathered in a triangulated fashion. In this project, these requirements are centered on the substantive issue of exploring the epistemic beliefs that are most salient for PSTs in a setting for teacher training advocating for inquiry-based methods, and to describe how these beliefs may support understanding how PSTs can reflect upon teaching and learning in this context.

**Design of Study**

This exploratory qualitative study utilizes a single case with embedded units. The rationale for a single case was to support an in-depth analysis of the epistemic beliefs found within the context of a laboratory school that utilizes inquiry-based methods. The single case design allowed for analysis of data in sub-units at the individual level with a cross-case analysis that considers data across these subunits. This design was useful to detail each PSTs epistemic beliefs about teaching and learning as well as the beliefs found across the whole group. This group was considered the main unit.

The sub-units consider data at the individual level. The research questions required consideration of the participants “espoused theory” or assumptions about the self (Argyris & Schon, 1974). The contextual influences surrounding the research participants were considered as it related to these questions as well (i.e., enacted beliefs in the laboratory classroom/facets of the environment that lend themselves to action or inaction of certain beliefs). Each of the sub-units represented an individual person training in one
specific teacher education course. These individuals shared a common condition of learning in the situated environment of the ECE laboratory school.

The cross-analysis of the sub-units was helpful to determine how the PSTs epistemic beliefs are similar or different. Specifically, analysis of the sub-units served to explore whether PSTs experiencing the same curriculum, and engaging in a practicum with peers and pupils engaged in a similar experience, illustrate and express similar dimensions and developmental levels of knowledge beliefs. Each sub-unit analysis showed how individual PST reflection supports the maturation/development of these beliefs. The eight individuals who participated, and had a complete data set, were collectively considered the main case. The cross-case analysis considered a range of similar and contrasting perspectives from each individual sub-unit to support a single case finding. This was useful to as it concerned “the precision, the validity, and the stability of the findings” (Miles & Huberman, 1994, p. 29). Hammer and Elby (2002) articulated this method as providing an in-depth understanding of a small group of individuals rather than a shallow understanding of a large group.

**Limitations**

The study is constrained to eliciting participants from a population found in a unique research site. More specifically, participants in this study were from three (out of a total of five) experiential classrooms for a one semester long course within a larger facility for teacher training, and therefore are potentially not representative of the beliefs found in the entirety of the teaching program. In addition to the unique context, the formal dissertation process favored the case to be prebound. This means that the boundaries of the case were determined before the study commenced. These limited
certain aspects of a constructivist perspective that might have prevented changes to the theoretical framework and the boundaries of the case as the data was collected and analyzed (Maxwell, 2005). These factors contributed to a population size and method of inquiry that does not warrant results that are generalizable or statistically significant. The case study method accounts for this by not placing a premium on generalizable findings, but instead seeks two alternate goals: to “expand and generalize theories (analytic generalization) and not to enumerate frequencies (statistical generalization)” (Lin, 2009, p. 15). However, the exploratory nature of study did not seek to serve the goals of expanding and generalizing theory. Rather, it served to “demonstrate existence” about certain epistemic beliefs that pertain to teaching and learning (Starke & Strohschneider, 2010, p. 2). However, a thick description of the context will be offered below in order to allow for individuals in their own unique contexts to make judgements about the transferability of findings (Lincoln & Guba, 2000).

**Research Site**

The research site that was chosen is a university laboratory school. Since the study of personal epistemology relates to the concept of learning it has historically involved the study of college students (Hofer, 2004). More specifically, the laboratory school serves an important role in offering an experiential learning opportunity for teacher pedagogical development (McBride and Barbour, 2003).

The context of this research is a university course for education majors seeking a baccalaureate degree in Early Childhood Education (ECE). This upper-level course (i.e., third year students) offers a field-based or situated learning experience in a child development laboratory (McBride et al., 2012). The modern-day laboratory is defined as
“campus-based units that provide part-day or full-day early childhood programming for young children, including research, teacher training, or outreach and dissemination” (McBride et al., 2012, p. 155). While engaged in this course, pre-service teachers are placed in one of three pre-school classrooms or one kindergarten classroom housed at the laboratory school.

According to the mission statement, displayed prominently upon entrance to the facility, the center places a high value on inquiry-based methods and social constructivist learning principles. This philosophy is expressed through “Reggio Emilia inspired elements” as outlined by educators “Rinaldi and Malaguzzi” (personal communication, laboratory school director, October 20th, 2016). In this study’s literature review, the ideas found in the municipal schools of Reggio Emilia are described in detail as it relates to the laboratory school, however, in brief, the course that is the object of this study supports the tenets of critical thinking and the development of reflective practitioners for learning about children and the decision making entailed in teaching and learning (personal communication, laboratory school director, October 20th, 2016). According to the course syllabus, this is done through a variety of modes which include developing and enacting a student-centered curriculum, documentation of child learning, documentation of children’s inquiry-investigation, conducting action research, and engagement in collaborative discussion. This dialogue occurs amongst teaching peers, course teaching mentors, and pedagogues about matters of curriculum and instruction.

The course is noted as being “cumulative in nature,” meaning that all prior learning experiences provided through the program are expected to be practiced in-situ (personal communication, laboratory director, October 20th, 2016). This translates to a
host of educational pedagogies, strategies and methods being supported. The philosophy of the center, conveyed through the mission statement, the physical space, the laboratory director, and the course syllabus, conveys the notion that developing personal practical knowledge through situating learning in student experience are valued. These same principles can be found embedded in the objectives for the student teaching experience which closely follow the National Association for the Education of Young Children’s (NAEYC) Pre-professional Standards (see Appendix F: NAEYC Standards). When considered collectively, the objectives of this course and the philosophy espoused in the ECE laboratory school support a reflective theoretical perspective on ontological and epistemological grounds.

**Participants**

Eight teacher candidates participated in this study. Each was enrolled in a four-year early childhood education certification program serving students from birth to eight. The pool of teacher candidates drawn from for this study represents a narrow homogenous sample, but is representative of the predominantly female and Anglo-Saxon origins of teacher education candidates who attend a medium sized public university in a Midwestern state. The parameters used to define a qualified volunteer research participant were as follows: (a) He or she is enrolled in the Early Childhood Education Program; (b) He or she has completed a methods course in the teacher education program in the Spring of 2015 and has completed the general survey courses required for a bachelor’s degree in education; (c) Individuals will have obtained the credits necessary to reflect the status of a junior at the university level; and, (d) He or she was enrolled in the
laboratory teaching experience offered in the Fall of 2016. (e) He or she was familiar and comfortable with the laboratory teaching experience at the time of the study.

Polkinghorne (1989) suggested maximum variation sampling is the preferred method. This requires the research participants to have shared a common experience but vary in demographic characteristics as much as possible. However, due to the unique context and limited number of participants, a wide variety of demographic criteria was not gained. Therefore, a convenience sampling logic was used (Creswell, 2012). This was done through the selection of all individuals who were willing to participate in the study. The study gained two entire classroom groups of PSTs consisting of two teachers in kindergarten and four teachers who taught in a preschool classroom serving 4 to 5 year old students. The make-up of each classroom group was determined by the organizational logic of the laboratory school director before the course began (i.e., five classrooms).

Three additional teachers were included from two additional preschool classrooms also serving 4 to 5-year-old (n=2) as well as 3 to 4-year-old (n=1) students, however a complete data set from one participant was not gained making the total number of participants who completed the study (N=8). These participants consisted of two males (25%) and six females (75%). This quantity exceeded the five participants noted by Yin (2009) as the minimum necessary to achieve saturation size for a case study.

**Recruitment and Access**

Research participants were sought through the assistance of the program director at XXXX Center for Early Childhood Education. A letter was sent to the director, electronically, to request permission to conduct research on the XXXX program on current teacher candidate experience. This permission to access letter outlines the
research rationale, goals, questions, methodology, and potential outcomes (see Appendix A: Permission for Access).

Once permission was granted and access gained, an informal group presentation of PSTs participating in the laboratory school was scheduled in November of 2016. There a broad overview of the study was presented and what it means to be a participant was explained (see Appendix B and C: Information Sheet and Telephone Recruitment Script). This session offered information concerning the aim of the study and any questions potential participants had about their participation were answered. At the culmination of this meeting, everyone was distributed an individual copy of a pre-fabricated note for gaining contact information in the event he or she was willing to learn more about the study and/or be a potential participant. On the first business day after the meeting, I contacted each willing participant. The consent process, interview time, and location was negotiated with any willing participants at that time. At the onset of the study process, consent forms were distributed and explained to each potential research participant (see Appendix D: Informed Consent). One copy of the signed consent form was retained for my records. Participants received an additional signed copy.

It was determined by NEU IRB that an additional consent form would not be required to obtain a video of instructional practice from PSTs. This determination was made based on the condition that no identifying information would be collected about any child that might be present or visible in the video. However, approval by the laboratory school director to access the research participants was sought, gained and shared with Northeastern University’s IRB.
Data Collection

The purpose of this study was to collect data that allowed for the exploration of the espoused and enacted beliefs of PSTs in the context of a laboratory school. Therefore, multiple forms of data were necessary (Yin, 2009). Interview data, as well as observation of video and audio recording of instruction suited the study’s context and goals. Data was collected during a two-week period in November of 2016 as the semester was concluding. The rationale for this data collection period allowed the student teachers to become comfortable with the planning and instruction process in the laboratory course, allowing the interview about epistemic beliefs to be contextualized. Secondly, it has been identified that the end of November allowed the PSTs to have developed a familiar routine in their small-group investigations (e.g., 2-7 pre-school students engaged in a lesson or learning engagement).

The epistemic nature of the interview questions was contextualized to be reflective of a setting for early childhood education. These questions required recording the meaning for participants “subjective understanding” of an experience (Schutz, 1967, as cited in Seidman, 2006, p. 11). As such, these questions required data collection through interviewing in a semi-structured format (Creswell, 2009). An interview protocol (see Appendix E: Interview Protocol) was utilized for administrative organization. Therefore, the protocol contained the contextual related questions that served as a reminder, and guide, during the semi-structured interviews (Yin, 2009). This protocol supported the collection of data necessary to answer the case study questions.

The duration of each interview varied between 40-60 minutes. These occurred within two weeks of a PST self-recording of a small group investigation. This allowed for
gaining continuity of beliefs between the PSTs teaching practice and the interview portion. King and Kitchener (1994) found that the personal epistemology of college students tends to shift only a half stage (using a developmental stage theory) over the course of their entire undergraduate experience. Therefore, research suggests it is unlikely for a PST to experience “epistemic development” within a two-week time frame (Bråten, Sandoval, & Greene, 2016, p. 502).

The interview structure sought the espoused beliefs of the participant and consisted of reflection on “the meaning of the experience” (Seidman, 2006, p. 34). As such, the interviews were geared towards identifying espoused epistemic beliefs. The researcher scheduled a meeting between weeks 13-15 during the 16-week term. The meeting was held at a time and place of convenience for the participants. The interview was recorded using a hand-held recording device.

A secondary source of data was provided from PSTs audio and video recording of instructional practice. A small group investigation (e.g., small group instruction 20-30 minutes in duration) was requested of participants, however four (n=4) individuals submitted a whole group lesson (10-17 children). Small group investigations are opportunities for PSTs to offer a lesson or play experience centered around a plan amongst apart from the larger classroom group. This instructional group usually consists of between 2-6 children. Video data of instructional practice was recorded by the participants in an on-going manner throughout the course, however this video was requested within a two-week after the interview for reasons noted above. The data used in this study were recorded by pre-service teachers using the laboratory recording equipment and collected from the participants after IRB approval (see Appendix B:
In summary, two data gathering methods were used within the two-week period allotted for data collection:

**Data source 1:** A video of teaching practice, as chosen and recorded by the PST, was recorded within a two-week timeframe of a small-group investigation or a larger group lesson. This video of practice was elicited from PSTs with a request to demonstrate a typical lesson conducted where enacted beliefs can be witnessed which was provided in this study as secondary source data.

**Data source 2:** A semi-structured interview (e.g., using open ended questions) explored pre-service teachers’ espoused beliefs. An interview protocol acted as a guide, offering questions that were scaffolded from domain-general beliefs to domain-specific beliefs concerning the early childhood education instruction experience.

**Data Analysis**

Data were analyzed using qualitative content analysis (QCA), a technique that supports a systematic development of inductive and deductive coding schemes. The analysis was supported by Atlas Ti (Version 1.6.0), a qualitative research software that provides tools for systematic coding and analysis of visual, textual, and audio data (Creswell, 2009; Muhr, 2004). Audio and video data were transcribed independently to analyze the data systematically. Video of instructional practice was analyzed by myself as secondary sources of data. The QCA method will be explained in the paragraphs below. Subsequently, it will be detailed how this method was used in this study supported by ATLAS Ti (Version 1.6.0).
QCA provides a rule-based format as articulated and scaffolded based on seven steps. Each of the steps are itemized below utilizing the language of Mayring (2014):

1. Concrete research question (relevance to praxis, eventually hypotheses, formulation and explication of preconceptions)
2. Linking research question to theory (state of the art, theoretical approach, preconceptions for interpretations)
3. Definition of the research design (explorative, descriptive, correlational, causal, mixed)
4. Defining of the (even small) sample or material and the sampling strategy
5. Methods of data collection and analysis articulated
6. Processing of the study, presentation of results in respect to the research question
7. Discussion in respect to quality criteria

(Mayring, 2014, p. 15).

This seven-step process is dynamic in the sense that the structure is not to be reproduced in a rigid manner. Rather, how each of the seven steps is actualized is dependent on the research inquiry. Mayring (2014) suggested that a broad theme-based question, such as ones useful for grounded theory, cannot be useful for this method. Therefore, a certain specificity was necessary in the articulation of this study’s research questions. Mayring’s (2014) reasoning is that “scientific progress” must be guided by prevailing assumptions about these questions (p. 11).

In the case of exploratory/descriptive research where a hypothesis is absent, as a condition of this study, Mayring posited the research can be guided by the “conception of a researcher-subject-interaction” (Mayring, 2014, p. 10). This occurs when the researcher articulates the method that guides the study. In this study, the research-participant interaction is guided by constructivist ideals to the extent that meaning was sought
through an approach and questioning style of the participants in an effort to diminish anxiety as far as possible to make the interview schedule appear to be more conversational than script. This was done in an effort to develop trust and build rapport to increase the quality of open, honest, and rich dialogue. However, the study itself follows a post-positivist approach, as articulated below, therefore a personal inclination toward a constructivist approach was constrained by administrative concerns articulated by Yin (2009) and Mayring (2014). This methodological positioning has been discussed at the onset of Chapter 3.

QCA is derived from the methodological insights gained from the processes of quantitative research, alongside the categorization of themes derived from texts found in qualitative paradigms (Mayring, 2014). A requisite of QCA is to place an established theory at the forefront of the study. As such the PEM framework (Feucht, 2011) served to guide the development of the research question(s), as well as the subsequent collection and analysis of data. This was accomplished through three methodological techniques for handling the data: summary, explication, and structuring. Each of these steps is articulated below as it pertained to this study.

**Summary.** QCA requires the transcribed data to be summarized (Mayring, 2002, 2014). The first step required a careful reading of each individual transcript. Next, a summary of each interview was created which effectively reduced the data to main points. This amounted to a generalized and “rough outline” of each participant’s account (Mayring, 2014, p. 64). This process was iterative in the sense that the complexity of the outline was increased as the data was analyzed deductively during the structuring phase noted below. Regardless, inductive reasoning was sought by noting a surprising trend in
the data first identified after initial analysis of the transcript summaries, but was not confirmed through subsequent review of the data (Mayring, 2014). The inductive finding was not confirmed after the deductive categories were processed through several times, therefore the presentation and analysis of the study findings were limited to deductive analysis as articulated in Chapters 4 and 5.

*Explication.* At this stage of the analysis the annotated material was reviewed. Open-coding began at this stage as the analysis progressed through each individual participant’s transcript. The first step was a careful rereading of the material. Here tentative categories were developed from meaning units based on the participant’s own words (e.g., “teacher”; “hands-on”, “Pinterest”). At other times, for the purposes of reducing the quantity of codes, a synonym was used to describe a concept located in the participants’ words (e.g., “experiential” was used for all responses stating the idea of “trial and error”). Next, I considered passages that were not clear enough for category development but seemed to have epistemic value. Here research memos were useful to clarify certain constructs related to the dimensional view of personal epistemology. This stage also was useful for considering specific language of the participants and useful synonyms to contextualize the a priori codes as provided by the language found in the PEM framework (see Table 1).

*Structuring.* Coding of the data occurs at this stage (Mayring, 2014). Utilizing ATLAS-Ti (V6), quotations and meaning units were extracted from the transcribed interviews and were useful to develop preliminary labels of a category system. Again, categories also were developed deductively from the language found in this study’s conceptual framework, as well as the language of the participants. The participants’
language contextualized the development of categories alongside the a priori codes found in this study’s Personal Epistemology Framework (Feucht, 2011). In this inquiry, the theoretical frame provides dimensional and developmental aspects that were useful using the ATLAS-Ti code-by-list function (i.e., stability, structure, source, justification). This was done by utilizing language found in the definitions of the dimensions and developmental levels of the framework alongside the participants’ responses. For example, if the participant was answering a question geared toward the source of knowledge dimension and the individual responded that knowledge was connected because she knew something based on information from her teacher, as well as this idea being confirmed by peers, the following codes were developed: [Source: External: Teacher] and [Source: External: Friend]. Codes were defined and a description of each detailed the types of responses it would be applied. Further, an exemplar quotation was attached to each unique code. Each time a code was added or refined, the quotation or meaning unit was reviewed to see if the new or original category was sufficient. The ATLAS Ti software supported and facilitated this review process.

The ATLAS Ti (V6) software facilitated the management of the data by offering a graphic of the knowledge collected in a network of nodes and links. In this study, the relationship amongst each code was arranged in a hierarchical fashion to facilitate reporting of the findings in Chapter 4. These connections can be represented visually through what is known as tree coding where relationships are noted through codes and branches of sub-codes. Each code is related to a code group through an association related to Kuhn’s (1999) developmental levels of epistemological understanding (i.e., external sources = absolute, internal sources = multiplist, internal & external sources =
evaluativist). Next the code group is specified by a parent code that is a sub-category where a reduced code is named for each developmental level (e.g., facts, self, authority knowledge and personal experience). The final branch of the tree code is derived from the concepts articulated in the interview data as derived from language of participants (see Figure 2). Each dimension of this study’s conceptual frame forms one quarter of each coding network.

<table>
<thead>
<tr>
<th>Dimension of Knowledge</th>
<th>Source</th>
<th>Criteria of Developmental Level</th>
<th>Parent Code</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>External</td>
<td>Facts</td>
<td>Academic Sources</td>
<td>Teachers</td>
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<tr>
<td></td>
<td>Internal</td>
<td>Self</td>
<td>Reflection</td>
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<td></td>
<td>Internal &amp; External</td>
<td>Authority Knowledge and Personal Experience</td>
<td>Evaluation</td>
<td>Judgement</td>
</tr>
</tbody>
</table>

Figure 2. This figure represents a tree coding network developed using ATLAS ti (V6) software to demonstrate how a code (i.e., academic sources, teachers, peers) was related to and derived deductively from each of Hofer’s (2001) four categories utilizing the language from Feucht (2011) 12-cell matrix (i.e., structure, stability, source, and justification). Figure 1 offers an example using the source dimension.

Once the coding network was complete (see Figure 3) each individual code was reviewed by code group (e.g., source: external/source: internal/source:). There was a total of 12 code groups for Interview Data Set 1 and Set 2 (see Appendix E: Interview Protocol). Within each category of the 12-cell matrix or PEM framework (see Table 1) consistency of quotations (i.e., over 500 in quantity before fine-tuning the results) were confirmed. For example, each cell of the PEM framework consisted of between 1-12 individual codes and each code held between 1-12 quotations for a total of 87 nodes for the first interview set. First, each interview question was reviewed to confirm the reduced
code fit the code label *(structure, stability, source, and justification)*. In the event a probing question was asked or a participant’s response gained data outside the original intent of the interview question, language of the probing question, as well as the response was reviewed against the PEM framework to confirm the use of an additional or separate dimensional code. Each participant’s response was read in context to determine if this was the case. Additionally, research memos were crafted alongside any participant response that was lacking clarity and further discussion helped to confirm the code label. There is a sliding scale of interpretation that exists in the field of epistemology as it concerns the labeling of evaluativist beliefs. According to King and Kitchner (1994) “true evaluativism” is recognize with a “great frequency” amongst those who have advanced beyond the undergraduate level of their education (as cited in Weinstock and Tabak, 2011, p. 182). In this inquiry, a high-bar concerning the development of expertise was used through careful consideration of the language found in the PEM framework. When an evaluativist code was up for debate, Kuhn’s (1999) standard for recognition of critical thinking as method for making a claim or supporting arguments with evidence being used was consulted to stay close the language and rationale of the framework.

*Figure 3.* This figure offers a visual representation of one quarter of the coding network as it was uniquely developed for the *Source* dimension from participants interview data with support of ATLAS Ti software. Figure 2 depicts one network created
to organize the codes from the interview data sets 1 and 2 into one of the four quadrants. Each quarter of the network depicts one of the four dimensions of knowledge derived from theory (structure, stability, source, and justification). Each of Hofer’s (2001) dimensions were reduced into one of three code groups utilizing criteria to broadly define each of the developmental levels provided by Kuhn (1999) (e.g., Source: external sources, internal sources, internal & external sources). These are represented on the network by the colors blue (e.g., external sources = absolute), grey (e.g., internal sources = multiplist), and red (e.g., internal & external sources = evaluativist).

The initial coding (e.g., after the first iteration of the structuring phase was complete) was cross-checked by an expert in the field of epistemology. The first reading of one participant’s data set revealed a discrepancy in approximately 40% of the codes. This was due to a close coding of each meaning unit as opposed to what was later determined as a more productive approach to consider the collective response from each interview question (see Appendix E: Interview Protocol). For example, by coding each line at the individual level, labels that could be reduced separately to absolutist, multiplist and evaluativist for a given response could alternatively be coded evaluativist as it fulfilled the objective and subjective orientation necessary to earn this label. Further, there was disagreement under the justification network. Through the first set of coding, several codes were noted as absolutist as determined by a belief in facts that are based on right or wrong from eternal sources. Upon further discussion, it was determined these codes were reevaluated as a fact being determined through an integration of internal and external sources that closely follows the language and concept for an evaluativist justification using the PEM framework. A second review of 20% of the total amount of codes was cross-checked. Any individual codes that did not fit the final category scheme were reviewed individually and agreed upon. After discussion, a third and final review of 10% of the codes revealed a 100% calibration.
Data from Interview Question Set 3 (IQset3) were categorized according to developmental level of epistemological understanding (e.g., *absolute, multiplist, evaluativist*). These questions were crafted to target specific knowledge beliefs present in instructional practice in ECE setting to gain participant’s developmental level of epistemic understanding (see Appendix E: Interview Question Protocol). Each question was scaffolded according to Kuhn’s (1999) developmental levels in order to elicit an overall level of epistemic development (i.e., *absolutist, multiplist, evaluativist*).

A simplified coding network was produced for the eight videos of practice. Here audio and video were uploaded to the Atlas Ti software apart from two videos that were in a format not compatible with this software. Therefore, the latter were viewed using DVD equipment and notes taken on a Word document for any selections of epistemic value alongside a screenshot. The videos that were uploaded to Atlas Ti allowed for selection of certain video segments that had epistemic value to be selected.

Data from PSTs video of practice was considered according to Kuhn’s (1999) developmental level of epistemological understanding (i.e., *absolute, multiplist, evaluativist*). Video excerpts of questioning strategies and dialogue were selected and coded according to their perceived epistemic developmental level dependent on the “epistemic underpinnings” enacted during instruction (Feucht, 2011, p. 240).

Consideration of PSTs classroom conversations as it related to the constructs provided in the PEM framework provided a logical organization scheme for category development. Three overarching categories were deductively identified to house the forty-three coded responses (n=44) from PSTs video. This was done according to the language of the PEM framework with emphasis on Kuhn’s (1999) developmental
positions focused on the process of epistemic reasoning. Categories were based on Kuhn’s developmental scheme of objective knowledge; subjective ways of knowing, as well as a combination of objective and subjective criteria. In Kuhn’s model, these are noted respectively as absolutist, multiplist, and evaluativist thinking about inquiry-based methods. Lastly, each code was transferred in sequence from the interview transcripts to an Excel document for analysis and reduction to a ratio/percentage. This reduction is articulated below under techniques for data analysis.

The final step in this analysis required a composite description of each PSTs espoused and enacted fine-grained epistemic beliefs. Rogers and Fuller’s (2007) advice was followed concerning the data being organized “into individual intrinsic cases to acknowledge the complexities of each teacher candidate as an individual with particular histories of participation in the program” (as cited in Schieble, 2015, p. 250). Next, a cross-comparison, using patterns and themes, was sought from the individual cases across the whole group. This allowed the data to specify in detail the dimensional aspects and developmental levels espoused through interview and observed in practice to identify “epistemic patterns in the data” (Feucht, 2011, p. 227).

Table 3
Research Questions, Data Collection Procedures, and Method of Analysis

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Collection Procedure</th>
<th>Method of Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Question (RQ) 1 Sub-question a.</td>
<td>Interview set 1 (Domain Specific Dimensional Beliefs Instruction)</td>
<td>Method 1 &amp; Method 2</td>
</tr>
<tr>
<td>What are PSTs’ espoused epistemic beliefs about the dimensions of knowledge and knowing in the inquiry-based laboratory</td>
<td>Interview set 2</td>
<td>Individual case ➔ Coded ➔ Codes translated to developmental patterns and reduced for each interview data set (1 &amp; 2) for</td>
</tr>
</tbody>
</table>
Table 3 offers a visual of this study’s research questions, data collection procedures, and method of analysis. Each method is articulated in detail below.

**Data Analysis Triangulation**

The interviews and observation of video were triangulated. The above description can be synthesized and articulated through three methods of analysis following the QCA method adapted from Ziegler (2014). This analysis can be understood through support of Table 3, as well as Figures 4, 5, and 6. Each is listed as follows:
Data Analysis Method 1

Method 1

*Data analyzed at participant level*

Data Coded $\rightarrow$ Participants Beliefs

*Figure 4.* Method 1 depicts the method of analysis following the QCA guidelines used to determine each participant’s beliefs. Each meaning unit from data is applied to a theoretically deduced code at the participant level. Adapted from “English Language Learners’ Epistemic Beliefs about Vocabulary Knowledge” (p. 71), by Ziegler, N., 2014, University of Toledo (Diss.). Copyright 2014 by Ziegler, N. Adapted with permission.

The first level of analysis deductively sought the dimensional aspects of espoused beliefs for each participant using a priori codes from the PEM framework (i.e., *stability, structure, source, and justification*) (see Figure 4). These codes were then reduced at the participant level through consideration of code frequency.

Data Analysis Method 2

Method 2

*Multiple code occurrences quantified and reduced at participant Level*

Multiple Data Sources Reduced $\rightarrow$ Participant Overall Belief

*Figure 5.* This figure depicts the method of analysis used to determine each participant’s overall epistemic level of understanding as *absolute, multiplist, evaluativist*. For each unique data source, multiple code occurrences were reduced using a ratio and percentage scheme to reflect an epistemic developmental level for each data set (i.e., *absolute, multiplist, evaluativist*). Adapted from “English Language Learners’ Epistemic Beliefs about Vocabulary Knowledge” (p. 73), by Ziegler, N., 2014, University of Toledo (Diss.). Copyright 2014 by Ziegler, N. Adapted with permission.
In the second level of analysis, the developmental level of each participants' epistemic understanding (i.e., absolutist, multiplist, evaluativist) (see Figure 5) was examined. I then considered the code frequency to determine an overall epistemic level of development at the individual level. This second level of analysis was repeated for espoused beliefs as deduced from analysis of teaching. Here codes were verified, partially validated, or not validated based on code occurrences according to the developmental language of Kuhn (1999), as found in the PEM model: absolute, multiplist, and evaluativist. Following Mason, Boldrin & Zurlo (2006), the method of reducing the quantity of total response to a ratio was considered as representative as tendencies or “prevailing patterns” of the participants (p. 48). For example, if three out of four responses indicated absolute, this represented a tendency of 75% for the participant to be recognized as a belief reflective of absolutism using Kuhn’s (1999) developmental levels. The code absolutist was then assigned to the participant for IQ set 3. This pattern was used to identify multiplist and evaluativist tendencies as well. Adapted from Ziegler’s (2014) model, the language fully validated, partially validated, and not validated were employed. Responses that were fully validated occurred over 50% (>50%) of the time, per participant. This percentage was reflective of dominant beliefs. Responses that occurred 50% of the time were partially validated. Responses that were under 50% were categorized as not validated. Indicating the individual may be in transition between beliefs.

Data Analysis Method
Figure 6. This figure depicts the method of analysis following the QCA guidelines used to determine the overall epistemic pattern of development for each participant’s beliefs. First, data from multiple sources were analyzed based on the quantity of occurrences. Next, data were then triangulated on the participant level to determine an overall epistemic belief code. Adapted from “English Language Learners’ Epistemic Beliefs about Vocabulary Knowledge” (p. 71), by Ziegler, N., 2014, University of Toledo (Diss.). Copyright 2014 by Ziegler, N. Adapted with permission.

For the third method of analysis an overall epistemological level of understanding was assigned for each participant. This was done in the following manner: first, each reduced epistemic code from each data set was quantified and reflected as a percentage and verified for an epistemic level of development based on a rationale developed by Ziegler (2014) as articulated here in method 2. Through this process an overall pattern of epistemic development was revealed (see Figure 6).

Lastly, espoused and enacted codes were compared for each participant and trends were recorded. Next, I compared trends across the group. Finally, an overall trend was deduced from this situational context to answer this study’s primary research question. This was done through a triangulation and reduction of interview data to an overall level reflective of absolutist, multiplist, and evaluativist tendencies and compared to a reduction of the frequency of codes ascribed to enacted beliefs in practice to an overall level of epistemic development. These results are reported in Chapter Four.

Trustworthiness, Quality, and Dependability
This section outlines the steps taken to ensure trustworthiness, quality, and dependability in a qualitative study. A measure of efficacy for the qualitative design approach requires participants to offer an accurate account of their perceptions and experiences. Therefore, Connelly and Clandinin (1990) argued that “criteria other than validity, reliability, and generalizability” are necessary in qualitative research and more emphasis should be placed on criteria such as “trustability, economy, selectivity…” (p. 53). Mayring (2014) agrees that the criteria of “objectivity, reliability and validity” are problematic in the qualitative approach but suggests that utilizing an entirely different set of standards presents its own complications (p. 14). Mayring (2014) suggests that reliability and objectivity can be sought using a broadened interpretation of these terms in an effort to present developed a “unified scientific process” (p. 14). To meet broadened standards of reliability Qualitative Content Analysis (QCA) uses a flexible but delineated set of procedures. The lack of dependence from a researcher’s interpretation makes the standard of objectively difficult to obtain in qualitative research. A criticism of interpretive research points out the ability of the researcher to produce a valid and accurate account of the experiences and perspectives of research participants. Although a justified argument, this threat to objectivity and trustability can be mitigated. Mayring (2014) suggests that a broadened interpretation of objectivity can be gained through attention to the “researcher-subject” relationship (p. 14). Secondly, triangulation of data is useful to verify what an individual perceives is what occurred. This is done when “building justification for themes” using multiple source of data (Creswell, 2009, p. 191).

However, Skott (2015) pointed out that the notion of ‘triangulation’ is premised on an assumption about the moment to moment understanding of what occurs in the
classroom and what is reflected upon later can be similar. Skott (2015) stated this sentiment as follows: “This methodological triangulation is based on the assumption of belief stability across contexts, as teachers’ self-reports or comments in research interviews are considered different manifestations, but reasonable proxies of their thinking in the classroom” (p. 20). Therefore, the beliefs that are manifest by a certain individual at a certain time might not necessarily be representative of the beliefs that the individual may possess. This is especially the case when considering a teacher’s enacted beliefs and what he or she demonstrates in an interview after the action has occurred. Therefore, this caveat concerning the reliability of the construct of triangulation is noted as a limitation of this inquiry. Qualitative interviews are sought to ameliorate this problem, but cannot eliminate the difficulty in gaining an individual’s deep-seated beliefs (Skott, 2015). However, it is recognized that there is often a gap between espoused and enacted beliefs, where what teachers profess about beliefs is not often reflected in situated practice (Fives & Buehl, 2012; Clandinin & Connelly, 2013). As this study is mindful of the contextual problems of beliefs as related to the data collection (see Literature Review), this concern will be diminished by choosing to not employ the use a pre-and post-measurement. The strategy may suit a study that concerned itself with measuring the shifting nature of a belief. For example, an assessment would be useful for noting how a certain intervention may support the development of a PSTs personal epistemology.

To understand the contextual nature and continually evolving understanding of truth, it was important to acknowledge bias, limitations, research tension, and the ethical and methodological complexities of the researcher-researched relationship. Attention to
this relationship is critical in qualitative research for gaining honest and accurate information from participants. What is possible depends on the level of trust gained and interconnectedness between the interviewer and interviewee. This latter point, Skott (2015) believes “calls into question the results of the field, as the trustworthiness of any study clearly depends on the degree to which the data generation process allows access to the key construct under investigation” (p. 21). In this study, attending to the researcher-researched relationship, taking a situated view of knowledge, and the use of video for observation were recognized in efforts to address these concerns about trustworthiness and fulfill criteria for a broadened interpretation of objectivity.

To enhance quality of the research, my dissertation committee considered the overall structure and logic of this investigation. Further, to ensure a logical research protocol was developed and executed, a linear-analytic structure (problem, literature, method, data collection, analysis) that is both appropriate for exploratory research (Yin, 2009) and a format useful for a dissertation committee were met. Additionally, an expert in the field of epistemology was included in my dissertation committee and consulted on interview questions, data analysis, cross-coding validation and findings. Further, my positionality statement allowed me to share my own identity and be mindful of bias. To further minimize the impact of personal experiences on this study, I closely followed the interview protocol. This was done to ensure all procedures were carried out in accordance with the highest standards to achieve trustworthiness, quality, and dependability.

**Data Storage and Management**

The data collected consisted of informed consent forms (see Appendix D: Informed Consent Form), interview recordings, interview transcripts, and videos of
practice. The data was coded to remove the identity of the participants and insurance of confidentiality is on-going. Pseudonyms were given to each participant (P1, P2, P3, etc.). The list of names was stored in a location separate from the interview data, and the videos offered on DVD were returned. Videos offered electronically using an USB device were stored for posterity. I will remain the only individual who knows the identity of the participants. All electronic files were password protected and each file was encrypted. Once the digital audio recordings were transcribed, they were copied to a portable hard drive and stored for future access in a secured cabinet in my home office.

Additionally, all informed consent forms will be kept for three years as required by Northeastern University’s Institutional Review Board (personal communication, Kate Skophammer, January 28th, 2013). The transcribed data will be retained for possible use in future studies. Following NEU requirements, this dissertation will be published using the ProQuest platform. The participants’ identities will not be made public at any time.

**Protection of Human Subjects**

All participants engaged in this study on a volunteer basis. Before any data was solicited, information regarding the purpose of the study, data collection, and the rights of the participants was made clear to the participants (see Appendix B, C, & D). This documentation included details about the study, data collection processes, and how the findings were used. It was articulated, verbally and in written form, that every effort to maintain the privacy of the participants was made. Confidentiality and anonymity have been maintained by recording data using a pseudonym for the participant (e.g., P1, P2…). This study poses no known risks to participants. Each participant had the right to decline answering any question with which he/she did not feel comfortable and it was made clear that he or she could withdraw from the study at any time. The informed consent form was
offered to each study participant outlining the above prior to each interview. Each informed consent agreement was distributed, explained, and collected by myself.

All research conducted followed the standards of practice set forth by Northeastern University Institutional Review Board (IRB). As such, all recruiting and consent materials reflected the name and contact information of personnel from Northeastern University. This research closely followed the protocol of Northeastern University IRB guidelines. No data was collected or contact made with participants until approval was gained, in writing, from the NEU IRB to ensure that all reasonable actions have been taken for the protection of human participants in this research.

The needs of the academic community were considered to ensure this research is accessible for a wider audience that also includes the student-teachers who served as shared participants in the study. Therefore, the voices of the practitioners were made known, but not their identities, through excerpts from their interview and practice that are pertinent to highlight certain findings that answer the research questions. This information is shared in Chapters 4 and 5. Because of the nature of sharing of personal beliefs, a concern for ethics was paramount and were attended to throughout this project and expressly addressed in the informed consent document (see Appendix C: Informed Consent) and interview schedule (see Appendix E: Interview Protocol). Anonymity of participants was protected in the collection of data, as well as in the presentation and publication of this dissertation.
Chapter 4: Findings and Analysis

In this chapter, empirical evidence is presented in a manner to allow the reader to visualize the structure of the data and how it was formatted. It begins with a review of the study’s research questions to support understanding of the results. Here the data is presented objectively, however it is interpretive in the sense that it is organized into themes centered on Hofer’s (2001) dimensions of knowledge, using the language provided by Feucht (2010, 2011) reflective of structure, stability, source, and justification, as well as Kuhn’s (1999) developmental level of epistemological understanding (absolutist, multiplist, and evaluativist). Evidence is provided with data exemplars to demonstrate credibility of the interpretation. Each exemplar from the audio and video transcript is referenced using the participant pseudonym (e.g., P1, P2, P3…) alongside the reference number offered by the Atlas Ti software (e.g., 1:1, 1:2, 1:3…). Therefore, each reference appears in the following format (P1, 4:22). This chapter concludes with a summary of the results and analysis.

The intent of this case study was to explore and document: (a) what beliefs PSTs espouse about knowledge and knowing and are able to reflect upon; and, (b) the beliefs PSTs enact. These beliefs were contextualized within an early childhood laboratory school associated with inquiry-based methods for teacher education amongst six females and two males of Midwestern origin. This study was guided by an Integrated Framework of Epistemic Dimensions and Epistemic Development, as seen in Table 1 (Feucht, 2011).

Organization of Findings

This section details the findings in relation to the study’s research questions based on two methods of analysis using the QCA pattern. Data is presented first by sub-
questions, then followed by a synthesis of the data to answer the study’s primary research question. Thereby, each data piece revealed in the sub-questions adds clarity to the primary research question.

For sub-question (1a), deductive analysis was guided by an empirically verified dimensional framework for understanding epistemic beliefs (Hofer, 2001). This question was analyzed and organized according to Hofer’s (2001) framework for consideration of certainty, simplicity, source, and justification dimensions of knowledge. Within each dimension, there are developmental distinctions that suggest naïve or sophisticated beliefs. These distinctions align with Kuhn’s developmental model of epistemic understanding. The overlap of the two models is highlighted in the PEM framework (see Table 1). Sub-question (1b) explored the features that are evident using a developmental model of epistemic understanding (Kuhn, 1999), moving from absolutism, multiplicity, and evaluativism. Sub-question (1c) required analysis of PSTs’ video of practice. These videos considered beliefs reflective of Kuhn’s (1999) developmental levels as articulated for sub-questions (1b). Lastly, findings are presented across the participants from the analysis of sub-questions (a), (b), and (c) to answer the study’s primary research question. The research questions are reiterated below.

**Primary Research Question**

1. What are PSTs’ epistemic beliefs about instruction in an inquiry-based laboratory school?

**Sub-questions**
1a. What are PSTs’ *espoused* epistemic beliefs about the dimensions of knowledge and knowing in the inquiry-based laboratory school (i.e., *stability, structure, source, and justification of knowledge*)?

1b. What are PSTs’ *espoused* developmental levels of epistemic understanding about instruction in an inquiry-based laboratory school (i.e., *absolutist, multiplist, evaluativist*)?

1c. What are PSTs’ *enacted* developmental levels of epistemic understanding about instruction in an inquiry-based laboratory school (i.e., *absolutist, multiplist, evaluativist*)?

**Domain-Specific Epistemic Beliefs about Instructional Practice in ECE**

**Research Question 1(a)**

Sub-question (1a) was answered using data from interview question sets 1 and sets 2 (IQ set 1 & 2). Data targeted specific responses about knowledge beliefs present in instructional practice in an early childhood setting (see Appendix E: Interview Question Protocol). Data were first analyzed on the participant level through the assigning of codes (see Figure 4). Then codes were organized by themes based on the dimensions of *stability, structure, source and justification*. Each of the four dimensions are listed below alongside the individual codes and quantity of occurrences. Results are reported in relation to a definition, description, and example quotation for each code. Occurrences for each code are quantified for each participant and quotations are included to substantiate the main findings.
Figure 4. Method 1 depicts the method of analysis following the QCA guidelines used to determine each participant’s beliefs. For IQ set 1 & 2 these codes were based on dimensions of knowing (e.g., structure, stability, source, and justification). Each meaning unit from data is applied to a theoretically deduced code at the participant level. From “English Language Learners’ Epistemic Beliefs about Vocabulary Knowledge” (p. 71), by Ziegler, N., 2014, University of Toledo (Diss.). Copyright 2014 by ProQuest. Adapted with permission.

Stability Dimension

Data for the domain-specific codes labeled under stability (n=45) were drawn from IQ set 1 under the topic of Curriculum and Resources, Question 4, as well as IQ set 2, under the topic of Instructional Planning, Question 3, and Question 7, as well as applicable probing questions. This coding scheme is associated with beliefs about stability/certainty found in domain-specific knowledge about instructional practice. These codes were grouped according to developmental level criteria used to identify statements across the domain that considered stability of knowledge. This dimension was categorized by three criteria of knowledge: the certain and fixed nature, the contextually uncertain and possibly changing nature, and the relatively certain contextually, but uncertain depending on certain contextual conditions. The Certain and Fixed theme corresponds with the absolute level of epistemological understanding. The Uncertain and Changing coding scheme corresponds with the multiplist level. Contextually, Certain but Changing was associated with the evaluativist levels of understanding concerning domain-specific beliefs about instructional practice in ECE.
Table 4

*Stability: Certain, Uncertain/Changing, Contextually Certain*

<table>
<thead>
<tr>
<th>IQ Set 2 &amp; 3 Data by Participant</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>P6</th>
<th>P8</th>
<th>P9</th>
<th>Totals</th>
<th>Dev. Orientation Totals</th>
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<td>1</td>
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<td></td>
<td></td>
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<td>1</td>
<td>1</td>
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Note. Table 4 illustrates how PSTs can reflect upon epistemically concerning the stability of knowledge. The total number of codes are recorded across the study’s eight participants (P1-P9). Data were omitted from P7 as the set was incomplete. The stability theme was categorized into three groups: Certain, Uncertain/Changing, Contextually Certain Orientations. These groups were aligned with their corresponding epistemological level of development which is reflected in the right-hand column under developmental orientations totals. These are related and framed by color: blue is indicative of absolute beliefs, while grey is reflective of multiplist thinking, and green represents evaluativist levels of epistemological understanding.

**Stability: Certain and Fixed**

The certain and fixed scheme (n=3) provides an overarching category of codes used for responses that identify individuals who believe the stability of knowledge is certain and only has the capacity to change when new knowledge is developed in the field of early childhood education. These codes were applied to beliefs that indicate that the nature of knowledge is certain and therefore, absolute (e.g., Kuhn, 1999). These codes are recognized as absolutist using Kuhn’s (1999) developmental model. Participants (n=8) stated that stability is evident in one or more of the following: Universal Facts (n=3); Knowledge Discovery (n=1); Transmitted (n=1).

**Universal Facts.** Three participants (n=3) responded that domain specific knowledge about instructional practice is certain and stable based on the universality of facts. This code was used to label three responses (n=3) to include the role of experts and the stability of knowledge based on objectives. For example, one participant stated the following about the certainty of knowledge as it concerns curriculum objectives, while maintaining a position of uncertainty about teaching methods:

I think your goal end result is always going to be the same there, but the ways you get to it and if you get to it could change. I guess if you don't get to it or you don't get to it in even the time frame that you hope, or everyone that you hoped to reach could be different, but you still have that same end result goal. (P9, 8:25)
Another participant noted she is now questioning the certainty that she has held when considering her response to a disagreement amongst experts:

It kind of shakes that knowledge that I feel like I've known, because they're the experts. They're supposed to ... You know what I mean? They're supposed to know, but they're disagreeing on it and it's different. I don't know. It doesn't take away that knowledge that I have, but it kind of makes me question it and think about it more, and I - just - that's what I do. (P8, 9:37)

**Knowledge Discovery.** One participant’s response \((n=1)\) indicated she believes knowledge is certain and stable in early childhood education, but it changes when new knowledge is developed. For example:

I would say it's simple. It's not changing a whole lot about the information that we're getting right now. It'll change but it's such a slow change in a lot of theories and concepts and ideas, that it's hardly noticeable until one big idea just bursts through something. Then it's, oh now we've got to change! Now it's moving. Now it's dynamic. Now we've got to, everything's changed. (P7, 2:30)

**Transmitted.** One participant \((n=1)\) held beliefs that indicated that knowledge is transmitted. This code was used when the participant believes knowledge is certain, and facts are stable and transmitted to students. For example, "I think it's just, ‘What are they saying?’ Then telling them, ‘Yes, that's right. No, it's not,’ just based on overall. I don't think you get into specifics with the kids until they get older, but just the baseline.” (P6, 3:55).

**Stability: Uncertain and Changing**
The uncertain and changing scheme provides an overarching category of codes used for responses \((n=34)\) that identify individuals who recognize stability of knowledge is subjective and uncertain and has the capacity to change. This scheme allows for a perspective that knowledge may change dependent on context in the field of early childhood education. These codes are recognized as multiplist using Kuhn’s (1999) developmental model. Eight participants \((n=8)\) suggested that stability of knowledge is recognized as uncertain and changing as revealed in the following codes: Children \((n=8)\); Learning \((n=7)\); Generational \((n=5)\); Methods of Teaching/Learning \((n=4)\); Adaptability \((n=1)\); Culture \((n=1)\); Technology \((n=1)\); Curriculum \((n=1)\).

**Children.** This code was used to label eight responses \((n=8)\) that identified beliefs about the stability of knowledge concerning instruction in ECE. This label was used by seven participants \((n=7)\) who acknowledged that knowledge about instructional planning in early childhood education is uncertain as determined by the opinions and needs of children. For example, one participant articulated this belief as follows:

> [W]hen you're dealing with each child, sometimes there isn’t [a right answer]. Sometimes this child is so smart, you literally can't give them the right answer, but also what you do with this child isn't going to work with [another] child, so there isn't one specific right answer, like flat line: It's all based on each child. (P6, 3:56)

**Learning.** Four participants \((n=4)\) responses were coded learning. This code was used to label seven responses \((n=7)\) that indicated that knowledge is uncertain based on how the content of learning changes. For example, when questioned whether knowledge about instructional practice for early childhood changes one participant explained, “When
talking to my parents, you hear, ‘Oh you're learning this at this age. I don't remember learning that until I was so and so's age.’ You're seeing a lot more complexity’” (P7, 2:29). Other participants referenced a personal shift in beliefs through learning such as in the following quote:

Yeah. I used to think that when I became a teacher I would be lecturing third graders. Just standing up in front of the classroom teaching things. I've learned more that hands on, that's the way kids really want to learn at that age. (P2, 7:25)

**Generational.** This code was used to identify five responses \((n=5)\) that indicated that knowledge about instructional practice in early childhood education is uncertain based on changes in society and shared generational values. Three participants \((n=3)\) held beliefs that were labeled *generational.* When asked if knowledge about teaching changes overtime one participant responded, “I think with each generation, it's different. The ones that are just being born now, they might not want to move at all. They might go back to needing the repetition. I think it will change” (P6, 3:70). A second response suggested:

It does change as a collective whole and knowledge about teaching is always morphing. It is definitely not the same as it was thirty years ago or forty years ago. Like the individuals with disabilities with education act that is what it is called somewhat. That was implemented in ‘75. Until then it was not a shared thought. Although, there will always be outliers and others in the teaching community that do things a certain way it’s just whether not they were born in the right time, I suppose, for society’s sake. (P1, 4:89)

For the above quote, the participant demonstrated he is aware that knowledge judgements are made about practice at a societal level, however this response did not
make clear how judgements are made, therefore it was classified as a multiplist belief. (P1, 4:47)

**Methods of Learning/Teaching.** Four participant (n=4) responses were labeled methods of learning/teaching. This code was used to identify four responses (n=4) that indicated knowledge is uncertain and therefore subject to change across contexts. This was attributed to opinions in society about truth, how society is changing due to advancements in knowledge and how societies view of teaching and learning are changing as it concerns what has been deemed effective instructional practices. For example, one participant suggested, “They come out with different teaching strategies all the time. What worked in the past doesn't work now. I think it's an always changing, complex” (P3, 6:61). This comment was labeled as subjective as there was no indication that critical thinking or argument and evidence was necessary for this change. Another respondent replied:

> Definitely. I think overall as a society, we're starting to learn more about children as an individual, versus as a whole. We're starting to learn that each one learns differently, each teacher teaches differently. There are ways to teach things. You can try to teach one math concept in a bazillion different ways, based on how you want to teach it, but your goal is to get to the end result. It's not just one way anymore. (P9, 8:22)

**Setting.** Two participant (n=2) responses were identified under the code *setting.* Four responses (n=2) indicated that the stability of knowledge about instructional practice is uncertain based on opinions about the setting or classroom space. For example, one participant illustrated this point as follows:
I think it will change, because I am going to learn more as I gain new experiences. I will be teaching in Harrisburg next semester and that is going to be completely different from what I have experienced thus far. (P8, 9:60)

**Adaptability.** One participant’s (n=1) response was identified as *adaptability*. This code was used to identify a response that indicated that knowledge about instructional practice in early childhood education is uncertain as determined by the success or failure of engagements. Here the participant believes that the implementation of a lesson plan may have to be flexible to accommodate for change. This code is evident in the following response: “being adaptable in the classroom and willing to accept that it won't work, or that it could change. Not being so strict and rigid with that. I like to practice the flexibility” (P9, 8:39).

**Culture.** One participant (n=1) response indicated that that stability of knowledge in early childhood education is uncertain due to the subjective nature of cultural worldviews. This participant stated:

> I think it has to do also with their cultures because some have certain information and knowledge background on that and then it depends what they're talking about but I think each child has a great amount of knowledge on a certain topic. (P4, 5:33)

**Technology.** One participant (n=1) held beliefs that were labeled *technology*. This code identified a response that indicated that stability of knowledge in early childhood education is uncertain due to how changing technology influences individuals socially. When addressing change this participant suggested, “I think so because technology is rising and it's really taking away their social skills” (P6, 3:51).
**Curriculum.** Two participants’ responses (n=2) were labeled *curriculum.* This code was used to label four responses (n=4) that indicated that the knowledge contained in curriculum content is uncertain and therefore, changing. These changes were due to curriculum initiatives inspired by government policy or changing needs in local communities.

**Stability: Contextually Certain**

The *Contextually Certain* scheme provides an overarching category of codes used for responses that identify individuals who recognize stability of knowledge is contextually certain but is uncertain across contents and can change based on evaluation of information in the field of early childhood education. These codes were applied to beliefs that indicate that the nature of knowledge is contextually certain and therefore, does not change. These codes recognize certainty in domains, judgements, and how knowledge is reevaluated when new information is presented. These codes are categorized as evaluativist using Kuhn’s (1999) developmental model and are noted as *sophisticated* epistemic beliefs. Four participants (n=4) suggested that *contextual stability* is recognized in the following codes: *Practice* (n=2); *Evaluated* (n=2); *Constructivist* (n=1); Context (n=1).

**Practice.** Two participants (n=2) held beliefs that were labeled *Practice.* This code was used when the participant believes knowledge is uncertain, but it changes as knowledge about instructional practice is reevaluated against new information. A change of settings and the children in each can precipitate this change. This person stops short in articulating a constructivist notion of meaning is being made by students.
It could be like your setting, or where you're at, your children, how you think that your practices will work with them. You could have to be flexible and change that, depending on your children. If you're coming into a brand-new school and you try your practices that you've known for these last five years, but it just is not working on those kids, you have to figure something else out. (P9, 8:61)

**Reevaluated.** One participant \(n=1\) held beliefs that were labeled *reevaluated.* This code was used when the participant responded that knowledge is certain within context, but it changes as knowledge is reevaluated against new information. For example, this participant stated:

> It could be like your setting, or where you're at, your children, how you think that your practices will work with them. You could have to be flexible and change that, depending on your children. If you're coming into a brand-new school and you try your practices that you've known for these last five years, but it just is not working on those kids, you have to figure something else out. (P9, 8:42)

**Constructivist.** One participant \(n=1\) held beliefs that were labeled *constructivist.* This code was applied to a belief that indicated that the nature of knowledge changes based on knowledge being dependent on the context in which the experience occurs, the objective content to be taught, as well as how an individual makes meaning. One participant responded when asked if instructional practice will change, “Yeah, because again, it's just the environment of the classroom, the background of the children, background of the teacher” (P5, 1:38).

**Context.** Two participants \(n=2\) held beliefs that were labeled *context.* This code was applied to a belief that indicated that the nature of knowledge changes based on
judgements made within the specific context. One participant articulated this sentiment as follows:

I think so because for every subject they might need a different way to learn. Not everyone learns the same way for every subject, so I think a math teacher could do something extremely different than say, the language teacher and still be effective. (P6, 3:49)

Here the respondent is evaluativist as it concerns the stability of knowledge by making judgments within unique contexts. Another response echoes a similar sentiment about the contextual nature of beliefs:

Their opinion, if they've done something or had this issue happen in the past, in a different classroom, their opinion could be true in that regards, but it could also be false, that it's not going to work in this setting. Their opinions are true because it's happened and they've seen it, but it could be false in the current situation. (P9, 8:53)

Structure Dimension

Data for the domain-specific codes labeled under structure (n=32) were drawn from IQ 1 Curriculum & Resources, Question 3, and IQ2 Instruction, Question 4, and Question 8, as well as pertinent probing questions. This coding scheme is used to label domain-specific beliefs concerning the structure of knowledge as it is contextualized in instructional practice. These codes identified forty-one responses (n=41) about the structure of knowledge as found in instructional practice. Structure codes were grouped according to developmental level criteria of being either absolute, multiplist, or evaluativist (Kuhn, 1999). These themes corresponded to three overarching categories:
simple, connected, and complex. The structure of knowledge that is recognized as simple is not recognized as connected with other objective information. Therefore, the simple theme corresponded with the absolute level of epistemological understanding. The connected coding scheme corresponded with the multiplist level. This is an overarching category of codes to label responses that indicated that different forms of knowledge are connected often through opinions. The final coding scheme under the structure dimension was developed to identify and code responses where participants recognized the structure of knowledge as complex and connected through judgements. This category is attributed to the evaluativist level concerning domain-specific beliefs about instructional practice in ECE.

Table 5

Structure: Simple, Connected, Complex Orientations

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<tr>
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<th>P1</th>
<th>P2</th>
<th>P3</th>
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Structure: Complex: Practice: Transdisciplinary

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Note. Table 5 illustrates how PSTs can reflect upon epistemically about the structure of knowledge in ECE. The total number of codes are recorded across the study’s eight participants (P1-P9). The structure theme was categorized into three groups: Simple, Connected, and Complex. These groups were aligned with their corresponding epistemological level of development which is reflected in the right-hand column under developmental orientations totals. These are related by color: blue is indicative of absolute beliefs, while grey is reflective of multiplist thinking, and gold represents evaluativist levels of epistemological understanding.

**Structure: Simple**

The simple scheme \(n=1\) is comprised of one code used for a response that indicates the structure of knowledge is simple. This category and code is recognized as absolutist using Kuhn’s (1999) developmental model. One participant \(n=1\) stated that structure of content knowledge that is taught is classified as Simple \(n=1\). However, this participant went further to clarify the act of teaching is not simple, therefore this label only applied to the knowledge contained in the curriculum.

I think it would be more simple. I think the knowledge is we go through this education program and you learn how to become a teacher. You learn how to do the subjects and then that's where it stops being simple. I think just the aspect of teacher knowledge, being a teacher, all of that, is the simple part, until you get into actually teaching. (P6, 3:26)

**Structure: Connected**

The connected scheme provides an overarching category of codes \(n=5\) used for responses \(n=21\) that identify individuals who recognize this is a salient feature in the
structure of knowledge. This coding scheme is used to identify epistemic beliefs about subjective claims to knowledge. Individual codes are used to identify beliefs about the structure of knowledge as connected by prior knowledge, worldview, opinions, or experience. These beliefs can be influenced by persuasion (Hofer, 1999). Many responses utilized the word complex, possibly influenced by the interview question, therefore if a participant stated the term “complex” it could be placed in one of two categories: connected or complex. Here responses that contained an opinion that was not balanced with objective information were appropriate for the connected scheme regardless if the word complex was employed. Eight participants (n=8) stated that structure is recognized as connected as revealed in the following codes: Experience (n=5); Children’s Needs (n=5); Prior Knowledge (n=4); Community (n=3); Interests (n=1).

Children’s Needs: Five participants (n=5) held beliefs that were labeled children’s needs. This code was used to label five responses (n=5) that identified the structure of knowledge in ECE is connected by opinions about children’s needs and what might be determined as necessary for their further development. For example, one participant stated:

I would say it's complex. Just because it's up to the student what they want to learn at the same time. If they're actually going to comprehend it and if it's going to stay with them. It's up to the teacher at the same time to instill in them, that is important and how to make sure that they understand it, and use it later on when they need it. (P5, 1:44)

Another participant suggested this sentiment as follows:
No, because each child communicates differently and someone could be a great communicator, but struggle with eye contact. No one knows [inaudible], that's the problem. It's different for each person, so that's why I think it's complex, that it's literally different for every person. Some people will struggle to communicate verbally, but non-verbally, they're all over the board. You can definitely tell what they're thinking. (P6, 3:52)

**Experience.** Four participants \( (n=6) \) responded with statements that were coded *experience*. This code was used to identify four responses \( (n=4) \) that indicated knowledge about teaching is based on personal experience and structured based on how a teacher implements a variety of strategies. For example, "It's always building. Like teaching experiences" (P2, 7:19).

Another participant suggested that the structure of her own knowledge has changed. In the following quote the PST response did not include knowledge that can be found in a wider community conversation about knowledge.

> But my experience here has changed that knowledge, and like it's gotten bigger. It's like it's taken to the next. It's like every new experience I am with children, it gets bigger. Like I never want. I had an opportunity to student teach at my job. I didn't want to do it because I feel like that would hold me. It wouldn't take me to that next level with my knowledge. My knowledge wouldn't grow. (P8, 9:23)

**Prior Knowledge.** Three participants \( (n=3) \) indicated *prior knowledge* was important in ECE. Four responses \( (n=4) \) indicated that knowledge about teaching and knowledge that children draw from is based on personal experience and structured on prior-knowledge. One participant suggested, “[There is a belief] that children can't pick
up higher level thinking and it's proven that that's wrong, because they can. They can do complex thinking. They can take what they know and they can expand higher” (P6, 3:58).

Another participated offered:

I think it's connected because, back to children, in general, I think they take their experiences from one thing and they can pull it into something else. Like they learned a skill: like learning to read…I think knowledge is connected because it builds upon. Your knowledge is always building. You start with this and then when you're done you have - this I guess - and it's almost like a path of knowledge. (P8, 9:9)

**Community.** One participant (n=1) held the belief that the structure of knowledge is influenced by community. Three responses (n=2) identified structure as connected by, and gained through, community. These codes were used to identify responses that indicate knowledge about teaching is based on community connections, as well as social connections. One participant articulated this sentiment as follows:

I personally like to bring the community into the classroom. I like the kids to not feel like they're in their own community in the classroom, that they're still part of the major community. This year, every time it was my lead teaching week, I had either a parent, a family member, or someone from the community come in and speak about them, or we do research on things out in the community, like real life. I don't like it when they come to preschool and its preschool life and home life. I want it to be connected. (P9, 8:40)

This same participant noted that community influences the learning of a child through social interactions. This participant explained, “I think it's important for them to
learn that they're an individual. That each person builds on each other in the classroom” (P9, 8:49).

**Interests.** One participant (n=1) identified the structure of knowledge as connected through personal interests. This following response indicated that the structure of knowledge is developed based on personal interests. This participant stated: “I think it's all personal. It could be a different connection between each person. What I might connect with something might be different than what you might connect with something, so I think it's personal with the connection” (P6, 3:7).

**Structure: Complex**

The *complex* scheme (n=5) provides an overarching category of codes used for responses that indicate the structure of knowledge in early childhood education is complex and dynamic. This scheme contained nineteen responses (n=19) that corresponded to beliefs that indicated the structure of knowledge is simple or connected by subjective experiences, as well as complex based on objective information. This occurs when an individual evaluates knowledge in the context in which learning occurs and/or considers interconnections between knowledge. Participants (n=8) related that complexity is recognized in the following ways by PSTs: *Simple & Complex* (n=7); *Judgments* (n=7); *Transdisciplinary* (n=2); *Adapting* (n=2); *Situated Practice* (n=1).

**Simple & Complex.** Six participants (n=6) indicated that the structure of knowledge is both simple and complex. This code was applied to seven responses (n=7) responses that indicated that knowledge about teaching and/or instructional practices is both simple and complex in nature. Several responses indicated that knowledge found in academic domains is fixed and certain, but learning and the construction of knowledge is
complex. Other responses include the level of simplicity or complexity that is necessary for each child when engaged in lesson planning or engagement level necessary for certain children in certain learning activities. One participant stated, “Point blank they do need to learn. In that idea that it's simple - that they need to do - it's complex in [figuring out] how do they do that. How do you get that information to them?” (P3, 6:46). Another participant spoke about the dichotomy inherent in this code in the following response:

That one I think could be both. I think it's simple when you think that you want them to learn that they're an important person in this world, but it's also complex in trying to figure out how to teach that to them. How to get that across to them. It's also complex that you have to do it differently for every child, and you have to change the ways that you do it for every child. You have to tell each child something differently. (P9, 8:65)

**Judgments.** Four participants (n=4) indicated that judgements using multiple criteria are useful for understanding the structure of knowledge in ECE. This code was used to identify eight responses (n=8) that indicated certain children may require instructional practices that help a child engage in knowledge with a greater depth of complexity depending on subjective criteria. One participant related:

I think it's complex. I think there's textbook knowledge with teaching. You need to know what behaviors to look for and the standards that they need to know and what development they need to be at, but then you also need to have a people knowledge with the kids. You need to understand how they are and what's going to help them cope or what's going to set them off or what's going to make them smile. (P7, 2:5)
Another participant articulated the complexity of differentiating instruction based on children’s conceptual background knowledge:

When you're planning something there's so many different factors that you have to think of. For example, I have some six-year-olds and I have some five-year-olds that don't turn six until the middle of July next year. I have to think about where each child is at. While some of the kindergartners are ready to add, and start with money and stuff, some don't have that concept yet. How do I plan to meet the needs of all my students? That's a very complex thing with curriculum. (P7, 7:21)

Transdisciplinary. Two participants \((n=2)\) responded that complexity is based on the interconnections between knowledge domains or the transdisciplinary nature of early childhood education. One participant articulated this sentiment as follows:

I think it's complex. I think teachers have a lot of knowledge on a lot of different things, especially early childhood education because you're focused on everything, not just, for instance middle schools like, "Oh you want to be a math teacher, that's your content," and obviously, every teacher does English but not doing Science or Social Studies or whatever, but early childhood education, it's like everything all at once. (P4, 5:58)

This PST went on to state how they decide what knowledge is important: “they also base it off of their knowledge, what they might think is important and then they might research some things, what other things might be important so that could also benefit the teachers” (P4, 5:58).
Flexibility. One participant (n=1) responded that flexibility is necessary for early childhood educators that recognizes the structure of knowledge as complex, and therefore, it is necessary to evaluate the nature of knowledge through evaluation and judgements. This code was used to identify two responses (n=2) that indicate that domain specific knowledge for an early childhood educator is complex due to the need to make judgements based on the efficacy of certain methods.

I think complex because it's always changing or there's so many ways of teaching and instructing kids that you're trying new ways to get information across or does this method work or does it not work. I think just the fact that it's always changing. It's not like a this is what you're doing, this is how you do it. The fact that it can be molded and be flexible I think makes it complex. (P3, 6:45)

Situated Practice. One participant response (n=1) indicated that the structure of knowledge is complex and this is determined by the children and setting where that knowledge resides. The participant stated:

Complex -There's so many layers to it. There's just so many factors and aspects into your knowledge that get you your knowledge. I think everyone's knowledge is different…It could be like your setting, or where you're at, your children, how you think that your practices will work with them. You could have to be flexible and change that, depending on your children. If you're coming into a brand-new school and you try your practices that you've known for these last five years, but it just is not working on those kids, you have to figure something else out. (P9, 8:62)

Source Dimension
Data for the domain-specific codes labeled under *source* \((n=81)\) were drawn from IQ set 1, Question 2 and IQ set 2, Question 2, Question 9, as well as pertinent probing questions. *Source* codes were grouped according to developmental level criteria of being either absolute, multiplist, or evaluativist (Kuhn, 1999). These themes corresponded to *external sources*, *internal sources*, and *internal & external sources*. The *external* theme corresponded with the absolute level of epistemological understanding. This coding scheme concerns itself with belief that knowledge is external of one-self or is outside of one’s own knowledge creation, such as authority. *The Internal* coding scheme corresponded with the multiplist level. This is an overarching category of codes to label responses that indicated that different forms of knowledge reside in and are drawn from internal sources, such as experimentation and experiential learning. The final coding scheme under the *source* dimension was developed to identify and code responses where participants draw from both *external and internal sources*. Combined, this category is attributed to the evaluativist level concerning domain-specific beliefs about instructional practice in ECE.

**Table 6**

*Source: External, Internal, External & Internal Orientations*

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<thead>
<tr>
<th>IQ Set 2 &amp; 3 Data by Participant (P1-P9)</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
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| 44 Absolutist |

**Table 6**

*Source: External, Internal, External & Internal Orientations*
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Note. Table 6 illustrates how PSTs can reflect upon epistemically about the source of knowledge in ECE. The total number of codes is recorded across the study’s eight participants (P1-P6; P8-P9). The source theme was categorized into three groups: External, Internal, & External & Internal. These groups were aligned with their corresponding epistemological level of development which is reflected in the right-hand column under developmental orientations totals. These are related and framed by color: blue is indicative of absolute beliefs, while dark grey is reflective of multiplist thinking, and green represents evaluativist levels of epistemological understanding.

Source: External
The *external* scheme \((n=9)\) provides an overarching category of codes used for responses that indicate a variety of sources of knowledge are external to one’s self or are received from authority outside of one’s own knowledge creation. These codes are recognized as absolutist using Kuhn’s (1999) developmental model. Participants \((n=8)\) stated that sources are legitimately derived from the following sources: *Received* \((n=10)\); *Internet* \((n=8)\); *Social Media* \((n=9)\); *Resources* \((n=6)\); *Peers* \((n=3)\); *Environment* \((n=2)\); *Technology* \((n=3)\) *Institutions* \((n=2)\); *Observation* \((n=1)\).

**Received.** Seven participants \((n=7)\) held beliefs that indicated that knowledge is received. This code was used to label ten responses \((n=10)\) that suggested different forms of authority were useful for knowledge such as online dictionaries, textbooks, professors, lectures, and those in a higher social position were sources of knowledge. One participant replied,

> I think by talking to people who have been there and done that. I think of the instructors in the [redacted] Center. I have learned so much from them about curriculum and just on what to do if something doesn't work, then you've got to go to this. I guess I think that's a good method of learning. (P8, 9:47)

Another articulated this sentiment from the child’s point of view:

> Well, in early childhood I see a lot of going to the teacher. They don't have necessarily the social skills quite yet to feel comfortable going to their peers. There are some that do go to their peers, and they try to work through it together, or they just talk about it. (P9, 8:66)

**Internet.** Five participants \((n=5)\) held beliefs that were labeled *Internet (general)*. This code was used to label eight \((n=8)\) unique responses that posited that sources of
knowledge were gained through the aid of a general Internet search. This code was used to label responses that said sources of knowledge were found though a variety of search engines or websites. One example was stated as follows: “Good old Google” (P9, 8:27). Another respondent noted, “I like searching stuff on the Internet, because we watch a few educational videos…” (P5, 1:22).

**Social Media.** This code was used by six participants \( (n=6) \) that identified sources of knowledge as found on social media accounts. Seven responses \( (n=7) \) indicated that sources of knowledge about instructional practice can be gained through information provided by Pinterest \( (n=5) \), Teacher Blogs \( (n=1) \), and Wikipedia \( (n=1) \). For example, one participant suggested:

- I have always been a kind of a naysayer of Pinterest for better or worse, but I’ll admit I have buckled in the last few months with the preschool. I mean, I don’t know if there is anything I have really done 100% off of it, but I’ve used it to get inspiration, you know kind of tweak it. So, I have seen the advantages of that and I am glad because I don’t really want to dismiss anything. (P1, 4:44)

**Resources.** This code was used to label six responses \( (n=6) \) that identified sources of knowledge about instruction in ECE. This code is used to label four participants \( (n=4) \) that stated different forms of resources, such as educational videos, music CDs, and passed shared lesson plans were useful as sources for lesson planning and instruction. One participant suggested, “[I] just look in the resource room” (P5, 1:16). Another response considered resources from the perspective of a child, “She could watch a video on how to make a volcano and then they would make a volcano themselves, as it's playing” (P6: 3:34).
**Peers.** This code labeled two participant responses \((n=3)\) that recognized peers as sources of knowledge. This domain specific belief reflects knowledge as external of oneself or derived from outside of one’s own knowledge creation. This code was used to label three \((n=3)\) responses that stated different forms of knowledge are useful for making truth judgments about the social world. Examples included knowledge shared amongst peers about instructional practice. One participant suggested the following: “I guess looking at other peers and seeing what they've used and what works and what doesn't work” (P3, 6:24). Another suggested, “…even the student teachers that are a semester ahead of me. I'll say, ‘Oh, I'm doing this. Is there something that you've done, or do you have an idea as of how I can do this?’” (P2, 7:28).

**Environment.** Two participants \((n=2)\) made three separate responses \((n=3)\) stating that environment, such as the classroom space, and student peers, and student teachers were sources of knowledge. One participant suggested, “Mainly I think it's their environment, and what they see and watch. Their environment could change and then ... I don't know. Watching how someone, being models to them, or if they see someone else doing…” (P9, 8:50). Another participant explained, “I constantly think of the environment as the third teacher” (P8, 9:31).

**Technology.** Two participants \((n=2)\) recognized that knowledge about instructional practice is external to one’s self or is derived from outside of one’s own knowledge creation, as found in technology. This code was used to label three responses \((n=3)\) that posited specific websites and applications were sources of knowledge for informing instructional practice. One participant suggested that knowledge was found at:
Another participant believed, “Computer apps” (P4, 5:20), and further stated:

’Cause for instance, technology is obviously advancing and I think they will learn more based on technology ’cause you can do anything with technology. You can look up anything, whichever I think those tools will help them further their knowledge and then will just keep on improving. I guess. (P4, 5:79)

Institutions. Two participants (n=2) responses indicated that knowledge about instructional practice in ECE can be provided by institutions. This code was used to label two responses (n=2) that said sources of knowledge were found through organizations, namely, the NAEYC (P2, 7:16), as well as the state education authority. This latter participant stated, “Online, the state website has a lot of different things you can look on…” (P6, 3:24).

Observation. Two participants (n=2) responses indicated that knowing requires careful observation for individual application of knowledge. This code was used to label two responses (n=2) that indicate that sources of knowledge are externally derived and can be found through observation and mimicking of other teachers, as well as through children who use the environmental resources, such as a picture, schedule, or classroom poster. This latter belief was stated as follows:

Then there are things where we've done as a class, we've made a poster of a list, or we've made a social story and we have it hung up, they could refer back to that. Or if we have a picture schedule, or a list of how to do your hand washing, they could refer back to those. I think if we offer those resources up in visible and accessible to them, it would reduce them having to come to us. (P9, 8:67)
A second participant suggested, “I guess I mimic how someone else has done something and I do it very similar to how they did it, but I guess I try to give it my own…twist on to it and make it my own, too” (P8, 9:58).

**Source: Internal**

The *internal* scheme (*n*=6) provides an overarching category of codes used for responses that indicate a variety of sources of knowledge are internal. These codes are recognized as multiplist using Kuhn’s (1999) developmental model. Participants (*n*=8) posited that sources are legitimately derived from *Experiential* (*n*=7); *Experimentation* (*n*=7); *Communicative Relationships* (*n*=4); *Reflection/Strategies* (*n*=3); *Gut/Internal Confidence* (*n*=3); *Tactile/Kinesthetic* (*n*=1).

*Experiential*. Four participants’ (*n*=4) responses were coded *experiential*. These individuals suggested the source of knowledge is through experiential learning engagements. Seven responses (*n*=7) shared this code. *Experiential* engagements can be through the exercise of planning, teaching, or applying prior knowledge. Other responses include engagements that support children’s own construction of knowledge, such as being involved in daycare and sports. One participant stated, "But maybe when you start getting into something like policies or methods of what works best and what doesn’t that is where I go experiential and rely on my own abilities to understand something" (P1, 4:17). When asked about what instructional practices a person can rely on, another participant suggested,

Um, by pulling from my own experiences and kind how I was taught. I am not sure…when I think of writing, when I see kids writing the lower case G, this is a
house and that middle line is upstairs/downstairs. G lives downstairs but his tail is in the basement. That is how I was taught. So, I come back to it. (P8, 9:69)

Another response was indicative of this epistemic belief about curriculum in ECE.

I am not much of…ah, let me read up on the curriculum. I am more like, I’ll be more experimental and then I’ll find out what works personally for me and what doesn’t. Um, I don’t know. I think that is the best way to go about it. I don’t want to put the energy into trying to comprehend what some psychologist said back in 1960. I would rather see what works best, right here, right now and put my energy into that sort of thing. (P1, 4:92)

**Social Relationships.** Four participants’ (n=4) responses were coded Social Relationships. This is the epistemic belief that knowledge in ECE is internally derived based on communication with others. This code was used to label four quotations (n=4) that suggested the source of knowledge in early childhood instruction is found through communication with peers, family, and/or teachers, as well as being part of a social community. For example, one participant stated, “Their peers are one of the biggest educators, I think. Their teachers, their moms, their dads, their grandmas, their grandpas, everyone around them is a good source for them to learn” (P6, 3.53). Another participant responded that social learning principles are evident as a source of knowledge.

Collaboration with one another above all. What other sources do they need? I think the job of a teacher, as a source, is to guide more so than dictate. Um, Yeah. Using each other and working together. Finding a way to do that. (P1, 4:63)

**Reflection/Strategies.** Two participants’ responses (n=2) indicated that knowledge is internally derived through observation and thinking. This code is used to
label responses that stated a source of knowledge is gained through reflection as means to develop knowledge about instructional practice. One participant suggested how knowledge about instructional practice is internally derived by stating:

They always say borrow and steal and stuff, but I always feel I am not doing a good enough job if I don’t think of things on my own. So, I have settled, at least for now, I try to make a few lessons and lesson plans originally, and the rest will be picked up or a culmination of everything. (P1, 4:6)

Another participant suggested that observation was important for understanding a child.

Yeah. I'm a people watcher, exactly. I love to read, I guess read expressions and I almost like when a child throws a fit because I just ... I want to know like why. I want to know why, and I love to just watch them. (P8, 9:2)

**Gut/Internal Confidence.** Two participant’s (n=2) responses indicated that knowledge is internally derived through gut reaction or personal feelings. One participant suggested, “I don’t know if you would call that a source. You need to be aware or feeling. Feeling. I don’t know how you really develop that confidence. That is something that I am still trying to figure out” (P1, 4:69).

Another participant also posited that sources are based on personal feeling. “kind of your gut reaction and your opinion” (P3, 6:62).

**Tactile/Kinesthetic.** One participant indicated (n=1) the epistemic belief that a source of knowledge is internally derived. This code is used to label responses that stated the source of knowledge in early childhood instruction is developed from kinesthetic “hand’s on” experiences (P4, 5:70).

**Source: External/Internal**
The external/internal scheme \((n=5)\) provides an overarching category of codes used for responses that indicate the integration of knowledge as internal as well as external. These responses are recognized as evaluativist using Kuhn’s (1999) developmental model. Participants \((n=6)\) indicated that sources are legitimately derived from the following: Authority & Experience \((n=6)\); Application \((n=2)\); Student Centered \((n=1)\); Action Research \((n=1)\); Collaboration \((n=1)\).

**Authority & Experience.** Six participants \((n=6)\) were given this label to indicate a belief that required the integration of knowledge from internal as well as external sources through authority and experiences. One participant explained:

I think I use a lot of prior…, I look at what's done before, what hasn't been done. I like to try to discuss it with other colleagues, professors. You know, "What do you think about this? It's an idea of mine, but is it just a crazy idea I'm having, or do you actually think it could work?" (P9, 8:19)

Another participant indicated that knowledge is developed, “Through reflection. I do that a lot. It's kind of, "This is what I did. What theorist does that pertain to?" Looking at your own philosophy, and things, and what theorist you're pulling into your own teaching practices” (P2, 7:31).

**Application.** Two participants’ responses \((n=2)\) demonstrated the evaluation of knowledge through internal (subjective tastes) and external (observation of the external world) sources was gained through application and experience. This was demonstrated through reflection and planning, as well as research and student dialogue. For example:

Reflection. I was talking to one of my friends who's a teacher in a public school system and she's like, "Oh, planning for math is so easy. I just look at what I'm
supposed to do each day as says the book and teach it the way the book tells me." I'm like, "Well, are you coming up with your own" I mean you're lecturing then based on the curriculum that you've chosen. You're just standing up in front of the classroom. She's like, "Sometimes I'll add some of my own lessons, but it's easier to do it this way." It's not always ... We spend a lot of time in here planning and then prepping for those lessons just because there's a lot of things that aren't simple... I don't know. (P2, 7:38)

Another participant responded about knowledge about instructional practice as follows:

From articles, I'd say. Like just information I research about what we're talking about and then maybe having activities along with that. For instance, if it's like math, I would have quotes from math experts on how they understand that concept and then I'd maybe have them form groups and see which way is the best for them to solve that problem. (P2, 5:43)

_Student Centered._ One participant response ($n=1$) was coded _student-centered._

This code revealed the integration of knowledge from internal and external sources through discussion. When asked how certain sources are validated for student use or even if it is the role of a teacher to decide, one participant suggested the following:

I don't think I decide. I let them take control of their own critical thinking and research. I think it's good for me not to lead that, because they're going to be more comfortable, and become more independent with that. (P2, 7:49)

_Action Research._ One participant ($n=1$) response demonstrated that the integration of knowledge as internal and external was through _action research._ This participant stated:
I believe [I can trust this knowledge], because it was in that point and at that moment. What we saw, what we were documenting and then we had pictures that verify what we were doing, and I believe we had recordings also. (P5, 1:36)

**Collaboration.** One participant \((n=1)\) was given this label to indicate a belief that required the integration of knowledge as internal and external as gained through collaboration. When asked about instructional practices used, this participant indicated:

What we did for our investigation as a teaching group, we did mindfulness…because our question was how we can use mindfulness from a high-energy activity to a low energy activity. So, when they come in from recess into group time, or free time to group time again. It's how do we get them to calm their bodies down, they pay attention to what we're trying to instruct. (P4, 1:42)

**Justification Dimension**

This coding scheme is based on how an individual makes judgements about knowledge as it concerns instructional practice in Early Childhood Education. Data for the domain-specific codes labeled under justification \((n=78)\) were drawn from IQ set 1: Question 5, Question 6, and Question 7, and IQ set 2: Question 5, and Question 10, as well as pertinent probing questions. Justification codes were grouped according to developmental level criteria recognized as *absolute, multiplist*, or *evaluativist* (Kuhn, 1999). These themes correspond respectively to *objective, subjective*, and *objective & subjective* ways of knowing (Kuhn, 1999). Each category is concerned with how an individual justifies a knowledge claim in order to make an informed judgment using or certain criteria: objective criteria, subjective criteria, or how an evaluation integrates objective and subjective orientations to knowledge. The *objective* theme corresponded
with the absolute level of epistemological understanding. This coding scheme concerns itself with belief that knowledge is justified by facts that are external of one’s self or are outside of one’s own knowledge creation, such as authority. The *subjective* theme is an overarching category of codes to label responses that indicated that knowledge is justified based on opinion or non-objective information. This corresponded with the multiplist level of epistemological understanding. The *subjective & objective* orientation corresponded with the evaluativist level of epistemological understanding. This category recognizes that individuals justify knowledge based on an integration of both subjective and objective sources.

Table 7

*Justification: Facts, Non-Objective, Subjective & Objective Orientation*

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<tr>
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Table 7 illustrates how PSTs can reflect upon epistemically about the justification of knowledge in ECE. The total number of codes is recorded across the study’s eight participants (P1-P6; P8-P9). The justification theme was categorized into three groups: Objective, Non-objective, and Objective & Subjective. These groups were aligned with their corresponding epistemological level of development which is reflected in the right-hand column under developmental orientations totals. These are related and framed by color: blue is indicative of absolute beliefs, while grey is reflective of multiplist thinking, and green represents evaluativist levels of epistemological understanding.

### Justification: Objective

The objective scheme (n=11) provides an overarching category of codes used for responses that indicate the justification of knowledge is external of one’s self or is received from authority outside of one’s own knowledge creation. These codes are recognized as absolutist using Kuhn’s (1999) developmental model. Participants (n=8) stated that knowledge is justified legitimately from the following categorization of objective information: Verification (n=7); Transmission (n=3); Prevailing Authority (n=3); Passively Received (n=1).

**Verification.** Seven participants (n=7) suggested that knowledge about curriculum or instructional practice is verified by absolute authority. Four responses (n=4) indicated
that knowledge about instructional practice can be found in domain specific areas of instruction or provided by policy or guidelines. One participant synthesized this belief as follows, “I like to have true or false, right from wrong” (P9, 8:55). Another participant justified knowledge stating:

Well a lot of times I Google stuff and obviously, I don't go to Wikipedia because that's not very trusted at all but I'll go to a source like I would type in, "What's the best way for the children to learn how to learn about museums," because that's what my investigation group is doing and then I'll go to like museum type sites, like children museums and all that stuff, so I make sure it's actual information. (P4, 5:75)

*Transmission.* One participant explained that instructional practice is justified by knowledge that is factual and transmitted from one source to another. Three responses (n=3) indicated that knowledge was justified by facts that are ascertained by everyday people, but not validated by the self or an expert.

I would make it in my own, whether it would be a hands-on, instead of a paper, that's how I would communicate with the kids. I'd be like, "Oh. Okay," so I'm going to show it to them, "This is what you need to learn. This is what we're going to do, but we're not going to do a worksheet, but this is how we're going to do it," (P6, 3.31).

*Prevailing Authority.* Three participant (n=3) responses indicated that justification of knowledge about instructional practice is based on the prevailing ideas of those in authority. The response below alludes that this authority knowledge should not be challenged.
Each has different beliefs, each has a different philosophy of education, and I think teachers that come into that situation have to conform, basically, to what they believe. It is their word against mine. I am not considered an ‘expert’, I guess, in their eyes, yet. (P8, 9:55)

Another participant also indicated that this authority determines what is learned about instructional practice: “we study and what professors themselves have deemed is important for us to learn” (P5, 1:26).

**Passively Received.** One participant (n=1) suggested that instructional practices are not justified using criteria, but rather are received passively. This code is used to label responses that said that knowledge was absolute and passively received through observation of previously established norms. This participant response was as follows:

I really like ones that have been implemented already. I know that they had to start somewhere, so there are things that you’re the first one to implement them, but I just usually like observing how it works, and if it works in your area, if you're even able to do it. (P9, 8:38)

**Justification: Non-objective**

The non-objective coding scheme (n=11) provides an overarching category of codes used for responses that indicate knowledge is subjective, suggesting that every opinion has equal validity. These codes were used to label fifty-six responses (n=56) that stated different forms of opinions are correct, such as those developed from working with children, gained from experience, and from internal confidence or gut. These codes are recognized as multiplist using Kuhn’s (1999) developmental model. Participants (n=8) indicated that sources are legitimately derived from *Experience* (n=17); *Perspectives*
Experience. Seven participants \( n=7 \) suggested that opinion gained from experience can provide justification for certain practices in early childhood education. This code was used to label seventeen responses \( n=17 \) that suggested different forms of opinions based on experience in early childhood education are correct. For PSTs in the laboratory school this is often expressed as experiential and based on trial and error. For example, one participant stated:

Oh, man, how do I do that? How do you feel if something is accurate or is it garbage or am I just looking at what I want to look at? I don’t know. With factual knowledge, it is actually easier if it’s like, okay, Van Gogh was an impressionist painter and he shot himself and died seven days later. That is facts. I don’t really need any validation. But maybe when you start getting into something like policies or methods of what works best and what doesn’t that is where I go experiential and really on my own abilities to understand something. (P1, 4:13)

Another participant responded as follows:

I think it's all backed up if it works for them. If those teachers are like, "Yeah. We have a huge diversity here and I found this one way that works really well," you'd know it worked there, but it might not work here, but you could definitely try it. I think you've got to trial and error. (P6, 3:42)
A third participant responded, “You don’t necessarily use one approach. You take based on your own personal experiences, and what you believe as a person, and you take those and make them your own. I think every teacher is so different” (P2, 7:12).

**Perspectives.** Two participants’ \( n=2 \) responses were justified through individual perspectives. This code was used to label eight responses \( n=8 \) that identified knowledge claims about instructional practices are justified based on personal beliefs about what is appropriate. These perspectives were articulated as moral and ethical beliefs, personal beliefs about instruction, as well as reflection on aesthetics as appropriate indicators to determine efficacy.

Personally, I would just go towards my views…like everyone won't agree with them but as teachers, we have our own teaching beliefs and I guess, independently we think like what's the most effective in a classroom and then we would look up to those experts to maybe try new strategies to help improve those views of teaching. (P4, 5:36)

Another participant explained:

I have a personal aesthetic. If I open up the website and it doesn't look well put together, I'm going to backspace and go back to a different one. If it looks like it's got a lot on there, or they took time into getting it. I also like seeing a little biography about them and what they have that qualifies them to putting this up there. I'm not particular. I don't use resources word for word. I use them to generate ideas, so I don't always look for the most accurate, but I look for it to get ideas to figure it out myself. (P9, 8:13)
**Gut/Internal Confidence.** Four participants \((n=4)\) indicated that knowledge is justified based on subjective feelings. This code was used to label seven responses \((n=7)\) that stated knowledge is justified based on internal feelings about children and early childhood education. This experience is often based on tacitly held beliefs about instructional practices.

One participant explained, “If I feel I like I have done a good job, I have done a good enough job. So, I trust that extinct” (P1, 4:23). Another stated, “I think by what you feel, because each person has their own opinion and each person feels a certain way” (P9, 9:40). When making decisions about instructional planning a third respondent suggested, “I think it’s that gut feeling” (P2, 7:76).

**Engagement.** Five participants \((n=5)\) indicated knowledge about instructional practices is justified based on engagement through direct observation. This code was used to label seven responses \((n=7)\) that indicated non-objective criteria was used to justify the efficacy of instructional practice. Non-objective information includes opinions about student engagement, responses of students, and personal commitment for discerning the efficacy of instructional practice. For example, one participant stated this sentiment as follows:

The response of the students and the people I am working with and whether or not they are engaged because I think the older kids get, the more they can hide the engagement, but the preschoolers it is easy to tell. So, I guess until I start working with older kids that is the method I am going to use for now. (P1, 4:64)

When asked to about how a participant makes decisions when choosing content from the social network, Pinterest, the following was articulated:
I think that kind of goes back to the interests. I guess what kind of draws my eyes and what I think the children would find interesting in the classroom. What I think would be the most successful in the classroom. (P3, 6:25)

**Open-ended.** Four participants \((n=4)\) indicated that knowledge is based on open-ended criteria concerning drawn from non-objective sources. This code was used to label five responses \((n=5)\) that stated knowledge can be justified by information from sources that do not require any certain criteria for making judgements. These sources include research on the Internet, needing validation for a claim, and using research to get generate independent ideas, or following other ideas to maintain a peaceful environment. One participant shared:

I am okay with people disagreeing on different methods and everything if they can back it up and aren’t totally ignorant and if they have an open mind and are at least willing to listen don’t dismiss something as stupid of dumb. If they have a point I will get along with them just fine (P1, 4:18).

When one participant was asked how she determines which piece of information is more valid than others, the response was as follows, “That's the hardest part, because I still don't know the answer to that question. I feel like when I do research on the Internet, you know what I mean? I just don't know what is right and what's wrong” (P5, 1.58).

**Demonstration.** Five participants \((n=5)\) indicated that knowledge claims are based on non-objective criteria and backed by demonstration of certain outcomes. This code was used to label five responses \((n=5)\) that stated demonstration of efficacy in early childhood education justifies effective practice. These codes apply to responses that utilized open-ended questioning, observation, and using a variety of assessment strategies.
to learn about the utility of a certain practice. One participant indicated, “I guess kind of seeing the success of the students and what concepts they're learning and gaining” (P3, 6:65). A second participant suggested:

When they can express it to me without me asking or without me prompting. If you could be like, "Oh, wow. Look at that," and they'd just be like, "Oh, yeah. We did this, this, and this." I think that really shows that they picked it up. (P6, 3:27)

Success. Two participants (n=2) indicated knowledge is evaluated by non-objective criteria, suggesting that opinions gained from the experience of others, perhaps influenced by persuasion, have validity in early childhood instructional practice. This code was used to label responses that stated different forms of opinions based on others' experiences about early childhood education are correct. This justification is often based on persuasion. For example, one participant suggested that instructional practice can be justified by asking questions such as: "How long have you been using this? What are the results? Have you noticed the kids? Are they picking it up? Are they not picking it up? Do they like it?” (P6, 3:38).

Ethics/Morality. One participant (n=1) indicated that knowledge claims are based on ethics and moral choices. This idea was stated in the following manner:

I think I have to go back within myself, my morals, my ethics and whichever I feel is best that way and then I will just explain why. I would be like, "You know what? I see your point. I really do, but this is how I feel. This is how I think it should be done and I can't do what you're asking.” (P6, 3:18)

Temporal/Contextual Concerns. One participant (n=1) response suggested that knowledge about instructional decision making is based on temporal and
contextual conditions. This code is used to label responses that indicated situational concerns are used to justify a knowledge claim. The following example addresses affective considerations and environmental factors, “By what I feel I think at that time and what environment I am in” (P8, 9:68).

**Justification: Objective & Subjective**

The *objective & subjective* coding scheme (*n*=4) provides an overarching category of codes used for responses that indicate justification of knowledge is based on integration of subjective and objective information. These codes were used to label nine responses (*n*=9) from three participants (*n*=4) that suggested that knowledge is justified by evaluation through techniques such as inquiry-based methods, autonomy supporting behaviors for instruction, efficacy, and evaluation. These codes are recognized as evaluativist using Kuhn’s (1999) developmental model. Participants (*n*=8) indicated that sources are legitimately derived from *Evaluation* (*n*=7); *Efficacy* (*n*=1); *Autonomy* (*n*=1); *Inquiry* (*n*=1).

**Evaluation.** Three participants’ (*n*=3) responses concerning the justification of knowledge is based on the strength of argument where judgements are made based on criteria for evaluating certain claims. This code was used to label seven responses (*n*=7) that considered the integration of knowledge of opinion and fact to make judgments. For example:

I always relate to Howard Gardner's Theory of multiple intelligence, and how each child learns differently. I also really like that it's putting the responsibility on the children to learn. When they get to college, I mean, we're responsible for our grades, and if we go to class. We don't have somebody telling us this is what we
have to do, so it's preparing, I think, it's preparing children better for real world.

(P2, 7:45)

Another participant suggested that determination about learning require: “Their baseline. Where are they right now? Where are they supposed to be? Then, you have a target…You have the early learning guidelines or if you're in school you have the standards, so basing it off of those” (P6, 3:21).

**Autonomy.** One participant (n=1) indicated knowledge claims are based on non-objective criteria for developing autonomy as a value in early childhood practice. This response suggested that opinion and observation based on children’s experiences in early childhood education are justified. Knowledge concerning the development of practice is often based on autonomy seeking behavior in ECE.

In regard to being asked how a teacher can decide about the efficacy of certain instructional strategies in early childhood education when two experts disagree one participant stated, "[The children] can you use as a resource, as well ‘That teacher thinks this. I think this. What do you think based on that?’” (P3, 7:52).

**Efficacy.** One participant (n=1) response indicated that judgements are made based on criteria for evaluating the efficacy of a knowledge claim. This code was used to label the integration of opinion and fact to make judgements about the efficacy of a teaching practice. This was articulated as follows:

I think researching it as well, going online. “Has anyone wrote about this? Has anyone tried this? Other than here, because what works in the mid-West might not work on the coast, so just seeing, is it overall, every child it works with or is it specific children? (P6, 3.40)
Inquiry. One participant’s (n=1) response indicated that knowledge about ECE instructional practice can be gained through the rules of inquiry and evaluation. This code was used to label the integration of opinion and fact to make judgements about the efficacy of a teaching practice. This participant indicated that these include experimentation, testing, and observation in the following example:

I think that kind of goes to personal preference. Also, I think experimenting, trying out. I can try out this new method and if it doesn't work I can go back and try a different method. I think teaching, while it has its set things, it's also very flexible of getting the information or gaining new concepts to the children. I think that's what's cool is it's flexible that you can change your ways of getting information across. (P3, 6:27)

Alignment of Dimensional Beliefs by Developmental Level

Question 1a requires the reporting of results by dimensional level. However, the triangulation that is necessary to answer the primary research question requires reporting on results by developmental level. Therefore, the domain-specific dimensional beliefs about ECE curriculum and instruction are aligned with their equivalent developmental level using the PEM framework. The categorization of each dimension as reported for research question 1a were aligned in this manner, thereby facilitating this process and the most significant results are listed in the two paragraphs below.

The most prevalent codes that had the greatest frequency amongst the study’s participants (n=8) are listed sequentially as follows (see Table 8). Knowledge is absolute and fixed and received through sources of authority (n=7); the source of knowledge is from social media (n=7); knowledge is justified from experience (n=7) and engagement
Additionally, most participants recognized the stability of knowledge as uncertain and changing due to the needs and desires of children (n=7). The most prevalent evaluativist category across the participants was the source of knowledge as integrated from objective sources of authority alongside the subjective experience.

The least prevalent codes that had a minimum response rate of one (n=1) are listed sequentially according to four dimensions, beginning with the nature of knowledge (stability and structure), followed by the processes of knowing (source and justification):

**Stability:** Certain: Knowledge Discovery (n=1); Transmitted (n=1). Stability:

Uncertain/Changing: Adaptability (n=1), Culture (n=1), Technology (n=1). Stability:

Contextually Certain: Constructivist (n=1); Context (n=1). Structure: Simple: Simple (n=1). Structure: Complex: Transdisciplinary (n=1); Situated Practice (n=1). Source:

Internal: Tactile/Kinesthetic (n=1). Source: External/Internal: Action Research;

Collaboration (n=1). Justification: Subjective: Ethics/Morality (n=1); Inquiry (n=1);

**Temporal/Contextual** (n=1).

Table 8

*Domain-Specific Dimensional Beliefs About ECE Curriculum and Instruction Aligned by Developmental Level*

<table>
<thead>
<tr>
<th>Domain-Specific Dimensional Beliefs About ECE Curriculum and Instruction Reported by Developmental Level</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>P6</th>
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*Note.* Table 8 illustrates how PSTs can reflect epistemically about each dimension of knowledge in ECE. This table also offers the developmental equivalent for each category articulated for research question 1a. For example, the *stability* dimension was categorized into three groups: *Absolutist*, *Multiplist*, and *Evaluativist*. These groups were aligned with their corresponding epistemological level of development which is reflected in the left-hand column under each dimensional belief. The total number of these beliefs is recorded across the study’s eight participants (P1-P6; P8-P9).

**Summary of Analysis**

Sub-question (1a) revealed several patterns of epistemic beliefs that can be espoused by PSTs in the laboratory school amongst the 261 ($n=261$) responses that were coded using Hofer’s dimensional framework. The following themes were from Interview Question set 1 and Set 2 (see Appendix E). The below figures do not account for probing questions for each dimension. Probing questions were not quantified, as they varied per interview. Therefore, caution is urged in making deductions from the quantity of total codes related here. The most prevalent theme was a *non-objective* orientation concerning the justification of knowledge ($n=54$), however the interview schedule and protocol listed 25% more questions targeting this dimension. The second most common theme was that static or certain facts and external information from authorities were recognized as
sources of knowledge \((n=45)\). The source and justification themes are both processes of knowing. The third most prevalent theme was stability being recognized as uncertain and changing \((n=34)\). The next greatest occurrence was found to be source codes, but this fourth most ranking was recognized as internal and subjective \((n=22)\). Two sets of Structure categories were recognized next. Both connected and subjectively held as well as complex views of this dimension were recognized \((n=19)\). The least recognized category of any dimension was the structure dimension. The structure of knowledge in ECE as received was used to label one response \((n=1)\).

**Domain-Specific Developmental Level of Epistemic Understanding**

**Research Question 1b**

As noted in Chapter 3, Interview Question Set 3 (IQ set 3) targeted specific responses about knowledge beliefs present in instructional practice in an early childhood setting. This was done to fulfill the purpose of gaining each participant’s developmental level of epistemic understanding (see Appendix E: Interview Question Protocol). Each question was scaffolded according to Kuhn’s (1999) developmental levels in order to elicit an overall level of epistemic development (i.e., absolute, multiplist, evaluativist). An example of this line of questioning and its logic for deducing an epistemic level of development is explained in detail in the paragraph below.

Data was first analyzed on the participant level through the assigning of codes \((Figure 4: Method 1)\). Codes were organized by theoretical based themes using the developmental language of Kuhn (1999) as found in the PEM model: absolute, multiplist, and evaluativist thinking. Each participant was assigned a minimum of four codes for the
data set and a maximum of five codes. The top six code occurrences are reported across the participants and quotations are included to substantiate the codes.

**Figure 4.** Method 1 depicts the method of analysis following the QCA guidelines used to determine each participant’s beliefs. For IQ set 3, each meaning unit from data is applied to a theoretically deduced code at the participant level based on developmental levels of epistemological understanding (e.g., absolute, multiplist, and evaluativist). From “English Language Learners’ Epistemic Beliefs about Vocabulary Knowledge” (p. 71), by Ziegler, N., 2014, University of Toledo (Diss.). Copyright 2014 by Ziegler, N. Adapted with permission.

As noted above, the questions for IQ set 3 were scaffolded in a manner to elicit developmental levels of epistemological understanding empirically developed by Kuhn (1999). For example, Question 1 asked “Do you think most problems or dilemmas that arise in teaching often have a simple solution?” (see Appendix E). The participant would then follow up a “Yes/No” answer and an explanation. For example, a “yes” response indicated that knowledge is simple and is indicative of an absolutist position. A “no” response would be followed by the next question in sequence: “Do you think there is often more than one correct solution to a teaching dilemma?” The response and explanation revealed if a multiplist orientation was a possibility. If the participant answered “yes” then an additional question seeking the justification of knowledge would be asked. “Can multiple solutions be correct? Why?” This response would confirm a multiplist belief or suggest evaluativist thinking. In the latter case, a probing question would follow: “How can a teacher determine the best possible solution to a classroom
problem”. The answer to this probe would help to confirm a multiplist or evaluativist response. Therefore, almost half of the developmental codes attributed in the analysis of IQ set 3 were based on responses to the final question that sought how the participant decides or justifies a position about knowledge (n=17). A total of forty (n=40) codes were applied to eight participants IQ set 3. Below the deductive categories of absolutist, multiplist, and evaluativist categories are reported to answer Question 1b concerning the beliefs that were evident for each of the study’s participants.

**Absolutist.** Three participants’ (n=3) responses indicated that knowledge is absolute and indicative of the nature of knowledge being evaluated based on authority where facts can be determined as either right or wrong. This code was used for three responses that indicated that knowledge about instructional practice can be recognized as either right or wrong. One participant offered an absolutist sentiment as follows, “Who it's coming from? If it's coming from a professor who has done it for 20 years, yes. If it's coming from an assistant … who doesn't have as much experience as me, then maybe not” (P9, 8:59).

Another participant stated the following about transmission of expertise:

I think that's kind of where you're the teacher so you have to give those more definitive answers, those answers that are better than others. I mean you can say, I guess you can believe this or think this, but then I think you also just show them evidence of why this answer is better than that answer. (P3, 6:56)

**Multiplist.** Eight participants (n=8) indicated that it is not necessary to evaluate knowledge based on objective criteria. This code was used to identify twenty-four responses (n=24) that indicated instructional practices are uncertain and any given
position on instructional practice is as reasonable and supported as any other. Therefore, there is no benefit to question these practices as they are internally derived. Stated in another manner, every opinion has the right to be right, but validation can come in the form of an expert who is found to agree with a certain perspective. PSTs that indicated this was the case do not evaluate the logic of an argument or look for support that one interpretation may have in public opinion. It also might be found that reflection and evaluation do not relate to any underlying theory, but trial and error and opinions from personal experience, as well as opinions of those whose perspective is in agreement. For example, one participant suggested the multiplist thinking in the following manner:

Yeah. It depends on your own ways of thinking, I suppose. Everything is subjective in life and in the world, and it hard to know where to draw things and you can almost go all day and question whether or not something is real.

(P1, 4:95)

When asked if one expert in early childhood education can be more correct than another, one participant illustrated multiplist thinking in the following statement, “No, again, it's based on your prior knowledge, your experiences, and what you're searching for” (P9, 8:70). Another respondent noted a similar response, “No, it’s all based on the person, I think” (P3, 7:62).

**Evaluativist.** Four participants’ \((n=4)\) responses demonstrated evaluativist thinking based on the logic of argument (criteria) or one judgement might be better than another judgment based on criteria. This code is used to identify eleven responses \((n=11)\) that indicated that certain instructional practices were more reasonable and justified within context by a determination of value. The value judgements are made using criteria
such as coherence, logic, efficacy, setting, or the experience of the individual. One participant demonstrated this evaluative thinking using multiple criteria when making decisions in ECE, in the following quotation:

If you have more time ‘well what can we do to make this better?’ You can observe, or write down notes, see how a test goes. If it goes bad you go in instruction, but if you don't have that extra time you have to make those quick decisions to move on in order to go on with the day because you can't just focus on one thing all day long. (P3, 6:52)

Another participant responded about the timing of a decision and included perspectives from multiple sources into the solution to a classroom dilemma.

Sometimes I leave the situation, and we can come back to this situation later. I need to breathe, you need to breathe. But I also look to people who are also there. You know my assistants, my co-teachers, or my mentor. People who are watching and getting another perspective of the situation. Then I take that information and see if I can answer it. (P8, 9:70)

**Espoused Beliefs from IQ set 3 Reduced to Epistemic Developmental Level**

Next, multiple data sources were considered for each participant from IQ set 3 and reduced to an overall level of epistemic development. This step was necessary to complete the analysis for answering research Question (1b) (see Figure 5).
Method 2

Multiple code occurrences quantified and reduced at participant Level

Multiple Data Sources Reduced → Participant Reduced Belief

*Figure 5.* This figure depicts the method of analysis used to determine each participant’s overall epistemic level of understanding as *absolute, multiplist, evaluativist.* For each unique data source, multiple code occurrences were reduced using a ratio and percentage scheme to reflect an epistemic developmental level for each data set (i.e., *absolute, multiplist, evaluativist*). Adapted from “English Language Learners’ Epistemic Beliefs about Vocabulary Knowledge” (p. 73), by Ziegler, N., 2014, University of Toledo (Diss.). Copyright 2014 by Ziegler, N. Adapted with permission.

As noted in chapter three, codes were verified based on the average code occurrences according to the developmental language of Kuhn (1999) as found in the PEM model: absolute, multiplist, and evaluativist. Following Mason et al. (2006) reduction method the ratio of items was considered as “prevailing patterns” or tendencies of the participants (p. 48). If 3 out of 4 responses indicated absolute, this represented a 75% absolutist tendency as it concerned the participants’ developmental level. This code was then assigned to the participant for IQ set 3. This pattern was used to identify multiplist and evaluativist tendencies as well. Based on the rationale developed by Ziegler’s (2014) model, the language *fully validated, partially validated,* and *not validated* were employed. Tendencies that were *fully validated* were reflective of a ratio of responses over 50% (>50%). This percentage demonstrated that the participant held a dominant epistemological belief. Two developmental levels that were rated at 50% were *partially validated.* This was indicative that an individual’s beliefs were in transition. Tendencies under 50% were reserved for the label *not validated.*
Table 9

*Developmental Beliefs’ Reduced from Code Frequencies*

<table>
<thead>
<tr>
<th>Participants</th>
<th>Code Frequency: Ratio and Percentage</th>
<th>Fully Validated</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1, M</td>
<td>M=4/5, 80%; E=1/5, 20%</td>
<td>Multiplist</td>
</tr>
<tr>
<td>P2</td>
<td>M=4/5, 80%; E=1/5, 20%</td>
<td>Multiplist</td>
</tr>
<tr>
<td>P3</td>
<td>A=1/10, 10%; M=2/10, 20%; E=7/10, 70%</td>
<td>Evaluativist</td>
</tr>
<tr>
<td>P4</td>
<td>A=1/4, 25%; M=3/4, 75%</td>
<td>Multiplist</td>
</tr>
<tr>
<td>P5</td>
<td>M=2/5, 40%; E=3/5, 60%</td>
<td>Evaluativist</td>
</tr>
<tr>
<td>P6</td>
<td>M=3/4, 75%; E=1/4, 25%</td>
<td>Multiplist</td>
</tr>
<tr>
<td>P8</td>
<td>M=3/5, 60%; E=2/5, 40%</td>
<td>Multiplist</td>
</tr>
<tr>
<td>P9</td>
<td>A=1/5, 20%; M=3/5, 60%; E=1/5, 20%</td>
<td>Multiplist</td>
</tr>
</tbody>
</table>

*Note.* Table 9 illustrates how PSTs can reflect a developmental level of epistemological understanding: Absolutist, Multiplist, and Evaluativist. These findings apply to one data set where the sum of the code frequencies is divided by total at the participant level. All codes reflective of over 50% of the total were recognized as fully validated. The right-hand column reflects their reduced developmental level for each participant (P1-P6; P8, P9).

**Analysis Summary**

Sub-question (1b) explored the features that are evident using a developmental model of epistemic understanding. Three participants’ (n=3) responses indicated that knowledge is absolute. Eight participants (n=8) indicated that it is not necessary to evaluate knowledge based on objective criteria, but demonstrated a tolerance for subjective ways of knowing in ECE. Four participants’ (n=4) responses demonstrated evaluativist thinking based on the logic of argument (criteria) or one judgement might be better than another judgment based on criteria. When the code frequencies were reduced
through a ratio/percentage, six individuals were labeled as multiplist \((n=6)\) and two participants \((n=2)\) were labeled as evaluativist.

**Enacted Beliefs Revealed from Video of Practice**

**Research Question 1c**

In order to answer sub-question (1c), data from PSTs video of practice was considered according to Kuhn’s (1999) developmental level of epistemological understanding (i.e., *absolute, multiplist, evaluativist*). Video excerpts of questioning strategies and dialogue were selected and coded according to their perceived epistemic developmental level dependent on the “epistemic underpinnings” enacted during instruction (Feucht, 2011, p. 240) (see Figure 4). This data was investigated in an exploratory manner as videos were secondary sources of data.

**Method 1**

*Data analyzed at participant level*

| Data Coded | Participants Beliefs |

*Figure 4.* Method 1 depicts the method of analysis following the QCA guidelines used to determine each participant’s beliefs. Each meaning unit from data is applied to a theoretically deduced code at the participant level. From “English Language Learners’ Epistemic Beliefs about Vocabulary Knowledge” (p. 71), by Ziegler, N., 2014, University of Toledo (Diss.). Copyright 2014 by Ziegler, N. Adapted with permission.

Given that the laboratory school supports inquiry-based methods, consideration of PSTs classroom conversations as they related to the constructs provided in the PEM framework provided a logical organization scheme for category development. Eight PSTs \((n=8)\) were found to universally employ questioning strategies in their classroom
Three overarching categories were deductively identified to house the forty-three coded responses ($n=43$) from PSTs’ video using the PEM framework with emphasis on Kuhn’s (1999) developmental positions focused on the process of epistemic reasoning. Categories based on objective, subjective, and objective and subjective criteria are listed as in order each representative of absolutist, multiplist, and evaluativist thinking about inquiry-based methods (see Table 8).

Each category is based on the following developmental levels: **Absolutist** (teacher focus on right or wrong answers and knowledge from authority), **Multiplist** (teacher guided by solicitation of opinions or following interests), and **Evaluativist** (teacher encouraged students to use subjective and objective knowledge to make judgements). PSTs tended to demonstrate a mixture of beliefs, therefore the above categories were overarching categories useful for documenting and exemplify codes that were not indicative of an overall pattern found for each PST. Meaning, PSTs were found to have occupied at least two positions.

**Absolutist**

Seven participants’ ($n=7$) enacted beliefs that can be interpreted as knowledge being *facts* transmitted from sources of authority. Using the PEM framework this is aligned with absolutist beliefs about reasoning. This label was used to identify enacted beliefs about the nature of knowledge that is either transmitted by authority or evaluated based on authority initiating a task, eliciting a response through questioning and evaluating facts as either right or wrong. These messages suggest that knowledge is simple, stable, and from authority. This code was used for twenty responses ($n=24$) that indicated that knowledge delivered through instruction can be recognized from authority.
Authority. Seven participants \( n=7 \) communicated tacitly through their interactions that teachers were sources of authority. Thirteen responses \( n=13 \) suggested epistemic messages that teachers were arbiters of knowledge. This was evident in the following transmission of information from teacher to student when introducing this as a new concept: “The cause of the book, *If You Give a Mouse a Cookie*, is he will need a glass of milk. So, the cause would be giving him a cookie, and the effect of that would be giving him a glass of milk.” (P9, 1:11). Another participant communicated a view of authority in the following example when offering behavioral expectation for working in a certain space: “Okay, what are my three rules for being in this class?” Student one replied, “No running unless you’re hurting yourself or your friends.” Student two replied, “Have fun”. Student three suggested, “Don’t run”. The teacher responded, “Don’t run unless who tells you? The students chorally responded, “the teacher!” (P6, 4:1).

Facts. Seven participants \( n=7 \) espoused an objective view about facts as stable and absolute. Eleven \( n=11 \) suggested that facts could be gained through questions where one singular response was accurate and true. One PST engaged four students in a game of Chutes-and-Ladders where the mathematics principle of one-to-one correspondence was being practiced. During the game, several students evidenced ability to count independently, for example “If I just go: one, two, three, four, five, six, seven, eight, nine, ten – I win!” (P4, 2:36). However, the teacher supported each student in their counting to six with each roll of the die demonstrating that the source of knowledge is from authority. This was the case even though students demonstrated they could assist one another with counting (P4, 2:37). This teacher would assist the student in number recognition, but at times the pupil would call out the number first as in the following
Another teacher, when offering a lesson on geometric shapes, sought facts by asking: What country would you find that [pyramid] in?” (P2, 6:1). Several students responded in unison “Egypt” and the teacher affirmed this response was correct (P2, 6:1). Another PST offering a similar lesson on 3D shapes inquired of a student, “What shape is that?” (P9, 9:14). Several children responded with the appropriate shape name. This PST then asked for students to justify their knowledge of a sphere “How do we know it is a sphere? What makes it a sphere” Several students responded, “It rolls” (P9, 10:3). The PST then reiterated, “It rolls - that is what makes it a sphere. That is how we know” (P9, 10:3). Although the question had the potential to be evaluativist in nature, it was offered in an absolutistic fashion where the justification of knowledge was communicated as factual. In the absence of criteria being elicited to evaluate geometric shapes, such as comparing it to other shapes that have the ability to roll such as a cylinder or a cone, this questioning strategy could not be recognized as an evaluativistic thinking.

**Multiplist**

Seven participants (n=7) enacted beliefs that could be recognized as *multiplist*, where a value is placed on following student interest and supporting children’s decisions. However, any teacher’s questioning stopped short of permitting students to make judgements evaluated based on evidence as all opinions were accepted. This category was used to identify enacted beliefs about the nature of knowledge that is subjective and
internal and connected by internal tastes, observations, and interests. This label was used for twenty-two responses (n=21) that indicated that knowledge was subjective and therefore justification of thinking was not necessary. Questioning strategies were grouped into two categories based on questions that have an open-ended nature (n=12). The second category, dialogue and opinion, also offer opened-ended questions, but are differentiated by their capacity and potential for students to explain their thinking processes alongside community members.

**Open-ended.** Five participants’ (n=5) interactions with children were labeled open-ended. These types of questions and the responses they garnered suggested a belief that all answers are acceptable for the learning engagement recorded. Therefore, the epistemic message these questions send is that knowledge and knowing are subjective. Eight responses (n=12) were coded with this multiplistic understanding and were exemplified in the following exchanges: One group of students was engaged in developing an obstacle course. Students were asked where each piece of the course should go as they developed a unique design. “Where should we put the balance beam?” (P6, 4:3). This technique allowed for a subjective view that was accountable only to the student. In another small group lesson, another PST exemplified the use of open-ended questions using the text, “Where the Wild Things Are”, stating, “I want you to draw what you think it looks like” (P9, 9:7). This demonstrated that the source of knowledge was subjective and internal.

**Dialogue & Opinion.** Three participants (n=3) utilized questioning strategies to help students to develop their thinking in social situations. Nine responses (n=9) were labeled with this multiplist view of knowledge. In one example, during a small group
engagement (n=5) with support from the text, *Otis and the Tornado*, the instructor asked each child the open-ended question: “What is your favorite thing about the tornado investigation?” (P3, 3:4). In this same piece, we can witness a subjective orientation concerning the structure of knowledge as connected in the following teacher-student dialogue, in small group, one child remarks: “That barn is broke.” The PST confirmed and connected this observation with experience “Yep, it is blowing away from the wind from the tornado. Like that one day you destroyed those structures” (P3, 3:34). This was said in a conversational manner and was not conveyed as negative. This PST supported the student’s sense of agency to respectfully interrupt the text to support dialogue as curiosity permitted. Another PST elicited responses from students on why a scientific investigation turned out as it did. Multiple children were given opportunities to share their “guess” as to why a toy on a balloon moved across a string as the air was expelled (P7, 11:1). It was not clear how this lesson ended, as a second PST suggested “We will have to look at that further won’t we?” (P8, 11:5). This allowed the possibility for an evaluativist perspective as this lesson resumed off the record. However, from the video offered, these teachers affirmed each child’s response, but did not suggest that children should consider each other’s opinions and decide on the best possible answer. Therefore, this dialogue supported an epistemic view that the source of knowledge is active and internal, but subjectively held as all answers are possibly valid.

**Evaluativist.** One participant (*n=1*) enacted beliefs that could be interpreted as evaluativistic. This view is based on valuing subjective and objective orientations for making judgements about knowledge in ECE. Further, the construction of knowledge is encouraged through questioning strategies and use of student’s ideas language and ideas.
Using the PEM framework, this questioning pattern for supporting dialogue was revealed in three responses (n=3) that were aligned with evaluativistic beliefs about reasoning. For example, in one small group lesson three four-year-old students were encouraged to work together on the design and development of a zoo using wooden blocks. The first prompts were subjective and open-ended. As the engagement proceeded, the PST would encourage questions that required the evaluation of objective information. For example, one student stated: “This is a doggie house!” The PST asked, “Are there any doggie houses at the zoo?” (P5, 5:11), in other words, suggesting, can the child verify having seen one (objective). A second child answered for the first by suggesting they could build an alternative space for animals to play. This suggested problem solving was valued and encouraged as an autonomous ideal. Afterwards, the first child suggested a new idea. The students were encouraged to develop their ideas in social collaboration through continuous prompts and questions that encouraged creativity and reasoning. In the example provided below, a student was making an area for gazelles at their zoo. Here the PST demonstrated that she values students making their own judgments based on evaluation of information.

PST: So, if the tigers are right here. Do you think we should put the gazelle’s next to them?
Child: no.
PST: No, why do you think we shouldn’t put them next to each other?
Child: Because they eat em! (5:33)
The following exchange could be termed absolutist in isolation, however in the context of dialogic teaching being evident it demonstrated an evaluativist position toward reasoning that some ideas are better than other based on judgements made by a pre-school student.

**Figure 5.** This figure depicts the method of analysis used to determine each participant’s overall epistemic level of understanding as *absolute, multiplist, evaluativist*. For each unique data source, multiple code occurrences were reduced using a ratio and percentage scheme to reflect an epistemic developmental level for each data set (i.e., *absolute, multiplist, evaluativist*). Adapted from “English Language Learners’ Epistemic Beliefs about Vocabulary Knowledge” (p. 73), by Ziegler, N., 2014, University of Toledo (Diss.). Copyright 2014 by Ziegler, N. Adapted with permission.

After the coding was completed the next step commenced. Each code was transferred in sequence from the interview transcripts to an Excel document for analysis and reduction to a ratio/percentage as articulated for *Data Analysis Method 2*. Next, the videos codes were verified and reduced to a level of developmental understanding (i.e., *absolutist, multiplist, and evaluativist*). This was done to support triangulation of data useful to answer the primary research question. Video of instructional practice revealed three PSTs were *fully validated* as absolutist (n=3). Three participants were *partially validated* as absolutists, as well as multiplists (n=3). Two individuals were *fully validated* as multiplistic thinkers (n=2). One PST was *partially validated* as a multiplist, as well as an evaluativist. The label *not validated* was not necessary for this data set (see Table 10).
Table 10

Validation of Enacted Beliefs

<table>
<thead>
<tr>
<th>Participants</th>
<th>Absolute</th>
<th>Multiplist</th>
<th>Evaluativist</th>
<th>Fully validated/ partially validated/ not validated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Objective</td>
<td>Subjective</td>
<td>Subjective &amp; Objective</td>
<td></td>
</tr>
<tr>
<td>P1, M</td>
<td>Authority (3); Facts (2)</td>
<td>Open-ended questions (1); Observation (1); M=2/7, 29%</td>
<td></td>
<td>Absolutist Position Fully Validated A=71%</td>
</tr>
<tr>
<td>P2, F</td>
<td>Facts (1); A=1/4, 25%</td>
<td>Open-ended questions (2) Dialogue &amp; Opinion (1); M=3/4, 75%</td>
<td></td>
<td>Multiplist Position Fully Validated M=75%</td>
</tr>
<tr>
<td>P3, M</td>
<td>Authority (3), Facts (2)</td>
<td>Open-ended questions (2) Dialogue &amp; Opinion (3); M=5/10, 50%</td>
<td></td>
<td>Absolutist &amp; Multiplist Positions Partially validated A= 50%, M=50%</td>
</tr>
<tr>
<td>P4, F</td>
<td>Facts (1); Authority (4)</td>
<td>Dialogue &amp; Opinion (3); M=3/6, 50%</td>
<td>Dialogue &amp; Decision (3) E=3/6, 50%</td>
<td>Multiplist &amp; Evaluativist Positions Partially validated M= 50%, E=50%</td>
</tr>
<tr>
<td>P5, F</td>
<td>Facts (1); Authority (2)</td>
<td>Open-ended questions (3); M=3/5, 60%</td>
<td></td>
<td>Multiplist Position Fully Validated M=60%</td>
</tr>
<tr>
<td>P6, F</td>
<td>Facts (1); Authority (2)</td>
<td>Observation (1); Dialogue and Opinion (2); M= 3/6, 50%</td>
<td></td>
<td>Multiplist Position Partially Validated A=50%; M=50%</td>
</tr>
<tr>
<td>P8, F</td>
<td>Facts (3); Authority (1)</td>
<td>Open-ended questions (2) M=2/6, 33%</td>
<td></td>
<td>Absolutist Position Fully validated A=67%</td>
</tr>
</tbody>
</table>

Note. Table 10 illustrates the epistemic reasoning that was evident in PSTs instructional practice in ECE. This table offers the developmental equivalent for each category articulated for research question (1c). For example, the objective dimension was categorized as Absolutist. Each PST belief was noted as fully validated or partially validated as reflected in the right-hand column. The total number of these beliefs is recorded across the study’s eight participants (P1-P9, excluding P7).

Table 11

Enacted Beliefs about Instruction in ECE
<table>
<thead>
<tr>
<th>Partially validated</th>
<th>Absolutist</th>
<th>Multiplist</th>
<th>Evaluativist</th>
</tr>
</thead>
<tbody>
<tr>
<td>P3, P8</td>
<td>P3; P5; P8</td>
<td>P5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fully validated</th>
<th>Absolutist</th>
<th>Multiplist</th>
<th>Evaluativist</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1; P4, P9</td>
<td>P2; P6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Table 11 offers a visual of PSTs enacted beliefs that have been noted as fully validated or partially valid as absolute, multiplist or evaluativist. Participants noted in two categories (i.e., P3, P5, P8) were partially validated with 50% occurrence for each. Participants located in one category (i.e., P1, P2, P4, P6, P9) were noted as fully validated with a code occurrence greater than 50%.

Analysis Summary

Although correlations between espoused and enacted beliefs about PSTs digital video of instructional practice could not be reached due to their status as secondary sources of data, nonetheless the exploratory nature of the study allowed the analysis to reflect that three PSTs were fully validated as absolutist (n=3). Three additional participants were partially validated as absolutists, as well as multiplists (n=3). This may indicate these individuals were in transition. Two individuals were fully validated as multiplistic thinkers (n=2). One PST was partially validated as a multiplist, as well as an evaluativist. Therefore, suggesting this individual may have been in transition between levels.

Primary Research Question

The study’s primary research question required the documentation of PSTs’ epistemic beliefs about instruction in an inquiry-based laboratory school. This necessitated a synthesis of data from sub-questions (1a), (1b), and (1c). The final step in this analysis required a composite description of each PSTs espoused and enacted fine-grained epistemic beliefs. Next, a cross-comparison, using patterns and themes, was sought from the individual cases across the whole group. This allowed the data to specify
in detail the dimensional aspects and developmental levels espoused through interview, and observed in practice, to identify “epistemic patterns in the data” (Feucht, 2011, p. 227).

**Method 3**

*Multiple Data Sources Triangulated for Participants*

Data Sources Triangulated → Participant Overall Epistemic Level Determined

*Figure 6.* This figure depicts the method of analysis following the QCA guidelines used to determine the overall epistemic pattern of development for each participant’s beliefs. First, data from multiple sources were analyzed based on the quantity of occurrences. Next, data were then triangulated on the participant level to determine the overall epistemic belief about ECE. Adapted from “English Language Learners’ Epistemic Beliefs about Vocabulary Knowledge” (p. 71), by Ziegler, N., 2014, University of Toledo (Diss.). Copyright 2014 by Ziegler, N. Adapted with permission.

For the third method of analysis, an overall epistemological level of understanding was assigned for each participant: *absolutist, multiplist, or evaluativist*. This was done in the following manner: first, each reduced epistemic code from each data set was quantified and developed into a ratio and percentage following a rationale developed by Ziegler (2014), as articulated in Data Analysis Method 2. To do this, a frequency was determined across the codes for each participant. The codes were then reduced using a ratio/percentage to determine each PST's tendency. These tendencies were labeled *fully validated, partially validated, or not validated* as noted above. This then revealed an overall pattern of epistemic development (see Figure 6).
Analysis Summary

Findings revealed that six participants overall level of epistemic development was reflective of a multiplistic reasoning using the PEM framework. One participant’s beliefs were not validated with a pattern of less than 50% of any given position. This lack of validation evidenced may suggest this PST was in transition. One participant was recognized as evidencing evaluativistic thinking across the data sets (see Table 12).

Table 12

<table>
<thead>
<tr>
<th>IQ set 1 Espoused Beliefs about ECE - Curriculum</th>
<th>IQ set 2 Espoused Beliefs about ECE - Instructional Practice</th>
<th>IQ set 3 DS Espoused Beliefs about ECE - Developmental Level</th>
<th>Ratios &amp; Percentage of Epistemic Development</th>
<th>Overall level of Epistemic Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1 M</td>
<td>M</td>
<td>M</td>
<td>M=3/3, 100%</td>
<td>Multiplist Fully Validated</td>
</tr>
<tr>
<td>P2 M</td>
<td>M</td>
<td>M</td>
<td>M=3/3, 100%</td>
<td>Multiplist Fully Validated</td>
</tr>
<tr>
<td>P3 A</td>
<td>M</td>
<td>E</td>
<td>A=1/3, 33%; M=1/3, 33%; E=1/3, 33%</td>
<td>Not validated</td>
</tr>
<tr>
<td>P4 M</td>
<td>M</td>
<td>M</td>
<td>M=3/3, 100%</td>
<td>Multiplist Fully Validated</td>
</tr>
<tr>
<td>P5 A</td>
<td>E</td>
<td>E</td>
<td>A=1/3, 33%; E=2/3, 67%</td>
<td>Evaluativist Fully Validated</td>
</tr>
</tbody>
</table>
Note. Table 12 illustrates the overall pattern of epistemic reasoning that was evident in PSTs instructional practice in ECE. This table offers the triangulated analysis for answering the study’s primary research question. Each participant’s validated belief is evident in the right-hand column across the study’s eight participants (P1-P9, excluding P7).

**Analysis Synthesized**

Chapter 4 presented the results of this inquiry. The results are organized by research question. First, research sub-question (1a) was answered by identifying the salient dimensional beliefs that were reflected upon in the laboratory setting from the 261 (n=261) responses coded. These results are listed as follows: justification: non-objective (n=54); source: external (n=45); stability: uncertain and changing (n=34); source: internal and subjective (n=22); structure: connected and subjective (n=19); structure: complex (n=19). The least recognized category for any dimension was structure: simple (n=1).

Further, research sub-question (1a) revealed the greatest frequency of dimensional aspects of knowing amongst the study’s participants (n=8) to answer question (1a) are listed sequentially as follows: Source: received/authority(n=7); Source: social media/Pinterest (n=7); Justification: experience (n=7); Justification: engagement (n=7).
Stability: *uncertain and changing: children* \((n=7)\).

Research sub-question (1b) explored the features that are evident using a developmental model of epistemic understanding. Three participants’ \((n=3)\) responses indicated that knowledge is absolute. Eight participants \((n=8)\) indicated that it is not necessary to evaluate knowledge based on objective criteria, but demonstrated a tolerance for subjective ways of knowing in ECE. Four participants’ \((n=4)\) responses demonstrated evaluativist thinking based on the logic of their response. The assumption of an evaluativist stance being that one judgement might be better than another based on criteria. When the code frequencies were reduced through a ratio/percentage, six individuals were labeled as multiplist \((n=6)\) and two participants \((n=2)\) were labeled as evaluativist.

Triangulation of data across the participant level revealed an overall level of epistemological development. A synthesis of the study’s data sets revealed a dominant majority held multiplist beliefs \((n=6)\). Another participant’s beliefs could not be validated \((n=1)\) indicative of beliefs in transition, while one participant’s overall level of epistemic development was recognized as evaluativist \((n=1)\).

**Conclusion**

Analysis of the espoused beliefs through interviews indicated that PSTs views of knowledge, contextualized in a situated learning environment that supports inquiry based and constructivist engagements, tend to align with multiplist understandings that recognize instruction as uncertain, complex and changing. PSTs recognize the structure of knowledge is connected by experiences, prior knowledge, and children’s needs. They look to external and internal sources of authority to receive and construct understanding
about their practice. These vary from advice provided by instructors about best practice; and information found on social media; to a combination of experiential engagements and advice from authority accounts. Largely, they look to justify knowledge through experience and seek confirmatory accounts of their perspectives, as others begin to seek sophisticated ways of knowing through making judgements about instructional practice through evaluation of subjective and objective information.

Lastly, absolutist, multiplist, evaluativist positions are evident in enacted practice with a majority of respondents recognizing that an individual construction of knowledge was valued. This is reflective of society as a whole, where expertise requires domain-specific knowledge (Kienhues, Broome & Porsch, 2010). In ECE, expert knowledge is recognized on a developmental continuum that requires years of practice to obtain (Britzman, 2003). Therefore, multiplistic thinking was found to be dominant across the participant level. Six (n=6) of eight (n=8) total participants demonstrated an overall epistemic developmental level that valued personal opinions about experience. One participant was noted as having beliefs that were evaluativist (n=1) in nature. One participant’s beliefs were noted as unverified (n=1), indicating this individual was in transition between beliefs. Another possibility is that this individual, and possibly others, were able to develop the ability to reflect epistemically over the course of the interview.

Chapter 5: Discussion of Findings and Implications
Personal epistemology encompasses an individual’s beliefs about the nature of knowledge and the process of knowing (Hofer, 2001). Hofer’s (2001) empirical work defined four dimensions to conceptualize the nature and process of knowing. The nature of knowledge is articulated under the nomenclature of stability (is knowledge a certain or changing product) and structure (is knowledge connected to facts, opinion or judgements). The process category contains the terms source (what sources are used in the process of knowing) and justification (how is a knowledge claim justified) (Feucht, 2011). Research has demonstrated that these views influence learning and an increasing body of scholarly literature is considering the influence of epistemic thinking on teaching (Brownlee et al., 2011a; Feucht, 2011).

Epistemic beliefs are understood to function as a filter and guide (Fives, 2011). The filter serves as a personal conceptual lens to interpret messages about knowledge. These beliefs act as a guide based on their role in application of knowledge to experience. Fives eloquently stated this latter point, “[They] guide practice by providing an impetus for teachers to engage in particular teaching and learning behaviors” (Fives, 2011, p. 123). Therefore, it stands to reason an educator can guide and support the processes of knowledge acquisition for students, but not beyond his or her own epistemological development (Brownlee, Schraw, Walker, & Ryan, 2016). This development is measured on a continuum from naïve to sophisticated thinking (Brownlee, Purdie, & Boulton-Lewis, 2001) Naïve beliefs recognize knowledge as certain, existing as absolute facts where critical thinking is not necessary and the voice of authority is paramount. On the other end of the spectrum of development, sophisticated beliefs recognize knowledge as uncertain and judgements based on contextual demands where understanding can be
negotiated through argument and evidence (Kuhn & Weinstock, 2000). The middle position of this continuum is occupied by subjective ways of knowing, where opinions take precedent for interpreting and choosing engagements that support learning. In this stage, like that of the absolutist, critical thinking and engagement in debate is not necessary as personal beliefs are beyond reproach. Therefore, it has been recognized that sophisticated epistemic thinking or evaluativist levels of epistemological understanding (Kuhn, 1999) can help a PST gain the most from the learning experiences offered during the induction period (Yadav et al., 2011). Epistemologists who specialize in learning consider the development of these beliefs as a rich area for nurturing in teacher education programs (Brownlee et al., 2016).

The intent of this inquiry was to explore the epistemic beliefs that PSTs can reflect upon and are found to be most salient in a setting for teacher training that supports inquiry-based methods and constructivist practice. This chapter will outline key findings from Chapter 4, and articulate the implications of these beliefs, with evidence from scholarly literature in the description of these beliefs. This is done to support understanding how PSTs can reflect upon teaching and learning in the unique environment of the laboratory school. Recognition of the beliefs that individuals call to attention can expand the ability of educators and researchers to perceive how initial teaching experiences, and the ability to learn about teaching are influenced, in part, by personal epistemology.

The findings reported in this chapter do not make claims about how individuals have developed or not developed epistemically through the program in which the PSTs were engaged. That would require, at a minimum, a study that utilized a pre-and-post
assessment to determine epistemic thinking (For a consideration of the complexity of
documenting beliefs that are recognized as contextually stable see Hammer & Elby,
2001). Due to the exploratory nature of this inquiry, it only discerned what beliefs can be
reflected upon and which beliefs were evident at the time of the study. Therefore, the
episemic snapshot and suggestions below provide a synthesis of certain positions that
were evident amongst a majority of PSTs, either \( n=7 \) or \( n=8 \), in November of 2016 in
the laboratory school. The participants consisted of two males (25%) and six females
(75%). Correlations to these findings are derived from the scholarly literature found in
the field of teacher’s personal epistemology, as well as theoretical research on learning.
Further, secondary sources of data of video recorded by PSTs of instructional practice
were considered when gathering data on enacted beliefs. Therefore, the enacted findings
are tentative in nature and therefore do not seek to establish claims about how pedagogy
is related to epistemic thinking.

**Key Findings as Related to the Scholarly Record**

**Espoused Beliefs**

*Transdisciplinary Learning.* As the scholarly record suggests, the epistemic
climate, or the messages about knowledge and knowing that function in a holistic
learning environment found in different classrooms, is dependent in large part by the
pedagogical content knowledge, teacher epistemology, and the resources used (Feucht,
2010, 2011; Muis & Duffy, 2013). An inquiry-based laboratory for ECE requires
knowledge of many domains and, therefore, the concept of personal epistemology
becomes uniquely complex. For example, the instructor has epistemic beliefs that are
unique to the interpretation of the subject area being taught, as well as to the pedagogical
methods that support learning. In a setting that supports transdisciplinary, or learning across subject areas, there are multiple epistemic messages dependent on content, the classroom space, the curriculum, the teacher, and the students.

We can consider the effect of two of these influences in the laboratory. In this study, one PST suggested that reflection was necessary to develop knowledge about instructional practice (subjective view), but went further to bring theory into her practice (objective), therefore she could demonstrate an evaluativist justification about development as a practitioner. However, when asked about instructional practice using specific examples, she revealed absolute tendencies about knowledge in areas such as science. For example, when asked the following question about certainty of knowledge: “Do you think that the knowledge itself that we're communicating changes?” She responded: “Yes and no, on some things. You add on to what you've learned or if something changes in science, per se, then you change that information. I think the knowledge itself mainly stays the same” (P2, 7:43).

Another PST response to change about instructional practice is as follows:

Definitely. I think overall as a society, we're starting to learn more about children as an individual, versus as a whole. We're starting to learn that each one learns differently, each teacher teaches differently. There are ways to teach things. You can try to teach one math concept in a bazillion different ways, based on how you want to teach it, but your goal is to get to the end result. It's not just one way anymore. (P9, 8:22)

This participant was then asked: “Is the end result always the same, as it concerns knowledge? Let's say in that example you offered?” The response was noted as follows:
I think your goal end result is always going to be the same there, but the ways you get to it and if you get to it could change. I guess if you don't get to it or you don't get to it in even the time frame that you hope, or everyone that you hoped to reach could be different, but you still have that same end result goal. (P9, 8:22)

In a study about science teachers’ epistemic beliefs a PSTs admission that the end result of learning as fixed and certain would reveal the basis for a preferred pedagogical practice (Elby & Hammer, 2010; Russ & Luna, 2013), but, again, a student of ECE requires knowledge of many domains (e.g., math, science, child development) and benefits from being metacognitive about the epistemic demands of each domain (Hofer, 2004). Much of the literature on personal epistemology considered epistemic beliefs from a domain-specific viewpoint (i.e., subject-specific). The reason being is that single-subject areas, such as math or science, are argued to be taught from a certain epistemic standpoint (Hofer & Pintrich, 1997). What benefit would be provided should the ECE teacher reconcile an absolute belief about science, but not other domain areas? The answer is that multiple messages will be sent to the learner. Therefore, a teacher’s epistemology often does not reflect the epistemic climate of the classroom in which they are teaching. When this occurs, there can be a discontinuity in students learning and classroom pedagogy. For example, another PST noted the contrary by stating that science is a subjective field, but math was not (P6, 3:67). Each of these perspectives supports a certain pedagogical belief (e.g., Tsai, 2006; transmission of information is suited for knowledge that is certain; a constructed perspective is supportive of a belief that knowledge is uncertain). However, in many regards, ECE, and tenets of Reggio Emilia practice in particular that are supported at this laboratory school (e.g., student-centered
(curriculum) allow for the flexibility of differing epistemic demands through teachers advocating autonomy-seeking behaviors (see Weinstock & Roth, 2013). Therefore, a shifting account of personal epistemology supportive of a contextual view of knowledge and dependent on the task and engagement in ECE would be useful when making suggestions on how to scaffold epistemic metacognition in these types of programs. Further, this leads credence to Elby and Hammer’s (2010) resource model for recognition of contextual differences for operationalizing an epistemic meta-cognitive model in ECE.

**Complexity.** The structure of knowledge was recognized to have a complex nature in ECE in some form by all eight participants ($n=8$). Generally, PSTs were challenged when prompted to speak about the epistemic nature of curriculum in ECE beyond a subjective orientation or multiplist way of knowing. Research suggests that in settings where a government prescriptive mandate on curriculum exists, individuals tend to view knowledge as derived from authority (Feucht, 2011). Within the laboratory, prescriptive standards can be found that are reinforced by collaboration between a state school and the laboratory. This was the case in only one classroom that served students at the kindergarten level. One of the two study participants in this setting suggested evaluativist thinking about curriculum. This evaluativist response to reasoning about curriculum was espoused by a learner with an overall multiplist epistemic level of development. Therefore, in this setting, it might be the case that prescriptive curriculum standards facilitate more evaluativistic thinking. One respondent stated this as follows:

Yeah. When you're planning something there's so many different factors that you have to think of. For example, I have some six-year-olds and I have some five-year-olds that don't turn six until the middle of July next year. I have to think
about where each child is at. While some of the kindergartners are ready to add
and start with money and stuff, some don't have that concept yet. How do I plan
to meet the needs of all my students? That's a very complex thing with
curriculum. (P7, 7:21)

This PST also suggested that lesson planning could be organized by child interest, which
is a subjective orientation to knowing coupled with standards, which is objective. She
then combined the two based on judgements, made in context, which can be classified as
an evaluativist position. She stated this as follows:

Just child interest and what they need. Especially in here, I'm able to take the
standards, the Common-Core standards, and apply them to interest, in a way. You
can incorporate reading in almost anything you do. Math is the same way. So,
taking those interests and putting them into the curriculum. (P2, 7:66)

This line of thinking demonstrates a potential exists for PSTs to explore an evaluativist
perspective given that the proper environmental conditions are offered for teacher-guided
inquiry alongside social collaboration amongst peers and teacher mentors. Research
could document how mandated standards and inquiry-based methods may be integrated
through evaluativist reasoning. Further, as PSTs move beyond the practicum experience
teaching in the U.S., it would be interesting for research to document how this view on
knowledge changes as PSTs extend their experiences from the laboratory school.

**Experience.** Experience was noted as a key factor in the process of knowing in
the laboratory school. Seven PSTs (n=7) suggested a personal construction of knowledge
was useful, but that this knowledge development took subjective forms rather than being
supported by evidence from theory. Therefore, a multiplistic understanding was a source
for understanding instructional practice in ECE. This perspective recognizes that opinions
do not require being questioned. An assumption of this position, suggested by Kuhn
(1999) is that critical thinking is not necessary and therefore debate about ideas will not
be fruitful. As noted in this study’s literature review, in a democratic society, critical
thinking is a quality that is prized for citizens to possess in a democratic society.
However critical thought is not necessary if all opinions can be recognized as correct
(Kuhn, 1999). Therefore, it benefits a learner to engage in efforts to mature
epistemologically to recognize certain views as more desirable based on determinations
about the credibility and justification of certain information; a response that requires
critical thought.

**Social Media.** Pinterest and the use of social media were a key source of knowledge
in the laboratory school. Seven PSTs \( n=7 \) espoused this belief. When asked how content
on Pinterest was justified, a typical response that revealed multiplistic thinking was as
follows:

Interviewer: How do you decide when you see an idea? Or when you read, let's
say, a certain blog, or find something on Pinterest? How do you make a decision
based on that?

Participant: I was talking to [the mentor teacher] and [a fellow PST in the same
classroom] about this, but I, it's just that feeling. I'll think of an idea and before I
even type it into my lesson plan, I let those ideas ponder for a couple of days. If I
have a negative, even just a little, small negative feeling about a lesson, I won't do
it. Just because I think there's something inside me that is just like, ‘It probably
won't work’ (P2, 7:23).
When asked to explore that “gut feeling” she replied, “I think, subconsciously, I'm thinking about what we learned, and then of course, the individuals that I'm going to be teaching that concept to. So, consciously thinking about everything. If it doesn't work, it doesn't work (P2, 7:24).

**Authority.** Authority was viewed as dominant source of knowledge. Six PSTs \( (n=6) \) espoused the view that knowledge was received. This espoused belief seemed to have had an oversized effect on enacted beliefs found in instructional practice. Constructivist perspectives on learning were supported by the curriculum, through the environment, the modeling of teacher educators, and the potential for epistemic messages to be presented about the uncertainty of knowledge, however students generally had difficult time speaking about the epistemic nature of curriculum in ECE beyond a subjective orientation or multiplist way of knowing. A reliance on knowledge acquired from authority sources of information is a reflection on the division of cognitive labor in society (Kienhues, Broome, & Porsch, 2010). This is due to prior schooling tending to support the view that knowledge is transmitted from one source of authority to another. These claims are found in textbooks, lesson plans, and in educators’ minds. This view communicates that “other people’s experiences, considerations, and analyses” are more important sources of knowledge than that provided by personal experience (Kienhues et al., 2010, p. 164).

Kuhn (1999) conceptual frame is supportive of the view that evaluativist understanding is possible for the individual who incorporates personal experience with expert knowledge. Therefore, critical thinking requires objective knowledge to be integrated with subjective understanding for educators to make the best decisions (Dewey, 1903).

**Enacted Beliefs**
It is difficult to enact evaluativistic beliefs through judgements based on evidence through learning engagements in the laboratory. The developmental abilities of 3 and 4-year-old students allow for this type of thinking, however a concern for the affective needs, alongside the management and curiosity of the group require a scaffolding of judgments that accept multiplist views on knowledge. This means that multiple answers to a question may be appropriate, at times. For example, in an inquiry-based setting, a teacher might question the logic and reasoning of a child’s engagements, but asking a child to evaluate which is the best possible scenario or decision should be reserved for certain conditions (i.e., once affective considerations are met). The application of the PEM framework in any and all situations may be determined to be inappropriate depending on the situation and context.

As the field has sought to clarify and tighten the construct of personal epistemology, affective considerations (care and identity), as well as beliefs about learning (speed of learning and fixed ability) have been argued to be more suited for a construct about learning rather than a strict interpretation of knowledge and knowing (Hofer & Pintrich, 1997). This clarification was useful for the field to advocate and support research focused on fine-grained analysis of beliefs, however, this study demonstrated beliefs about care were salient in early childhood educator’s enacted practice and that they influenced the questioning strategies and dialogue between student and teacher as epistemic messages are embedded in these interactions. The exploratory nature of the enacted findings in this study did not suggest a correlation that any given epistemic belief was more influential than another as it concerns PSTs preference for a given method of instruction, however a snapshot of how inquiry-based methods were
employed by the study participants has been juxtaposed here alongside theoretical research.

The videos revealed that the use of questioning strategies was universally recognized in all of the study participant’s enacted practice (n=8). Given the laboratory school supports inquiry-based methods, this provided a natural and logical organization for this scheme. Therefore, pedagogical strategies in the literature were related to the types of strategies associated with PSTs questions. Quotations selected were assigned a simple label or code based on a pedagogical strategy found in epistemological literature supportive of Kuhn’s (1999) developmental positions, rather than direct application of the PEM framework as done in the analysis (see Chapter 4). These labels were based on Tabak and Weinstock’s (2011) review of everyday classroom dialogue (i.e., recitation focusing on right or wrong answers), emerging student-centered practice (focusing on individual knowledge construction), and autonomy supporting teaching practices (focusing on knowledge construction and student’s making judgements). Each related, respectively, to absolutist, multiplist and evaluativist reasoning.

The examples below were taken out of context from the entirety of the lesson, meaning that each participant demonstrated different types of beliefs at different times. However, a shift in beliefs is noted by several PSTs to demonstrate how mixed epistemic messages are evident in teaching practice. It is important to note PSTs did not rely on these strategies uniformly, but, each theme provided is useful to understand the types of messages that are influenced by each developmental position as found in ECE practice.

**Recitation.** The questioning pattern evidenced by seven participants’ (n=7) enacted beliefs can be interpreted as knowledge being transmitted from sources of
authority to the learner through recitation. Using the PEM framework, this is aligned with absolutist beliefs about reasoning. This label was used to identify enacted beliefs about the nature of knowledge that is either transmitted by authority or evaluated based on authority initiating a task, eliciting a response through questioning, and evaluating facts as either right or wrong. Recitation can be used to describe twenty-two responses \((n=22)\) that were labeled in this study’s findings as absolutist. These indicated that knowledge delivered through instruction can be recognized from authority. In the case of the ECE, recitation relies more on teachers as sources of knowledge, as children progress through schooling messages of authority knowledge also come from resources such as textbooks (Tabak & Weinstock, 2011). This pattern was described by Tabak and Weinstock (2011) as the initiation-response-evaluation (IRE) model. This is where the teacher offers a question with a known and fixed answer. Students are offered space to answer the question followed by teacher evaluation of the response and the possibility of confirmation or correction by the instructor. Tabak and Weinstock (2011) pointed out that this offers a limited range of possibilities for the students. Overtime, students are conditioned to the epistemic conditions of this classroom space. These boundaries present limitations on student autonomy where the questioning of knowledge and the possibility of multiple “interpretations” of what is occurring and students’ “agency” in knowledge development is diminished (p. 184). The teacher who relies on recitation may value knowledge being constructed, but the process of this development is “invisible” to students (p. 184). Overtime, it produces an epistemic climate where students ask questions to gain knowledge from authority, but may not understand how knowledge can be justified (p. 185).
In this study, one example of enacting an IRE view was evidenced in a reading lesson to the whole group of three and four-year-old students concerning cause and effect ($n=10$). It was evident this was an introductory lesson to this concept and reflective of beliefs about children’s learning. It was apparent that this PST believes that children need to be respected and offered space for questions to be asked based on student curiosities, as well as student observations about the text. One child responded, “That is a big [cookie] for him” and the PST affirmed this child’s response by stating, “I thought so, too.” (P4, 1:13). However, concerning the epistemic climate, this PSTs instruction was based on questioning and answering strategies that demonstrated an absolutistic understanding of knowledge. Students readily asked questions, and the source of knowledge for answering these questions is derived from authority. This can be witnessed in the following transmission of information: “The cause of the book, *If You Give a Mouse a Cookie*, is he will need a glass of milk. So, the cause would be giving him a cookie, and the effect of that would be giving him a glass of milk.” (P4, 1:11). At another point in the text, knowledge was justified by the PST as facts that are determined as being right or wrong (P4, 1:10). This pattern may be may be evidence of the traditional methods of instruction as noted by Tsai (2007). Tabak and Weinstock (2011) suggested a “narrow space of acceptable responses” places the instructor in a position of authority over knowledge and limits student “agency” as a producer of knowledge (p. 184). The epistemic message of the teacher as authority masks a view that knowledge construction thus making a constructivist perspective “invisible” to students as they do not see the need for “justified evidence (p. 185). Using Kuhn’s model, this message suggests
knowledge as simple, stable, and from authority. All positions that are reflective of the absolutist level.

The IRE method could be witnessed in a variety of questioning patterns amongst PSTs. The following example was demonstrated when offering ground rules to safely play a game: “We don’t run unless who tells you?” Students replied, “the teacher” (P5, 4:1). Another teacher used this technique when offering a lesson on geometric shapes by asking: What country would you find that [pyramid] in?” Several students chorally responded “Egypt” and the teacher affirmed this response was correct (P2, 6:1). Another PST asked, “Do you think this is an upper case or lower case [letter]?” Then after eliciting responses, she communicated knowledge and knowing as absolute by stating, “Usually it is in the beginning of a word. So, it looks like the T is upper case and the others are lower case” (P9, 9:1).

**Emerging Student-Centered Practice.** A questioning pattern that was termed *student-centered* was used by seven PSTs (*n*=7) that could be described as open-ended, where all opinions were accepted. When engaged in facilitating this particular brand of student-centered curriculum, PSTs demonstrated student learning benefited from a constructed view of knowledge. Here children were encouraged to think and respond to teacher questions and to make choices individually, but not between competing ideas in order to make a collective decision. This pattern was described by Tabak and Weinstock (2011) as helpful for supporting students to develop agency, “be active”, and express opinions, but not yet able to demonstrate an understanding of inquiry as an evaluativist practice (p. 189). Therefore, this label was used to identify enacted beliefs about the
nature of knowledge that is subjective and internal and connected by children’s tastes, wishes, and interests. Using the PEM framework this is aligned with multiplist beliefs.

Sixteen responses ($n=16$) indicated that knowledge was subjective and therefore the justification of thought was not necessary. This pattern of instruction often followed students’ interests and was frequently a continuation of a previous learning experience. For example, one small group ($n=5$) sense of agency was supported to develop their own exercise obstacle course. The PST suggested “We can do this. We have been practicing all semester” (P5, 4:8). The students then were asked where each piece of the course should go as they developed a unique design with any response being appropriate. This demonstrated that the source of knowledge was subjective and internal.

In another example, one participant followed a pattern that can be described as an emerging form of student-centered practice. This was deemed emerging as this participant demonstrated a mixture of epistemic messages that knowledge is absolute and certain about science but also that the structure of knowledge is connected based on student interest and oftentimes was a continuation of a previous learning experience. During a small group engagement ($n=5$) with support from the text, *Otis and the Tornado*, the instructor asked each three to four-year-old child the open-ended question: “What is your favorite thing about the tornado investigation?” (P3, 3:4). This PST supported the students’ sense of agency to respectfully interrupt the text as dialogue was guided as curiosity permitted. Therefore, this dialogue may convey an epistemic message that the source of knowledge is active and internal. However, most questions students responded to were supplied an answer by the instructor. Therefore, a message was communicated that the knowledge was external and derived from authority. Regardless, it
could be argued that since students asked their own questions, the teacher served as a source of expert knowledge that helped the students to scaffold the answer to their own questions into their existing schema.

Consideration of a small-group lesson offers demonstrated that a PST exemplified the use of open-ended questions using the text, *Where the Wild Things Are*. This participant suggested, “I want you to draw what you think it looks like” (P9, 9:7). This technique allowed for a subjective view that was accountable only to the student. This participant lesson objective was fixed and determined by the instructor, thereby communicating a mixed epistemic message that there are multiple paths to the correct answer, but the answer is fixed and stable. This mixture of simplicity and complexity of knowledge also was evident in enacted beliefs “I think there is some knowledge, that it's the fact, like science and math, there's one answer. Well, not really with science, but with math there's one answer. With science and language, there's multiple answers, so I think it's both [simple and complex]” (P6, 3:67).

**Autonomy Supporting.** One participant (*n*=1) enacted beliefs that could be interpreted as evaluativistic by supporting instructional practice recognized as *autonomy supporting* behaviors. This view is based on valuing subjective and objective orientations for making judgements about knowledge in ECE. This pattern was described by Weinstock and Roth (2013) as *Autonomy Supporting Teaching* (AST). These authors explained how encouraging student autonomy for decision making was likely for the evaluativist thinker. The authors posited:

> [P]erhaps evaluativists would be more likely than multiplists to engage in other AST behaviors such as the provision of rationale, as they believe in the necessity
of justification, or the encouragement of criticism, as they believe that claims are open to critical evaluation. (Weinstock & Roth, 2013, p. 409)

Support for these behaviors in students has been noted to nurture student creativity and encourage problem-solving. Further, the construction of knowledge is encouraged through questioning strategies and use of student’s ideas language and ideas. In ECE this was witnessed through dialogue and encouragement of reasoning. Using the PEM framework, this questioning pattern for supporting dialogue was revealed in three responses \((n=3)\) that were aligned with evaluativistic beliefs about reasoning or were demonstrative of a supporting reasoning. The questioning pattern used required students to think for themselves and take action through responses to teacher questions. For example, in one small group lesson \((n=3)\), four-year-old students were encouraged to work together on the design and development of a zoo using wooden blocks. This engagement was a continuation from previous small group investigations based on the development of community. The lesson began with a closed question: “What have we been doing every day?” (P5, 5:1). Then the PST elicited ideas of how the team would begin. Each child shared their ideas and began their work. The first prompts were subjective and open-ended. As the engagement proceeded, the PST would encourage questions that required evaluation of objective information. For example, one student proclaimed: “This is a doggie house!” The PST asked, “Are there any doggie houses at the zoo?” (P5, 5:11), in other words suggesting can the child verify having seen one (objective). A second child answered for the first by suggesting they could build an alternative space for animals to play. This suggested problem solving was valued and encouraged as an autonomous ideal. Afterwards, the first child suggested a new idea. As
students constructed various parts of the zoo the PST prompted each child with a question about their thinking, such as “Why would you want to make that entrance bigger?” This suggested that some answers are better than others. However, this could be termed multiplist as it is possible that the PST would have accepted different answers as sufficient. Regardless, the students were encouraged to develop their ideas in social collaboration through continuous prompts and questions that encouraged creativity and reasoning. Therefore, the following exchange could be termed absolutist in isolation, however in the context of dialogic teaching being evident it demonstrates an evaluativist position on reasoning that some ideas are better than others based on judgements made by a pre-school student:

   PST: So, if the tigers are right here. Do you think we should put the gazelle’s next to them?
   Child: No.
   PST: No, why do you think we shouldn’t put them next to each other?
   Child: Because they eat em! (P5, 5:33).

Future research can consider the conditions in which educators purposefully restrain engagements about the evaluation of knowledge due to beliefs about the capability of children, especially through dialogic teaching and social construction in ECE.

The question of balancing classroom management and engagements for higher level thinking should be considered as a factor in evaluating which beliefs are evident in practice. Brownlee, Edwards, Berthelsen and Boulton-Lewis (2011) considered a balance of epistemology, affective, and identity components in childhood care, but how the affective aspects of learning influence knowledge views have not yet been explored in
depth in ECE. However, several researchers have made progress concerning epistemological awareness in early childhood (see Burr & Hofer, 2002; Wildenger, Hofer, & Burr, 2010).

It is important for research to document how children make judgements and which types are appropriate to be negotiated as an aspect of learning. Chandler and Proulx (2010) articulated this idea when cautioning about direct application of Kuhn’s (2000) framework. These authors posited: “What would it actually look like, for example, to adopt an ‘evaluative’ stance toward claims such as ‘stoves are hot’ or ‘chocolate is better than vanilla’?” (p. 213). Determinations like these should be made before unilaterally advocating for the application of a developmental perspective in any and all situations that places a premium on evaluativist reasoning in ECE.

**Discussion of Espoused and Enacted Beliefs**

Although this study was exploratory and cannot make claims about correlation, the findings of this study underscored research that suggests that teacher’s epistemology often does not reflect the epistemic climate of the classroom in which they are teaching (Maggioni & Parkinson, 2008; Fives, 2011; Brownlee et al., 2016). When this occurs, there can be a discontinuity in students learning and classroom pedagogy. This dissertation not only looks how epistemology informs teaching, but it also shows the real need for teachers to have complimentary epistemic beliefs to the curriculum that they are being required to engage. In this case, I’m looking at the inquiry method, a well-supported pedagogy, and am finding that the preservice teachers in this program tend not to have complimentary epistemic values to suit this approach.
The mixed epistemic messages that were espoused and enacted by PSTs suggested that the source of student curiosity was internal, and the structure of knowledge was connected by previous experience or a continuity of experience, however the sources of knowledge were found externally from authority. In this epistemic snapshot, it may be the case that students did not have an opportunity to recognize the need for knowledge to be justified. Questioning strategies that prompt this type of thinking might be deemed appropriate in situations where classroom management allows for the “messiness” that might be associated with this view of knowledge as uncertain. Teachers might feign they do not have the answer to pupil questions in order to elicit thoughts and possibilities for future student exploration to find the answer.

At the pre-school level evaluativistic beliefs should not be measured in isolation, but a consideration of the entirety of PST practice must be considered. It may not be developmentally appropriate to set a standard of gaining evaluativistic reasoning, but rather a multiplistic view that accepts a variety of student responses as acceptable allows nurturing of student’s ideas and increases efforts and motivation. A teacher with knowledge of what is possible concerning children’s epistemic development (Carpendale & Chandler, 1996; Brownlee, Curtis, Spooner-Lane, & Feucht, 2017) can offer evaluativistic scenarios for questioning once trust and routines have been well-established.

Incongruence of Beliefs and Possible Solutions

Research has explored a variety of reasons why espoused and enacted epistemic beliefs are often not found to be in alignment. These range from the temporal and contextual features of beliefs, to the narrow parameters of research tools, and the lack of
congruency found without explicit reflection (for a treatment see teachers expressed epistemologies and the relationship to practice Kang, 2008; Schraw & Olafson, 2006; Maggioni & Parkinson, 2008). This discrepancy also has been attributed to problems concerning how beliefs are defined and measured (Hammer & Elby, 2001; Skott, 2015). Yadav et al. (2011) pointed out the disparity between espoused and enacted beliefs and the complications of linking knowledge beliefs to practice. Supporting PSTs to develop explicit awareness of these beliefs and how they inform planning and teaching practices has been advocated as the path forward (Maggioni & Parkinson, 2008; Fives, 2011; Brownlee et al., 2016).

**Implications for Practice**

Personal experience was noted as a key factor in the process of knowing in the laboratory, therefore, questioning PSTs about epistemic thinking and teacher educators modeling will benefit their reflexivity. Below, six strategies derived from extant literature are suggested in support of this study’s findings.

1. Pinterest and the use of social media can be evaluated for certain curricular aspects. Epistemically, this can be done by asking questions about the sources of knowledge and how they connect to objective information (standards) and subjective information (students’ personal learning styles)?

2. Supporting judgements based on available evidence from families, observation of students, and in consultation with teachers and theory is an area that the laboratory students are uniquely prepared to develop. Knowledge claims that communicate curriculum is a collection of facts that are certain and beyond questioning should be called to attention when appropriate. It is assumed
mathematically that the claim two plus two equals four is stable and fixed, however it might be productive for PSTs to support student development by asking those in their charge: “*How do we know this is true?* or *How can we prove it?*” In this way, teachers will be less likely to send messages about knowledge stemming from authority by confirming or suggesting the answer.

3. Findings from the current study suggest the recognition of teachers as absolute sources of authority knowledge must be questioned for the development of a constructivist-minded practice. This will help to overcome the problems associated with pedagogical change (Windschitl, 2002).

4. To support more advanced epistemologies as PSTs learn about pedagogy, the messages and questioning strategies that are useful in the laboratory can be helpful. Three ways of interpreting inquiry-based practice (recitation, student-centered, and autonomy supported teaching) were adapted from Tabak and Weinstock (2011) and, reported as inductive findings above, inform how PSTs use questioning strategies. Tabak and Weinstock (2011) suggested there is correlational support for teacher’s personal epistemology and "autonomy supporting behaviors" (p. 173). This is defined in the following manner: “A belief that there might be multiple perspectives on knowledge might better afford a teacher to try and understand and take the child’s perspective. In turn, the child sees this as supportive of his or her autonomy.” (p. 173). This independence can help students develop the ability to recognize that knowledge can be internally derived as well as be produced by authority. Autonomy supporting teaching was evident in the laboratory, but not widespread amongst the study population.
5. From an administrative perspective, where absolutists views of authority are
found it will benefit a mentor teacher to ask about sources of knowledge, such as
“Where do you think we can discover the answer to that question?”, and
justification questions, such as “How can you decide?” These same questions can
be adapted for use by PSTs during small-group investigations.
6. Bendixen (2016) suggested that epistemic change was supported in early
childhood education in each discipline area through development of
argumentative abilities. It has been suggested that pedagogical technique such as
argumentation and an explicit focus on epistemic cognition can support
transdisciplinary learning (Reznitskaya & Gregory, 2013). In referencing the
work of Kuhn, these authors pointed out that “multiplist and absolutist
epistemologies are incompatible with dialogic teaching,” but instead were in
concert with “evaluativist epistemology” (Reznitskaya & Gregory, 2013, p. 116).
ECE students need training in subject specific knowledge (math, science) in order
to facilitate argumentation that goes beyond the surface of engaging students in
inquiry. Bendixen (2016) pointed out the discipline knowledge will allow the
instructor to understand the epistemic demands of each subject area (p. 295). For
further treatment on the value of developing argumentation skills, see Kuhn,
(2005).

Transferable Implications about Constructivist Practice

Research has suggested a multitude of influences that impact the development of
teacher practice in support of a constructed view of learning. Windschitl (2002) posited
the reasons vary from reasons that are pedagogical, political, conceptual, and cultural
considerations. This study did not seek to make any unique claims about these influences, but did serve to document the beliefs about knowledge and knowing that are present in the ECE laboratory school. Through this process several results have been documented alongside connections to existing research. When speculating about the beliefs that influence the interpretation of a constructed view of learning, the definition of facilitation of learning can be clarified as well as having PSTs explore explicitly how pedagogy that relies on received knowledge from teacher to student is not supportive of a constructed understanding of knowledge.

Facilitation. Fives (2011) suggested that epistemic beliefs can be recognized as a filter and guide. This analogy was witnessed in how one PST thought about “student-centered” engagements. She acknowledged how facilitation of learning essentially lacks organization (P4, 5:56). This PST espoused a subjective view that knowledge could be justified when prompted to decide between two competing ideas about practice in ECE. She suggested she would go with the expert who was in alignment with her existing beliefs. The filter/guide analogy was witnessed in the quotation below concerning how interpretation of “student-centered” practice was essentially lacking engagement for the instructor and possibly the learner:

‘Cause, I don’t know, some of the experts think that maybe eventually having no teachers, like just standing there, think that's - like awesome – ‘cause the children are exploring and all that. Also like, teachers need jobs and if they have a job they need to like you know, do it. In that way, some experts think facilitating is great, some don't, and since I'm more towards like - no facilitating - or just sitting there —…Like I would help the children explore. (P4, 5:56)
**Sophisticated Beliefs.** Interview responses for the structure and simplicity of instructional practice in ECE were often viewed with increased sophistication within the laboratory school. Only one response identified the structure of knowledge for ECE instructors as simple. However, in this study recitation or transmission practices were enacted by four participants, demonstrating that the source of knowledge as absolute may be a greater influence on PSTs interpretation of constructivist learning. Knowledge that is received as absolutist tends to be received passively. Therefore, critical thinking is not necessary (Kuhn, 1999). An evaluativist perspective on epistemology benefits from pedagogical techniques that support a subjective orientation as well as a subjective and objective orientation about knowledge (Kuhn, 1999). A pedagogy supportive of these perspectives can be found in constructivist principles for teaching and learning (Fosnot, 1996; Windschitl, 2002). Teachers that support the development of “understanding” need to consider how the underpinnings of constructivist principles “translate into classroom strategies” (Windschitl, 2002, p.143). Therefore, development of personal epistemology that recognizes the value of an evaluativist perspective is best suited for this shift regardless of the educational setting (Kuhn, 1999).

**Contributions to Knowledge**

**Educational Implications and Solutions**

In the longitudinal scheme of development from what can considered a novice to expert in instructional practices, university preparation programs increasingly support PSTs in the transition from a rigid traditional rule-based format about teaching to finding value in acquiring knowledge, skills, and experience. This path is necessary for practitioners to support a developmentally appropriate practice based on reflection on
experience, alongside a well-defined body of child development literature. This view of learning recognizes the contextual and temporal considerations that are accounted for in becoming an expert (Flyvbjerg, 2006). In other words, meaning is drawn from experience through critical thinking (Dewey, 1903). Education psychologists, such as Hofer (2001), teased out the role of critical thinking alongside beliefs about knowledge and knowing in a simple conditional statement: If education is concerned with development and “epistemology is developmental”, then the path of education is “epistemological development” (p. 367). Kuhn (1999) empirically defined three levels of epistemological understanding a learner travels on the pathway toward expertise (i.e., absolute, multiplist, evaluativist). It has been suggested that a productive mindset necessary to gain the reasoning skills of a sophisticated thinker comes through relativist thinking about knowledge supportive of critical thinking (Kuhn, 1999). This is accomplished through an individual’s ability to integrate subjective as well as objective orientations to knowing (Dewey, 1903; Kuhn, 1999). Therefore, Kuhn’s evaluativist position and Dewey’s critical thinker are both seeking a social construction of objectivity, much like that attempted through triangulation where multiple pieces of information and multiple people consider discrepancies in each other’s work. Meaning, experts make decisions based on the integration of information from objectively held facts coupled with personal tastes, beliefs, and experience to make decisions in context. This study demonstrated that a relativist conception of knowledge can be accepted in a Midwestern laboratory school, however there was a strong cultural way of knowing where critiquing other opinions was beyond reproach. PSTs suggested each person has a right to their own opinion and it is not proper to question this knowledge. Therefore, consideration of what a critique entails
might be productive. Foucault (1988) suggested critique is not devaluing other opinions, but rather “a matter of pointing out on what kinds of assumptions, what kinds of familiar, unchallenged, unconsidered modes of thought the practices we accept rest” (p. 124).

Dewey (1903) wrote about the junction of education and experience that was gained from his own philosophical musing, and he put it into practice in the precursor to today’s laboratory school. He suggested, and even warned, that a body of knowledge gained through experience should be tempered by theoretical insights. The reason being, that experience can be limiting and, at times, misguided. Therefore, Dewey suggested a message that resonated with practitioners then, as well as today, namely, it is necessary for educators to develop a nuanced perspective on the wisdom of experience. The nuances provided in how individuals define these experiences are useful for organizations to develop in community, but are critical for each individual teacher to articulate as well (Dewey, 1903). Therefore, on the path toward expertise, the wisdom of experience must be joined with knowledge gained through a well-defined body of scientific findings, such as those contained within the field of child development. PST reflection on theoretical insights, alongside practical experience, are ideally suited in today’s ECE laboratory school.

Epistemologists Schraw, Brownlee, and Berthelsen (2011) have noted in their edited volume about teacher personal epistemology that all the authors’ research and theoretical papers have noted that engagements that are supportive of constructivist learning principals for “preservice (and in-service) teachers in order to promote change in personal epistemologies” (p. 276). Meaning, the path for supporting learners is one and the same for developing teacher personal epistemology. One specific route for PSTs to
gain from their formative experiences is to have availing beliefs that are reflective of an evaluativist stance that have been noted as supportive of learning from constructivist engagements (Schraw, Brownlee, & Berthelsen, 2011).

The faculty and student-researchers at the laboratory school might explore to what extent their enacting of traditional recitation practices may have been influenced by a belief that learning happens quickly. This belief about the speed of learning has been described by Schommer (1990) and has been argued to not necessarily be epistemic in nature (Hofer & Pintrich, 1997), however it may play a role in the recitation or transmission of information evident in practice. Alternatively, beliefs about knowledge being transferred from authority can be explored through ECE student’s case studies.

It might be found to be productive to conduct intervention research (student, teacher, and, professional) on how certain dimensions of knowledge shift within the laboratory course. This can be accomplished by focusing on specific existing curriculum objectives, such as, developing a student-centered curriculum, and reflective engagements on competing solutions to ill-defined problems found in instructional practice (Tillema, 2011).

Lastly, a two-pronged approach is advocated for supporting professional teacher induction programs: (a) reflect on personal epistemologies (Brownlee et al., 2001; Hofer, 1999, Hofer, 2004) and (b) reflection on belief calibration (Maggioni & Parkinson, 2008; Fives, 2011; Brownlee et al., 2016). Brownlee et al. (2010) articulated the need to promote reflexivity when stating the following:

Penn (1999) suggested that the professional preparation of early childhood teachers would provide optimal outcomes if there was a focus on promoting
flexible, evidenced-based processes of learning involving deep reflection. These beliefs about knowing and knowledge suggest that teachers would be more likely to weigh-up a range of viewpoints, drawing on evidence that is both theoretical and practical as the platform for effective practice with young children. (as cited in Brownlee, Petriwskyj, Thorpe, Stacey & Gibson, 2010, p. 479)

A suggestion for making judgements based on evidence is an area that the laboratory students are uniquely prepared to develop. PSTs demonstrated they can use evidence to make decisions about effective practice but after two interviews many participants were not necessarily able to reflect upon research on how they know a student is learning. Several participants suggested assessment about the content of what students know was an accurate indicator of learning, which Tabak and Weinstock (2011) consider an indicator of traditional recitation practice. Therefore, knowledge about assessment may have implications for those PSTs who enter a system that requires a unilateral focus on securing standards.

**Conceptual Implications**

The assumptions behind Hofer’s (2001) dimensional theory and Kuhn’s (1999) developmental progression have been, separately, well-tested and it has been noted that the field of epistemology has moved from questioning these constructs (Brownlee et al., 2016). These two frameworks taken collectively using Feucht’s (2011) 12-cell matrix as the PEM framework for this inquiry was productive in understanding how PSTs interpret the nature and processes of knowledge. The dimensional nuance from Hofer’s (2001) theory allows students, teacher educators and educational researchers a heuristic tool to label and describe how prospective teachers filter knowledge about curriculum and function as a guide for
strategies PSTs employ in the classroom. For example, a constructivist minded, as well as
inquiry-based lesson plan will benefit from a view that knowledge is tentative and uncertain
and sources of knowing are based on an integration of internal and subjective sources as
well as external and objective sources. Kuhn’s (1999) developmental progression also
offers a heuristic device for considering how PSTs evaluate evidence against criteria to
think critically about curriculum and instruction. The continuum provided by Kuhn is
useful to understand how objective and subjective orientations about knowledge function
in this domain. For example, the teacher who supports inquiry-based practices can operate
as a multiplist who recognizes subjective opinions as a justified position about knowledge
claim. However, a sophisticated position on Kuhn’s framework can recognize knowledge
claims as evaluated judgements, or an integration of subjective and objective positions.
This latter position supports a mature form of critical thinking. Therefore, Feucht’s (2011)
12-cell matrix is well conceptualized to emphasize both Hofer’s autonomously functioning
dimensional view of knowledge within Kuhn’s subjective and objective orientations to
demonstrate a nuanced understanding of how individual beliefs about knowledge are
incorporated with reasoning.

In the inquiry-based classroom, there are times when the instructor needs to be
explicit when offering instruction. This is not necessarily in every situation but the ECE
classroom contains different types of learners. An evaluativist position concerning the
stability of knowledge using the PEM model (see Table 1) allows for this perspective where
judgements are made in context. For example, a classroom teacher may decide that direct
instruction has a place amongst a relatively homogenous group of English language
learners in the general classroom. To offer an additional example, lecture or the delivery
of information can be a constructivist engagement if it is determined the learner is prepared to accept new information into their existing schema. Therefore, the PEM framework (i.e., Feucht’s (2011) 12-cell matrix) might be appropriately applied when gaining a depth of knowledge about a teacher’s instructional practice and beliefs, rather than utilizing decontextualized methods that exclude classroom observation at the least, or ideally, seek collaboration alongside participants using a critical emancipatory approach for exploring these concepts. Therefore, it stands to reason that great care should be taken in attempting to gain an accurate representation of epistemic beliefs through the sole use of quantitative methods and measures such as a Likert scale that decontextualize teaching practice. This study demonstrated, at the very least, that several participants developed their reflective capacities concerning epistemic thinking through engagement in dialogue. This echoes the claim by Yadav et al. (2011) that teachers could demonstrate a nuanced understanding in context rather than having beliefs assessed by a questionnaire or standardized measure.

Concerning the justification of knowledge, it has been recently argued that “an implicit hierarchy” of how beliefs are justified by teachers with an emphasis on “deliberation” and “reflection” having been developed by Schraw as well as in development by Luna et al. (as cited in Brownlee et al., 2016, p. 303). Once published, it would be interesting to situate this study’s findings against this construct. This may reveal further insights about how knowledge is justified in the laboratory school context.

**Methodological Limitations**

Concerning Mayring’s (2014) QCA method, it was determined this was useful to develop a process that accounted for the collection of data about dimensional and developmental beliefs in a deliberate manner. Therefore, reproducing the results of this
study are useful in so far as participants from the same background, social milieu, and academic experiences engage in its replication. However, the lack of conceptual clarity in the extant literature on what constitutes a stable belief contributed to the subjective decisions about the selection of certain data collection and the analysis methods could not bolster the technical rational design problems that Mayring was attempting to solve.

Regardless, each step of the QCA method was well-placed. Especially, Mayring’s (2014) suggestion for employing a pilot study. The absence of a pilot study, due to restrictions by the sponsoring university, diminished the possibility of refining follow-up questions for areas of knowledge that are not often discussed in teacher education programs. For example, while PSTs could readily answer questions about source and justification of knowledge, certain follow-up questions pilot tested may have been useful in gaining additional data about evaluativist thinking for the structure and simplicity dimensions. Therefore, future projects might allow pilot studies dependent on a case by case basis to better support practitioners’ recommendations for improving practice.

Concerning the data collected of situated practice, a useful epistemic snapshot was gained however, a replication of this study using a well-established research method for gaining primary source material of enacted practiced through high-quality video recordings may be employed to capture the complexity of PSTs practice. This may be useful to collect a full range of data about the nuance found in the teacher and child interactions. Further, it would be ideal to gain the PSTs lesson plan for the small-group investigation, as well to consider the epistemic value of their planning. These improvements to the study design would enhance quality of the reported findings as it would consider additional facets of the epistemic climate.
This study suggests a relationship between instruction and practice, however anomalies in the data remain as it concerns an increased frequency of complex beliefs about knowledge as well as establishing any correlation between espoused and enacted beliefs. The latter may be due to epistemic beliefs about practice and the epistemic demands of each discipline (science, math) as explained above or this may be due to how stability of a belief is defined (see Skott, 2015; Hammer & Elby, 2001).

Concerning an increased frequency of complex views of practice, it is possible that the laboratory school context allows for this belief, however, use of the language found in the conceptual framework terminology of *simple* and *complex* may not have been appropriate to gain nuance concerning the structure dimension. For example, an interview question about structure asked if knowledge was simple or complex. This binary may not have permitted understanding the evaluation of knowledge that occurs with PSTs. The dichotomy of these terms presented in the interview questions may have made it easier for participants to choose complex views as they are related to instructional practice. However, the same individual may maintain a simple understanding of knowledge in a domain area they are responsible for in ECE (e.g., math, science). Gaining this understanding may reveal how a unique lesson targeting a single-subject area may be approached. For example, if an individual believes knowledge about math is fixed and simple (P6, 3:67), then this person is likely to enact recitation practices.

**Methodological Implications to the Larger Community**

A theory driven approach was used to analyze deductively the models by using a Hofer (2001) and Kuhn (1999). To date, the PEM framework that integrated these two models has not been empirically verified. Feucht and Bendixen who developed a hybrid
model from Kuhn (1999) and Hofer’s (2001) conceptual work noted that this is “speculative and untested” (Feucht, 2011, p. 243). Further, interpretation of this framework against the data was representative of one individual; therefore, the results do not necessarily reflect how PSTs would characterize their own beliefs. A cross-check of the data sought to minimize this effect, but it did not ensure my interpretation was a definitive indicator of a PSTs beliefs. Following the advice of Feucht (2011) replication of this study requires the use of the PEM framework as a “coding scheme” (p. 243).

**Recommendations for Future Scholar Practitioner Research**

In the context of the laboratory school, the epistemology of “experience” was a prevalent theme concerning the deductive findings of this study. This concept was instrumental in Dewey’s (1903) first conceptualization of the laboratory school and this was found to be the case in this study as well. Bruner (2012) argued that the way of understanding experience is through narrative. This strategy offers a critical exploration of personal practical knowledge or teachers’ developing their own understandings of practice. Narrative inquiry has been developed as research technique to gain scholarly insight from experience (Clandinin & Connelly, 1996), and widely accepted for gaining knowledge about children and instructional planning in ECE. Therefore, it is reasonable that narrative inquiry should be used as a vehicle to understand ways of knowing in ECE.

This strategy of inquiry that borders on a post-positivist understanding of reality (Clandinin & Rosiek, 2007) that challenges traditional research accounts by placing the onus of learning about practice in the hands of those professionals who engage in this work (Elbaz-Luwish, 2005). The narrative form can allow this through a description of the "textuality" of experience that can enhance understanding the situated nature of
learning that occurs for participants (Elbaz-Luwish, 2005, p. 36). Therefore, the object of any future study can benefit from, not so much the nature of being meta-aware of epistemic thinking on practice, but the process of gaining stories about this practice in the study of being meta-aware of epistemic thoughts. The difference is through legitimizing words in the context they are spoken, instead of removing them as symbols to serve the "object of study" (Clandinin and Rosiek, 2007, p. 53).

The perspective of understanding a teacher landscape, as Clandinin and Connelly (1996) have conceptualized through narrative inquiry, is much like the landscape that Feucht (2010) has considered epistemically. Feucht's landscape of knowledge can be considered through knowledge representations found in the curriculum, the teacher and students, and the classroom and resources used in instructional practice. The linking of narrative inquiry and epistemology can reveal how teachers make sense of these two landscapes.

Reflexivity and Epistemic Meta-cognition

Reflexivity has been noted as a contributing factor in the development of teacher personal epistemology (Brownlee et al., 2016). Likewise, Murphy, Alexander, Greene, and Hennessey (2012) found that challenging student perceptions through reflection has supported the development of personal epistemology. In this study, several participants demonstrated an increased sophistication of beliefs through each iteration of the interview questions. As this study was exploratory it did not set out to discover this nor was the data gained able to make judgements about why this occurred. One hypothesis is that expectations on reflexivity in the laboratory, aspects of the course, and constructivist-based experiences offered in the program may have contributed to the nuance two
individuals were able to demonstrate as the interview sets unfolded. This was demonstrated when two individuals were able to speak epistemically in a sophisticated manner by the final interview question set. One individual was recognized as an absolutist in the first set of questions and matured to multiplist position and then evaluativist thinking by the third set of questions. This same individual espoused an absolutist view of authority as a source of knowledge more in alignment with the first set of general beliefs about knowledge. A finding of epistemic value to be explored by the research community might be to discern which qualities of reflexivity in an inquiry-based setting allowed for certain individuals to experience a shift in epistemic cognition (not epistemic development which is measured over long periods of time) over the course of a 50-minute interview. However, it was not possible in this study to deduce that the inquiry-based teaching program was the most influential factor in witnessing the change, however the results are worthy of further investigation.

At the least, this indicated that the measurement challenges of capturing epistemic beliefs can be sidestepped through qualitative interview and observation of practice. In this case, through the support of video as a secondary source of data. Taking further measures, such as considering enacted beliefs, helped to gain a more nuanced understanding of epistemic thinking. This might be attributed to the necessity of using interviews to tease out epistemic thinking or it could contain a valuable insight about the reflexivity present in the laboratory school and the potential for epistemic shift given the rich learning experiences that are occurring. Greene, Azevedo, and Torney-Purta (2008) have suggested that individuals are not able to articulate their epistemic beliefs clearly, positing that qualitative interviews were the way forward. This research underscores
Greene and colleagues’ (2008) suggestion. This study demonstrated that complexity can be teased out of a participants’ initial interview responses or this research showed that certain students that gain inquiry-based experiences are adept at developing their epistemic beliefs through dialogue. Future research may also explore further if participants who learn about certain concepts focused on child-centered learning and inquiry-based methods are able to interrogate their own beliefs through reflection and dialogue.

**Implications for Knowledge Development**

This study demonstrated that the laboratory setting provides a rich environment for the development of sophistication as it concerns personal epistemology. There is evidence of sophisticated beliefs concerning the dimensions of structure of knowledge and stability. Brownlee et al. (2011a) suggesting “Such beliefs are likely to lead to increased comprehension and metacognition when knowledge is conceived of as complex and integrated (p. 487). Further, the transdisciplinary nature of ECE allowed students to recognize interconnections and better “think across disciplines and integrate ideas, therefore promoting broader and deeper understandings of issues in early childhood education” (as cited in Brownlee et al., 2011a, p. 487). It is important for PSTs to seek a continuity of “organic connections” across learning engagements in ECE (Dewey, 1903, p. 25).

**The Laboratory School and Epistemological Development**

Fives et al. (2015) suggested there is a strong research basis to support the notion that beliefs about teaching are in direct correlation to beliefs about learning. The authors found that research on learning beliefs must target the specific “subject” and “content”
areas of teaching (Fives et al., 2015, p. 260). One way they suggested this can be done is through studying certain beliefs about learning in “relation of those beliefs to outcomes of interest (e.g., ‘practice’)” (Fives et al., 2015, p. 260). If we couple this finding with research that has noted how PSTs experiences of working alongside children has demonstrated the ability to “disrupt and change” an individual’s beliefs (Cook & Young, 2004, p. 342), then this holds promise for future research on personal epistemology found in the situated learning experience of the laboratory school. Cook and Young (2004) found that PSTs learned the demands of the profession from listening to the needs and interests of the children in their charge. In turn, they experienced a shift in thinking. The laboratory school offers potential for PSTs to develop critical thinking abilities when engaged in Early Childhood Education that supports an “image of the child” as capable, curious and knowledgeable (Renaldi, 2013, p.15); a concept that is critical for challenging the traditional roles of teacher as arbiter of knowledge and the student as passive receipt of that knowledge. This image has gained traction in ECE, in part, by those who support principles popularly developed in municipal schools in Reggio Emilia, Italy, and “recast” in education settings worldwide (Elliott, 2005, p.154). One such setting in which this image is supported is in the laboratory school for teacher training (Elliott, 2005). Likewise, the social constructivist environment of the laboratory classroom exposes the student teacher to beliefs about learning and beliefs about teaching in a context where one must observe, document the behaviors and learning of children, and reflect on these experiences in discussion alongside other PSTs and mentor teachers (i.e., teacher educators who support learning in the laboratory setting). Again, these practices are supported in the laboratory school course where this research occurred and,
therefore, the potential for epistemic development is primed by the conditions that support sophisticated views of knowledge already embedded in the philosophy of the laboratory.

**Critical Thinking about Contrary Perspective**

Research by Kardash and Howell (2000) can be considered a counter-weight, or at the least, temper the expectations toward change in beliefs that might be gained by working alongside children. Kardash and Howell (2000) considered the role of epistemic thinking on cognitive and strategic processing of information. Their study focused on comprehension of a reading selection by undergraduates in an educational psychology course. These students considered text concerned with two perspectives centered on an issue of controversy (i.e., dual-positional text). The authors tested the assumption that an individual filters information through previously held beliefs, regardless if the new information fits into their framework for understanding. This filtering of information is termed by Kardash and Scholes (1996) as “biased assimilation” (as cited in Kardash & Wood, p. 525). The authors suggested that individual beliefs about knowledge (i.e., Schommer’s dimensions: *certainty, structure and speed of acquisition*) vary in how they develop from one another due to how an individual aggregates new information with long-held beliefs, especially when the new information does not fit with previously held ideas. For example, individuals who believe that knowledge is *certain* are found to hold extreme positions on a topic and did not wish to engage in tasks that required cognitive effort. Further, when considering contrary perspective to their beliefs, these individuals were found to discard this information. The authors found that those that held a view that knowledge is *tentative* and *uncertain* appreciated challenging tasks. These individuals
were said to hold a growth mindset (Kardash & Howell, 2000). This mindset is a
cognitive theory about the dispositions necessary for goal attainment where effort is
recognized as a more productive stance toward success over a belief about inherent
intelligence (Dweck, 2006).

The introduction of the aforementioned perspectives is important for those in a
teacher induction program to be exposed. Epistemic thinking serves PSTs as a lens to
interpret instructional practice. It is integral for situated learning experiences to be
offered alongside explicit instruction in how beliefs about knowledge and knowing
influence curricula, resources, and the perspectives of students and teachers. Through this
reflexive engagement, PSTs can best be prepared to recognize how to deal with expert
knowledge throughout the course of one’s career (Tynjälä, 1999).

Conclusion

While preservice teachers develop through experience and lean on authority
sources of knowledge, it seems crucial to encourage the explicit reflection on
epistemology to help PSTs explore their own beliefs about knowledge and knowing and
how it relates to pedagogical theory within situated practice. This requires a consideration
of theory alongside practice (Dewey, 1903), an area that has largely been ignored in
discussions about curriculum (Walker, 2003). As PSTs matriculate to the wisdom of
experience gained outside of the laboratory, each will benefit from the consideration of
how certain learning environments may be more accommodating for refining
sophisticated beliefs about curriculum and instruction to improve learning engagements
for those children in their charge.
Through the act of developing a teacher identity it is important to sort out the process of knowing justified through personal opinions alongside the nature of knowledge emanating from and received through authority. Further, it is important for preservice teachers to begin to tease out personal perspectives which are inconsistent with theories that are advocated. Reflexive engagements on the epistemic messages of the individual and curriculum can provide a way forward. As teachers seek to gain a foothold on the perspectives they will be developing throughout their career, a consideration of the epistemic origins of curriculum and philosophy can support deep learning about the complexity of experiences students are offered. A shift in thinking about epistemological development from taking place over years to how to support that development through deliberate interventions (Kienhues, Bromme, & Stahl, 2008) offers a unique opportunity to move the needle on implementation of constructivist practice through situated experience. Reflexivity on epistemic thinking might be scaffolded through the curriculum sequence provided in teacher induction programs to support sophisticated beliefs (Brownlee et al., 2001). Although this study was explorative there are strong indications to suggest that the development of personal epistemology in ECE can be supported through constructivist principles and inquiry-based methods. This might best be accomplished through empowering PSTs to study how their own knowledge beliefs exist tacitly and how it can be reflected upon explicitly through narrative accounts of experience.

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Appendix A: Permission to Access Research Site

September 15th, 2016

Dr. [Redacted] University
XX Center for Early Childhood Education

Dear Dr. [Redacted]:

This is a request to elicit your support in allowing access for me, as a researcher, to conduct a qualitative research study with teacher candidates from [Redacted] State’s [Redacted] Center for Early Childhood Education (ECE). For this doctoral dissertation project, I have prepared an exploratory case study, developed under the guidance of my advisor, Dr. Karen Harbeck, at Northeastern University (NEU), Boston, MA. This study will document teacher candidates’ beliefs about the nature of knowledge and ways of knowing (i.e., epistemic beliefs), as they begin to develop their understanding of instruction in the laboratory school context.

I am specifically requesting permission to make initial contact with the pre-service teachers (PSTs) at the laboratory school through an informational meeting. It is my hope
this can be conducted during a *Friday Morning Meeting* (approximately 15 minutes in duration), contingent upon IRB approval granted by NEU. The intention of this meeting is to outline the study in broad terms and the implications of the study for PSTs who may wish to participate. The study will require, at a minimum, six participants who take part in the ECE teaching experience: *Student Teaching in Early Childhood Education*. However, the study will not be conducted through direct use of the laboratory observation rooms. Rather, data will be collected off-site. Data collection will include the use of a teacher candidate’s video of one small group investigation (approximately 30 minutes in duration); as well as one interview of each participating teacher candidate (approximately 60 minutes in duration).

It is my hope that this study will contribute to understanding the phenomenon of epistemic thinking on teaching and learning. To date, there is no documentation about knowledge beliefs of PSTs in the laboratory school context. This information can be useful for teacher educators who work alongside teacher candidates in order to learn *how* epistemic thinking can be *useful* in explaining individual differences in the quality of learning outcomes.

Should you have any questions regarding this study, please contact me at foss.ja@husky.neu.edu or at home (605-692-5315). Alternatively, you may contact the chairperson of my committee, Karen Harbeck PhD, JD, at Northeastern University at k.harbeck@neu.edu. Thank you in advance for your time.

Sincerely,

James Foss

As Director of [XXX State’s] Center for Early Childhood Education, I hereby give permission for James Foss to access the research site for the purposes stated on this letter eliciting permission to access, subject to any modification noted below:
Appendix B
Information Sheet for Presentation

Dear ECE:

As I prepare to begin my doctoral dissertation project, developed through studies at Northeastern University, Boston, MA, and with the support of the director, Dr. [Name] at [State’s Name], at Center for Early Childhood Education (ECE), I would like to invite you to participate in a case study related to your ECE experience: Student Teaching in Early Childhood Education. The title of this project is: *Pre-service teachers’ epistemic thinking in an inquiry-based early childhood laboratory school*. The topic of the study concerns your beliefs about knowledge in the context of your instructional planning and day-to-day practice. The intent of this project is to explore: (a) teacher candidates’ beliefs about knowledge and knowing, and (b) to consider what beliefs about knowledge and knowing teacher candidates can reflect upon within the university laboratory.

This research project is designed to present a minimal disruption to your course and your participation will not affect your curriculum delivery, nor will it affect any aspect of your grade. **Your participation in this study is entirely voluntary.** Furthermore, you have the right to withdraw from this study at any time. Not participating, or withdrawing from the study, will not affect your course grade or your standing as a teacher candidate at [State’s Name].
Your participation will require one face-to-face interview and the sharing of one video recording of your small group instruction. The interview will be approximately 60 minutes in length. In the interview we will discuss your beliefs about the nature of knowledge and how a person comes to know something, especially how you might draw from these beliefs as you plan and engage in small group investigations. A 20-30-minute video of small-group instruction will be solicited as an artifact to showcase your knowledge beliefs as they are evident in your teaching practice in the laboratory. You will select the video that you wish to share from those either recorded by yourself, with use of a tri-pod or given to you by your course instructor. However, your identity will be handled in a confidential manner. Only myself, as the researcher, will handle any information about you or what you say. In any publications from this study, your name will not be identified, and a pseudonym will be used to protect your identity.

Please sign a form, found at the back of the room, with your email address and/or phone number if you would like to volunteer for this study or if you would like any additional information.

Thank you for your time and consideration.

Appendix C
Telephone Recruitment Script

1. Introduction

Hello _______. My name is James Foss. I am a doctoral student at Northeastern University, Boston, Mass. and faculty member at XXXX. I am calling today to follow up about your possible participation in the research project I spoke to your class about on Friday, at the XXXXX Center. In brief, I mentioned this study was about the knowledge beliefs of PSTs who work in the laboratory classroom and the purpose of this inquiry is to document the knowledge beliefs PSTs have about when engaged in teaching and learning. As you may recall, Dr. Karen Harbeck is this study’s principal investigator and my dissertation mentor at Northeastern University, however, I will be the investigator and only person you will have contact with should you choose to participate.

2. Immediate opportunity to opt-out

Are you still willing to talk further about your potential participation in this study? If the individual indicates he or she is no longer interested. I will state:

“I understand. Thank you for your time”. If the individual indicates that he or she is willing to speak further I will state:
If you are willing to learn more about this research study, I would like to schedule a meeting with you.

You should know that when we meet we will first review, in detail, the particulars of this study and what it means for you to participate. In the event you wish to continue your participation in the study, you will be offered a consent form to sign. A copy of this form will be made available to you for your records.

However, at this time or anytime during the study you have the right to opt-out.

If you choose to offer your informed consent, we can immediately begin the interview or schedule it for another time. Whatever your schedule and comfort level allows for is acceptable by me. Plan on the interview taking about 60 minutes. As you may recall your participation will also require me to gain a 20-30-minute video of your practice working in a small-group with your students. I can get this video from you within two weeks of your interview at a time of your convenience.

Given this information, are you still willing to participate and interested in learning more about this study?

If not interested the individual will be thanked for his or her time.

If the potential participant is interested, I will state:
Please let me know a time and place that is convenient for you to meet?

Appendix D
Informed Consent
Pre-service Teacher

Northeastern University, College of Professional Studies
Principal Investigator’s Name: Karen Harbeck PhD, JD
Investigator’s name: James Foss
Title of Project: Pre-Service Teachers’ Epistemic Thinking in an Inquiry-Based Early Childhood Laboratory School

Informed Consent to Participate in a Research Study

This consent process requires you to be fully informed about the conditions of this research project and your rights as a participant. Each of the questions and answers below seek to fulfill this need.

**Will there be any compensation offered?**
There will be no compensation offered for your participation in this study.

**Is there any benefit for participation?**
There are no direct benefits to you for participating in this study. However, you may benefit from this project through discussion and reflection on the role of your beliefs as a component of developing your professional knowledge. Additionally, future teacher candidates may benefit from the outcomes of this research through improved teacher education/professional learning.
How will my identity be protected?
Your identity will be handled in a confidential manner. Only I, as the researcher, will see the information about you. In any publications from this study, your name will not be identified, and a pseudonym will be used to protect your identity.

What will I be asked to do?
If you decide to take part in this study, you will be asked to participate in one audio-recorded interview and submit one video of your instructional practice. Excerpts from the video recordings will be used to document your beliefs about knowledge and how these views are reflected in your classroom interactions and instruction. The interview will seek your beliefs about knowledge in the context of your instructional planning and day-to-day practice. This interview will occur outside the laboratory school, at a mutually agreed upon time, within the first two weeks of November, 2016. As part of the study, you will be asked to volunteer one 30-minute recording of your classroom interactions through small-group investigation, for the purpose of allowing me an unobtrusive way to observe your practice. As a component of the ECE [___] experience: [_________________________], you periodically are asked to reflect on these videos as part of the course. In this study, you will be asked to share one recording of a small-group investigation for my review before the interview. You can choose which lesson to record, using laboratory equipment (i.e., tripod and camera) during November.

Where will the study take place?
The interviews will be determined at a designated time of each participant’s choosing.

Will my performance be evaluated?
The project does not evaluate your performance, but intends to gain your perspective on your beliefs about knowledge and the impact of knowledge beliefs in your decision making. This study will not contribute to your course grade.

Is there any risk or harm to me through this study?
There are no foreseeable risks to you as part of this study. Any personal revelations or reflections that reveal challenges or tensions in your thinking will not be framed as individual failures. Should you choose to take part in the study, you have the right, at any time, to terminate your participation without any harm to your academic performance or standing in the education program.

What if I do not wish to participate in the study?
You do not have to take part in this study. Your participation is voluntary, even if you start, you can quit at any time.

If you have any questions or problems please contact James Foss (Northeastern University) foss.ja@husky.neu.edu 605-828-5578 or Karen Harbeck Ph.D., JD (Principal Investigator) k.harbeck@neu.edu.

If you have any questions about your rights as a participant you can contact: Nan C. Regina, Director, Human Subject Research Protection, 960 Renaissance Park, Northeastern University Boston, MA 02115 tel. 617-373-7570, email: irb@neu.edu.

I agree to participate in this study. I will receive a copy of this form for my information.

__________________________________ Research Participant (Printed Name)
__________________________________ Signature ___________ Date
Appendix E: Interview Schedules & Interview Protocol

Thank you for agreeing to take part in this research and being interviewed today. This interview will be about 60 minutes. Please remember there are no right or wrong answers and this project does not evaluate your performance. Should you feel uncomfortable sharing any aspects of your thinking, you do not have to do so. As stated in the informed consent, you can stop the interview at any time should you not wish to continue.

Do you have any questions before we begin?
Do I have your permission to begin recording this interview?
(allow time for any questions before beginning audio recording)

Interview protocol

Set 1: Domain-specific questions about instructional practice

Epistemic beliefs about curriculum and resources:
1. What plays a role in your lesson planning?
2. What sources do you use when planning for teaching? (source)
3. Do you believe knowledge about teaching is simple or complex? (structure)
4. Does knowledge about how to teach change over time? Why? (certainty)
5. Do you use any resources in your lesson planning? What resources do you use? How do you choose what is a good resource? (justification)
6. What are good methods for gaining knowledge about curriculum? How do you know these are good methods? (justification)
7. Considering the methods and sources you just mentioned, how can you determine if these are valid/accurate? (justification)

Set 2: Epistemic beliefs about instruction:
1. What instructional practices do you use?
2. Where do you get them from? (source)
3. Do you think these instructional practices will change? (certainty)
4. Is knowledge about these instructional practices simple or complex? (structure)
5. How do you know if these practices are good or not? (justification)
6. What do you think is important for students to learn?
7. Do you think this will change over time? (certainty)
8. Concerning the knowledge that students should learn, is it simple and static or complex and dynamic? (structure)

9. What sources do students need to use to learn? (source)

10. What helps you decide if these sources are accurate/effective? (justification)

Set 3: Accessing the development of epistemological understanding

Questions 2-4 follow the YES/NO line of questioning evidenced for question 1.

1. Do you think most problems or dilemmas that arise in teaching often have a simple solution?
   YES/NO
   
   Yes: Please explain. Then move to question #2.
   
   No: Do you think there is often more than one correct solution to a teaching dilemma?
   YES/NO > No: Please explain. Move to question #2. A
   
   Yes: Can multiple solutions be correct? Why? M or E > Ask probing question:
   How can a teacher determine the best possible solution to a classroom problem?

2. Do you think that knowledge about effective teaching practices are certain and static (lacking in movement or change)?
   a. No: Do you think that effective teaching practices are based on opinions?
   b. If yes, do you believe that certain teaching practices are more effective than others?
   c. How can you determine which practice is better than any other?

3. When teaching students in an inquiry-based setting, do you believe that there are no definitive answers and any given opinion can be equally valid?
   a. No: Can you think of an opinion that you think is not valid?
   b. If yes, do you believe that certain answers are more correct than others?
   c. How can you decide which is better?

4. When you want to know something about Early Childhood education do you think you should always seek the advice of an expert?
   a. If multiple experts about teaching cannot agree how can an early childhood teacher determine what is correct/true?
   b. Can one expert be more correct than the other?
Appendix F: NAEYC Professional Preparation Standards

Standard #1: Promoting Child Development and Learning

Early Childhood professionals are grounded in a child development knowledge base. They use their understanding of young children’s characteristics and needs and of the multiple interacting influences on children’s development and learning to create environments that are healthy, respectful, supportive, and challenging for each child.

Key Elements of Standard 1: 1a.: Knowing and understanding young children’s characteristics and needs. 1b.: Knowing and understanding the multiple influences on development and learning 1c.: Using developmental knowledge to create healthy, respectful, supportive, and challenging learning environments

Standard #2: Building Family and Community Relationships

Professionals prepared in early childhood degree programs understand that successful early childhood education depends upon partnerships with children’s families and communities. They know about, understand, and value the importance and complex characteristics of children’s families and communities. They use this understanding to create respectful, reciprocal relationships that support and empower families and to involve all families in their children’s development and learning.

Key Elements of Standard #2 2a.: Knowing about and understanding diverse family and community characteristics. 2b.: Supporting and engaging families and communities through respectful, reciprocal relationships 2c.: Involving families and communities in their children’s development and learning.

Standard #3: Observing, Documenting, and Assessing to Support Young Children and Families

Professionals prepared in early childhood degree programs understand that child observation, documentation, and other forms of assessment are central to the practice of all early childhood professionals. They know about and understand the goals, benefits, and uses of assessment. They know about and use systematic observations, documentation, and other effective assessment strategies in a responsible way, in partnership with families and other professionals to positively influence the development of every child.

Key Elements of Standard #3 3a. Understanding the goals, benefits, and uses of assessment 3b. Knowing about and using observation, documentation, and other appropriate assessment tools and approaches 3c. Understanding and practicing responsible assessment to promote positive outcomes for each child 3d. Knowing about assessment partnerships with families and with professional colleagues.

Standard #4 Using Developmentally Effective Approaches to Connect with Children and
Families

Professionals prepared in early childhood degree programs understand that teaching and learning with young children is a complex enterprise, and its details vary depending on children’s ages, characteristics, and the setting within which teaching and learning occur. They understand and use positive relationships and supportive interactions as the foundation for their work with young children and families. Early childhood professionals know, understand, and use a wide array of developmentally appropriate approaches instructional strategies, and tools to connect with children and families and positively influence each child’s developmental and learning.

Key Elements of Standard #4  4a. Understanding positive relationships and supportive interactions as the foundation of their work with children

4b. Knowing and understanding effective strategies and tools for early education  4c. Using a broad repertoire of developmentally appropriate teaching/learning approaches

4d. Reflecting on their own practice to promote positive outcomes for each child

Standard #5: Using Content Knowledge to Build Meaningful Curriculum

Professionals prepared in early childhood degree programs use their knowledge of academic disciplines to design, implement, and evaluate experiences that promote positive development and learning for each and every young child. They understand the importance of developmental domains and academic (or content) disciplines in an early childhood curriculum. They know the essential concepts, inquiry tools, and structure of content areas, including academic subjects, and can identify resources to deepen their understanding. Early childhood professionals use their own knowledge and other resources to design, implement, and evaluate meaningful, challenging curricula that promote comprehensive developmental and learning outcomes for every young child.

Key Elements of Standard #5:  5a. Understanding content knowledge and resources in academic disciplines  5b. Knowing and using the central concepts, inquiry tools, and structures of content areas or academic disciplines  5c. Using their own knowledge, appropriate early learning standards, and other resources to design, implement, and evaluate meaningful, challenging curricula for each child.

Standard #6: Becoming a Professional

Professionals prepared in early childhood degree programs identify and conduct themselves as members of the early childhood profession. They know and use ethical guidelines and other professional standards related to early childhood practice. They are continuous, collaborative learners who demonstrate knowledgeable, reflective, and critical perspectives on their work, making informed decisions that integrate knowledge from a variety of sources. They are informed advocates for sound educational practices and policies.
Key Elements of Standard 6:  
6a. Identifying and involving oneself with the early childhood field  
6b. Knowing about and upholding ethical standards and other professional guidelines  
6c. Engaging in continuous, collaborative learning to inform practice  
6d. Integrating knowledgeable, reflective and critical perspectives on early education  
6e. Engaging in informed advocacy for children and the profession