



January 2014

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Jacob Manu

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AN INVESTIGATION ON RELATIONSHIP BETWEEN EPISTEMOLOGICAL
BELIEFS AND INSTRUCTIONAL PRACTICE OF PRESERVICE
AND INSERVICE TEACHERS

by

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A Dissertation
Submitted to the Graduate Faculty

of the

University of North Dakota

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

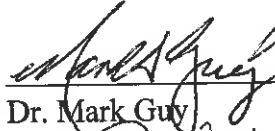
Grand Forks, North Dakota
December, 2014

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This dissertation, submitted by Jacob Manu in partial fulfillment of the requirements for the Degree of Doctor of Philosophy from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.



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Instructional Practice of Preservice and Inservice Teachers

Department Teaching and Learning

Degree Doctor of Philosophy

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Jacob Manu

December, 2014.

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ACKNOWLEDGEMENTS

I thank God Almighty for giving me knowledge, strength and divine protection throughout this program. I would like to express my profound gratitude to my chair, Dr. Woei Hung without him the research would have been fruitless. My sincere appreciation is expressed to my graduate committee members: Dr. Mark Guy, Dr. Jodi Holen and Dr. Yun Ji for their insight, feedback and time during this research process. Also, many thanks go to my friend and brother in Christ Samuel K. Manu for his financial and spiritual assistance throughout this journey.

Special thanks go to Dr. Richard Vaneck and all faculty members in the Teaching and Learning Department for their invaluable support and assistance extended to international students. Gratitude is expressed to the Wagar family in Bottineau and all Ghanaian graduate students in the College of Education and Human Development of University of North Dakota. God bless you all.

This dissertation is dedicated to Rose, Kenny, Kelvin, Karl and the Wagars in Bottineau.

ABSTRACT

This quantitative research sought to investigate the relationship between epistemological beliefs and instructional practice of preservice and inservice teachers. Despite the vigorous emphasis and investment on the need for teachers to adopt teaching and learning practices that are more authentic, learner-centered, project-based, meaningful, and context-based, there is a growing trend where inservice teachers are trained in constructivist learning environment but end up adopting traditional learning pedagogies. Thus, teachers are constantly struggling to incorporate the tenets of constructivism into the teaching and learning process. With the use of the discipline-focused epistemological beliefs questionnaire and instructional practice scale, preservice and inservice teachers were purposively sampled to respond to the survey questions.

After gathering the data and analyzing the responses, the researcher found that there was no significant difference between the epistemological beliefs of preservice and inservice teachers. There were significant differences among the four dimensions of epistemological beliefs (certainty/simplicity of knowledge, source of knowledge, justification for knowing, and attainment of truth) for both preservice and inservice teachers. Also, there was evidence to support the hypothesis that teachers did not have the same level of epistemological development across the four dimensions studied. Finally, this research indicated that there were significant positive correlational relationships between the overall epistemological beliefs and instructional practice of preservice and inservice teachers. The implications for practice are discussed.

CHAPTER I

INTRODUCTION

This quantitative research was designed to look at the relationship between personal epistemological beliefs and instructional practice of preservice and inservice teachers. For about three decades now, constructivism has become the preferred instructional pedagogy of the American education at all levels (Lektorskii, 2010; Wilson, 2012). Barak and Shakhman (2008) stated that there was a general consensus on the need to shift the teaching of science from “traditional schooling to constructivist-oriented instruction” if the goal of education would be “independent learning, problem-solving, decisions-making and critical thinking” (p. 11). Constructivism is one of the educational philosophies within a body of philosophies known as “rationalism” (Smith & Ragan, 2005, p. 18). This set of mainstream learning pedagogies requires the teaching and learning process to be meaningful, authentic as well as context-bound to create opportunity for students to construct and make sense of their own knowledge in novel ways (Vygotsky, 1978; Wilson, 2012). In recent times, constructivism has become the preferred educational philosophy in the United States as indicated in the standards and benchmarks of different states.

In the 21st century, there seems to be an unprecedented access to information as a result of the World Wide Web. As a result of this development, it has become possible for teachers and students to have access to different kinds of information without necessarily having to memorize them. As one of the strengths of the behaviorism, students were required to memorize information to be able to retrieve when needed (Bruning, Schraw & Norby, 2011). There is

foundational knowledge that students need to know in order to have a better perspective of a particular discipline. Nonetheless, when education is structured around rote memorization of facts, it might probably deny students of their ability to think critically. The challenge for both teachers and students is their ability to connect with information and get deeper understanding through interaction. With this challenge, the most promising educational philosophy is constructivism due the opportunity students have to relate with what they learn in authentic environment.

However, some studies showed that many inservice teachers were not practicing the contemporary learning pedagogies (constructivism) in their various classrooms, despite the investment and other commitments made to that end (Kang, Brian & Ricca, 2010). There might be a possible reason why constructivism has become the preferred educational philosophy at all levels of American education. Whatever the reason, most preservice teachers are trained in the constructivist environment. If preservice teachers eventually revert to the use of more traditional learning pedagogies, then the purpose of constructivism being the preferred educational philosophy is defeated. At the same time, the financial resources and other non-fiscal commitments into training preservice teachers are wasted.

The implication of this problem is that teachers will be more likely to continue to provide their students with content knowledge without helping them to relate with the knowledge in different contexts. Such learning strategy might possibly deny students from being critical thinkers and better problem solvers. Another question that should be asked is why do preservice teachers demonstrate inclination towards constructivist pedagogies (Brownlee, 2009) whereas inservice teachers, who at a point in their studies; might have espoused to constructivist paradigm still use traditional learning strategies in their classrooms (Niaz, 2008; Bol & Strage,

1996)? For some years now, educators have emphasized the need to make learning more student-centered (Huba & Freed, 2000). To do this, one of the areas that influences teachers' choice of instructional practice is their epistemological beliefs (Hofer & Pintrich, 1997; Hofer, 2001; Brownlee, 2003b). Therefore, it is important to study the relationship between epistemological beliefs and instructional practice of teachers in order to have better perspective on the nature of the dynamics that influence the inservice teachers to practice traditional learning pedagogies.

Preferred Learning Paradigm

Teaching pedagogies that emphasize controlled guidance in the classroom have gained popularity as the instructional paradigm in recent years (Kirschner, Sweller & Clark, 2006; Lektorskii, 2010). This learning and philosophical paradigm rose to prominence as an alternative to the objectivist orientation, which dominated the research world on human learning until the mid-20th century (Boghossian, 2006; Kirschner, Sweller & Clark, 2006; Louden & Wallace, 1994). Niaz (2008) observed that different kinds of constructivist instructional pedagogies were adopted by science educators, which led to more emphasis on scientific theories and meaningful learning through experience by the students. He, however, added that the nature of science (tentative nature of science knowledge) education made it strategically appropriate for science students to be exposed to the different kinds of constructivist learning environments.

Lektorskii (2010) observed that a constructivist pedagogical environment is the current fashion that most schools, at different levels aspire to. He added that as a result of its popularity and wide anointing, many researchers from different disciplines write and talk about it. Explaining the reason for its popularity, Lektorskii (2010) mentioned that the constructivist paradigm “expresses a number of specific features of contemporary human sciences and even of contemporary culture as a whole” (p. 6). Contrary to this assertion, Kirschner, Sweller and Clark

(2006) argued that from the understanding of the human cognitive architecture stand point, there were less empirical studies to support the effectiveness of minimally guided instructional strategies like constructivist learning environments. Nonetheless, after eight years of this publication, there has not been much change in the acceptance and popularity of constructivism in American educational system.

The learning of science, technology, engineering, and mathematics (STEM) has also seen different programs and projects that were constructivist-oriented. In 2010, the federal government made available \$4 billion to states that were willing to design “comprehensive, coherent, statewide education reform” across four key areas: standards and assessments, teacher quality, data systems, and turning around low-performing schools” (Robelen, 2010, p. 6). Among the eleven states that won the second round of the federal grant, the philosophical paradigm of their programs was using constructivist approaches to help students learn meaningfully in the these four strategic areas (Robelen, 2010). Discussing constructivist ways of learning science and technology, Kruse and Wilcox (2013) lamented that science classes were perceived as rote memorization of facts whereas technology involved proficiency in the use of a tool. They argued that the purpose of learning these disciplines was for students to be critical in the cultural discourse in order to make better personal decisions. Teaching students to learn facts, and skills by using technology tools falls short of students’ ability to apply the knowledge in real life situations. Therefore, if inservice teachers continue to use the traditional learning pedagogies, it might be difficult for their students to have deeper understanding of scientific principles as they apply to their immediate and distal contexts. In the 21st century, we need students who are able to think critically and make informed decisions about their personal and societal lives.

This state of affairs might be a potential threat to the quality of instructional practice that helps students to learn meaningfully. Also, the caliber of students' performance that stakeholders envision might fall below expectation under such situations. Brian and Ricca (2010) noted that issues that relate to how teachers make instructional decisions in classroom deserve the full attention of educators. One of the things that researchers seem to overlook is conscious follow-up on the results of their research findings when they are applied in a real life environment. When researchers fail to undertake situational analysis on how their research findings are utilized, it is likely to create a knowledge vacuum between what was recommended after the study and how it was practiced. As a result of the knowledge gap, researchers might not be able to discern the new challenges that emerge during implementation of their recommendations. This might potentially blur the usefulness of the research findings.

The missing link in this line of argument is that contemporary teaching pedagogies for preservice teachers are constructivist. However, the literature reviewed seems to suggest that inservice teachers are practicing teaching and learning strategies that are not consistent with the constructivist philosophical paradigm. In order to avoid the propensity of using mere speculated statements to explain this state of affairs, the need exists to empirically study this inconsistency.

One of the factors that has stronger empirical support in influencing teachers' decisions in the classroom is the concept of personal epistemologies (Hofer, 2001; Hofer and Pintrich, 2002; Brownlee, 2003). Schommer (1990) observed that epistemological beliefs influence teaching and learning attributes like the depth of understanding, and critical thinking. If the epistemological beliefs of teachers influence their choice of instructional practice in the teaching and learning process (Hofer, 2001), then, understanding the relationship between the epistemological beliefs and instructional practice of both preservice and inservice teachers is

important in ensuring that students succeed in the teaching learning process (Braten & Stromso, 2006; Hofer, 2001; Trigwell & Prosser, 2001). With the knowledge and understanding of the relationship between personal epistemologies and instructional practice of preservice and inservice teachers, educators are likely to be mindful of the importance of their students' epistemological beliefs to learning. With this as a frame of reference, educators will be more likely to address specific areas of instruction when designing professional development and mentorship programs.

Personal Epistemology

The concept of personal epistemology was first studied in the late 1960s (Perry, 1970). Perry (1970) studied college students and found that college students possessed four main stages of beliefs: dualism, multiplicity, relativity, and commitment. Dualism referred to the view of knowledge that had to be transmitted by leaders or experts as either right or wrong. The assumption was that authorities connoted absolute knowledge. Multiplicity, as the second stage, implied the mixture of personal views as well as absolute truth. At this stage, college students began to think that there were other ways or sources of knowing besides what had been obtained from authorities. Also, students began to add their voice as a potential alternative to what was known and received from experts and authorities. During the relativist stage, students no longer believed in absolute truth but started to see knowledge as meaning making, which usually varied from one individual to another. This meant, what was right in one context would not necessarily be so in another context. At the last stage (commitment), college students relied solely on making sense of experiences and using evidence to support what they believed about a particular body of knowledge. Perry added that not all college students were able to make it to the commitment stage.

Schommer (1990) defined personal epistemology “as a system of more or less independent beliefs, conceptualized as beliefs about the simplicity, certainty, and source of knowledge” (p. 540). Hofer (2002) stated that epistemology was “concerned with the origin, nature, limits, methods, and justification of human knowledge” (p. 4). Evaluating the epistemological beliefs of preservice teachers, White (2000) categorized epistemology into “...certainty of knowledge, simplicity of knowledge, source of knowledge and justification for knowing” (p. 279). From the various definitions cited, epistemology can be summarized as an individual understanding and belief about the nature of knowledge, origin of knowledge, certainty of knowledge, and how one justifies knowing a phenomenon.

Despite the availability of different definitions, Brownlee et al. (2009) argued that there is still debate on the right definition of personal epistemologies, since different researchers have used the concept based on the variables they have studied. On this note, the concept continues to attract researchers from within and without the United States, who continue to investigate the different aspects of personal epistemological beliefs (Brownlee, 2003b; Hofer, 2001; Schommer, 1990; Tsai, 2000). Brownlee (2003b) observed that epistemology serves as a “filtering role” as teachers with advanced epistemological beliefs create opportunity for students to construct meaning within the learning environment, whereas those with naïve epistemology see truth as “absolute and categorical,” thereby transmitting knowledge to their students (p. 2). Therefore, knowledge on the relationship between epistemological beliefs and instructional practice of preservice and inservice seems to be one of the reliable ways to better understand why teachers possibly revert to traditional learning pedagogies.

Barriers Influencing Teachers' Instructional Practices

At the beginning of this study, it was mentioned that the reasons why inservice teachers fail to practice constructivist pedagogies in their classroom are multifaceted. This section is a brief description of some of the observations and studies about other factors, beside epistemological beliefs, that can potentially influence inservice teachers to adopt instructional practices that are at variance with their epistemological beliefs. Cady, Meier & Lubinski (2006) observed that newly trained teachers can revert to traditional method of teaching due to the enormous job-related challenges that are placed on their shoulders as novice teachers. Such fear can adversely affect the choice of instructional strategies that newly trained teachers adopt in the classroom. Also, the No Child Left Behind Act (2001) required all elementary and secondary schools to have adequate yearly progress, based on state standards. No matter the availability of evidence-based learning strategies that possibly help students to learn meaningfully, teachers can possibly resort to teaching to test, in order to help their students make the kind of progress envisioned by the federal act.

There have been the introduction of the Common Core State Standards and Race to the Top, which beyond the No Child Left Behind Act, sought to prepare students for college and work expectations as well as encourage state and local school districts' ability to satisfactorily meet educational policy directives. With these policies, designers of the standards possibly used evidence-based research as well as insight from highly performing countries at the global level as a guide. For example, the Common Core sought to envision a teaching and learning environment that would help students to be competent in both content mastery as well as the application of knowledge through higher-order learning skills (CCSSI, 2010). After four years of implementation, teachers are required to put in their best in helping students develop the kind of

proficiencies and readiness as expected by the Common Core State Standards and Race to the Top educational initiatives. To do this, it is likely that some inservice teachers may have to teach in ways that might be inconsistent with their epistemological beliefs in order to be able to prepare their students to attain the needed proficiency (Hallet, 2010).

Another reason why it is increasingly difficult for inservice teachers to design their instructional environment in ways that align with their epistemological beliefs is students' resistance. The popular perception of students' academic success in a more traditional learning environment (Kirschner, Sweller & Clark, 2006) coupled with the potential inability of teachers to cover all the instructional learning content in a constructivist learning environment (Paul et al. 1995), has led to students finding different ways to resist teachers who adopt constructivist instructional practice. Clift and Brady's (2005) observed that despite preservice teachers going through the same program from the same institution, there is no guarantee that their epistemological beliefs and practice will be the same. Yilmaz-Tuzun and Topcu (2008) reported that despite sophisticated epistemologies of elementary preservice science teachers, they still seemed to believe that students would only be successful if they memorized scientific concepts and facts. Some studies have also cited cultural differences as reason for inservice teachers' inability to use constructivist learning pedagogies (Schommer, 1993; Schraw & Elafson, 2008; Woodside-Jiron & Day, 2001). Doing this study will potentially give more insight on our understanding of the relationship between epistemology and instructional practice.

Statement of the Problem

One of the reasons that explains the basis for preservice and inservice teachers' instructional practice is personal epistemological beliefs (Brownlee, 2003; Hofer, 2001; Schommer, 1990). Teachers with naïve epistemological beliefs are likely to adopt guided

instruction whereas those with sophisticated beliefs might consider using either unguided or less guided instruction (Kirschner, Sweller & Clark, 2006; Muis, 2004). Despite that constructivism is the preferred pedagogy of the United States at all levels of education, inservice teachers continue to use traditional or direct instructional practice in the teaching and learning process. It is interesting that all standards and benchmarks are designed with the constructivist philosophy. Nonetheless, inservice teachers continue to use traditional learning pedagogies.

The question is what factors might account for the inservice teachers' inability or refusal to adopt these contemporary instructional practice? Could it be that these inservice teachers have dualist epistemological beliefs (Perry, 1970)? Yilmaz-Tuzun, and Topcu, (2008) found that preservice teachers did not have the same level of epistemological development. Where preservice teachers demonstrated sophistication in certain dimensions, less sophistication was also reported in other dimensions. Again, Topcu (2011) observed that the epistemological beliefs of elementary preservice teachers did not make any unique contribution to their moral reasoning as they demonstrated different levels of epistemological sophistication. Further, Tanase and Wang (2010) found that whereas some preservice teachers were opened to changes in their personal epistemological beliefs, there was no evidence of change in the beliefs of other participants in the study. Similarly, Buehl and Fives (2009) observed that inservice teachers possess a range of epistemological beliefs. Lastly, Chai (2010) observed that Singaporean inservice teachers were more relativist, yet they adopted instructional practice that was more knowledge transmission oriented.

Most research on epistemological beliefs has been with the use of college students, and there is a limited number of studies on preservice and inservice teachers. For this reason, it is difficult to conceptualize teachers' epistemological beliefs (Schraw & Olafson, 2008). Without

research-based evidence on preservice and inservice teachers' epistemological beliefs level, such discussions on their beliefs will remain as speculations. Therefore, the need exists to empirically find the relationship between preservice and inservice teachers' epistemological beliefs' level, instructional practice, and the relationship between them.

Purpose of the Study

This quantitative study investigated preservice and inservice teachers' epistemological beliefs as well as their inclination of instructional practice. The results of the study will be useful in adding to the body of research on personal epistemological beliefs as well as how certain epistemological beliefs translate into instructional practice in the school setting. With this, teacher education programs can consciously facilitate and nurture certain epistemological worldviews of preservice teachers that will lead to the desired results in the classroom (Brownlee, 2003). In the same vein, developers of professional development programs for inservice teachers will be drawn to some of the dynamics between epistemologies and instructional practice of their teachers. Such knowledge will be useful in helping to make decisions about inservice teachers. As of now, there has not been much emphasis on the need for educators to ascertain information on learners' epistemological beliefs before they develop their instruction. Some experts in the field of instructional design have written extensively on the need to carry out learner and other performance-related analysis (Dick, Carey, Carey, 2009; Smith & Ragan, 2005) before the instructional environment is implemented. The results of this work will potentially create the awareness on the need for such exercise to be part of the preservice and inservice teachers' educational experience.

Research Questions

1. What are the differences between preservice and inservice teachers' epistemological beliefs?

Null Hypothesis:

- a. There is no difference between preservice and inservice teachers' epistemological beliefs.
2. What are the differences in preservice teachers' projected and inservice teachers' actual instructional practice?

Null Hypothesis:

- b. There is no difference between the instructional practice of preservice and inservice teachers.
3. What are the relationships between preservice and inservice teachers' epistemological beliefs and their instructional practice?

Null Hypothesis:

- c. There is no relationship between preservice teachers' epistemological beliefs and their instructional practice.
- d. There is no relationship between inservice teachers' epistemological beliefs and instructional practice.

CHAPTER II

LITERATURE REVIEW

This quantitative research investigated the relationship between epistemological beliefs and instructional practice of preservice and inservice teachers. Over three decades now, constructivism has become the contemporary pedagogy of the American education (Wilson, 2012). Meanwhile, inservice teachers are required to perpetuate the existence of this teaching practice. Unfortunately, they find it difficult to implement instructional practices that are meaningful, learner-centered and authentic (McKinney & Frazier, 2008). Vigorous research and findings support the relationship between knowledge and epistemology, yet the impact of these research findings is not felt (Hofer & Pintrich, 2002). Below is a discussion of the history of the concept personal epistemology.

History of Personal Epistemology

Personal epistemology refers to the nature of knowledge and how people come to know. This concept was first studied in the late 1960s (Brownlee, 2003; Schommer-Aikins, 2004). Perry was the one who laid the foundational research on personal epistemology (Perry, 1970). With the use of college students at Harvard, Perry used interviews during the four-year period to identify the progression of epistemological beliefs and development of college students. At the end of his study, Perry (1968) found that college students varied significantly in terms of their level of epistemological beliefs. From this maiden research, he reported that most undergraduate liberal arts students at Harvard progressed through their program from a dualist knowledge perspective where knowledge was absolute (right or wrong) and obtained from authorities to

relativist knowledge where knowledge was no longer absolute (right or wrong) but based on the context within which it was discussed. From the finding, college students in their senior years ceased to believe in right or wrong and begin considering other perspectives besides authorities as potential solutions to a problem. Though Perry (1970) found support for four main epistemological views (*dualism, multiplism, relativism, and commitment*) among college students, in actual sense, the four main areas were further divided into nine positions that explained some transitions that college students made before moving into a new belief level.

Ryan (1984), taking Perry's work to another level, categorized the four stages into dualism and relativism. He conducted an experimental test and concluded that the distinction between dualist and relativist's college students went beyond differences in their epistemological beliefs. He reported that relativist students had more advanced learning strategies as compared to dualist college students. Ryan allowed these groups to explain in detail the strategies they used to understand the materials studied during lessons. After extending this research for over a semester, he reported that dualist students focused more on superficial content materials (explicit content) whereas relativist learners constructed knowledge, based on the context of the material.

Similarly, Kuhn and Weinstock (2002) described this same process from absolute (knowledge was either right or wrong and transferable), *multiplism* (knowledge based on individual opinions) and to *evaluativism* (knowledge was based on evidence-based research). Within the research community in this area, there is a growing consensus that personal epistemological beliefs start from simple absolute knowledge and move to sophisticated knowledge (Brownlee, 2001; Hofer, 2001; Muis, 2004; Pajares, 1992; Pintrich, 2002). However, Muis (2004) argued that the use of novice and sophisticated terminologies to refer to simple and

advanced epistemological beliefs development was not appropriate and suggested availing and non-availing epistemological perspective to represent these knowledge extremes.

The Dimensionality of Personal Epistemology

In order to empirically gather more information on the epistemological beliefs of college students on how they come to know as well as their perception of knowledge, various empirically validated epistemological beliefs' instruments have been designed. These instruments are used to measure different academic variables after the monumental work of William Perry. One of the earliest quantitative instruments, designed to measure students' epistemological beliefs, was the Schommer epistemological questionnaire (Schommer, 1990). The Schommer epistemological questionnaire (SEQ) is a 63-item survey with Likert scale questions that requires respondents to rate their beliefs from strongly disagree (1) to strongly agree (5), based on certainty of knowledge, control of knowledge, structure of knowledge, speed of acquiring knowledge and source of knowledge. Prior to the validation of this epistemological instrument, most researchers investigating epistemological beliefs used interviews, participant responses and thick descriptions to explain their epistemological beliefs (Schommer-Aikins, 2004). Before the introduction of the epistemological beliefs questionnaire, most of the studies were qualitative in nature.

With the use of the 63- item survey questions, Schommer (1990) originally identified five independent dimensions that formed the epistemological beliefs of college students. These five independent beliefs were *certain knowledge* (whether knowledge was absolute or fixed to knowledge as constantly changing); *simple knowledge* (whether knowledge was made up of discrete facts and figures or integrated and interrelated); *omniscient knowledge* (knowledge was accessible to authorities only); *quick learning* (that knowledge did not have a particular form,

either it was learned quickly or not at all); and *innate ability* (knowledge was gained at birth and for that matter learning was based on ability). The five dimensions were described by Schommer (1990) as independent due to the idea that students could demonstrate sophistication in one dimension and possess less or naïve epistemological beliefs in another dimension. Each dimension was a continuum where college students occupied somewhere between the extremes. For example, the simplicity of knowledge dimension ranged between knowledge as pieces of discrete facts to knowledge as integrated and closely interrelated ideas.

Schommer (1993) studied the epistemology and cognition of college students. After the study, she reported more evidence to support the assertion that epistemological beliefs were multidimensional and more or less independent. In comparison between Schommer's understanding of the nature of college students' personal epistemologies and Perry's foundational research, Schommer believes that personal epistemologies are independent from one another and not a continuum. By implication, students can hold different levels of epistemological sophistication depending on the nature of the domain being reviewed. The debate is on-going regarding the dimensionality of personal epistemologies.

To get a more holistic view of the concept of personal epistemology, more and more researchers began to use the Schommer epistemological questionnaire instrument. In the process, some began to identify how the various items on the 63- point survey questions could clearly or consistently lead to her proposed epistemological beliefs dimensions. The results of this exploration have been controversial since some researchers reported all five dimensions whereas others did not (Chan & Elliot, 2000; Hofer, 2001). For this reason, there has been the development of similar epistemological instruments that are either a slight modification of

Schommer epistemological questionnaire or entirely new instruments to measure epistemological beliefs.

In a longitudinal study of college students for five years, Baxter Magolda (1992) developed a four-stage model known as model of epistemological reflection (MER). These four stages reported by Baxter Magolda (1992) were absolute knowing, transitional knowing, independent knowing, and contextual knowing. Like *dualism* (Perry 1970), Baxter Magolda (1992) explained *absolute knowing* as certainty of knowledge, which was received from authority. *Transitional knowledge* combined absolute truth as well as uncertainties. Students at this stage had resolved that there were other truths elsewhere that could possibly be known besides what was knowable to authorities. For this reason, these college students continued to explore the world around them with the view of finding the other truths. *Independent knowing* required that instructors provided the environment for students to make sense or construct their own knowledge, which was different from the teachers' position whereas *contextual knowledge* implied that knowledge was context-bound and one needed evidence to back or support a claim. At the *contextual knowledge* stage, it was appropriate for individuals to have a point of view, yet such views needed to be substantiated by evidence.

Different terminologies were used by Perry (1970) and Baxter Magolda (1992) in explaining the different stages of college students' epistemological beliefs. However, these researchers seem to be consistent on the characteristics of each of the four stages, identified in their separate studies. For example, whereas Perry (1968) used *dualism* to represent college students' belief in right or wrong, Baxter Magolda (1992) coined the term *absolute knowledge*. Also, both researchers agree that the concept of epistemological beliefs is a continuum rather than independent sets of beliefs as originally proposed by Schommer (1990).

In a comprehensive meta-analysis and review of the major studies on epistemological beliefs, Hofer and Pintrich (1997) recommended that the concept of personal epistemology be broadly categorized into two main headings. These two headings were the nature of knowledge and the process of knowing. Explaining the nature of knowledge, these reviewers mentioned that the nature of knowledge was concerned with how an individual perceived knowledge. The reviewers further divided this aspect into certainty of knowledge and simplicity of knowledge. Certainty of knowledge referred to the beliefs that individuals held about knowledge as either fixed or constantly changing. The simplicity of knowledge component is concerned with whether knowledge was a collection of unrelated facts to knowledge as integrated and closely interrelated. The second area as suggested by Hofer and Pintrich (1997) was the nature of knowing. This aspect referred to the process by which people received or acquired knowledge. Similar to the nature of knowledge, this aspect had two sub-components: source of knowledge and justification of knowledge. The source of knowledge component ranged from knowledge as transmission of discrete information to knowledge as a process of construction and reconstruction of ideas and concepts. The last sub-component, justification of knowledge, dealt with knowledge as being able to evaluate the accuracy or correctness through evidential support.

Wanting to identify the empirical inconsistencies with the use of the Schommer epistemological questionnaire (SEQ) through exploration with preservice teachers in Hong Kong, Chan and Elliot (2000) used all the 63-item questionnaires with the twelve subscales to examine the beliefs of preservice teachers in the Asian context. At the end of the exploratory study, Chan and Elliot (2000) reported that three factors were generated with an Eigenvalue cut-off of 1.00. Also, they reported that some of the features generated were distinctly different from the ones Schommer (1990) found in her study. Again, the subscale omniscient authority, which

was not found by Schommer (1990) through factor analysis, strongly loaded as a subscale. With this finding, the researchers identified the socio-cultural differences of the participants as a possible reason why the omniscient authority variable could not be found in the studies conducted in the western context.

Hofer (2001), studying personal epistemology and its implications for learning and teaching, used the epistemological beliefs questionnaire (EBQ) to test the internal consistency of the five independent beliefs described by Schommer (1990). After conducting the study and the inferential analysis, Hofer (2001) reported that four out of the five independent dimensions or factors were statistically generated. Out of the five factors, the source of knowledge (omniscient knowledge) was the only independent belief that was not empirically supported. Just between the studies by Chan and Elliot (2000) and Hofer (2001), there is the manifestation of this epistemological contradictory finding over the source of knowledge subscale. Schommer-Aikins (2004) also stated her inability to statistically find any evidence for source of knowledge. Against the independent nature of factors or dimensions, Hofer explained that the four factors generated were rather a continuum where students were located at different stages. Up to this point, there seems to be agreement among Perry, Baxter Magolda and Hofer on the conception that the concept of epistemological beliefs system is a continuum in nature.

Schraw et al. (2002) modified the Schommer epistemological questionnaire (SEQ) into a 32-item questionnaire and named it epistemological beliefs inventory (EBI). With the view of addressing the potential anomalies or concerns often raised against the Schommer epistemological questionnaire, the thirty-two items were able to yield all five beliefs proposed by Schommer. Schraw et al. (2002) removed thirty-one items from the original epistemological beliefs questionnaire instrument. The question is what factors account for the inconsistencies that

seem to appear in different studies? The answer to this question should be a concern to the researchers who find themselves in this area of study. Despite these manifestations and concerns raised by researchers about the inconsistency and validity of epistemological beliefs questionnaire (Schraw & Elafson, 2008), Hofer (2001) mentioned that Schommer's epistemological beliefs questionnaire still "remains the primary written assessment of personal epistemology" (p. 360) upon which most of the researchers in this area have drawn inspiration.

Using the same geographical context for their previous research in 2000, Chan and Elliot (2004) used a set of traditional and constructivist conceptions of teaching and learning among a number of preservice teachers in Hong Kong to undertake a relational analysis of personal epistemologies and teaching and learning conceptions. The sample consisted of three hundred and eighty-five preservice teachers in one of the tertiary institutions (higher education) in Hong Kong. The preservice teachers were told to respond to the epistemological beliefs questionnaire (EBQ) as well as the teaching and learning conceptions questionnaire (TLCQ). After rating their responses on a five-point Likert scale from strongly disagree (1) to strongly agree (5), Chan and Elliot (2004) identified four epistemological beliefs dimensions and two main teaching and learning conceptions in the study. The epistemological beliefs dimensions identified were described as innate/fixed ability, learning effort/process, authority/expert knowledge and certainty of knowledge.

The researchers added that their finding was different from what Schommer (1990) reported due to the different cultural context within which the study was conducted. After running the Pearson correlation statistical procedure, Chan and Elliott (2004) found a strong correlation between innate/fixed ability, authority/expert knowledge, and certainty of knowledge with traditional conceptions, and learning effort/process with constructivist learning conceptions.

Preservice teachers who believed that knowledge comes from authority, it is stable and given at birth, were more likely to have inclination for traditional method of teaching. The reason was that they were not able to conceptualize an active role in the teaching and learning process.

Another important study that made use of Schommer epistemological questionnaire (SEQ) was done by Braten and Stromso (2005). These researchers used all of the 63 items originally designed by Schommer (1990) to test how Norwegian postsecondary students' epistemological beliefs related to their implicit theory of intelligence and self-regulatory learning. Since the study was done in a non-native English speaking country, they reported that a team of educational psychologists, who were proficient in English, translated the SEQ into Norwegian version. With a sample size of one hundred and seventy-eight students, the first factor analysis yielded sixteen factors with Eigenvalues and scree plot, showing only four factors. After eliminating nineteen items as a result of poor and multiple loadings, the factor analysis generated four clear factors. According to the researchers, "The four factors were labeled: speed of knowledge acquisition, certainty of knowledge, knowledge construction and modification, and control of knowledge acquisition" (p. 551). These researchers further explained that their study confirmed the multidimensionality of epistemological beliefs system in the Norwegian context as originally proposed by Schommer (1990). They illustrated that students, who demonstrated epistemological beliefs sophistication in one academic discipline, could potentially demonstrate less or naïve understanding in another area of study.

Also, Chai, Khine and Teo (2006) wanted to identify the epistemological beliefs on teaching and learning of preservice teachers in Singapore. With a total participant population of five hundred and thirty-seven preservice teachers, these participants had already completed their bachelors' degree in different disciplines and were required to take this one year full-time teacher

education program to get certification to be professional inservice teachers. The researchers modified the 63-item epistemological beliefs questionnaire of Schommer (1990) with the intention of investigating four main epistemological dimensions. These dimensions were innate/fixed ability, learning effort/process, authority/expert knowledge and certainty of knowledge. After this study, the result indicated no significant difference between preservice teachers who had teaching experience before signing up for this teacher preparation program and those who did not have any prior teaching experience. More importantly, the researchers found that preservice teachers had homogenous epistemological beliefs about teaching and learning. With this finding, they attributed it to the centralized nature of the Singaporean educational system with more emphasis on external examination and the use of common curriculum. Interestingly, the evidence for similar epistemological orientations of the participants who come from different disciplines and might have had different life experiences might possibly not replicate in a western context.

In terms of how preservice teachers construct knowledge from different learning environments, epistemology has an effect on students' performance. In a study investigating how using wikibooks to write textbooks online can enhance the epistemological beliefs of two hundred and twenty-nine preservice teachers, Ren, Baker and Zhang (2009) administered the epistemological beliefs inventory (EBI) as well as a demographic information to two separate batches of preservice teachers at the end of one of the teacher education preparatory courses in 2005 and 2007. The first group of preservice teachers, made of one hundred and forty-nine participants, was taught with the use of traditional textbooks in the teaching and learning process. This cohort of students completed the course in spring 2005. After two years, the second group, made up of eighty preservice teachers, instead of using traditional textbooks for the same course,

was made to write their own electronic textbooks through the wikibooks. The difference was that the first group depended on already published book (passive learning) whereas the second group was guided step-by-step to write their own course textbook online (active learning). At the end of each of the semesters, respective participants (preservice teachers) were given the epistemological beliefs inventory in addition to some demographic information to answer. Ren, Baker and Zhang (2009) found evidence of a significant difference between the two groups on the certainty of knowledge dimension. No difference was observed in the other four dimensions: simple knowledge, innate ability, omniscient authority, and quick learning.

As common with every field of study, there might be conflicting opinions among researchers in the field of personal epistemological beliefs studies. At the same time, the conversation on epistemological beliefs has impacted the understanding of researchers in this field. Schraw and Elafson (2008) stated that the discussion on what constitutes epistemology has led to meaningful sets of constructs that are used to test epistemological beliefs. Again, there have been “preliminary findings concerning the relationships among epistemological beliefs and a variety of outcome variables such as age, education level, gender, moral reasoning skills, and academic achievement” (p. 29). As it happens with every new area of study, the study of personal epistemological beliefs is still evolving and being redefined as researchers use appropriate statistical procedures to unravel the mysteries surrounding these important beliefs. In a similar mindset, Hofer (2001) wrote “My sense is that this may be because we are still struggling with some conceptual issues that need resolution and because we are not yet clear about the educational implications of this work” (p. 354). Similarly, Pajares (1992) wrote:

That researchers should find themselves pleading for attention to teachers' beliefs is itself an indication of the direction educational psychology has taken and of the issues with

which it has chosen to concern itself, but it is not surprising that researchers have avoided so formidable a concept. As a global construct, belief does not lend itself easily to empirical investigation. Many see it so steeped in mystery that it can never be clearly defined or made a useful subject of research. (p. 308)

On this note, it is expedient for researchers in this field to continue to explore different educational variables that relate to the epistemological beliefs with the view of making sense of how such findings will impact and improve teaching and learning of preservice and inservice teachers.

Constructivism

Wilson (2012) mentioned that constructivism gained more attention in the early part of 1990s, based on the focus of research studies at that time. He added that this period was preceded by rigorous research activities in the 1970s and 1980s. Most people agree that Jean Piaget was the originator of constructivism (Smith & Ragan, 2005). However, Perkins (1991) observed that “constructivism has multiple roots in the psychology and philosophy of this century” (p. 20). If this is the case, it would not be fair to only single out Jean Piaget as the originator of constructivism. In support of Perkins assertion, Driscoll (2005) identified and acknowledged people like Dewey, Vygotsky, Gibson, Goodman, Bruner, Glasersfeld and several others as the people who have had tremendous influence in enacting the constructivist philosophy. Yilmaz (2011) also acknowledged the contributions of different theories that came together to form cognitivism, which later served as a catalyst for the popularity of constructivism.

Epistemological Beliefs and Academic Performance

A close relationship exists between the development level of epistemological beliefs, how the individual learns, and other academic outcomes (Schommer-Aikins, Duell & Baker, 2003).

Hammer (2003), in a research on how to tap the epistemological beliefs' resources to help physics students learn, found evidence that students who had absolutist epistemic orientation did not succeed academically whereas those who held evaluative perspectives and adopted constructivist learning approaches were successful. Similarly, Philips (2001), studying the ability of accounting college students to solve problems, reported that students who held more sophisticated or advanced epistemological beliefs were able to critically analyze the assigned data as compared to those who had simple epistemological beliefs. On the other hand, students with simple and absolutist epistemologies, who perceived knowledge as a collection of discrete facts that had to be memorized and recalled or recognized, would fail to critically analyze data and come out with reasonable alternatives (Brownlee, et al. 2009). They added that this conception did not help to solve complex problems within the academic arena.

In another study of fifty-three preservice teachers, who had just enrolled in one of the psychology classes on how participants' prior epistemological beliefs could be used as avenues to convert teaching and learning obstacles into opportunities, Joram and Gabriele (1998) asked these preservice teachers to complete a set of questionnaires to define the meaning of teaching and learning on the first day of class (pretest). The same exercise was repeated at the end of the last day of the semester (post-test). In addition to answering the questionnaire, students were asked to describe how their understanding and views about teaching and learning have changed throughout the course. At the end of the study, only 8% of the students felt that their understanding about teaching and learning did not change. Also, fifty-seven percent (57 %) of preservice teachers felt that their understanding on the two concepts underwent tremendous changes as a result of what was learned from the class. From this study, Joram and Gabriele

concluded that educators should target and incorporate the prior beliefs of preservice teachers into their instructional practice for meaningful learning and development.

The ability of preservice teachers to be successful in learning is related to their epistemological beliefs. In a study captioned *preservice teacher education students' epistemological beliefs and conceptions about learning*, Chan (2011) administered a set of questionnaires to two hundred and thirty-one preservice teachers at one of the universities in Hong Kong. With the view of looking at the relationship that exists between epistemological beliefs and the learning conceptions of these preservice teachers, the author used factor analysis, Pearson correlations, and series of regression analyses to quantitatively test the dataset obtained from these participants. After the study, this researcher found evidence that the epistemological beliefs of the preservice teachers had a significant predictive relationship with both quantitative and qualitative conceptions of learning. By implication, Chan (2011) observed that epistemological beliefs of preservice teachers had a significant relationship to their conception of learning.

Apart from the learning conceptions found to relate to the epistemological beliefs, preservice teachers are likely to learn meaningfully and deeply when the classroom activities are optimized to their epistemological beliefs levels (Cho, Lee & Jonassen, 2011). In a study with one hundred and twenty preservice teachers in an educational technology class as part of the required courses lined up for the teacher education preparation program certification, Cho, Lee and Jonassen (2011) investigated the perception that students are motivated to learn meaningfully in a web-based learning environment that is consistent with their epistemological beliefs. Participants in this study had the option of either responding to sets of questions in a form of a summary or argumentation through the wiki platform. At the end of the study, these

researchers found that students with less sophistication in epistemology performed better on the collaborative summary task, which required comprehension than collaborative argumentation, which obviously needed higher-order thinking skills. They also reported that “independently of epistemological beliefs, collaborative argumentation promoted more constructive and interactive peer questioning activities and helped to construct higher quality arguments in case problems than collaborative summary” (p. 112). Based on the finding, the researchers concluded that the need exists to match the epistemological beliefs of preservice teachers with web-based academic tasks. To organize such environment, teachers and educators should be mindful of the content and learning strategies they adopt since the success of such learning experience depends on the nature of the learning outcomes.

Using a longitudinal study to investigate the changes in primary school teachers’ beliefs about knowing in one of the large metropolitan universities in the country of Australia, Brownlee (2003b) sampled twenty-nine elementary school preservice graduate teachers for this study. With a teaching program designed to facilitate the reflection and development of more sophisticated epistemological beliefs among these graduate preservice teachers, this year-long teaching program in a psychology class required preservice teachers to reflect on the content of the educational psychology class in terms of their epistemological beliefs through journal entries. Again, all preservice teachers (participants in the study) were interviewed at the beginning of the year-long educational program (interview 1) and at the end of the program (interview 2). Also, eleven of the participants were interviewed three years after graduation (interview 3) to identify the changes that have taken place in the epistemological and teaching experiences. The researchers wanted to report the changes that had taken place in between when preservice teachers graduated and three years into the actual their teaching career. At the end of the study,

Brownlee (2003b) reported that over time the interview showed that seven of the eleven students developed more constructivist epistemological beliefs about knowing, two inservice teachers maintained their initial or original epistemological beliefs about knowing whereas two showed less sophistication in their epistemological beliefs about knowing.

In a study by Perkins et al. (2005), investigating the correlation between epistemological beliefs about science and learning conceptions using the Colorado Learning Attitudes about Science Survey, sampled over seven hundred and fifty students across several course areas with some courses altered to ensure or promote positive conceptions about the study of physics. The Colorado Learning Attitudes about Science Survey was a 38-item with Likert survey questions that required students to rate their responses from strongly disagree (1) to strongly agree (5). Also, this study required students in these classes to respond to these survey questions before and after taking the course. These researchers analyzed several academic variables in addition to the epistemological beliefs of the students. Perkins et al. (2005) reported that several of these students, after writing two major standardized examinations, demonstrated some median gains of 0.67 and 0.76 in the fall 2003 and spring 2004 semesters respectively. Other interesting aspects of the instructional activities are that students showed evidence of gains. In conclusion, Perkins et al. (2005) observed that their findings were suggestive of the possible shift in epistemological beliefs, which correlated with higher-order learning gains.

Once again, Braten and Stromso (2005) wanted to find the relationship between epistemological beliefs, implicit theories of intelligence, and self-regulated learning among one hundred and seventy business students and one hundred and eight preservice teachers from one of the universities in Norway. After examining the dimensionality of the Schommer's epistemological beliefs questionnaire (SEQ) through factor analysis, the resulting dimensions

that emerged were tested in relation to implicit theories of intelligence. Also, other motivational and strategic components of self-regulated learning, epistemological beliefs, and implicit theories of intelligence were analyzed by the researchers. At the end of the study, Braten and Stromso (2005) reported that the epistemological beliefs (knowledge construction and modification) of the one hundred and eight preservice teachers predicted their self-regulated learning skills, which is an important metacognitive ability that students need to develop in order to become successful (Bruning, Schraw & Norby, 2011). For the business administration students, the belief about the certainty of knowledge played a useful role in their self-regulation. In conclusion, Braten and Stromso (2005) reported that the epistemological beliefs predicted self-regulated learning more than implicit theories of intelligence. However, the researchers noted that the relationships between epistemological beliefs and self-regulated learning may be different from one academic environment to another.

One year later, these same researchers wanted to investigate the short and long-term relative contribution of epistemological beliefs and implicit theories of intelligence to students' adoption of mastery, performance-approach and performance-avoidance goals in two separate academic learning environments: business administration and teacher education. The participants included one hundred and five business administration students enrolled in a four-year program and eighty teacher education students with similar program duration. With the business administration students, competition was very high since these students admitted into the program had to write several entrance examinations, and those with good grades were offered admission. At the same time, the business students took several teacher-made examinations that business students took in their first and second years of college. The researchers cited some

instances where the business administration students had to take approximately eleven different examinations in one semester.

By contrast, the teacher education program did not require the students to write any entrance examination before gaining admission into the teacher education program. Also, the writing of examinations was not frequent among the students in the teacher education program. At the end of the study, Braten and Stromso (2006) reported that epistemological beliefs about the speed of knowledge predicted the achievement goals of the preservice teachers. Students who believed that knowledge occurs quickly or not at all were less likely to adopt mastery learning goals as well as use performance-avoidance goals. In addition, those preservice teachers who believed in stable and given knowledge were less inclined to use mastery goals in their learning. In conclusion, Braten and Stromso (2006) found that epistemological beliefs of preservice teachers played a more significant role in their propensity to adopt learning goals than the implicit theories of intelligence. With this finding, it is likely that students who can adopt performance goals might also have self-regulated learning skills.

Another academic pursuit that continues to present challenges to the developing learner is his ability to solve ill-structured or ill-defined problems. A popular saying is that the school system presents knowledge as black or white. Meanwhile, real-life problems come as gray. On a more serious note, some research looks at the relationship between preservice teachers' epistemological beliefs and their ability to solve ill-structured or ill-defined problems. Oh and Jonassen (2006), using scaffolding in an online argumentation in a problem solving context, sampled fifty-eight undergraduate students, who were all enrolled in one of the teacher education preparatory courses in one of the large-sized Midwestern universities in the United States. In this study, four different sources of data were used to gather information from preservice teachers,

which were scaffolding, epistemological beliefs, argumentation, and diagnosis–solution problem solving in three different conditions. The conditions were preservice teachers with constrained-based argumentation scaffolding, students without constrained-based argumentation scaffolding, and non-usage of discussion boards.

At the end of this research, Oh and Jonassen (2006) reported that a relationship existed between epistemological beliefs and preservice teachers' ability to solve ill-structured problems. Again, the scaffolding discussion groups generated more evidence notes and messages. Also, the three dimensions of simple knowledge, omniscient authority, and fixed ability significantly predicted problem-solving performance. Further, a significant negative relationship was found between simple knowledge and individual problem-solving performance. This finding implied that preservice teachers who believed in simple knowledge were less likely to consider the use of alternate solutions in problem solving endeavors.

In the teaching and learning process, an advocacy for teachers was created to help their students to develop problem solving skills (Bruning, Schraw & Norby, 2011; Jonassen, 2006). This learning characteristic is normally associated with higher order thinking like application, analysis, synthesis, and evaluation. Erdamar and Alpan (2012), investigating the epistemological beliefs and problem solving skills of preservice teachers during one of their student teaching sessions, sampled one hundred and eighty-nine preservice teachers from Gazi University of Vocational Education. By using qualitative methodology to study this population, the researchers used both the epistemological beliefs scale (EBS) and problem solving inventory (PSI) before and after the teaching practice. The study revealed three major findings that are relevant to the present study. First, the most sophisticated epistemological belief of preservice teachers was the belief that the process of learning depended on the effort of the student. Second, preservice

teachers who believed that learning was through the effort of students were found to be thoughtful, confident, evaluative, and planning oriented. Last, the epistemological beliefs of preservice teachers were impacted positively by the teaching practice.

Preservice Teachers' Epistemological Beliefs

Research on preservice teachers' epistemological beliefs started a few years ago (Schraw & Olafson, 2008). Prior to this time, most of the research on personal epistemology centered on college students as participants, and for that reason Chai, Khine, and Teo (2006) mentioned that since the previous studies focused on college students, it was difficult to conceptualize teachers' epistemological beliefs. At the same time, Schraw and Olafson (2008) mentioned that most of the research with preservice teachers has presented teachers epistemological beliefs as more holistic than college students. Today, various studies have focused on preservice teachers compared with different variables. In a study of thirty-five first year preservice teachers and creative arts students in one of the metropolitan universities in Australia, Brownlee et al. (2009) found a relationship between student-teachers core beliefs about knowing and their conceptions about learning. These researchers reported that student-teachers held varied views about knowing, ranging from "complex evaluativism, practical evaluativism, subjectivism, and objectivism" (p. 606).

Students who were categorized under complex evaluativism believed that knowledge was evolving, tentative and dependent on the context. Such student teachers had a flexible mindset that knowledge could easily change. Practical evaluativism student teachers no longer believed in the experts as the only source of truth but also were more inclined towards individual opinions and considered constantly weighing these opinions. Student teachers who fell into the subjectivist bracket did not associate true knowledge to the availability of evidence; rather, it was

either what felt right or based on personal emotions. Personal experience was the basis of decisions for this particular category. The last category of student teachers believed in the absolute nature of knowledge. For example, “if the textbook was wrong they wouldn’t be published” (Brownlee et al., 2009, p. 607). These students believed in the need to master pieces of information that were delivered by the teacher or expert. In conclusion, these researchers advocated for the need for higher education to approach knowledge and learning in an evaluative nature as informed by epistemological beliefs of preservice teachers to guide their teaching choices as compared to any other instructional strategies.

In a study of four hundred and twenty-nine preservice elementary science teachers on the relationship between epistemological beliefs, epistemological worldviews, and self-efficacy beliefs in one of the Turkish Universities, Yilmaz-Tuzun, and Topcu (2008) found that preservice teachers did not have the same level of epistemological development in four out of the five epistemological dimensions, according to Schommer (certainty of knowledge, control of knowledge, source of knowledge, speed of knowledge, and structure of knowledge). Where preservice teachers demonstrated sophistication in certain dimensions, less sophistication was reported in other dimensions. They added that preservice teachers acknowledged the instructional gains of using student-centered pedagogies, yet they also believed that students needed to memorize certain specific knowledge and scientific facts and concepts in order to be successful in learning science. This study is consistent with Schommer (1994) on how preservice teachers can demonstrate multidimensional ways of knowing.

Investigating the relationship between epistemological beliefs and moral reasoning to determine the nature of epistemological beliefs of ninety-six elementary education preservice teachers in Turkey, Topcu (2011) reported that the epistemological beliefs of these elementary

preservice teachers did not make any unique contribution to their moral reasoning. Also, regarding the unending controversy as to whether epistemological beliefs was a continuum (Hofer, 2001; Perry, 1970), or multidimensional (Schommer, 1990), these researchers reported that Turkish preservice teachers possessed independent epistemological dimensions. This study implied that preservice teachers were likely to demonstrate different levels of epistemological sophistication, based on the dimensions studied.

Tanase and Wang (2010) studied four initial preservice teachers on epistemological beliefs and how these beliefs changed within one of the education methods classes. At the initial stages of the study, these researchers observed that preservice teachers had similar epistemological beliefs that viewed the teacher as the main source of knowledge in the classroom. The main point of the study was to enable preservice teachers to make a paradigm shift and consider other alternatives that would allow students to construct and make their own meaning during the teaching and learning process. In the course of the semester, the researchers used sets of survey questions and teaching observation sessions to monitor the changes that occurred during this instructional environment. At the end of the study, Tanase and Wang reported that the four preservice teachers developed different epistemological beliefs as compared to their epistemological outlook at the beginning of the course, which were similar in nature. Secondly, they found that some preservice teachers were resistant to change whereas others experienced tremendous changes in their epistemological beliefs.

Providing a background to their study, Kienhues, Bromme, and Stahl (2008) stated that many studies have reported that the more sophisticated teachers were in terms of their epistemological beliefs, the more they were capable of adopting positive instructional practices that translated into better student learning and development. With the aim of investigating the

potential for influencing domain-specific epistemological beliefs through a short instructional intervention in one of the German universities with a participant population of fifty-six preservice teachers, the researchers divided the students into two groups, based on their epistemological beliefs' levels. With two distinct groups made of naïve and sophisticated epistemologies, the naïve group was assigned to a refutational epistemological instruction whereas the sophisticated group was assigned to informational epistemological instruction. The refutational epistemological instruction required students to use evidence-based information to argue with their colleagues by way of finding issues with the information they presented. The informational epistemological instruction group used the traditional learning approach in this study. Interestingly, these researchers assigned the naïve group to the use of refutational epistemological instruction and the epistemologically sophisticated group to informational epistemological instruction. At the end of this study, the researchers found that students who possessed naïve epistemological beliefs (the experimental group) made many gains towards relativist decisions whereas those with sophisticated epistemologies (the control group) changed towards a more naïve standpoint. Based on this evidence, they suggested that short courses could be used to alter students' epistemological beliefs in domain-specific knowledge areas. However, the caveat was that the nature and depth of the domain knowledge should be taken into consideration, meaning the choice of course content should be comprehensive and strategic.

In an attempt to study the nature of preservice teachers' epistemological beliefs or their beliefs about knowing, Brownlee (2001) used semi-structured interview questions to gather qualitative data from these student-teachers, using an interview schedule. The semi-structured interviews took place at the end of a year-long graduate diploma in teacher education course and were analyzed using a descriptive-interpretative approach to data analysis. By using the

descriptive-interpretive approach, the researcher did not only use their thick description as provided by preservice teachers. In addition to the thick description, she also triangulated the information with literature on epistemological beliefs. At the end of the analysis, Brownlee (2001) found that preservice teachers' epistemological beliefs ranged from somewhat naïve with belief in the transmission of absolute knowledge to more sophisticated knowledge with belief in constructing truths that are reasonable. She added that this research replicated some of the earlier studies in epistemological beliefs (Baxter Magolda, 1992; Perry, 1970).

In a similar study to investigate how twenty-nine preservice teachers improved upon their epistemological beliefs in a one-year teacher education course at the Queensland University of Technology, Australia, Brownlee, Purdie and Boulton-Lewis (2001) asked the research group to submit a reflective journal in relation to their epistemological beliefs. The experimental preservice teachers' group was interviewed at the beginning of the course (Time 1) and at the end of the program (Time 2). The comparative group was not interviewed at all. Instead, the comparative group was made to respond to a set of written statements of their beliefs about knowing at the beginning (Time 1) and at the end of the program (Time 2). At the same time, both the research and comparative groups responded to the epistemological beliefs questionnaire by Schommer (1990) at the beginning (Time 1) and at the end (Time 2) of the year-long program. The results of both quantitative and qualitative data showed that preservice teachers, who were required to reflect and submit journal entries, experienced more growth in their epistemological beliefs than the comparative preservice teachers, who only responded to statements about their epistemological beliefs.

In a literature review research focusing on preservice music teachers' development of beliefs about teaching and the ways these beliefs influence their instructional practice, Schmidt

(2012) observed that most studies supported the assertion that preservice music teachers were likely to enter into the music program with differing epistemological beliefs, which would have further implications on the kind of instructional practice they would adopt in their classrooms. Expounding on the various methodologies by which different researchers have adopted to gather epistemological beliefs' data from their participants, she noted that the use of survey has helped in gathering rich data for having insight into the epistemological development perceptions of these teachers. However, she mentioned that these self-reported survey questions gave limited information about how effectively and efficiently these participants demonstrated their epistemological beliefs in the real world. For this reason, this reviewer concentrated her literature review on longitudinal studies.

After reviewing several empirical studies that used different metaphors against the use of student-self reported survey questions, Schmidt (2012) found that music preservice teachers enter their profession with different levels of epistemological development. These different levels were found in their teaching and the notion of the caliber of teachers they aspired to be. The researcher also added that these beliefs, overtime, are strongly held and may influence the entire decisions and choices that take place throughout their program of study. For example, their personal observation of inservice teachers, personal reflection, and learning content knowledge from methods classes are potential areas to be influenced. The second part of this literature review identified that peer teaching or other authentic instructional environments, feedback, structured journals, and observation skills were all important in enhancing preservice teachers' epistemological beliefs. However, these learning strategies do not happen without challenges according to the researcher.

In a study about preservice teachers' epistemological beliefs on the nature of knowledge and the process of knowing, White (2000) reported four different findings, which are relevant to this study of preservice teachers' beliefs. These findings were: 1. The researcher found that preservice teachers differed in their epistemological beliefs. 2. Preservice teachers did not move from one stage to another as previous studies have reported (Hofer, 2001; Perry, 1970). White (2000) explained that once preservice teachers realized that knowledge was uncertain, they went through series of alterations before finally changing their beliefs about the certainty of knowledge. 3. The epistemological beliefs of preservice teachers were connected like a web. 4. There appeared to be no relationship between the level of students in the school and their epistemological beliefs. Contrary to what Perry (1970), Baxter Magolda (1992) and Hofer (2001) reported, this study presents a challenge on the need for researchers in this area to use other rigorous qualitative and statistical instruments in identifying the true characteristics of the concept epistemological beliefs.

Education departments will mount methods courses at certain times with the view of helping preservice teachers to develop certain epistemological and pedagogical beliefs and practice in order to come out as effective and efficient teachers. Clift and Brad (2005) emphasized that the connection between the instructional strategies learned in college and the development of beliefs and practices of preservice teachers are not always automatic. For this, they wrote:

Although researchers report that methods courses and field experiences have an impact on prospective teachers' beliefs about content, learning, and teaching, it is difficult to predict what impact a specific course or experience may have; the impact is often

different from what instructors or student teaching supervisors may imagine or wish. (p. 331)

Sharing the same opinion with the above statement, Chan and Elliot (2000) emphasized that though it is difficult to study the epistemological beliefs of preservice teachers, relevant pieces of information exist that can be obtained if studies are carefully planned and executed with the appropriate qualitative and quantitative instruments. These statements seem to indicate the need for educators to be mindful of the teaching and learning strategies that they inculcate into their preservice teachers as they constantly take into account preservice teachers' epistemological beliefs.

In another study to investigate the structural relationship between epistemological beliefs and conceptions of teaching and learning of six hundred and seventeen preservice teachers in one of the middle-sized universities in the Netherlands, Otting et al. (2010) used a problem-based learning context to undertake this study in the 2005 and 2006 academic year. With research participants' nationality from Europe, Asia, Africa and the United States, sixty-five questions were answered by these participants, which were made of questions from epistemological beliefs questionnaire (EBQ) and the teaching and learning conceptions questionnaire (TLCQ) in a Likert scale format, ranging from strongly disagree (1) to strongly agree (5).

After using the Statistical Package for Social Sciences software (SPSS 14.0) to analyze the reliability, factor analysis, Pearson correlation, t test and others, Otting et al. (2010) reported three major findings that are relevant to this study. First, the belief in effort as the process of obtaining knowledge was positively related to the constructivist teaching and learning conceptions and negatively related to the traditional teaching and learning conceptions. Secondly, the belief in expert knowledge had a positive relationship with the traditional

conceptions of teaching and learning and negatively related to the constructivist conceptions of teaching and learning. This meant that preservice teachers who believed in their teachers as the only source of all knowledge were likely to have preference for traditional learning environment. Thirdly, a positive path was found between certainty of knowledge and traditional conceptions of teaching and learning. This finding implied that students who subscribed to the epistemological dimension of fixed and unchanging nature of knowledge were more likely to accept traditional learning strategies. Overall, this study confirmed the multidimensionality of epistemological beliefs and the distinctiveness of the individual four dimensions as innate/fixed ability, learning effort/process, expert knowledge, and certainty of knowledge. The findings from this study were consistent with Schommer (1990).

Inservice Teachers' Epistemological Beliefs

Very little research has been conducted on the epistemology of inservice teachers (Bruning, Schraw, & Norby, 2011; Schraw & Elafson, 2008). Among the limited studies done, they argued that the epistemological beliefs of teachers influenced their teaching or instructional practice (Brownlee & Berthelsen, 2006; Chan & Elliot, 2004; Yang, 2005). In a study of one thousand, eight hundred and eighty-two teachers in fifty-one Singaporean schools on their beliefs on how knowledge and learning influence the uses of information and communication technology (ICT), pedagogical approaches, and types of assessments used in the Singaporean schools, Jacobson et al. (2010) reported that the epistemological beliefs about knowledge and knowing of teachers did not determine the pedagogical practices of Singaporean teachers. Instead, Singaporean teachers' epistemological beliefs about learning influenced their pedagogical practice.

Explaining further, Jacob et al. (2010) mentioned that certain teachers made instructional decisions not based on their epistemological beliefs about the nature of knowledge but the caliber of students they needed to prepare for standardized examinations as well as the confidence they had in certain tried and tested teacher-centered pedagogies. Against what has been replicated in numerous studies of teachers who use the traditional pedagogical practices, Jacobson et al. (2010) found support that some of these teachers used learner-centered learning pedagogies as well as incorporating technology into their lessons. As a result of the use of mixed methods in this study, interviews gave further insights on some of the reasons for certain discrepancies that existed between teachers' epistemological beliefs and their pedagogical practices. For example, since teachers were required to help their students pass their standardized examinations, most teachers adopted teacher-centered pedagogies that had been proven to work. However, these researchers were quick to admit that their findings contrasted with most of the findings in the United States and, therefore, recommended future studies in different countries to get better insight and holistic perspective on their finding.

In a case study by Bennett and Parks (2011), investigating the seemingly epistemological beliefs' controversy that surrounds a veteran and experienced biology science teacher, found that this inservice teacher possessed two different epistemological worldviews. Meanwhile, his classroom instructional practice was predominantly teacher-centered. To gain a deeper understanding of the factors that influenced the choice of this experienced science teacher's instructional practice, the researchers undertook a follow-up study through interview and classroom observation. At the end of the follow-up session, they reported that personal experiences with students, contextual teaching, personal beliefs and beliefs about the learning of science contributed to his adoption of the traditional instructional pedagogies. Upon this

revelation, these researchers argued that the teacher educators were not aware of such information and, therefore, suggested the need to consider these beliefs when encouraging students to adopt modern learning strategies.

The need exists for technology related reform efforts of the teacher education programs to take into consideration the epistemic beliefs of teachers in order to become good facilitators in technology integration learning environments. Using a qualitative approach to investigate the relationship between inservice teachers' epistemic beliefs and their pedagogical beliefs or practices, Chai (2010) interviewed seven Singaporean inservice teachers as well as using a case study design to analyze transcripts that reflected their assertions on their epistemological and pedagogical beliefs in the classroom. At the end of the research, Chai (2010) found that these Singaporean inservice teachers held a more relativist epistemic beliefs. However, their pedagogical beliefs showed that most of the teachers used a knowledge transmission method of teaching. He added that the results seemed to indicate that inservice teachers' pedagogical beliefs seemed to have been influenced by their learners' readiness to learn and the school environment within which they found themselves.

Investigating teachers' epistemological beliefs about teaching knowledge and from where that knowledge comes from, Buehl and Fives (2009), through open-ended responses, analyzed fifty-three preservice and fifty-seven inservice teachers in terms of the source and stability of knowledge. At the end of the study, these authors found that both preservice and inservice teachers possessed range of beliefs on teaching knowledge. In all, there were six themes that emerged from the open-ended responses given by teachers, which were formal education, formalized bodies of knowledge, observational learning, collaboration with others, enactive experiences, and self-reflection. From the responses given, both preservice and inservice teachers

shared a common epistemological beliefs system. However, these beliefs did not usually translate into their corresponding instructional practice.

To gain a better perspective of the epistemological beliefs of inservice chemistry teachers at the high school level, Veal (2004), through a case study, followed two high school inservice chemistry teachers, who were enrolled in one of the teacher education universities in the United States. Wanting to see the link between these inservice teachers' knowledge base and their beliefs about teaching, the researcher used the methods course, practicum experience and student teaching internships to evaluate these constructs. Pedagogical content knowledge vignettes, micro-genetic models, and other data sources were administered by the researcher to monitor the conceptual changes that took place among the participants overtime. The results of this study showed that the epistemological beliefs about the content knowledge did not change. However, their conceptions about teaching did change: one focusing on epistemic understanding and the other on subjective realization.

Instructional Practice

According to Brew (2001), engaging in a discourse that involves epistemology and instructional practice is difficult due to the complex interrelationships that exist between these concepts. Instructional practice can simply be explained as any evidenced-based intervention, adopted by a classroom teacher to promote teaching and learning. Discussing the meaning of instructional method, Mayer (2009) explains that "it is a way of presenting a lesson, such as using spoken versus printed text along with an animation" (p. 51). In this definition, he focused on only the choice of tools available to the classroom teachers and ignored important aspects such as learning strategies, mode of assessment, and etc. He added that an instructional practice does not change the content of the subject matter of the discussion; neither does it change the

medium of instruction. Certainly, instructional practice cannot change the subject matter. However, the medium of instruction can be altered and manipulated in a way to ensure better understanding on the part of the learners. For example, a native language could be infused into a lesson to help students who are not native speakers of English to learn meaningfully (Peyton, Moore, & Young (2010).

The ability of students to understand the subject matter, to a greater extent, neither depends on content nor medium of delivery but rather on evidenced-based instructional practice adopted by the classroom teacher (Peyton, Moore, & Young, 2010). Pratt (1998), discussing teaching styles for college students mentioned five different perspectives, which are as follows:

1. A transmission perspective: Delivering content
2. An apprenticeship perspective: Modeling ways of being
3. A developmental perspective: Cultivating ways of thinking
4. A nurturing perspective: Facilitating personal agency
5. A social reform perspective: Seeking a better society. (p. 11)

The author added that none of these teaching styles can singularly be recommended as the best practice that needs to be used in promoting students' learning. At any point in time, a blend of the practices should be based on the specific needs of the students. Generally, it seems the different teaching perspectives form a continuum within which teachers select those they are comfortable. Preservice and new inservice teachers are likely to demonstrate the characteristics of level one (delivering content) and grow to adopt strategies that promote deeper learning. This teaching style inventory is consistent with the five domains of epistemological beliefs dimensions proposed by Schommer (1990). For example, a teacher who believes in absolute knowledge is likely to stay focused on knowledge transmission.

The National Association of Sports and Physical Education (2009) compared appropriate and inappropriate instructional practices and categorized instructional practices into “learning environment, learning strategies, curriculum, assessment and professionalism” (p. 1). Though there are other instructional practices that can be added to this list, yet these five areas give a basic understanding of what happens in the classroom. For example, the creation of a learning environment is one of the responsibilities of the teacher. Whether it is face-to-face, online or hybrid, teachers are expected to use their expertise to create an environment that has respect, acceptance, trust and a sense of oneness in the teaching and learning process (Conrad, 2008). In such an environment, opportunity is given to all students to excel as they interact meaningfully as well as serve as support for one another (Kanuka, 2011). Students can interact with one another as well as get feedback from their peers on instruction.

Investigating students’ preferred role as learners, Kinchin (2004) surveyed several secondary school students to rate their preferred learning environment whether objectivist or constructivist as well as explain the implications of the choices they have made in their learning process. In order to throw more light on the concepts of objectivist and constructivist learning environments to their participants, the researcher designed a cartoon that depicted characteristics of the two opposing learning paradigms. At the end, the secondary students, overwhelmingly, indicated preference for constructivist learning environments. By implication, this finding has useful lessons on how preservice and inservice teachers are prepared for the 21st century classroom.

Preservice teachers’ instructional practice. Preservice teachers are educated in the constructivist teaching and learning environments, yet these future teachers are not always espoused to these contemporary pedagogies thereby adopting alternate learning strategies when

they become inservice teachers other than learning strategies that were explicitly discussed and emphasized in the teacher education program (Barak & Shakhman, 2008; Bol & Strage, 1996). In a study about the epistemological beliefs and teaching conceptions of preservice teachers, Yilmaz and Sahin (2011) used the traditional teaching (TT) and constructivist teaching (CT) instruments to investigate preservice teachers' views about teaching. This instrument by Chan and Elliot (2004) has two sets of survey questions that differentiate constructivist-oriented teachers from those using traditional methods in their classrooms. With a sampled population of four hundred and ninety preservice teachers from different teacher education programs in Turkey, the researchers reported that preservice teachers preferred a constructivist learning environment to traditional learning pedagogies. Interestingly, preservice teachers who were freshmen and sophomores preferred traditional learning strategies to constructivist learning environments. This finding is consistent with most of the early epistemological beliefs' studies (Baxter Magolda, 1992; Hofer, 2001; Perry, 1968).

To study the teaching and learning conceptions of preservice teachers and their relationship to epistemological beliefs, Aypaya (2011) sampled three hundred and forty-one preservice teachers for this study. Besides the other epistemological beliefs dimensions that strongly correlated with partial factor structure, the researcher reported that preservice teachers preferred a constructivist learning environment to traditional pedagogies. What was not clear in this study was whether the learning preferences of preservice teachers related to their own projected instructional practice.

Studying a similar topic with different participants in a different geographical context, Chan (2007) wanted to find epistemological beliefs, learning strategies, and conceptions of learning of two hundred and thirty-one teacher education students in one of the universities in

Hong Kong. The three variables of epistemological beliefs, learning strategies, and conceptions of learning were measured respectively using the epistemological beliefs scale (EBS) (Chan & Elliott, 2002), conceptions of learning inventory (COLI) (Purdie & Hattie, 2002) and a revised two-factor study process questionnaire (R-SPQ-2F) (Biggs, Kember, & Leung, 2001). At the end of the study, the correlation and primary analysis showed a significant relationship among epistemological beliefs, conceptions of learning, and learning strategies. The results suggested that the concept of epistemological beliefs had significant impact on preservice teachers' conceptions of learning as well as the other learning strategies that students needed to use in order to become successful in the learning environment. Purdue and Hattie (2002) emphasized that the learning conceptions of students played a major role in the quality of their learning outcomes.

Evidence supports the assertion that preservice teachers enter into their various courses with a set of beliefs that influence their instructional choices. At the same time, some situations might challenge these already-formed epistemological beliefs. Based on the nature of the teacher preparation programs offered by universities and colleges, certain interventions can cause these teachers to rethink and alter their beliefs. In a study to identify the change in epistemological beliefs and beliefs about teaching and learning among preservice teachers in Singaporean University, Chai, Teo and Lee (2009) sampled four hundred and thirteen preservice teachers, who were enrolled in a nine-month teacher education preparation program. The participants were required to respond to online survey questionnaire during the first week of class to get their current epistemological outlooks on teaching. After students submitted all course materials as well as completing their teaching practice, they were required to respond to the same online survey questions that were administered at the beginning of the program. At the end of the nine-

month long program, the researchers reported significant changes in the participants' epistemological beliefs and beliefs about teaching and learning. They also found that preservice teachers were more relativist in terms of the epistemological worldview but less constructivist in their teaching conceptions. By implication, preservice teachers from Singapore believed in multiple sources of knowledge. At the same time, their conception about instruction was, more or less, a transmission of information. The researchers also found in the same study that preservice teachers, after the course, believed more in innate knowledge ability than using effort. This evidence makes it imperative for further qualitative studies to identify the underlying reasons for such discrepancies in epistemological and pedagogical conceptions of knowledge.

Inservice teachers' instructional practice. In a study to examine the correspondence between students' learning outcome goals and their assessment measures as designed by ten high school biology science teachers in one of the San Francisco Bay area school districts, Bol and Strage (1996) interviewed these biology teachers separately, based on their teaching philosophies and other classroom practices. Also, the student-teachers' learning goals were rated and categorized as well as the assessment measures as to whether these teacher-made test items tested basic information, integration or application of knowledge. At the same time, the test formats were evaluated to identify them as either recognition or recall during the teaching and learning process. At the end of the study, Bol and Strage (1996) reported that these biology science teachers wanted the students to have an understanding of scientific concepts and principles as applied in the real world and also develop higher-order thinking skills in interpreting scientific information. However, a majority of their assessment instruments did not support the student-teachers' learning goals as envisioned at the beginning of their lessons. Bol and Strage (1996) found that more than half of the assessment measures tested declarative

knowledge (basic recognition and recall) and less than five percent of questions required students to apply their knowledge. Further interviews with the ten high school teachers revealed that they were not aware of the inconsistencies between test items and learning goals of their students.

In an attempt to investigate the epistemological beliefs and practices of eleven experienced physics inservice teachers in one of the administrative districts in Israel, Barak and Shakhman (2007) used a semi-structured interview questions to gather data from these science teachers on their beliefs and practices. Data obtained revealed that inservice teachers occasionally used learner-centered instructional practices that were explicitly required by the developers of the curriculum. At the same time, the teachers' own instructional strategies did not challenge the students to engage in higher-order thinking, such as formulating their own questions or engaging in problem-solving scenarios to help their students connect the new knowledge they were learning to the real world. The researchers added that despite the notion that physics was a well-established learning area in Israel; a good number of physics inservice teachers struggled to use constructivist learning pedagogies to help students learn and develop. Again, the researchers noted that teachers developed an attitude that reformed-based practices were "idealistic views rather than a clear schooling practice" (p. 11). Though the sample size was small, the study gives an idea of the attitudes of most physics science teachers towards bringing new learning paradigms in the teaching and learning process.

With a catchy title "*What happens when first year teachers close their classroom? An investigation into the instructional practices of beginning teachers,*" Smeaton and Waters (2013) wanted to know how first year teachers would conduct their instructional learning environment after graduation. Wanting to answer the question whether these fresh teachers were using the modern learning strategies learned in college, these researchers invited ten new teachers who had

completed their teacher preparation program and had taken the same teaching methods class from the same professor. This method course was designed to introduce preservice teachers to the new trends in learning and other classroom strategies, which were consistent with the constructivist learning paradigm. At the end of the short meeting with the teachers who were invited to take part in the study, six of them were randomly sampled, of which all willingly volunteered to participate in the study. By using interviews, focus groups and twenty-four different classroom observations, Smeaton and Waters (2013) compared the instructional practices of these six teachers to the requirements of a teacher preparation curriculum as used by the professor when the participants were still in college. Despite their knowledge of the method class that exposed preservice teachers to various constructivist learning strategies from the same professor, most of these inservice teachers used direct instruction. Direct instruction is a rigorous and step-by-step method of presenting content information to students (transmission of knowledge). They also reported that the purpose of their assessment measures was to generate grades and not necessarily to help students to learn. Probing further to identify the constraints that impeded the effort of these teachers to implement the evidence-based instructional strategies learned in the teacher preparation method class, inservice teachers cited teaching in multiple classrooms with multiple lesson preparations as well as teaching only struggling students compounding the problems as first year inservice teachers.

Similarly, McKinney and Frazier (2008) wanted to know the impact of a new professional development program, conducted for teachers in one of the low socio-economic status communities in the United States. With a sampled population of sixty four middle school mathematics inservice teachers, these researchers compared inservice teachers' instructional strategies in the classroom with the extensive and comprehensive goals that were documented in

the principles and standards for a school mathematics program. Despite advanced knowledge of the program and access to all the resources and support in their respective school districts, the researchers reported that these mathematics inservice teachers resorted to using the lecture method, drill and practice as well as other teacher-centered instructional practice in their various classrooms. The reasons why inservice teachers from this study used more teacher-centric instructions as compared to evidence-based learning strategies adopted by the school districts, and given appropriate training to teachers were beyond the confines of the study. However, the finding remains that inservice teachers did not use the new learning strategies in their classrooms despite knowledge of the new program.

In discussing the instructional practice of inservice teachers, educators of higher education automatically fall into this category. In a study by Hallet (2010) to compare whether educators of preservice teachers in one of the universities in the United Kingdom practice what they teach their students to be effective and efficient in their instructional practice, the researcher sampled forty preservice educators and required each of the participants to use a metaphor to complete the statement “when teaching, I am aiming to...” (p. 439). In all, eleven themes emerged from the metaphoric representations or statements provided to complete the researcher’s statement. After using the metaphor to gather data, the researcher reported that four main categories emerged from the responses, which were characteristic of the teacher educators, which were sharing (14 responses), opening doors/guiding (10 responses), mining (9 responses), and cage rattling (5 responses).

To distinguish between the responses given by beginning teachers from participants who taught masters’ level courses, further relevant information was obtained. First, the initial teacher educators obtained these responses as sharing (12 responses), opening doors/guiding (4

responses), mining (0 responses), and cage rattling (1 responses). With the graduate preservice educators, the data obtained were sharing (2 responses), opening doors/guiding (6 responses), mining (9 responses), and cage rattling (4 responses). Also, participants from each of the theme area was selected for interview on their typical teaching session, nature of teaching and learning objectives and the caliber of teachers each of the participants was aspiring to become. After comparing the metaphor statements to the interview responses, Hallet (2010) concluded that there were serious inconsistencies between what these educators believed to be best practices and how that were translated in the classroom. Where initial teacher educators felt pressured to teach in ways contrary to their epistemological beliefs, educators at the master's level observed that by teaching in ways consistent with their epistemological beliefs, they seemed to be not addressing the real-world teaching and learning concerns of their preservice teachers.

Discussing the influence of culture and other ethnic backgrounds as a neglected area when it comes to identifying the right instructional practices for diverse students, Cabello and Burstein (1995) wanted to find the beliefs of inservice teachers about teachers in culturally-diverse classrooms. These researchers sampled ten inservice teachers who came from diverse areas of ethnicity, years of teaching experiences, and different subject backgrounds. Also, the participants were part of the first cohort for one of the teacher education upgrading courses in the university. These inservice teachers kept teaching portfolios, which had collections of application letters of teacher's background, professional experiences interest, and how they could contribute to the program for which they were applying for consideration for admission. Again, Burstein (1995) obtained pre and post data on their beliefs about the influence of culture in the teaching and learning environment, reflective logging, teaching strategies and case study. At the end of the study, the researchers found that inservice teachers began their teaching career with

their own personal beliefs. However, as they became exposed to more information and were directed to consider other strategies, reflect upon these strategies and write about them, these inservice teachers saw symptoms of increased student success, which eventually led them to modify their epistemological beliefs. This finding is synonymous with Pajares (1992) assertion that teachers will only change their instructional practice when they are convinced and satisfied of their efficiency and effectiveness. In conclusion, Cabello and Burstein (1995) found that changes in inservice teachers' beliefs were gradual and seen throughout the two-year program.

Epistemological Beliefs and Instructional Practice

A close relationship exists between epistemological beliefs and instructional practice of teachers. Bandura (1986) stressed that epistemological beliefs are assumed to be the best indicator of why certain actions are taken in the instructional process. This observation is not to misconstrue epistemological beliefs as the sole predictor of teachers' choices. Other reasons might possibly account for why preservice and inservice teachers might make certain decisions in the instructional process. Chai (2010), discussing the epistemological beliefs of inservice teachers, underscored the dichotomous views in terms of teachers' pedagogical beliefs. He explained that teachers who believed in knowledge transmission provided most of the information students needed to know. As a result, these students became passive members of the class. In the same vein, teachers who were espoused to the constructivist or knowledge construction pedagogies created student-centered learning environments where students became active participants in the teaching and learning process.

Foundational to the teaching and learning expectations and experiences for both teachers and students is the concept of personal epistemologies (King, 2000). Researchers have also shown that epistemological beliefs are important in understanding the cognition and teaching

practices of preservice and practicing teachers (cited in Bernardo, 2008). Some studies have found evidence for consistency between teachers' epistemological beliefs and their instructional practice (Raymond, 1997; Richardson et al., 1991). At the same time, other findings confirm how the teaching and learning experiences of preservice teachers can potentially affect their epistemological beliefs (Tatto, 1998; Wilson, 2000). With such evidence, it is important for educators to identify how one of the variables can be conditioned to create the needed changes for the betterment of the teaching and learning process. King (2000), on his part, noted that there is a great deal of confusion when there is bigger discrepancy between inservice teachers' and their students' epistemological beliefs. Similarly, Kinchin (2004) commented that "A mismatch between teachers' and students' epistemological views is likely to perpetuate problems in the classroom and this must be addressed by explicit dialogue in a manner that is accessible to students" (p. 310). The current study is about preservice and inservice teachers, yet students are the main beneficiaries or the consumers of the instructional practice that is adopted by the teacher. Secondly, since preservice teachers still fall within the college students' category, the need exists for researchers to explore how students respond to the instructional decisions of their teachers. In practice, it seems the suggestion on the need to have this important dialogue between teachers and students has fallen on deaf ears as more and more teachers fail to tap into students' epistemological beliefs for instructional purposes.

Fruge and Ropers-Huilman (2008), investigating the congruence of epistemological beliefs between faculty and their students in a community college, reported that the epistemological congruence of students influenced how they internalized the entire classroom experiences. The finding seemed to suggest that students who did not share similar epistemologies of their faculty members would feel disrespected, not attended to in the

classroom, and invariably affect their academic performance adversely. Concluding his work on teachers' beliefs and educational research, Pajares (1992) intimated "Little will have been accomplished if research into educational beliefs fails to provide insights into the relationship between beliefs on one hand, and teacher practices, teacher knowledge, and student outcomes on the other hand" (p. 327). This quotation seems to suggest a possible connection among epistemological beliefs, knowledge possessed by teachers, their instructional practice and how the two concepts impact students' performance. If this argument holds, then, King (2002) and Kinchin (2004) might be right to suggest that any inconsistency between how teachers approach their teaching and the epistemological beliefs of their students might affect students adversely.

The concept of epistemological beliefs determines inservice teachers' employment of instructional choices in the degree of open-ended internet access. In a study to explore the epistemological beliefs of the internet environment of inservice teachers, web-search strategies and web outcomes, Tsai, Tsai and Hwang (2011) sampled one hundred and five grade one through grade nine inservice teachers from Taiwan. With the view of monitoring the web searching strategies used by these teachers and the quality of information that was obtained, Tsai, Tsai and Hwang (2011) reported that inservice teachers with more sophisticated epistemological beliefs could use complex web searching strategies with less irrelevant information selection, better information filtration and organization as compared to those with less advanced epistemological beliefs. Also, they found evidence that advanced epistemological beliefs correlated with search outcomes for open-ended questions. At the end of this study, Tsai, Tsai and Hwang (2011) concluded that level of epistemological beliefs in an internet environment would play important role in a web-based learning.

The ability of preservice teachers to conceptually change or alter their beliefs and perceptions about certain subject areas has also attracted the attention of researchers. In a literature review on the relationship between epistemological beliefs and conceptual change learning, Qian and Alvermann (2000) found that students had introductory knowledge of the purpose of science, nature of scientific knowledge and scientific principles. These reviewers added that because these beliefs were engrained in them, students were less likely to make a paradigm shift in acquiring a more integrated understanding of scientific principles as well as change their conceptions after they had been formed. By implication of this literature review, student teachers (preservice teachers) who had naïve epistemological beliefs would certainly struggle in understanding higher-order learning principles whereas those with advanced epistemological beliefs were likely to understand these principles with limited or no support in the teaching and learning process. With this finding, inservice teachers who have been exposed to constructivist teaching and learning pedagogies while in college are more likely to revert to using the traditional methods of learning.

Apart from the several studies that have found evidence for the close relationship that exists between epistemological beliefs and instructional or pedagogical practices, other studies have found inconsistencies between epistemological beliefs and instructional practice. For example, Chan and Elliot (2000), investigating preservice teachers in Hong Kong concluded that preservice teachers were inclined towards the relativist epistemic orientation. However, the researchers reported that the teachers did not show any inclinations towards creating a constructivist learning environment. Richardson (2003) also stated that preservice teachers may show inclination towards constructivist epistemic orientations, yet their instructional practices are still based on knowledge transmission.

In a similar study that compared novice and experienced students who were enrolled in a part-time program in one of the universities in Hong Kong, Kember (2001) sampled fifty-three students to study how these different students coped with the difficulty levels of course assignments that students needed to complete within a semester. At the end of the study, Kember (2001) reported that students were split into didactic/reproductive and facilitative/transformative categories. The researcher explained that novice students, who were didactic/reproductive, could not catch up with the demands of higher education in situations where learning was not an explicit transmission of knowledge. Also, these novice students struggled with assignments that required higher-order reasoning other than simple recall or reproduction. The researcher, therefore, concluded that future methods courses should aim at helping students to adjust to and make difficult transitions to the epistemological beliefs' orientations towards the more experienced students in class.

In the 21st century classroom where personal computers and other technological gadgets have become ubiquitous in the classroom, researchers need to identify how the beliefs held by teachers in their technological competence influence their instructional choices. With the use of approximately six hundred science and mathematics junior high school teachers from one province in Taiwan, Hsu, Wu and Hwang (2007) wanted to know the factors that influenced these junior high school teachers' computer-based instructional practices on the level of their instructional evolution, which represents a five point stage that rated inservice teachers' capacity and competence to use computer-based instruction. The stages were entry, adoption, adaptation, appropriation and invention. The researchers correlated the computer-based instructional evolution stage with their attitudes towards computer-based instruction, belief in its effectiveness, years of teaching as well as the frequency of practicing or using computers in their

various classrooms. At the end of the study, they reported that the belief in the effectiveness of a computer-based instruction was the biggest predictor of inservice teachers' instructional practice in the classroom. Though it was not explicitly stated that these inservice teachers' instructional outlook was influenced by their epistemological beliefs, their belief in the effectiveness of the instructional practice accounted for their total acceptance of this instructional practice.

After the review of the major studies in the areas of epistemological beliefs and instructional practice of preservice and inservice teachers, Chapter Three centers on the methodology used in collecting data for this study. The chapter is based on the population, instruments, and the procedure used in the data gathering process.

CHAPTER III

METHODOLOGY

This was a quantitative study to survey preservice and inservice teachers at an Upper Midwestern University in the United States about their personal epistemological beliefs, and how those beliefs related to their instructional practice in the classroom. The purpose was to investigate whether there was any relationship or discrepancy between the epistemological beliefs and the instructional practice of preservice and inservice teachers.

Participants

This quantitative study sampled two different populations to compare their epistemological beliefs and instructional practice. The first group of participants was preservice teachers studying education (K-12) at an Upper Midwestern University in the United States. The preservice teachers had prerequisite course combinations to enroll in the teacher education seminar class offered in the spring of every semester. Since the researcher was comparing these preservice teachers with inservice teachers, the researcher wanted to have a cohort of preservice teachers who have finished course work within the teacher education program. This was the reason why only preservice students in their senior years were sampled for this research. Second, all preservice teachers selected were exposed to the experiences in the actual classrooms through various methods courses. In all, fifty preservice teachers were included in this study. These preservice teachers were made up of seven in early childhood; 28 in elementary education, two in elementary/middle, and ten at the secondary level (which comprised five taking mathematics; three in English, and one in music and one in social studies).

In order to have a sample group of inservice teachers with similar teaching and learning experiences as the preservice teachers mentioned, inservice teachers at the preschool, elementary, junior high, and high schools from the vicinity of the University were contacted to participate in this study. The inservice teachers were invited through email from their school website provided by the School District. They were, therefore, surveyed on their epistemological beliefs and instructional practice that they adopt in their day-to-day teaching and learning process with their students. The researcher involved inservice teachers with teaching licenses and teaching certificates issued by the state.

There were two demographic questions on grade level, and number of years in teaching of inservice teachers. The responses to the grade level survey question (*What level or subject area do you teach?*) had different disciplines and levels, which could not be presented as individual entities. For this reason, these disciplines were recoded into early, elementary, middle and secondary teachers in order to make statistical procedures easier. Inservice teachers' years of teaching ranged between one and thirty-nine. The years were further broken down into 1-10 (32 participants), 11-20 (20 participants), 21-30 (18 participants), and 31-40 (11 participants).

In all, a total of one hundred and thirty-one (131) participants, which comprised of fifty preservice teachers and eighty-one inservice teachers were sampled in this research. In order to have dependable data, all the survey questions were anonymous so that both preservice and inservice teachers could be honest in their responses. See Table 1 for details.

Table 1.

Descriptive Statistics on Demographics

Preservice teachers	Grade level	<i>Number of Participants (50)</i>
	Early Childhood	7
	Elementary	28
	Elementary/Middle School	2
	Mathematics	5
	English	3
	Music	1
	Social Studies	1
		<i>Number of Participants (81)</i>
Inservice teachers	Early Childhood	6
	Elementary	26
	Middle School	7
	High School	42
Years	1-10	32
	11-20	20
	21-30	18
	31-39	11

Instruments

Epistemological beliefs questionnaire. There have been many epistemological instruments designed to measure personal epistemology (Hofer, 2001; Schommer, 1990; Schraw et al., 2002). Among these instruments, there are conflicting research findings that have been reported, and as such, there are bases for criticisms of one instrument to the other (Schraw & Elafson, 2008). Nonetheless, the instrument chosen for this research was the 18-item discipline-focused epistemological beliefs questionnaire (DFEBQ) by Hofer (2000). Since this study was targeted at the preservice and inservice teachers, there was the need to use an instrument that took into consideration the specific field or discipline of the participants. Across the epistemological beliefs' literature, the instrument best represents the four main dimensions of

personal epistemologies (Cazan, 2013; Hofer, 2000; Hofer & Pintrich, 1997). This instrument is validated instrument and has been in different studies (Muis, Franco & Geirus, 2011; Cazan, 2013).

Hofer's disciplined-focused epistemological beliefs instrument was developed by a team of researchers who were familiar with the literature on personal epistemology. The team of researchers checked the four thematic constructs that seemed to be consistent with most of the studies in personal epistemology—certainty of knowledge, simplicity of knowledge, source of knowledge, and the justification of knowing (Hofer, 2000). At the end of the study, Hofer (2000) reported that there was evidence to support the dimensionality of these four constructs. However, she observed from the factor analysis that certainty and simplicity of knowledge merged unto one construct (eight items) with source of knowledge (four items), justification for knowing (four items), and attainment of truth (two items) making the last of the dimensions. With this result, she cited Qian and Alvermann (1995) as having found a similar evidence in the use of domain-general epistemological beliefs questionnaire.

Cazan (2013) recently used the Hofer's discipline-focused epistemological beliefs questionnaire. Cazan reported Cronbach alpha for all four dimensions as certainty of knowledge (.75), source of knowledge (.67), simplicity of knowledge (.65), and justification for knowing (.55). Because of the background of the participants as teacher education major students for this current study, most of the items of the epistemological beliefs questionnaire were modified by inserting "*in the field of education*" to remind participants to approach each survey question with a teacher's mindset. The disciplined-focused epistemological beliefs questionnaire instrument had eighteen items based on the conclusion of the factor analysis by Hofer (2000).

Cazan (2013) surveyed three hundred and ninety-eight first year psychology students in one of the universities in Romania. At the end of the study, Cazan obtained all the four constructs (certainty of knowledge, simplicity of knowledge, source of knowledge, and justification of knowing). However, she reported that some of the items fell onto more than one factor during the confirmatory factor analysis. Since several studies have confirmed the dimensionality of the discipline-focused epistemological beliefs questionnaire, this study also used the four dimensions that were originally found by Hofer (2000) due to the small sample size of this study. One important characteristics of Hofer's instrument which should be borne in mind is that higher scores represent agreement with less sophistication. Below is a discussion of the meaning of the four dimensions as applied in this study.

Certainty/simplicity of knowledge. Certainty of knowledge refers to the extent to which an individual sees knowledge as stable or constantly undergoing through changes. At the lower level, people begin to see knowledge as unchanging no matter the circumstance or discipline within which such knowledge is discussed. Several researchers in this area have come to the conclusion that knowledge becomes tentative and open for interpretation at the advance level (Hofer, 2000). Simplicity of knowledge, as hypothesized by Schommer (1990; 1994), can be explained as the view about knowledge as a collection of basic facts or the integration and interrelatedness of ideas. This means, those who are naïve see knowledge as discrete and unrelated facts whereas those who have advanced see knowledge as conditional, contextual, and systemic in nature. Since these two separate dimensions loaded unto the same factor, this subscale will be explained as a continuum between the belief of knowledge as absolute (unchanging) and unrelated to the perception of knowledge as tentative and interrelated. The set of items that loaded onto this scale was 1, 2, 5, 9, 11, 18, 23, and 24 with .74 and .81 Cronbach

alpha for psychology and science students respectively. In the original article, items 11 and 23 were reverse coded in order to be in line with the scale. Also, the items on the certainty/simplicity scale were recoded from *certsim_1* to *certsim_8*.

Source of knowledge. This dimension identifies the situation of knowledge. The question that needs to be asked is whether knowledge is located outside the individual or resides within the individual. In other words, source of knowledge distinguishes between knowledge as a transmission of information and knowledge as a construction of ideas. Perry (1970) explained that individuals who used to consume or receive knowledge from others, became creators of knowledge. Most of the researchers in this field see source of knowledge as developmental in nature (Baxter Magolda, 1992; King & Kitchener, 1994; Schommer, 1990). The items on the disciplined-focused epistemological beliefs questionnaire were 3, 7, 20, and 26 with .51 and .64 Cronbach alpha for psychology and science students studied by Hofer (2000). The items were recoded into *sour_1*, *sour_2*, *sour_3*, and *sour_4*.

Justification for knowing. The justification for knowing dimension refers to a continuum within which individuals judge the correctness and accuracy of knowledge (Hofer & Pintrich, 1997). At the lower level of Hofer's discipline-focused epistemological scale, individuals discriminate between information based on observation. There are certain times people in such bracket accept whatever comes from authorities or experts without any further inquiries. At the higher level of this scale, the individual uses a set of criteria to evaluate the correctness or accuracy of knowledge. There are situations where evidence-based research finding should be provided before those who are sophisticated in this dimension accept the information as valid. The number of items that loaded unto this factor was 12, 21, 25, and 27

with .56 and .61 as the Cronbach alpha. These items were recoded into just_1, just_2, just_3, and just_4.

Attainment of truth. As demonstrated in this project, this construct was not originally part of the four dimensions that were hypothesized to be the core of epistemological beliefs (Hofer, 2000). However, it emerged after the exploratory factor analysis on the discipline-focused epistemological beliefs questionnaire did not clearly indicate the four dimensions that were hypothesized in Hofer (2000). With only two items (13, and 17), the items indicate a continuum as to whether experts or scholars will eventually get to the truth. With this, individuals at the higher level will always be seeking new knowledge, even beyond what would be branded as the truth, whereas novices will accept things without questioning. The Cronbach alpha reported by Hofer (2000) was .60 and .75 for psychology and science students respectively. The items on the attainment of truth had been recoded into attain_1, and attain_2.

Instructional practice questionnaire. Also, the instructional practice questionnaire (Hung, unpublished), which comprised of eleven items on a Likert scale with four of the survey questions reversed. The reversed survey questions were items (intru_2, instru_3, instru_5, and instru_7). The last three items qua_1, qua_2, and qua_3 on the instructional practice questionnaire were designed to gather additional qualitative information. Item qua_1 asked teachers whether they will be able (preservice) to or were able (inservice) to practice what they believed to be best practices, whereas item qua_2 asked teachers to check whether they were constructivist or behaviorist. The last question (item qua_3) specifically required the participants to choose from nine possible factors that explained why teachers' epistemological beliefs could be inconsistent with their instructional practice. The tenth option, of course, was an open-ended question ("*Others*") that required teachers to write other factors that were not part of the list

provided in the survey. This option created the opportunity for preservice and inservice teachers (see detailed information of instrument at Appendix A) who had other relevant responses beyond what was provided on the survey questions by the researcher. Based on the research questions for this project, the researcher designed two demographic questions to make better comparison between and among participants.

Depending upon the kind of questions the researcher wanted to answer, there was room for modification of the number as well as the content of the survey questions at any point prior to the first participant's response to the question. However, the researcher maintained the 18-item survey questions so as to better capture the epistemological beliefs of inservice and preservice teachers as examined by Hofer (2000). The epistemological beliefs questionnaire was originally designed in a Likert scale, which maintained the Likert scale, representing strongly disagree (1) to strongly agree (5). By using the Likert Scale, it created an avenue for participants who were not sure of where they identified with on the scale to remain neutral. There were two different approaches used in gathering the data. These were the online version created from the Qualtrics software for inservice teachers within the School District, and paper-based surveys administered to preservice teachers at the university during one of their senior seminar classes.

Procedure

In order to respect the fundamental human rights of the participants, this project commenced after the researcher satisfied all the requirements of the Office of Institutional Review Board at this Upper Midwestern University as well as the School District regarding ways to ensure safe and ethical research practice. At the same time, the researcher contacted the professor at the university, who taught the teacher education seminar course ahead of time to get access to preservice teachers for this study. Again, a meeting was scheduled between the

researcher and the professor at the university to discuss the overview of the study and how data would be gathered from preservice teachers. After meeting with the professor and laying out the procedure for data gathering, the professor sent an email notification one month earlier to inform preservice teachers of the impending study, and its relevance to the teacher education program. This same process was repeated one week before the set date (February 25, 2014) was due. Preservice teachers were informed of their right to opt out of the study by not returning the survey questions to the researcher. On the scheduled date, the professor for this seminar introduced the researcher and reminded students of the consent at the top of the survey questions. Out of the sixty students in class, fifty preservice teachers returned the paper-based survey questions to the researcher. The researcher took a moment to thank all preservice teachers for voluntarily participating in the study.

With regards to the inservice teachers, the Assistant Superintendent of the School District was contacted to officially request access to the various schools within the district. Upon the receipt of the approval letter from the Assistant Superintendent, the researcher contacted all principals within the School District to discuss the purpose of this study, and the possibility of allowing their willing teachers to participate. This exercise was done in person by the researcher. In all the schools visited, the researcher showed the permission letter from the Assistant Superintendent of the School District as well as the letter from the Office of the Institutional Review Board.

After discussing the purpose of the research with the different principals of the schools, all the principals I contacted agreed to participate in the study. They, therefore, gave the researcher the permission to electronically mail the link to recruit inservice teacher participants, in order to forward the content (survey link with consent information) to all the inservice

teachers through the schools' email lists. The Qualtrics survey software was used to create the survey for this study. Through the School District (principals), electronic mailing list was sent to inservice teachers for their participation in the study.

Participation in this study was voluntary, and was categorically emphasized in the consent statement provided on the survey questions. By the nature of this research design, participants could not be excused from taking part in the study after they have submitted their responses. This was because the survey questions did not require any of the participants to provide verifiable information or identification. For this reason, both preservice and inservice teachers could only opt out of the study at a point where they decided not to return their survey responses to the researcher. Once the responses were submitted, it was an indication of participant's willingness to be included in the study. Overall, the face-to-face and the online version of the survey administration were completed within one month. Afterwards, the researcher stopped collecting the data to make way for data entry and analysis.

Among all the principals emailed with the link to the survey, only one of them copied the researcher when the survey was sent out to the inservice teachers. As a result of the inability of the principals to copy the researcher when the survey was sent out to the inservice teachers, it made it impossible for the researcher to know, with all certainty, the number of principals who actually sent out the survey to their teachers. The online responses were received instantly as soon as participants clicked the submit button, whereas participants who responded to the paper-based (preservice teachers) were reached in their lecture hall. After the survey was administered and collected, the researcher used the Statistical Package for Social Science (SPSS) Software to do all statistical analysis and procedures.

Data Entry and Screening

Both preservice and inservice teacher's data were collected between February 1, 2014 and March 1, 2014. The survey link through the Qualtrics software was kept opened throughout this one month-period. At the end of March 1, 2014, there were a total of 88 inservice teachers who had responded to the survey questions online. The Qualtrics software allowed the researcher to download the entire document through the SPSS. The researcher downloaded all the data and securely saved them on his laptop with a password in order to protect the files from the contact of the public. Out of this number, seven participants (inservice teachers) did not complete all the survey questions. For this reason, their data were deleted from the research. This brought the total number of inservice teachers, who participated in this study, to eighty-one participants (81). The preservice teachers' survey, on the other hand, was administered face-to-face during one of the seminar classes on campus. In all, a total of fifty preservice teachers completed the survey and returned the responses to the researcher.

The next chapter is the presentation and the interpretation of the results obtained from the study. The first part is the presentation of the descriptive statistics and the reliability coefficients of preservice and inservice teachers. The rest of the data are organized, based on the order of the research questions. Each research question is followed by the statement of the null hypothesis. Thus, research question 1 is followed by the null hypothesis 1. The results and the interpretations are based on the data from just the self-report. Therefore, the need exists for caution in applying the results in other contexts.

CHAPTER IV

Results and Analysis

This quantitative study sought to investigate the relationship between epistemological beliefs and instructional practice of preservice and inservice teachers. The researcher used the 18-item discipline-focused epistemological beliefs questionnaire (DFEBQ) by Hofer (2000) and an instructional practice questionnaire in the study. This study had three major research questions that were broken down into four hypothetical statements. For the purpose of clarity, every research question was followed by the null hypothesis as well as the results that emerged from this study.

Statistical Analysis

The researcher used two main statistical procedures for the study, which were a test of group differences (t test) and a test of correlations relationships (Pearson coefficient r). The statistical analysis on group differences focused on the differences that existed within preservice teachers and inservice teachers as well as between preservice and inservice teachers' epistemological beliefs and instructional practice. A Pearson correlation was used to test how the four dimensions studied (certainty/simplicity of knowledge, source of knowledge, justification for knowing, attainment of truth) related to each other as well as instructional practice.

Descriptive Statistics

The 18-item discipline-focused epistemological beliefs questionnaire (DFEBQ) by Hofer (2000) was designed in a way that higher mean scores represented less sophistication in epistemological beliefs on the Likert scale. As a result, the researcher reverse coded two items of

the epistemological beliefs questionnaire (certsim_5 and certsim_7 as indicated in Hofer's coding book). Also, four items in the instructional practice questionnaire (intru_1, instru_4, instru_6, and instru_8) items were coded to make the scales of the two instruments consistent. To illustrate this coping process, item instru_4 was "*When appropriate, I will encourage my students to give their own opinions or viewpoints on the topic we are studying.*" With this question, participants who chose one or two strongly disagree or agree) on the Likert scale would be interpreted as using constructivist instructional practice whereas participants who chose four or five (agree or strongly agree) would be described as practicing traditional methods.

Preservice and Inservice Teachers

As stated earlier in the methodology section, a total of one hundred and thirty-one participants responded to the survey. This number was made up of fifty preservice and eighty-one inservice teachers. The fifty preservice teachers were all in their senior year and had met the requisite courses to be enrolled in the senior seminar class at the Teaching and Learning Department of this University. The preservice teachers finished all methods courses and were working towards graduation in May, 2014.

Preservice and Inservice Teachers' Epistemological Beliefs

The discipline-focused epistemological beliefs questionnaire is a validated instrument (Cazan, 2013). Therefore, the four dimensions reported by Hofer (2000) were used to test preservice and inservice teachers' epistemological beliefs system. These dimensions were certainty/simplicity of knowledge (8 items), justification of knowing (4 items), source of knowledge (4 items), and attainment of truth (2 items). To align the instructional practice instrument with the Hofer's scale, the researcher reverse coded the responses of four items

(intru_1, instru_4, instru_6, and instru_8), in the instructional practice questionnaire before running the statistical procedure (refer to Appendix A for details in the Code Book).

Since this study involved different research populations, the researcher saw the need to check the reliability or internal consistency of the responses that were given by preservice and inservice teachers. The overall epistemological beliefs reliability for preservice and inservice teachers was .47 and .69 respectively. One major thing noted about the preservice teachers' data was that the four dimensions of preservice teachers' Cronbach alpha had poor reliability (ranging from .28 to .48) whereas inservice teachers had acceptable reliability range (.59 to .71). Cazan (2013), using the Romanian version of the discipline-focused epistemological beliefs questionnaire, reported that the Cronbach alpha of the translated version of this instrument was lower than the Cronbach alpha reported by Hofer (2000). Table 2 shows the epistemological beliefs of preservice and inservice teachers with their Cronbach alpha.

Table 2.

The four Epistemological Beliefs Dimensions with their Cronbach alpha

variables	Preservice Teachers	Inservice Teachers
Overall epistemological beliefs	.47	.69
Certainty/simplicity	.39	.71
Source: authority	.48	.59
Justification: personal	.45	.71
Attainment of truth	.28	.64

Note. Individual items were rated on Likert scale; high score indicates agreement with less sophistication.

Regarding the individual dimensions on the discipline-focused epistemological beliefs questionnaire as well as the overall descriptive statistics for preservice and inservice teachers, the

researcher ran a frequency statistical procedure for each of the four dimensions after computing the various items of the scale into their respective dimensions. This frequency statistical procedure was done for both preservice and inservice teachers. Also, the researcher repeated the same process for the overall epistemological beliefs (all four dimensions put together) for preservice and inservice teachers and their instructional practice. The DFEBQ did not have the same number of items for each dimension. The next section is the presentation of the results, based on the research questions and the null hypothesis.

Research Question 1: What are the differences between preservice and inservice teachers' epistemological beliefs?

Null hypothesis 1. There is no difference between preservice and inservice teachers' epistemological beliefs.

No significant difference was found between preservice and inservice teachers' overall epistemological beliefs after an independent t-test statistical procedure was run ($t(128) = 1.355, p = .15$). The preservice teachers were slightly more advanced in their epistemological beliefs than the inservice teachers with a mean score of 2.4 and 2.5 respectively. This finding seemed to imply that differences in experience and number of years in teaching among inservice teachers were not likely to have impact on the development of inservice teachers' epistemological beliefs. Perry (1970) found that college students progressed in their epistemological beliefs within the four years in college. Similarly, the researcher expected to see a major difference due to extensive number of years in teaching of inservice teachers.

To further examine the above research question, the researcher compared the four dimensions of the preservice teachers (certainty/simplicity, source of knowledge, justification for knowing, and attainment of truth) to the four dimensions of the inservice teachers. To do this

comparison, the statistical procedure used was the independent samples t test to compare the means of each of the dimensions with the other. For example, the question was asked whether there was any difference between preservice and inservice teachers' beliefs about the source of knowledge dimension. As stated earlier, there was no significant difference among the other three dimensions (source of knowledge, justification for knowing, and attainment of truth).

In all of the four dimensions of epistemological beliefs, the preservice teachers had a slightly more sophisticated level of epistemological beliefs than did the inservice teachers with the exception of the source of knowledge and justification for knowing dimensions with a mean score of 2.3 and 3.4 for both teachers respectively. Also, a significant difference was found between the certainty/simplicity of knowledge dimension ($p = .03$). Based on the results for the preservice and inservice teachers' overall epistemological beliefs scores, the null hypothesis 1 was retained. However, further examination revealed that preservice and inservice teachers differed significantly on the dimensions of certainty/simplicity of knowledge. The results are presented in Table 3.

Table 3.

Descriptive Statistics and T Test for Preservice and Inservice Teachers Epistemological Dimensions

variables	Preservice Teachers Mean (SD)	Inservice Teachers Mean (SD)	t values	p values
Overall	2.4 (.28)	2.5 (.39)	1.369	.31
epistemological beliefs				
Certainty/simplicity of	1.9 (.37)	2.0 (.55)	2.200	.03

Table 3 cont.

knowledge

Source of knowledge:	2.3 (.54)	2.3 (.63)	-.584	.56
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authority

Justification for	3.4 (.59)	3.4 (.71)	.199	.84
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knowing: personal

Attainment of truth	2.8 (.77)	3.0 (.84)	.833	.41
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Research Question 2: What are the differences in preservice teachers' projected and inservice teachers' actual instructional practice?

Null hypothesis 2. There is no difference between the projected instructional practice of preservice teachers' and the actual instructional practice of inservice teachers.

The instructional practice construct (eight items) was created by Hung (unpublished) and was used for the first time. Therefore, the need existed to check the reliability of the construct in order to have dependable data for later analysis. The Cronbach alpha for preservice and inservice teachers' instructional practice scale was .73 and .63 respectively. The Cronbach alphas were statistically acceptable to conduct the appropriate procedure to check whether there was any difference between the instructional practice of preservice and inservice teachers (Cazan, 2013). With the mean scores of 2.1 and 2.2 for preservice and inservice teachers' instructional practice respectively, the independent samples t test statistical procedure with $t(128) = .777, p = .44$ showed no significant difference between the instructional practice of preservice and inservice teachers. Here too, the preservice teachers had slightly higher instructional practice score than the inservice teachers.

Examining the differences in time when some of the inservice teachers graduated from college (from one to thirty-nine years difference), there might be an educational philosophy gap between preservice and inservice teachers. The researcher expected a significant difference in the instructional practice orientation between preservice and inservice teachers. However, the finding did not show the anticipated difference. This result suggested that preservice and inservice teachers were likely to use similar instructional practice in their classroom. Therefore, based on the lack of significant difference between preservice and inservice teachers' instructional practice, the null hypothesis 2 was retained. Table 4 is a representation of information obtained.

Table 4.

Difference between Instructional Practice of Preservice and Inservice Teachers

Variable	Preservice Teachers Mean (SD)	Inservice Teachers Mean (SD)	<i>t</i> value	<i>p</i> value
Instructional practice	2.1 (.55)	2.2 (.50)	.777	.44

Research Question 3: What are the relationships between preservice and inservice teachers' epistemological beliefs and their instructional practice?

Null hypothesis 3. There is no relationship between preservice teachers' epistemological beliefs and their projected instructional practice.

In some of the studies that used Hofer's discipline-focused epistemological beliefs instrument, the individual dimensions were compared with other variables without necessarily computing the overall epistemological beliefs scale to test other constructs (Cazan, 2013; Muis,

Franco, & Gierus, 2011). The researcher consciously wanted to know how the overall preservice and inservice teachers' epistemological beliefs related to their instructional practice in the classroom. After running the Pearson correlation statistical procedure, the overall epistemological beliefs of preservice teachers had a positive significant correlational relationship with their instructional practice. With this finding, preservice teachers were more likely to teach based on their educational philosophy. The preservice teachers had a Pearson coefficient of $r = .43, p = .002$. The literature reviewed (Barak & Shakhman, 2008; Bol & Strage, 1996) seemed to suggest that more preservice teachers were being trained in constructivist learning environments and were expected to adopt constructivist teaching and learning pedagogies in their classroom. This finding provided an evidence of a positive significant correlational relationship, thereby confirming what has been found by previous researchers. Based on this significant correlational finding, the researcher rejected the null hypothesis 3.

To further examine how preservice teachers' epistemological beliefs compared with their instructional practice, another correlation was run to identify whether preservice teachers' individual dimensions of their epistemological beliefs correlated with their projected instructional practice. After the procedure, the researcher identified that two dimensions of preservice teachers (certainty/simplicity and source of knowledge) were identified and had significant positive correlation with their projected instructional practice. On the other hand, the other two dimensions (justification of knowing and attainment of truth) had negative (not significant) correlational relationship with their respective instructional practice.

Two dimensions of certainty/simplicity of knowledge ($r = .61, p < .001$) and source of knowledge ($r = .33, p = .02$) largely accounted for the significant correlational relationship found in the overall scores of their epistemological beliefs and instructional practice. However, two

negative insignificant relationships were found. The justification for knowing and attainment of truth dimensions had negative insignificant relationships. Though these relationships were not significant, one cannot be certain about their implications on the instructional practice of preservice teachers; they presented an interesting phenomenon for further examination.

By comparing the mean score of the certainty/simplicity of knowledge ($m = 1.9$) and source of knowledge ($m = 2.3$) with instructional practice scale ($m = 2.2$), the researcher could extrapolate that the more sophisticated the epistemological beliefs were, the more constructivist was the preservice teachers' instructional practice. This finding seemed to demonstrate that the two dimensions of epistemological beliefs of preservice teachers were consistent with their instructional practice. At the same time, the finding seemed to give a holistic view of the possible dynamics and complexity of the epistemological beliefs dimensions and how they relate to instructional practice (See Table 5 for details).

Table 5.

Relationship between Epistemological Beliefs Dimensions and Instructional Practice of Preservice Teachers

Variables	Correlation Coefficient (r)	p value
Overall epistemological beliefs	.43**	.002
Certainty/simplicity of knowledge	.61**	.001
Source of knowledge: authority	.33*	.02
Justification for knowing: personal	-.06	.68
Attainment of truth	-.12	.42

Note. Individual items were rated on Likert scale; high score indicates agreement with less sophistication. ($n = 50$). * $p < .05$, ** $p < .01$.

Null hypothesis 4. There is no relationship between inservice teachers' epistemological beliefs and their instructional practice.

The Pearson correlation coefficient for inservice teachers' overall epistemological beliefs and instructional practice was $r = .27, p = .01$. From this finding, it was clear that there was a positive significant correlational relationship. Overall, this finding seemed to suggest that whereas the epistemological beliefs of inservice teachers' increased, preservice teachers' projected instructional practice indicated a corresponding increment. Thus, inservice teachers were more likely to adopt their instructional practice, based on their epistemological beliefs. This finding confirms previous research that epistemological beliefs related to instructional practice (Brownlee, 2003b; Hofer, 2001; Hofer & Pintrich, 1997). Based on the results obtained, the researcher rejected the null hypothesis 4 since the results indicated a significant correlational relation.

After testing the relationship between the overall epistemological beliefs and instructional practice of the inservice teachers, the need was apparent to identify to what extent the four dimensions of epistemological beliefs related to their instructional practice. To test this relationship, all four dimensions of the inservice teachers' epistemological beliefs (certainty/simplicity, source, justification, and attainment) were compared with the eight-item instructional practice construct. The certainty/simplicity of knowledge dimension had moderately positive significant correlation with instructional practice ($r = .50, p < .001$). The significant relationship of the certainty/simplicity dimension indicated that inservice teachers, who believed in knowledge as dynamic and interrelated, were likely to adopt more constructivist instructional practice. The mean for inservice teachers' certainty/simplicity dimension was 2.0 whereas instructional practice dimension was 2.2. The finding was similar to that of the preservice

teachers' mean score for the certainty/simplicity of knowledge dimension ($m = 1.9$). However, where the certainty/simplicity and source of knowledge dimensions were the reason for the positive significant relationship between the overall epistemological beliefs and instructional practice, only certainty/simplicity dimension accounted for the significant relationship among the inservice teachers.

The three dimensions (source of knowledge, justification for knowing and attainment of truth) of inservice teachers had insignificant negative correlation with instructional practice. The results seemed to suggest that where these three dimensions (source of knowledge, justification for knowing, and attainment of truth) of epistemological beliefs of the inservice teachers did not develop, inservice teachers were still likely to use more constructivist instructional practice. Because the null hypothesis stated that there was no correlational relationship between the epistemological beliefs and instructional practice of inservice teachers, the researcher rejected the null hypothesis 4, based on this evidence provided. The result is presented in Table 6.

Table 6.

Relationship between Epistemological Beliefs Dimensions and Instructional Practice of Inservice Teachers

Variables	Correlation Coefficient (r)	p value
Overall Epistemological Beliefs	.27*	.01
Certainty/simplicity of knowledge	.50**	.001
Source of knowledge: authority	-.01	.10
Justification for knowing: personal	-.05	.68
Attainment of truth	-.10	.36

Note. Individual items were rated on Likert scale; high score indicates agreement with less sophistication. ($n = 81$). * $p < .05$, ** $p < .01$.

Other Findings

The researcher wanted to find whether any difference existed between the epistemological beliefs and instructional practice of preservice and inservice teachers, based on the level of education they were being trained or certified to teach (eg. early childhood, elementary, middle or high school), and years of teaching (inservice teachers). As discussed earlier, these independent variables were to be compared with the four dimensions of epistemological beliefs. After comparing preservice teachers' levels of concentration with the four dimensions of epistemological beliefs, no significant difference was found among preservice teachers. Table 7 below has details.

Table 7.

Differences of Epistemological Beliefs based on Grade Level of (Preservice Trs.)

Variables	<i>F</i> value	<i>p</i> value
Certainty/simplicity	.489	.69
Source	.128	.94
Justification	1.494	.23
Attainment	.728	.54

Next, the independent variable “grade level” of the inservice teachers was compared with the four dimensions of epistemological beliefs. After running the analysis of variance (ANOVA) statistical procedure, no significant difference was found among the four dimensions. The results seemed to indicate that there were no differences in epistemological beliefs of inservice teachers, based on their level of teaching. By implication of this finding, it is likely that an inservice

teacher at the early childhood level would possibly have similar epistemological beliefs as the teacher at the higher school level. Table 8 has details.

Table 8.

Differences of Epistemological Beliefs based on Grade Level (Inservice Trs.)

Variables	<i>F</i> value	<i>p</i> value
Certainty/simplicity	1.695	.81
Source	.321	.18
Justification	1.294	.28
Attainment	.635	.60

The last independent variable studied was the number of years in teaching of inservice teachers. Inservice teachers' years of teaching were compared with the four dimensions of epistemological beliefs by using the analysis of variance (ANOVA). After the procedure, certainty/simplicity had $F(3, 77) = .614, p = .61$; source had $F(3, 77) = 2.723, p = .05$; justification $F(3, 77) = .367, p = 0.78$; and attainment with $F(3, 77) = .463, p = 0.71$. The results indicated that there was a possible significant difference in terms of instructional practice in the source of knowledge dimension. Further analysis by the Bonferroni post hoc test indicated that the difference in years was between inservice teachers who had taught for 1-10 and 11-20 years. The researcher was expecting a significant difference between 1-10 and 31-40 due to the wide difference in years. However, the analysis turned out that the number of difference in years of experience did not translate into growth in the epistemological beliefs of inservice teachers. Interestingly, the certainty/simplicity of knowledge dimension, which had been versatile

throughout the analysis, did not indicate any significant difference in the instructional practice.

See the Table 9 below for details.

Table 9.

Differences of Epistemological Beliefs based on Years of Teaching

Variables	<i>p</i> value		
Certainty/simplicity	.61		
Source	.05		
	Bonferonni Test		
	1-10	11- 20 21-30 31-40	.07 1.0 1.0
	11-20	1-11 21-30 31-40	.07 .29 .18
	21-30	1-10 11- 20 31-40	1.0 .29 1.0
	31-40	1-10 11- 20 21-30	1.0 .18 1.0
Justification	.78		
Attainment	.71		

The researcher also compared the number of years of teaching to instructional practice of inservice teachers. After running the independent samples t test for each of the four categories of years of teaching, a significant difference was found between 1-10 and 31-40 years.

Interestingly, the inservice teachers within their first ten years of teaching were more likely to use more constructivists learning pedagogies than teachers who have taught for more than thirty years. The detail finding was $t(50) = -1.256, p = .26$ (1-10 and 11-20); $t(48) = .350, p = .73$ (1-10

and 21-30); $t(40) = -2.018, p = .50$ (1-10 and 31-40); $t(36) = 1.287, p = .21$ (11-20 and 21-30); $t(28) = -.777, p = .44$ (11-20 and 31-40); and $t(26) = -1.899, p = .07$. The significant difference found in instructional practice among inservice teachers was not surprising to the researcher due to the differences in the number of years in teaching.

Differences in the Dimensions of Epistemological Beliefs

As a result of the numerous studies that have underscored the importance of studying the epistemological beliefs of teachers and their relationship to other academic variables, the researcher thought it wise to investigate whether a significant difference existed among the four dimensions of epistemological beliefs for preservice and inservice teachers. To test the difference among the dimensions, the paired-sampled t test was used to run the statistical procedure among the four dimensions for preservice and inservice teachers respectively. At the end of the procedure, the researcher found that there was a significant difference among all the four dimensions of epistemology of preservice teachers as well as the dimensions of inservice teachers. Among the preservice teachers, there were significant differences between certainty/simplicity of knowledge and the other three dimensions with source: $t(49) = -6.270, p < .001$, justification: $t(49) = -14.508, p < .001$, and attainment: $t(49) = -7.483, p < .001$. The rest were source and justification: $t(49) = -9.992, p < .001$, source and attainment: $t(49) = -4.740, p < .001$, where justification and attainment was $t(49) = 4.077, p < .001$. See Table 10 for details.

Table 10.

T Test for Differences in Preservice Teachers' Dimensions

variables	Mean Diff. (SD)	t value	p value
Certainty/Source	-.47 (.53)	-6.270	.001
Certainty/Justification	-1.5 (.75)	-14.508	.001

Table 10 cont.

Certainty/Attainment	-.10 (.92)	-7.483	.001
Source/Justification	-1.1 (.75)	-9.992	.001
Source/Attainment	-.51 (.75)	-4.740	.001
Justification/Attainment	.56 (.96)	4.077	.001

On the part of the inservice teachers, certainty/simplicity of knowledge with the other three dimensions were $t(80) = -3.116, p < .003$ with source; $t(80) = -13.368, p < .001$ with justification; and $t(80) = -9.263, p < .001$ with attainment. The remaining dimensions were source and justification: $t(80) = -11.098, p < .001$; source and attainment: $t(80) = -7.052, p < .001$; and justification and attainment: $t(80) = 3.551, p < .001$. From this revelation, the researcher concluded that both preservice and inservice teachers did not have the same level of epistemological beliefs. Yilmaz-Tuzun, and Topcu, (2008) also found similar results about the disparities in the epistemological beliefs of teachers. These researchers observed that teachers did not have the same level of epistemological development across the spectrum of the five domains (certainty of knowledge, control of knowledge, source of knowledge, speed of knowledge, and structure of knowledge). See Table 11 below for more information.

Table 11.

T Test for Differences in Inservice Teachers' Dimensions

variables	Mean Diff. (SD)	<i>t</i> value	<i>p</i> value
Certainty/Source	-.23 (.68)	-3.116	.003
Certainty/Justification	-1.38 (.93)	-13.368	.001
Certainty/Attainment	-.93 (.90)	-9.263	.001

Table 11 cont.

Source/Justification	-1.1(.93)	-11.098	.001
Source/Attainment	-.69 (.88)	-7.052	.001
Justification/Attainment	.45 (1.1)	3.551	.001

The differences in the epistemological beliefs of both preservice and inservice teachers seemed to indicate that the four dimensions of epistemological beliefs of these participants did not have the same level of sophistication. Where the certainty/simplicity and source of knowledge dimensions were more sophisticated in preservice and inservice teachers, justification for knowing and attainment of truth dimension showed somewhat naïve epistemological beliefs. The interpretation of the finding is that both the preservice and inservice teachers were not likely to have some issues with their ability to determine the accuracy or correctness of information. Because the development of each of the dimensions is relevant to the overall epistemological beliefs system, poor development in one dimension will adversely affect the quality of the overall epistemological beliefs. At the same time, each of these dimensions has a relationship with the instructional decisions of inservice teachers. Therefore, it is likely to be an issue when preservice and inservice teachers do not demonstrate sophisticated levels in all four dimensions of their epistemological beliefs.

Differences in Qualitative Data

Beyond the quantitative information obtained from the use of the eight-point instructional practice scale, the researcher wanted to explore other possible reasons that accounted for the teachers' inability to adopt instructional practice, based on their epistemological beliefs. To do this further analysis, item qua_2 (*I am more inclined to educational philosophy of?*) percentage

ratings identified from the survey item showed some differences between these two populations. Where 80% (40 out of 50) of preservice teachers who responded to the survey questions claimed to be constructivist, fifty eight percent (47 out of 81) inservice teachers rated as constructivists. Similarly, eighteen percent (18%) preservice teachers showed that they were behaviorist compared to 34% inservice teachers. The finding seemed to indicate that more preservice teachers ascribed to the constructivist learning pedagogy than the inservice teachers.

Also, item qua_3 (*Which of these cause(s) discrepancies between what you believe and what you practice in the classroom?*) on the survey for both preservice and inservice teachers provided nine factors that could possibly explain why some teachers taught in ways that were not consistent with their epistemological beliefs. The researcher used only the preservice and inservice teachers who indicated being constructivist (80% of preservice and 58% of inservice teachers) for this further analysis. When the preservice teachers were asked the likelihood of these factors to prevent them from practicing what they believed, 29 (72.5%) chose mandated standardized tests; 16 (40%) chose workload; 22 (55%) based on pressure from parents; 17 (34%) preservice teachers chose workload; 17 (34%) as parental expectation; 14 (35.0%) for inadequate knowledge in practicing their beliefs; 11 (27.5%) for Common Core State Standards; 9 (22.5%) for fear of trying something new; 7 (17.5%) preservice teachers attributed the problem to government interference; and 7 (17.5%) for culture of school. The results indicated that these factors were possible hindrance to the practice of constructivism instructional practice by preservice teachers. Tables 12 and 13 show data on factors that account for preservice and inservice teachers' struggle in adopting instructional practice, based on their epistemological beliefs. The data are based on the 80% and 58% of preservice and inservice teachers respectively

who identified with the constructivist educational philosophy. See Tables 12 and 13 below for details.

Table 12.

Reasons for Preservice Teachers' Inability to Practice Constructivism

Factors	Preservice Teachers	
	Frequency	Percentage (%)
Mandated Test	29	72.5
Pressure	22	55.0
Workload	16	40.0
Expectation	14	35.0
Ignorance	13	32.5
Common Core	11	27.5
Fear	9	22.5
Government	7	17.5
Culture	7	17.5

Table 13.

Reasons for Inservice Teachers' Inability to Practice Constructivism

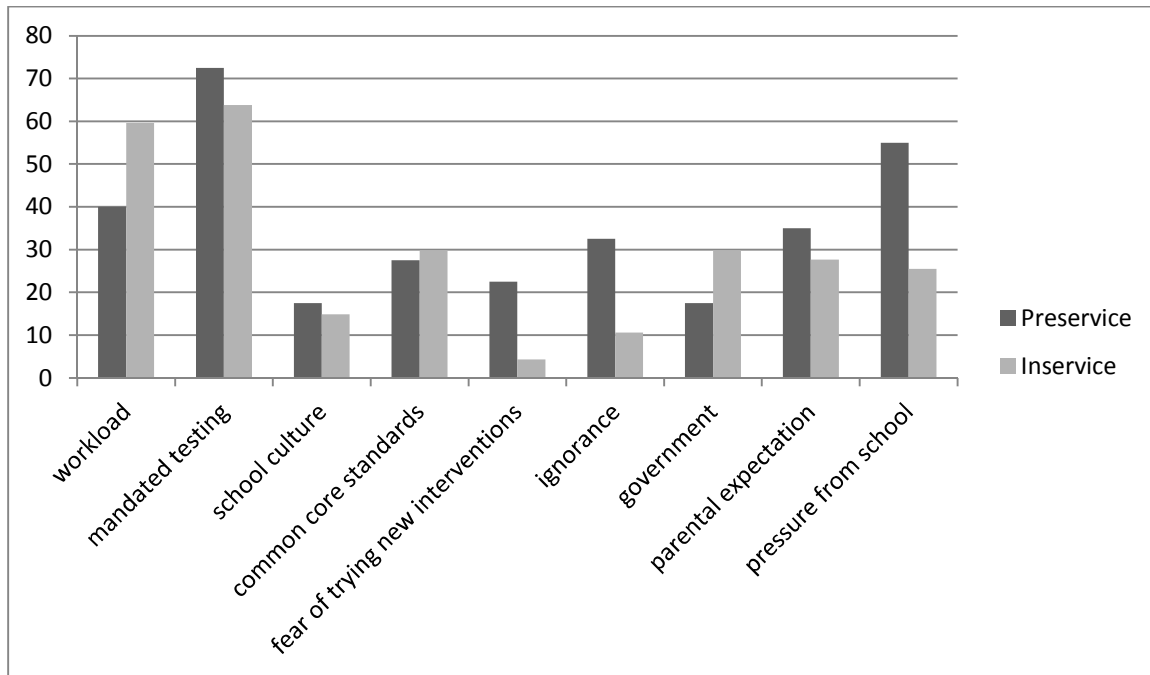
Factors	Inservice Teachers	
	Frequency	Percentage (%)
Mandated Test	30	63.8
Workload	28	59.8
Common Core	14	29.8

Table 13 cont.

Government	14	29.8
Expectations	13	27.7
Pressure	12	25.5
Culture	7	14.9
Ignorance	5	10.6
Fear	2	4.3

Comparatively, over fifty-nine percent (59.6%) of inservice teachers rated workload as the reason why they could not practice their beliefs in the classroom; 30 (63.8%) for mandated state standardized testing; 14 (29.80%) on Common Core State Standards; 14 (29.8%) as government interference; 13 (27.7%) as parental expectation for better scores on the state standardized tests; 12 (25.5.8%) mentioned pressure from school administration; 7 (17.90%) for culture of the school; 5 (10.6%) inadequate knowledge to apply beliefs; and 2 (4.3%) for fear of trying something new. The figure below is a histogram, showing the comparison of the factors responsible for preservice and inservice teachers' inability to teach according to their epistemological beliefs. The information in Tables 12 and 13 have been demonstrated in Figure 1 for the sake of comparison.

Figure 1. Factors Responsible for Discrepancy in Epistemology and Instructional Practice



This figure shows the descriptive data of preservice and inservice teachers, based on the factors that are likely to influence them in order not to be able to adopt instructional practice as determined by their educational beliefs.

Correlational Relationship between Dimensions

Researchers in the epistemological beliefs' field have found evidence to support the relationship that exists between epistemological beliefs and instructional practice (Hofer, 2001). The general finding was that teachers with naïve epistemological beliefs were likely to adopt a transmission type of learning environment whereas those with sophisticated epistemological beliefs would encourage their students to construct their own knowledge (Hofer, 2001; Pajares, 1992; Schommer, 1990, 1994).

To look for relationships among the dimensions of epistemological beliefs, two significant correlations were found among the preservice teachers after the Pearson correlation

statistical test was run. The source of knowledge dimension significantly correlated with certainty/simplicity of knowledge ($r = .36, p = .01$), and with attainment of truth ($r = .38, p = .006$). This observed significant relationship seemed to indicate that preservice teachers' advancement from transmission of knowledge to construction of knowledge was likely to see a corresponding belief in sophistication towards tentative and interrelated nature of knowledge. In this way, both dimensions were more likely to develop at a similar pace.

Interesting relationships were found between some of the dimensions, especially certainty/simplicity of knowledge with justification for knowing and attainment of truth. Though the relationships were not statistically significant, they were both negative, indicating the different directions of development of the dimensions. The mean scores for the preservice teachers' certainty/simplicity of knowledge ($m = 1.9$); source of knowledge ($m = 2.3$); justification for knowing ($m = 3.4$); and attainment of truth ($m = 2.9$) respectively seemed to demonstrate that preservice teachers did not have the same level of epistemological development in the four dimensions.

The data showed that preservice teachers had significant positive correlational relationships among certainty/simplicity of knowledge; source of knowledge; and attainment of truth dimensions. There was no significant relationship of these three dimensions with justification for knowing. This finding probably implied that preservice teachers did not witness significant improvement in their ability to check the accuracy of the information with which they interacted and therefore, did not demonstrate a corresponding increase in the attainment of truth dimension. The preservice teachers did not seem to have spent much time on distinguishing between valid and invalid sources of knowledge. See Table 14 for details.

Table 14.

Correlation among Preservice Teachers' Epistemological Beliefs Dimensions

Variables	1	2	3	4
Certainty/simplicity	—			
Source of knowledge: authority	.36*	—		
Justification for knowing: personal	-.15	.12	—	
Attainment of truth	-.21	.38**	.02	—

Note. Individual items were rated on Likert scale; high score indicates agreement with less sophistication. ($n = 50$). * $p < .05$, ** $p < .01$

Three main positive significant correlation relationships were found among inservice teachers. These correlational relationships were between certainty/simplicity of knowledge with source of knowledge ($r = .35, p = .001$), certainty/simplicity with attainment of truth ($r = .22, p = .05$), and source of knowledge with attainment of truth ($r = .31, p = .005$). Also, all of the significant correlations were weak relationships, ranging between $r = .22$ and $r = .35$. Unlike the preservice teachers who had two negative insignificant relations between certainty/simplicity with justification and attainment dimensions, inservice teachers had only one relationship between certainty/simplicity and justification. The other insignificant relationship was between justification and attainment dimensions.

In Hofer (2000), she found three positive and one negative significant correlations among first year psychology students with Pearson correlation coefficients ranging between $r = -.11$ and $r = .34$. Where she reported a relationship between justification of knowledge and attainment of truth among psychology college students, such finding was not replicated in this research.

Interestingly, a similar Pearson coefficient was found in this study and has been reported. Table 15 has detailed information on the results.

Table 15.

Correlation among Inservice Teachers' Epistemological Beliefs Dimensions

Variables	1	2	3	4
Certainty/simplicity	—			
Source of knowledge: authority	.35**	—		
Justification for knowing: personal	-.08	.04	—	
Attainment of truth	.22*	.31**	-.10	—

Note. Individual items were rated on Likert scale; high score indicates agreement with less sophistication. ($n = 81$). * $p < .05$, ** $p < .01$.

The next chapter is a discussion of the results of the study and the implications for practice. Following the same organization in Chapter IV, the discussion is based on the order of the research questions as well as the null hypothesis. The discussion is solely based on the data obtained from the self-report. Therefore, its application must be done with caution.

CHAPTER V

DISCUSSION

This quantitative study sought to compare the epistemological beliefs and instructional practice of preservice and inservice teachers. In this study, fifty preservice and eighty-one inservice teachers were purposively sampled to respond to a self-report survey consisting of two questionnaires that measured their epistemological beliefs and instructional practice. Preservice teachers were recruited from an Upper Midwestern University of the United States whereas inservice teachers were recruited from one of the public school districts within the same county.

Based on the literature reviewed, the related theories and studies support the notion that an individual's epistemological beliefs system serves as a fundamental beliefs system that dictates his or her everyday behaviors and practices at the cognitive level. Thus, this study was designed to empirically examine this relationship in the context of teachers' instructional practice in the classroom. With the use of the 18-item discipline-focused epistemological beliefs questionnaire (DFEBQ) by Hofer (2000), and eleven self-created instructional practice scale (Hung, unpublished), a comparative study was done between the epistemological beliefs and instructional practice of preservice and inservice teachers. The data collected were solely as self-reported. Below is a discussion of the three research questions with four null hypotheses. The implications of the study for classroom practice and limitations for future research are discussed.

Research Question 1: Differences between Epistemological Beliefs

Research Question 1: What are the differences between preservice and inservice teachers' epistemological beliefs?

As the statistical results indicated in the previous chapter, there was no significant difference between preservice and inservice teachers' overall epistemological beliefs (all dimensions put together). This result showed that preservice teachers in their final year and inservice teachers (who have taught between 1 and 39 years) were more likely to have similar beliefs system about the nature of knowledge and the process of knowing, regardless of whether or not preservice teachers had full-time classroom experience. There is a consensus among researchers studying epistemology that the epistemological beliefs system is developmental in nature (Hofer & Pintrich, 1997). However, with mean scores of 2.4 and 2.5 for preservice and inservice teachers' respectively (higher scores demonstrated less sophisticated epistemological beliefs system), this finding suggested that there seemed to be no advancement on the epistemological beliefs of inservice teachers after graduating from college. The preservice teachers were slightly advanced in their epistemological beliefs than the inservice teachers.

The epistemological beliefs' system is developmental in nature (Schommer, 19990; Hofer, 2000) and as a result, one would expect inservice teachers to have developed in their beliefs beyond the preservice teachers. However, the result from this study showed otherwise. Though this finding was not significant, the inservice teachers' epistemological beliefs system was less sophisticated than the preservice teachers. It can be hypothesized that inservice teachers might have inadequate knowledge about their epistemological beliefs or they might not have been directly involved themselves in activities that could possibly help them to improve upon their epistemological beliefs system. Again, it is possible that the epistemological beliefs of inservice teachers do not develop after they have graduated from college. Surprisingly, there has not been much research on how inservice teachers' beliefs develop beyond college (Lavigne, 2014). Because the researcher does not have records of the epistemological beliefs of the

inservice teachers when they were in college, there is no basis to make a strong case as to whether inservice teachers have developed in their epistemological beliefs or even possibly reversed to less sophisticated level due to some reasons over the years after college.

In any of these cases, somewhat average epistemological beliefs implied that both preservice and inservice teachers were likely to view knowledge as somewhat stable, based on the accumulation of discrete facts and being transmitted from the experts. Since there is not much literature on the development of inservice teachers' epistemological beliefs after college, it makes it difficult to gauge the optimum developmental level of epistemology of inservice teachers. If such information were to be available, it would have been easier to compare the epistemological beliefs' development level of these inservice teachers to what researchers have reported. In this specific context, the need exists for further research into the developmental stages of inservice teachers' epistemological beliefs throughout their professional career.

Hofer (2000) compared the epistemological dimensions of first year psychology and science students. After the study, she found that the development of epistemological beliefs was greatly impacted by the discipline within which the individual found himself or herself. From Hofer's finding, people from the same discipline were more likely to have similar epistemological beliefs system. Thus, because preservice and inservice teachers were from the field of education, they were more likely to have similar epistemological beliefs. Hofer's finding partially explains why preservice and inservice teachers could have similar epistemological beliefs. However, with the age difference as well as teaching experience between preservice and inservice teachers, it was expected that there would be a difference between preservice and inservice teachers' epistemological beliefs.

This finding presents a challenge on our understanding of the development of inservice teachers beyond college. Based on the maiden research by Perry and other researchers in the field, we know that epistemological beliefs system is developmental. What we do not know as of now is the nature of the development after college. This problem is due to the inadequate research to consciously target the epistemological beliefs development of inservice teachers and other professionals. There has been research on how certain interventions can be used to improve the epistemological beliefs system (Muis, Franco & Gierus, 2011). Unfortunately, the context is usually with preservice teachers. Hofer (2001) wrote:

We need to elaborate the cognitive nature of the model in order to better integrate this work within a larger field of cognitive development, both by locating personal epistemology within identifiable territory and connecting it to life-span cognitive development, and we need to better use cognitive psychology to understand mechanisms of acquisition and change, as well as the situated nature of the construct. (p. 362)

From this statement, it can be inferred that more work on the development of epistemological beliefs needs to be done across different age groups. The knowledge will possibly clarify our understanding of epistemological beliefs from the preschooler to the graduate student and beyond. Is it possible that the epistemological beliefs system of elementary students might not be different from high school students? What about the epistemological beliefs of college students and high school students? Is it possible to introduce some interventions as early as elementary school to help boost their epistemological beliefs? If there is a possibility, what might that set of interventions be? Answers to these questions through further research will be important to better our understanding of the epistemological beliefs development across all ages.

The data on the number of years of teaching was collected from only inservice teachers. After categorizing the years of teaching (from one to thirty-nine years) into four groups (1-10, 11-20, 21-30, 31-40), analysis of variance statistical procedure (ANOVA) revealed that there was no significant difference in the overall epistemological beliefs of inservice teachers based on years of teaching. However, a similar statistical test with the dimensions indicated that only the source of knowledge dimension of epistemological beliefs had significant difference in the epistemological beliefs of inservice teachers. With a mean difference of 1.8 between 1-10 and 11-20 years of teaching, the finding seemed to suggest that inservice teachers within their first ten years of teaching were less advanced. Therefore, they were more likely to believe that knowledge externally resided in experts, and from whom it was transmitted than inservice teachers who had taught from eleven to twenty years.

Katz (1972) explained that beginning teachers did not concentrate on the needs of their individual students until after one year. He continued that teachers only reflected on their teaching and learning practices after three years into their teaching profession. Manuel (2003) found that teachers within the first five years adopt a means to survive. By implication, inservice teachers within their first five years were not likely to focus on their instructional practice based on their educational philosophy. Thus, it is more likely that some of the effective instructional strategies learned in the methods courses might not be applied by inservice teachers within their first ten years of teaching. Once inservice teachers fail to apply the constructivist learning pedagogies, the default instructional practice is the traditional one. Therefore, it is likely that inservice teachers within their first ten years of teaching might use more traditional learning pedagogies in their classrooms as compared to eleven to twenty years.

Looking further into the responses to the item qua_3 (*Which of these cause(s) discrepancies between what you believe and what you practice in the classroom*) based on the years of teaching, seventy percent (23 out of 33) of inservice teachers within the 1-10 years of teaching bracket rated workload as one of the reasons why they could not adopt their instructional practice. Could it be that teachers especially in their early years of teaching, felt more pressured to meet certain conditions in order to secure their jobs? If this is the situation, it is likely that new teachers will be more under pressure than veteran teachers in adopting certain classroom decisions that might not align with their epistemological beliefs. As the above statistical analysis seemed to indicate, inservice teachers within their first ten years of teaching were more likely to believe in external sources of knowledge. So, if 70% of these inservice teachers struggle with how to teach based on their epistemological beliefs, it is likely that they would either seek help from veteran colleagues or consult textbooks for such knowledge.

Based on the 58% constructivist inservice teachers who responded to the survey item qua_3, twelve (25.5%) identified *pressure from school administration* as one of the reasons why they could not teach, based on their epistemological beliefs. Also, Rose and Rogers (2012), using a qualitative approach to study preservice teachers student teaching experiences, reported that there were scores of pressure from different sources to force preservice teachers to use learning strategies that did not align with the teacher education program. Therefore, pressure seemed to be part of the reasons why there was a significant difference between 1-10 and 11-20 years of teaching in the source of knowledge dimension of epistemological beliefs. In one sense, all the different factors that can possibly force teachers to make decisions that are inconsistent with their educational philosophy can be classified as external pressures.

By definition, the source of knowledge dimension at the lower level views knowledge as residing outside the self that has to be transmitted to the individual from experts or authorities. At a time when there is much emphasis on standardized testing, Common Core State Standards, NCLB, Race to the Top, and so on, it is more likely that teachers within their first ten years of their teaching will be likely to use transmission of knowledge as they see it as a more efficient teaching strategy and show immediate results in helping students pass their examinations. Novice teachers are more likely to be influenced by veteran teachers who are used to the transmission of knowledge in their classrooms. The researcher anticipated a significant difference between 1-10 and 30-40 years of teaching across all the four dimensions of epistemological beliefs due to the differences in the years of experience of inservice teachers (difference of thirty or more years in teaching experience). However, there was no significant difference between these two groups. The analysis could have been explained well if there were data on the epistemological beliefs development of inservice teachers throughout their years of teaching.

Brownlee (2003b) reported that the epistemological beliefs of teachers served as a lens in helping teachers adopt teaching and learning activities that encourage students to learn meaningfully. Similarly, majority of researchers agree with the idea that epistemological beliefs system has a useful role in influencing thought processes and the acquisition of information of the person (Hofer 2001; Hofer & Pintrich, 1997; Schommer, 1993). Therefore, if years of teaching did not contribute significantly to the development of the epistemological beliefs of the inservice teachers in the present study, then, it is likely that the epistemological beliefs system of inservice teachers was yet to be applied in the educational arena; not given the needed attention it deserved; or inservice teachers' epistemological beliefs ceased to develop after college. Because

if inservice teachers were conscious of their epistemological beliefs system and how that dictated their instructional choices, they would be more likely to be mindful of its development. If epistemological beliefs ceased to develop beyond college level, then there is no way inservice teachers would see advancement in their epistemological beliefs. At the same time, there have not been many studies on how inservice teachers' epistemological beliefs develop. Therefore, it will be appropriate for curriculum designers of professional development programs to reconsider emphasizing epistemological beliefs system in the curriculum. Also, further research will be helpful in identifying ways of improving inservice teachers' epistemological beliefs beyond college level.

Possible reasons for insignificant difference. The data from preservice and inservice teachers indicated somewhat average overall epistemological beliefs. Based on the mean scores of 2.4 and 2.5 for preservice and inservice teachers respectively, preservice teachers were slightly more advanced in their epistemological beliefs than the inservice teachers. This insignificant difference between preservice and inservice teachers was probably due to the nature of the preservice teachers' curriculum and how it aligned with the current instructional practice of the inservice teachers. A majority of these preservice teachers had completed all methods courses and their practicum. Within this period, it is likely preservice teachers might have spent time with some inservice teachers. For example, some of the method classes require preservice teachers to spend thirty hours in the classroom in order to complete different assignments. In most cases, teachers who demonstrate some level of excellence in their instructional practice are selected as cooperating teachers. However, demonstrating efficient instructional choices does not necessarily translate to sophisticated epistemological beliefs. Therefore, it is possible that preservice teachers, who spent time with such inservice teachers with naïve epistemological

beliefs, might have been influenced adversely in their beliefs about the nature of knowledge. At the same time, inservice teachers with sophisticated epistemological beliefs were also likely to influence the beliefs of preservice teachers.

Another reason that might possibly explain why there was no significant difference between preservice and inservice teachers' epistemological beliefs is the close collaboration between the teaching and learning faculty in this Upper Midwestern University and the school district's leadership. There are times during the school year where some faculty members lead professional development sessions and share current practices with inservice teachers. Also, in neighboring school districts, faculty members meet superintendents and school principals on a periodic basis to share studies and new instructional strategies in teaching. So, if there is collaboration between the university and the school district, it is likely that both preservice and inservice teachers will share similar knowledge. Such an approach can potentially influence both preservice and inservice teachers to have similar beliefs about knowledge.

The number of participants based on the years of teaching might possibly account for the reason why there was no significant difference between preservice and inservice teachers. Based on the demographic information, there were fifty-two inservice teachers who had taught between one and twenty years. Considering the time constructivism became the preferred educational philosophy at the K-12 setting of American education, it is more likely that inservice teachers within their first twenty years might have been educated in a constructivist pedagogical environment. Further, the Pearson correlation of 1-20 and 21-40 years of teaching experience with instructional practice indicated that, both 1-20 ($r = .31, p = .183$) and 21-40 ($r = .33, p = .07$) years of teaching subgroups were not significant. However, the finding seemed to indicate that inservice teachers with 21-40 years of teaching were closer to the 0.5 p value. This group

seemed to be more behaviorist than the 1-20 year group. For these reasons, inservice teachers were more likely to have similar instructional practice characteristics as preservice teachers who were being trained in a constructivist learning environment.

From the response to item qua_2 (*I am more inclined to educational philosophy of...constructivism/behaviorism?*), eighty percent (80%) of preservice teachers identified with constructivism whereas fifty-eight percent (58%) of inservice teachers were of the same educational philosophy. With such different percentages in teachers' philosophical paradigm, the researcher expected similar difference to manifest in their epistemological beliefs. It is difficult to know why these differences in constructivist ratings did not translate into significant differences in the epistemological beliefs of preservice and inservice teachers in this study. Since their educational philosophy is connected with their epistemological beliefs, the differences should have impacted the ratings of epistemological beliefs. Perhaps, the theoretical assumption that epistemological beliefs fundamentally influence practice is not true in different contexts. If it is, then there might be possible issues with how participants were able to internalize the meaning of the survey items. Cazan (2013) noted that some of the items on the discipline-focused epistemological beliefs questionnaire needed to be revised for better understanding. Since the ability of the participants to understand the survey questions has an implication on the validity and reliability of the response of subjects.

Differences between participants' dimensions. Also, among the four dimensions of epistemological beliefs, there was one significant difference reported in this study. The certainty/simplicity of knowledge was the only dimension that had a significant difference between preservice and inservice teachers. With the mean scores of 1.9 and 2.0, it was obvious that the preservice teachers were slightly more advanced in epistemological beliefs than the

inservice teachers (high score indicated agreement with less sophistication). The literature reviewed also indicated that constructivism was the preferred learning pedagogy in American education. As a result, all standards and benchmarks are designed based on constructivist philosophy. For this reason, this finding should not be a big surprise as preservice teachers are constantly reminded in the classroom to see knowledge as complex and interrelated. Apart from the constant emphasis, examinations and other course assignments in their program all center on constructivist thinking. Based on the repetition and reinforcement within the program, it is likely that preservice teachers will behave more as constructivist.

In contrast to preservice teaching and learning context, inservice teachers are not necessarily supervised on a daily basis to view knowledge as fluid and closely interrelated. Again, inservice teachers are daily confronted with making decisions on the most effective ways to help their students pass standardized tests. In their attempt to make such decisions, there are situations where inservice teachers might be pressured to teach to the test by helping their students to memorize factual information in order to be able to pass their mandated state tests with standardized answers. In the midst of all these situations, it will be slightly more difficult on the part of inservice teachers to consistently view the nature of knowledge as tentative and closely interrelated than preservice teachers. This situation might possibly explain why some inservice teachers use teacher-centered method of learning (transmission).

Jacobson et al. (2010) studied the epistemological beliefs of one thousand eight hundred and eighty-two inservice teachers in Singapore. They reported that inservice teachers did not make instructional decisions, based on the nature of knowledge and the process of knowing. Rather, inservice teachers' instructional practice was based on their students' learning, thus the caliber of students they needed to prepare for examination. So, if students were supposed to

prepare for examination, it was more likely for these teachers to think about how to help their students to pass their examinations and not necessarily how their beliefs affect their practice. Lavigne (2014) found that it took between three to four years before inservice teachers began to reflect on their instructional practice and revise them accordingly. From this finding, it is more likely that inservice teachers might adopt instructional practice that will not relate to their beliefs. Therefore, in order to avoid a situation where inservice teachers will continuously demonstrate less advancement in their epistemological beliefs, the concept of epistemological beliefs should be part of the professional development curriculum. In this way, the inservice teachers will likely be more conscious and reflect on how their epistemological beliefs may impact their teaching in the classroom.

Differences in epistemological beliefs dimensions. There were significant differences between the four dimensions of both preservice and inservice teachers. Within the preservice teachers, there were significant differences in the four dimensions. These differences were also found with the inservice teachers as well. As discussed above, the average ratings for preservice teachers' epistemological dimensions were certainty/simplicity of knowledge ($m = 1.9$); source of knowledge ($m = 2.3$); justification for knowing ($m = 3.4$); and attainment of truth ($m = 2.8$). The inservice teachers' epistemological dimensions indicated: certainty/simplicity of knowledge ($m = 2.0$); source of knowledge ($m = 2.3$); justification for knowing ($m = 3.4$); and attainment of truth ($m = 3.0$). Bearing in mind that higher score indicates less sophistication, it was observed that the level of epistemological development of preservice and inservice teachers was not the same across all four dimensions. Certainty of knowledge dimension attracted the highest ratings of 1.9 and 2.0 for preservice and inservice teachers respectively; whereas justification for knowing dimension had 3.4 for preservice and inservice teachers.

By implication, both preservice and inservice teachers did not demonstrate more advanced epistemological beliefs in all four dimensions. The question is what does each of the four dimensions of epistemological beliefs system represent? What will be the possible impact on instructional practice if preservice and inservice teachers are demonstrating somewhat less sophistication in a particular dimension of epistemological beliefs? Since the concept of an epistemological beliefs system is the belief about the nature of knowledge and the process of knowing (Hofer & Pintrich, 1997), there are ramifications when teachers demonstrate less sophistication in a particular dimension. In this way, teachers will not possibly have holistic beliefs about what knowledge stands.

The differences in the epistemological beliefs dimensions have been demonstrated in other studies (Cheng, et al., 2009). For example, Yilmaz-Tuzun, and Topcu, (2008) found that preservice teachers did not have the same level of epistemological development in four out of the five epistemological dimensions, according to Schommer epistemological beliefs questionnaire (certainty of knowledge, control of knowledge, source of knowledge, speed of knowledge, and structure of knowledge). Also, Tanase and Wang (2010) reported that whereas some teachers easily changed their epistemological beliefs at the end of a course, others maintained the same epistemological beliefs. From these two studies, it can be inferred that it is common for teachers to demonstrate different levels of sophistication in their epistemological beliefs. Tanase and Wang (2010) discussed some interventions used in the course of the semester to help preservice teachers improve on their epistemological beliefs. Their study gives some assurance of the availability of interventions that can help teachers to become more sophisticated in specific dimensions.

From the results, both preservice and inservice teachers were slightly more advanced in the certainty/simplicity and the source of knowledge dimensions than the justification and attainment. The advanced epistemological beliefs in these two dimensions (certainty/simplicity and source) implied that both preservice and inservice teachers were more likely to believe that knowledge is more fluid and resides in them as compared to knowledge being owned by authorities or experts. It also implied that both preservice and inservice teachers were more likely to construct new knowledge as a result of interaction.

On the other hand, the poor mean scores reported in the justification for knowing and attainment of truth dimensions indicated that preservice and inservice teachers were likely to use personal observation and what feels right as evidence to check the accuracy or correctness of knowledge. They were more likely to believe that authorities and experts could easily get to the true knowledge. When knowledge seems uncertain, it is likely that preservice and inservice teachers would possibly evaluate information based on what feels right to them (Hofer, 2000). As teachers, they are expected to “use rules of inquiry and begin to personally evaluate and integrate the views of experts” (Hofer, 2000, p. 381). Thus, they will be in a better position to help their students to distinguish between valid knowledge from opinions and fads. At the end of the instructional process, if inservice teachers fail to inculcate into their students the skills to discriminate between the authenticities of knowledge kinds, their students are more likely to accept information from informal sources.

It is important for teachers to have a holistic belief about the nature of knowledge and the process of knowing. The responsibility of teachers, unlike other professions, is to consciously help students to learn so as to be able to solve personal and societal challenges of life. To do this, teachers need to possess the right beliefs about knowledge in order to be able to effectively take

this challenge in the classroom. For this reason, the inservice teacher must be well-prepared to demonstrate sophistication in all four dimensions of knowledge (certainty/simplicity of knowledge, source of knowledge, justification for knowing, and attainment of truth). Deficiency in any of the dimensions will imply that teachers will not be likely to help their students to develop in that particular dimension of epistemological beliefs. For example, less sophistication in the certainty/simplicity of knowledge means teachers are likely to demonstrate to their students that knowledge is stable and unrelated. By looking at the meaning of each of these dimensions and the possible impact on students when teachers demonstrate less sophistication, it is more likely to affect the students adversely. Therefore, the need exists to put a program in place to periodically monitor inservice teachers' epistemological beliefs. With a comprehensive epistemological beliefs profiling, such data will be a resource when designing possible interventions for inservice teachers to help them develop in the areas where they demonstrate weakness.

Based on the significant difference found between preservice and inservice teachers' certainty/simplicity of knowledge dimension; the poor Cronbach alpha loadings among preservice teachers' epistemological dimensions coupled with the difference found between 1-10 and 11-20 years of teaching of the inservice teachers' source dimension, the data seem to suggest that there might be a possible difference between preservice and inservice teachers' epistemological beliefs. Though such speculation is possible, this study did not find enough support, hence, the retention of the null hypothesis.

Research Question 2: Differences in Instructional Practice

Research Question 2 asked: What are the differences in preservice teachers' projected, and inservice teachers' actual instructional practice?

Based on the research premise that preservice teachers were trained in constructivist learning environment (Lektorskii, 2010), the researcher wanted to find whether there was a significant difference between the projected instructional practice of preservice teachers and the current instructional practice of inservice teachers. Interestingly, both preservice and inservice teachers had a mean of 2.1 and 2.2 respectively. There was no significant difference between the projected instructional practice of preservice teachers and the actual instructional practice of inservice teachers.

By this result, it implied that if preservice teachers were to start their professional teaching today, they would have adopted more constructivist learning pedagogies like their inservice counterparts. The result also implied that the number of years in teaching as well as the experiences of inservice teachers did not translate into improved instructional practice over the preservice teachers. Therefore, both preservice and inservice teachers were likely to demonstrate similar level of pedagogical knowledge in the classroom. The results that the projected instructional practice of preservice teachers was more constructivist was an indication that the teacher education program of this Upper Midwestern University was in line with the preferred instructional practice of K-12 education in the United States.

It was demonstrated that the preservice teachers projected slightly advanced instructional practice choices than the actual instructional practice of the inservice teachers by comparing their mean scores. Lastly, the instructional practice of the inservice teachers, as reported in this present study, did not find evidence to support previous literature of inservice teachers reverting to the use of more traditional pedagogies (Lektorskii, 2010). Since more inservice teachers were adopting teaching and learning strategies that were more traditional according to previous research, the inservice teachers in this study were less likely to adopt instructional practice that

were traditional in nature despite having somewhat average epistemological beliefs (2.5 and 2.2 representing epistemological beliefs and instructional practice respectively).

Nonetheless, based on the response to item qua_2 (*I am more inclined to educational philosophy of?*), eighty percent (40 out of 50) of preservice teachers claimed to be constructivist, whereas 58% (47 out of 81) inservice teachers rated as constructivist. Similarly, eighteen percent of preservice teachers showed that they were behaviorist against 34% inservice teachers. In comparison, it seemed this information provided by both preservice and inservice teachers on their educational philosophy did not have a significant impact on the instructional practice ratings. It is hard to comprehend why preservice and inservice teachers with such percentage difference in their philosophical paradigms would end up using similar instructional practice in their classroom. Perhaps, both preservice and inservice teachers did not have an accurate understanding about behaviorist and constructivist philosophy and how that should inform their practice. If this assumption is true, then the self-report data might not have been 100% reliable. Therefore, the findings and interpretation reported here should be taken with caution.

Differences in instructional practice based on years of teaching. The difference in the instructional practice of inservice teachers based on years of teaching is worth-discussing. As presented in the previous chapter, there was a significant difference between teachers who have taught between 1-10 and 31-40 years. Based on their mean scores, teachers within their first ten years of teaching were more likely to use constructivist learning pedagogies than their counterparts who have taught for 31-40 years. From this finding, one might be tempted to conclude that the longer inservice teachers stay in the teaching profession, the less constructivist they become. However, it can be argued that teachers who have taught between 31-40 years were

not necessarily trained in constructivist learning environment, based on when constructivism became the preferred pedagogy in the United States.

From the significant difference found between inservice teachers who have taught between 1-10 and 31-40, it might be a logical conclusion that there should be a difference between preservice and inservice teachers. However, there were only eleven inservice teachers who had taught between 31-40 years as compared to thirty-two in their first ten years. Based on the overall averages of the different years of teaching categories, it was statistically inadequate to make a significant difference between preservice and inservice teachers. For example, out of the eighty-one inservice teachers, fifty had twenty or less years of teaching experience. With this number of inservice teachers, it is more likely that the instructional characteristics of teachers within this bracket would be more similar to the projected instructional characteristics of preservice teachers than inservice teachers who had taught for more than twenty years.

Further analysis of the inservice teachers who had taught between one and thirty-nine years revealed interesting information. Among the four categories of years of teaching (1-10, 11-20, 21-30, and 31-40), only the inservice teachers with thirty-one to forty years of teaching experience had a significant correlational relationship between epistemological beliefs and instructional practice ($r = .79, p = .004$). The veteran teachers seemed to be confident with their teaching. Therefore, they were more likely to practice what they believed. On the other hand, inexperienced teachers were not confident with their own teaching practice and seemed to be struggling with positioning themselves in the school. In this case, the internal beliefs system may not be as a prominent guide as external pressure (workload, meeting standards, etc.) in inservice teachers' decision making and might result in the inconsistency between their epistemology and instructional practice.

The correlational relationship found in this study between the overall epistemological beliefs (summation of all four dimensions) and instructional practice was predominantly due to the impact of inservice teachers within the 31-40 years of teaching category. From the data, it seemed to suggest that inservice teachers with more than thirty years of teaching experience were more likely to use less constructivist learning pedagogies than those who have taught less than thirty years. So, if there were more inservice teachers with more than thirty years of teaching experience included in this study, the result might have been possibly different from what was reported.

Looking at the time constructivism became the most preferred learning pedagogy in the United States, it is possible that teachers, who graduated in the 1970s and 80s, were not possibly trained to adopt constructivism in the teaching and learning process in comparison to those who were trained a decade ago. In this situation, it would be unreasonable to conclude that these veteran teachers have reverted from constructivist learning pedagogies. In actual sense, these older inservice teachers might have maintained the use of more traditional learning pedagogies all along. From this analysis, it can be inferred that the years inservice teachers have taught should be taken into consideration when making conclusions about their preferred learning pedagogies. As demonstrated in this study, the eleven inservice teachers with more than thirty years of teaching experience were the reason for the correlational relationship between epistemological beliefs and instructional practice. This impact might have been due to their confidence level to teach based on what they believed.

Reasons for similar instructional practice of participants. The finding that there was no difference between preservice and inservice teachers' instructional practice seems strange. However, the context of this research, nature of the teacher education preparatory programs as

well as the professional development curriculum could possibly play a role in this finding. For example, due to the close collaboration between the universities and the various school districts across the state, there is the possibility that university professors as well as the professional development educators would be conscious of the use of common standard or curriculum for both teacher preparation and professional development learning modules. A common curriculum for preservice and inservice teachers could lead to similar instructional practice, especially if these instructional decisions are based on evidential research. In the Race to the Top initiative, schools are encouraged to make better use of data to improve their instructional practice. Therefore, if teacher education faculty and school district instructional leaders are using data-driven decisions, they are more likely to pursue constructivist instructional practice.

Also, both preservice and inservice teachers are required to have a license or renew an old license before they are hired to teach across the state. The process involved in the acquisition of the license requires preservice teachers to have content knowledge about the preferred instructional practice (constructivist) as enshrined in the standards and benchmarks. Within the context, inservice teachers are required to take certain number of courses for renewal of licensure. Some inservice teachers identify themselves as behaviorist whereas others ascribe to constructivism. When it comes to the renewal of teaching license, both constructivist and behaviorist inservice teachers need to fulfill the requirements of the State Department of Public Instruction before their license is renewed. Therefore, it is possible that the common instructional practice required by the State Department of Public Instruction might have influenced preservice teachers, who are almost about to graduate and inservice teachers who are mandated to periodically renew their teaching license. With such condition, it is more likely that both preservice and inservice teachers might rate similar instructional practice in this self-report scale.

Furthermore, the location within which this study was conducted was a closely knit community. As one of the food baskets for the nation, most people own farming and oil lands, which are later passed on to the younger ones. As a result, most natives stay within the state and take various employment opportunities. Also, the state is increasingly harmonizing its academic activities through the State Department of Public Instruction. For example, most of their schools use the same software applications provided by the State. In such a situation, it is more likely that majority of the inservice teachers within the school district might have graduated from the university within the school district and have accepted teaching positions within the area. In such context, it will be possible to have similar instructional practice characteristics between preservice and inservice teachers.

Another reason why both preservice and inservice teachers would not show any difference in their instructional practice could be the level of preservice teachers in their program of study. At this point, all preservice teachers enrolled in the seminar course had taken all requisite methods courses in the teacher preparatory program. In most of the methods courses, preservice teachers are required to put in considerable amount of hours of observation at the various schools (not less than thirty hours in most cases). This experience begins as early as when preservice teachers enroll in the introduction to education course. Again, majority of these preservice teachers had either completed or were still doing the mandatory practicums. Exposure to the field experience could possibly afford the preservice teachers contextual and experiential knowledge within the school. As they work more and more with inservice teachers, who might be already practicing more constructivists learning practices, there is the possibility of preservice teachers projecting instructional practice similar to the inservice teachers.

Inconsistencies between Preservice and Inservice Teachers. With these assumptions as possible reasons that could account for the lack of significant difference in the instructional practice between preservice and inservice teachers, the qualitative data gave an additional lens in looking at this phenomenon. As explained earlier, item qua_3 (*Which of these cause(s) discrepancies between what you believe and what you practice in the classroom*) required constructivist preservice and inservice teachers to rate factors that could possibly account or accounted for their inability to practice their educational philosophy in the classroom. This descriptive information has several points worth-considering.

Workload and mandated state standardized test. While 59.6% (28 out of 47) of inservice teachers believed that they were not teaching according to their beliefs due to the *workload* in the classroom, forty percent (16 out of 40) of preservice teachers thought that *workload* would be a possible hindrance in their teaching career. The higher percentage among the inservice teachers was an indication of their acknowledgement of the impact of workload on their instructional practice. However, based on the number of preservice teachers who identified themselves as constructivist (40 out 50), it seemed they did not have the full grasp of the enormous responsibilities expected of the classroom teachers. Such misconception might have led to preservice teachers projecting more constructivist instructional practice with less possible impact of workload on their instruction.

Both preservice (72.5%) and inservice teachers (63.8%) had higher percentages for the *mandated state standardized test*. This result seemed to suggest that the preservice teachers did not necessarily need to be in the classroom for a longer time in order to grasp the importance of helping students to pass mandated standardized tests. Across the board, one of the distinguishing features of a successful school is its ability to help the students pass the mandated state

examinations. As a result, there are several teachers who have resorted to teaching to test in order to secure their jobs in their schools and not even realizing that a test can be used as effective tool to enhance learning and retention (Boulet, 2008). Agreement on mandated state standardized tests might have led to the choice of more traditional instructional pedagogies over constructivism. Some experts believe less guided instruction does not help students to gain the required proficiency (Kirschner, Sweller & Clark, 2006). On the contrary, both preservice and inservice teachers reported somewhat advanced instructional practice without a significant difference as indicated by the independent samples t test.

Cady, Meier & Lubinski (2006) observed that newly trained teachers reverted to traditional method of teaching due to the enormous job-related challenges that were placed on them. Vogell (2010) reported that there was a monthly convocation in the state of Georgia, where elementary, middle and high school teachers were acknowledged on their ability to help their students to adequately pass the state mandatory examination. By implication of these two studies, teachers would be pressured to adopt more traditional instructional practice in order to be able to manage the teaching workload as well as ensure students make adequate yearly progress as required (NCLB Act, 2001). In this particular situation, despite the various constraints discussed above, preservice and inservice teachers were more likely to maintain constructivist instructional practice.

Interestingly, both preservice and inservice teachers did not seem to be influenced by the constraints (workload, mandated standardized tests, etc.) on the relationship between overall epistemological beliefs and overall instructional practice scale. However, a further Pearson correlation test for just the constructivist preservice and inservice teachers (participants who rated themselves as constructivist) indicated otherwise. For constructivist preservice teachers,

there was a significant correlational relationship between epistemological beliefs and projected instructional practice. This relationship implied that the various constraints were not likely to influence constructivist preservice teachers to adopt more traditional learning pedagogies. The preservice teachers' self-report was based on their projected instructional practice, which could be different from their actual practice. After the Pearson correlation test with constructivist inservice teachers (only inservice teachers who rated constructivist), there was no correlational relationship between epistemological beliefs and actual instructional practice. The results seemed to indicate that constructivist inservice teachers were not likely to adopt instructional practice, based on their educational philosophy. By implication, the constraints (workload, mandated testing, Common Core, etc.) were more likely to prevent constructivist inservice teachers from practicing based on their beliefs.

With similar mean differences for the instructional practice scale of 2.0 and 2.1 for constructivist preservice and inservice teachers, it was surprising that the overall instructional practice score for both constructivist and behaviorist preservice and inservice teachers were slightly less advanced (2.1 and 2.2 for preservice and inservice teachers respectively). One would have expected the constructivist participants to have more advanced instructional practice than the instructional practice of both behaviorist and constructivist participants put together. Again, based on the number of preservice (40 out of 50) and inservice (47 out of 81) teachers who indicated being constructivist, there was an expectation of a significant difference between the mean scores of only constructivist and the overall preservice teachers' instructional practice. However, a significant difference was not expected between the instructional practice of constructivist and overall inservice teachers (47 out of 81).

Fear of trying something new. Fear was one of the factors that participants felt would prevent them from practicing their educational philosophy. On this factor, preservice and inservice teachers rated differently. From the data, twenty-two percent (9 out of 40) of preservice teachers agreed, whereas only 4.3% (2 out of 47) inservice teachers thought *fear of trying something new* would be an issue why they would not be able to practice their beliefs. This response made sense to the researcher due to the circumstances within which preservice teachers are hired and fired. By the nature of teachers' conditions of work, new hires are expected to sign a performance contract with clearly stated expectations to be met. Teachers are retained or rehired, based on the fulfillment of these conditions. Katz (1972) observed that beginning teachers focused more on measures that would help them to survive during their first year of teaching and gradually shift attention to their students' needs. In such an environment, it would not be the best option for newly trained teachers to be experimenting the new strategies and methodologies learned at college. It would be a possibility that novice teachers would adopt instructional strategies of teachers who perform well on state standardized tests without consideration of their educational philosophy.

Hong and Greene (2011) found that preservice teachers articulated more fears in the school at the commencement of their professional teaching career. Also, Stoner and Brause (1998) observed that preservice teachers carried many fears, especially on the first day of school. In terms of the enormous impact of fear on preservice teachers coupled with the percentage that rated *fear in trying something new* over inservice teachers, the difference should have impacted their choice of instructional practice. Unfortunately, it was not demonstrated in this research. Since preservice teachers are yet to experience these constraints in real life situation, it is

possible to rate their responses without reflecting deeper on the implications of the constraints on their instructional practice.

For example, the constructivist preservice teachers' epistemological beliefs had a correlational relationship with their projected instructional practice despite the possible constraints. Behaviorist preservice teachers did not have a correlational relationship between their epistemological beliefs and projected instructional practice ($r = .58, p = .08$) though the p value was close to the 0.5 cut point. It was expected that behaviorist preservice teachers would project more traditional learning pedagogies. This assumption was due to the possibility of behaviorist preservice teachers not likely to be influenced so much by the constraints (workload, mandated testing, Common Core, etc.) as compared to the constructivist preservice teachers. The finding indicated a small p value that seemed to suggest the possibility of a significant relationship. The inability of behaviorist preservice teachers to show a significant correlational relationship is another indication of preservice teachers' possible failure to reflect deeper on the survey items before their response.

In comparison, inservice teachers are more familiar with the school environment and might know what to do in order to be able to meet the conditions of their contract. In this situation, inservice teachers might not possibly have the issue of proving their worth in the classroom. With a secured job and possibly aware of what is expected of them is an indication of the absence of fear in the teaching and learning process. The Pearson correlational relationship for behaviorist inservice teachers indicated that these teachers were more likely to adopt their instructional practice based on their epistemological beliefs. From this analysis, it is obvious that preservice teachers are more likely than inservice teachers to entertain more fears in adopting instructional practice to reflect their epistemological beliefs.

With such fears, it is likely that preservice teachers will be pressured to adopt the default methods of teaching (traditional learning methods). Even with such a condition, preservice teachers are still likely to struggle with the ability to teach based on their epistemological beliefs. The presence of fear should have led to a significant difference in the instructional practice of preservice and inservice teachers. As noted elsewhere, it may be that preservice teachers did not think through some of these challenges and their impact on their instructional practice before making the projection. On the inservice teachers' part, it is not a surprise if fear did not seem to have impact on their instructional practice.

Common core state standards. The *Common Core Standards* option was rated 17.5% by preservice teachers whereas inservice teachers rated it as 14.9%. By implication, both preservice and inservice teachers had knowledge about the program. Again, about 15% of both preservice and inservice teachers rated the *Common Core Standard* as one of the reasons why they would not be teaching, based on their epistemological beliefs. This percentage was a demonstration of how the intervention had impact on teachers. It would have been a surprise to the researcher if preservice and inservice teachers had rated the Common Core Standards higher. The *Common Core Standard* had been in operation since 2010 (Common Core Standard Initiative, 2010). It is possible that both preservice and inservice teachers did not have much information about it due to the time the state joined the initiative. Therefore, it was not expected that the *Common Core Standards* would lead to major differences in the instructional practice of both participants. The similar ratings could partly explain why there was similar perception of preservice and inservice teachers' instructional practice.

It can be speculated that the introduction of the *Common Core Standard* is one of the examples of the fundamental problems that usually confront the educational system when it

comes to introducing a new intervention. In an attempt to introduce new ideas into education, there are times when preservice teachers are ignored in the process. Instead, such reforms could have started with preservice teachers who are still at their various stages of their training. Starting with preservice teachers is likely to give them the tool set needed to be effective, reflective and efficient teachers in applying the new intervention during professional teaching.

Porter et al. (2011) observed that there was the need for coordination between the Common Core project and the teacher education program. In agreement with Cobb and Jackson (2011), the researchers explained that “Quality was difficult to define and assess” (p. 186). When a conversation is started among the various stakeholders, there is the possibility of a better understanding of what the end result should be and how to get there. Therefore, exposing students to such reforms might possibly give them the opportunity to discuss and reflect upon such reforms for deeper understanding before they begin their professional teaching in the classroom. If the Common Core Standard is the embodiment of the skill set that preservice and inservice teachers will be required to demonstrate, then their instructional practice in the classroom must be at the center so as to help preservice teachers to avoid reverting to the use of more traditional pedagogies after college.

Inadequate knowledge in practicing constructivism. Preservice and inservice teachers demonstrated a marked difference in terms of the rating for inadequate knowledge on how to practice their educational philosophy. Thirty-two and half percent (32.5%) of preservice teachers thought they would not be able to practice their epistemological beliefs due to their inability to translate their educational philosophy into meaningful teaching and learning experience. On the same question, only 10.6% of inservice teachers thought they did not know how to teach, according to their educational philosophy in the classroom. The response implied that the

inservice teachers were more confident of their ability to teach, based on their educational philosophy than the preservice teachers. However, whereas inservice teachers' (81 participants) overall epistemological beliefs had a significant correlational relationship with instructional practice ($r = .27, p = .02$), a fraction of the inservice teachers who rated constructivist (47 out of 81) did not indicate a significant correlational relationship ($r = .08, p < .74$).

On the other hand, the preservice teachers, who were presumed to be not confident to practice based on their beliefs, had interesting information. The separate Pearson correlation tests between epistemological beliefs and instructional practice for all preservice teachers (50 participants), and constructivist preservice teachers (40 participants) had significant correlational relationships ($r = .43, p = .002$ and $r = .38, p = .02$ respectively). In comparison, the preservice teachers seemed to be more likely to adopt instructional practice, based on their educational philosophy than the inservice teachers. It can be inferred that the inservice teachers were overconfident of their ability to practice their educational philosophy without any hindrance. The data bring a relevant point when analyzing and interpreting only self-report data. There is the possibility of participants giving a wrong assessment of what they are capable of doing. Dunlosky and Rawson (2012) observed that overconfidence leads to underachievement and wrong self-evaluation of teachers. Such a tendency has negative impact on students' learning. Under this circumstance, the further statistical analysis on the constructivist inservice teachers serves as a triangulation mechanism to check the reliability of the information preservice and inservice teachers provided.

The percentage of preservice teachers who indicated inadequate knowledge did not influence their instructional practice projection. Neither did the inservice teachers' data have an impact on their instructional practice. This percentage rating implied that inservice teachers were

more confident than preservice teachers to apply their instructional practice. However, the independent sampled t test on instructional practice indicated that preservice teachers were slightly more constructivist than inservice teachers. Over a third of the preservice teachers projected inability to practice based on their educational philosophy. This finding implies the need for educators to build the confidence levels of preservice teachers. When preservice teachers are confident of what they are capable of doing, it is more likely to motivate them to continue to work hard and impact positively on their students.

Kang (2008) suggested the need for teacher educators to discuss the constraints of constructivism with their students. To expound on the above information, Rose and Rogers (2012) wrote that “As teacher educators, we can help students to critique dominant pedagogical beliefs...empower them to implement the kind of practices that most benefit young children” (p. 55). One of the best ways for teacher educators to influence the instructional practice of preservice teachers is to model what they expect their students to learn in the course of the teaching and learning process. With such an approach, preservice teachers will contextually have better perspective of what constructivism entails in real life world. With better perspective on constructivism, there is the possibility that preservice teachers might be more reflective on their instructional choices in spite of the constraints that come their way. Such an approach will be a helpful way to imbue preservice teachers with the right set of instructional tools to survive in the classroom.

Pressure from the school administration. Furthermore, the response to *pressure from the school administration* was also interesting. Over half of the preservice teachers (55%) were positive that pressure from school administration would be a problem whereas 25.5% of inservice teachers had a similar belief. If over half of constructivist preservice teachers felt they

would be pressured to adopt methods that would not align with their beliefs, it is interesting that they could still project more constructivist instructional practice in the midst of the pressure. In one sense, preservice teachers are yet to be in the classroom, and for that reason, there is the possibility that preservice teachers were unable to realize the enormity of the pressure from the school administration on their instructional practice. Rose and Rogers (2012) reported that there were scores of pressure from different sources to force preservice teachers to use learning strategies that they were not prepared for in their teacher education program. The question is if some teachers have acted differently based on the pressure, how would that be different from preservice teachers in this study? Because the answers to such questions were beyond the scope of this research, there would be the need for qualitative research to investigate deeper into whether there is a difference in the instructional practice of preservice and inservice teachers.

Beyond the factors discussed as possible reasons for teachers' inability to organize their instructional practice based on their epistemological beliefs, twelve (12%) of inservice teachers provided some additional reasons why they were not able to teach, according to teaching based on the constructivist educational philosophy. Preservice teachers did not indicate additional factors. Inservice teachers reported poor planning, time constraints, nature of textbooks, money, and individual differences as other reasons that accounted for discrepancy between epistemological beliefs and instructional practice. With these constraints in mind, it was beyond the understanding of the researcher to find no significant difference between preservice and inservice teachers' instructional practice.

Research Question 3: Relation between Epistemology and Instructional Practice

Research Question 3 asked: What are the relationships between preservice and inservice teachers' epistemological beliefs and their instructional practice?

One of the main reasons why this research project was undertaken was to look into the extent to which the epistemological beliefs of preservice and inservice teachers related to their instructional practice. Here, the researcher was curious to find out whether there was any significant relationship at all and whether the correlational relationships were either positive or negative. The results obtained from this statistical analysis are discussed below.

Overall epistemological beliefs and instructional practice. As indicated in Chapter Four, there were interesting findings reported in this study. Most importantly, there is evidence from this study to support previous literature on the relationship between the overall epistemological beliefs system and instructional practice. Both preservice and inservice teachers' overall epistemological beliefs (summation of all four dimensions) had a significant correlational relationship with instructional practice. With $r = .43^{**}$, $p = .002$, and $r = .27^*$, $p = .02$ for preservice and inservice respectively, the data suggested a stronger correlation between preservice teachers' epistemological beliefs and their projected instructional practice than the inservice teachers. This result seemed to imply that the preservice teachers' instructional practice was more likely to be in line with their epistemological beliefs than were inservice teachers. Empirically, there was a significant correlational relationship between epistemological beliefs and instructional practice. Conceptually, the significant correlational relationships were possible as a result of the statistical power of certainty/simplicity of knowledge (for both teachers) and source of knowledge (for only preservice teachers) dimensions. For this reason, the finding should be explained with caution in order not to over extrapolate what it means in practical terms.

Interestingly, this finding was also consistent with the responses of both preservice and inservice teachers to item qua_2 (*I am more inclined to educational philosophy of?*). Where 80%

of preservice teachers indicated being constructivist, only 58% of inservice teachers declared being constructivist. The finding that more preservice teachers indicated more constructivist is consistent with the theoretical framework of this study where teachers were trained in a constructivist learning environment. This finding may be partly due to the number of years preservice teachers have spent in college as well as the impact of the constructivist learning environment on them. By the time students graduate from college, they would have identified themselves with constructivism. On the other hand, the percentage of the inservice teachers did not align with their instructional practice. That is, if 58% of inservice teachers rated as being constructivist, the remaining 42% should have rated less constructivist on the instructional practice scale. By this rating, it would have changed the overall instructional practice of inservice teachers.

Comparison of constructivist and behaviorist preservice teachers. The researcher wanted to have better perspective of the educational philosophy of preservice teachers, based on how each of the two paradigms related to instructional practice. The preservice teachers who indicated being constructivist (80%) were selected from the fifty participants. The Pearson correlation coefficient indicated that constructivist preservice teachers' epistemological beliefs had a correlational relationship with their projected instructional practice ($r = .38, p = .02$). These constructivist preservice teachers had a mean score of 2.4 and 2.0 for epistemological beliefs and instructional practice respectively. The preservice teachers were more likely to adopt instructional practice based on their epistemological beliefs. The 20% behaviorist preservice teachers did not show a correlational relationship between epistemological beliefs and instructional practice ($r = .58, p = .08$). The finding implied that constructivist preservice teachers seemed to be more likely to adopt student-centered instructional practice in spite of the

constraints that could prevent them from practicing their beliefs. The behaviorist preservice teachers might not be able to adopt instructional practice based on their educational philosophy. The behaviorist preservice teachers had mean scores of 2.5 and 2.1 for epistemological beliefs and instructional practice respectively.

Comparison of constructivist and behaviorist inservice teachers. As demonstrated in this study, there was a significant relationship between the overall epistemological beliefs and instructional practice of inservice teachers. Based on the response to item qua_2 (*I am more inclined to educational philosophy of...constructivism/behaviorism?*), further analysis was done to see whether the constructivist inservice teachers' epistemological beliefs related to their instructional practice. After the Pearson correlation test was administered, there was no significant correlational relationship between epistemological beliefs and instructional practice with $r = .05$ and $p = .74$ of constructivist inservice teachers. This finding seemed to indicate that inservice teachers were not likely to adopt instructional practice, based on their epistemological beliefs due to a number of constraints. The constructivist inservice teachers had a mean of 2.5 and 2.1 for epistemological beliefs and instructional practice respectively.

At the same time, the Pearson correlation test was administered to check the relationship between epistemological beliefs and instructional practice of inservice teachers who rated themselves as behaviorist. The analysis revealed that epistemological beliefs of the behaviorist inservice teachers had a significant positive correlational relationship with $r = .48$ and $p = .006$ and mean scores of 2.6 and 2.2 for epistemological beliefs and instructional practice. The finding implied that the 34% of inservice teachers, who indicated being behaviorist, were more likely to adopt more traditional instructional practice as they were constrained by workload, mandated testing, etc.

The above findings bring into perspective two important things worth discussing. First, it is more likely that inservice teachers with constructivist learning philosophies might not be able to teach, based on their epistemological beliefs due to the certain constraints. Second, behaviorist inservice teachers are more likely to adopt instructional practice, based on traditional learning pedagogies. With such revelation, the findings seemed to suggest that majority of inservice teachers (both constructivist and behaviorist teachers) seemed to be using traditional learning pedagogies in their classrooms. This conclusion confirms the previous literature that inservice teachers gradually reverted to the use of more traditional learning methods. The exception is that there are teachers who might have been using traditional learning methods. In this case, they might not have necessarily reverted to more traditional methods. Rather, they might have been consistent in the use of traditional methods all along their teaching. Nonetheless, the current standards and benchmarks are designed with constructivist philosophical foundation. There is the possibility that inservice teachers would struggle to stay within such standards and benchmarks. When this happens, it will have adverse effect on students' learning and development.

In comparison with the preservice teachers, the results from both participants were directly opposite to each other. Where constructivist preservice teachers had a significant correlational relationship between epistemological beliefs and instructional practice, constructivist inservice teachers did not. On the other hand, whereas behaviorist inservice teachers had a correlational relationship between epistemological beliefs and instructional practice, the behaviorist preservice teachers did not. However, the behaviorist preservice teachers had a lower p value closer ($r = .58, p = .08$). This finding seemed to show that there is still some possibility of a correlational relationship. Also, the preservice teachers gave a projection of their instructional practice as compared to the actual instructional practice of inservice teachers. With

such projections, it is likely some of the participants might not have reflected deeply on what it takes to be a behaviorist before responding to the survey.

Preservice teachers' epistemological dimensions and instructional practice. Among the preservice teachers, correlation analysis indicated that two of the epistemological beliefs dimensions (certainty/simplicity of knowledge, and source of knowledge) had a positive significant correlation with instructional practice. Where the certainty of knowledge dimension had a moderate correlation ($r = .61, p < .001$), source of knowledge had a weak significant correlation ($r = .33, p = .02$). The significant correlational relationships implied that a development in the certainty/simplicity and source of knowledge dimensions of epistemological beliefs was likely to lead to preservice teachers becoming more constructivist. These two dimensions confirmed the findings of previous literature that epistemological beliefs related to instructional practice (Brownlee, 2003b; Hofer, 2001; Hofer & Pintrich, 1997; Pajares, 1992). The more preservice teachers believed knowledge was more fluid, closely interrelated, and constructed through interaction, the more they were to create student-centered learning environment (constructivist).

Conversely, two dimensions had insignificant negative correlations with instructional practice (justification and attainment). This finding illustrated the complex nature of the epistemological beliefs system. It was demonstrated that not all of the dimensions of epistemological beliefs developed at the same pace. With insignificant relation between justification, attainment and instructional practice, preservice teachers were likely to have difficulties in using evidence to discriminate between different kinds of knowledge claims. At this point, preservice teachers were likely to use observation and what feels right as criteria to validate knowledge instead of using step-by-step process of inquiry to evaluate the knowledge. It

can be inferred that preservice teachers with such lapses in their dimensions are more likely to accept or endorse certain kinds of knowledge without serious scrutiny. In this way, preservice teachers will not be good role models on validating knowledge claims to their students.

The ability of a student to discriminate between valid knowledge from opinions and assumptions is a higher-order learning skill that should be an important part of students' college education. For example, item jus_1 (*correct answers in the field of education are more a matter of opinion than fact*) required participants to critically evaluate between opinion and fact before they could respond to the survey. In this case, the need exists for effort and constant practice in order to be proficient in carrying out such a task. The Bloom's taxonomy places evaluation as a higher-order learning skill. In the same vein, the justification for knowing dimension requires rules of inquiry to validate the accuracy when discriminating about knowledge. Such activity will require extensive practice on the part of preservice teachers so as to become proficient in evaluating different kinds of knowledge. The need exists for further research into why there are differences in the development of epistemological beliefs dimensions. Findings from such research will give more insight to teacher educators on how to effectively help their preservice teachers to focus on developing holistic epistemological beliefs.

Inservice teachers' epistemological dimensions and instructional practice. Regarding the relationship between inservice teachers' epistemological beliefs dimensions and their instructional practice, the result was slightly different from the finding for the preservice teachers. The analysis showed only one positive significant correlational relationship between certainty/simplicity and instructional practice ($r = .50, p < .001$). Since this dimension represents the nature of the knowledge component (Hofer & Pintrich, 1997), it can be interpreted that inservice teachers with the epistemological beliefs that knowledge was ever-changing and

interrelated were more constructivist and were likely to make their instructional practice student-centered. The belief that knowledge is changing is a reasonable basis for inservice teachers to allow their students to actively participate in the classroom activities.

This finding is consistent with the previous literature that the more advanced in epistemological beliefs, the likelihood teachers use constructivist learning pedagogies (Hofer, 2001; Hofer & Pintrich, 1997; Pajares, 1992). However, this finding should be interpreted in its right context since it was just one out of the four dimensions of epistemology. The certainty/simplicity of knowledge was the only dimension with eight items. With a total of eighteen items, the certainty/simplicity alone was almost half of the total number of items. No wonder, the overall epistemological beliefs also had a significant positive correlational relationship with instructional practice. To calculate the overall epistemological beliefs, the dimension with the most number of items is likely to impact more on the overall mean score.

From another perspective, based on the years of teaching, the analysis indicated that only the eleven inservice teachers with 31-40 years of teaching experience had a correlational relationship between epistemological beliefs and instructional practice. Besides this category, none of the other year groups (1-10, 11-20 and 21-30) or combination of them had a significant correlational relationship. There would not have been any significant correlation relation if this group of inservice teachers had been left out of this study. It is interesting how the self-report ratings of the eleven participants could impact on the seventy inservice teachers and, eventually, lead to a significant correlational relationship.

The other three dimensions of inservice teachers' epistemological beliefs had insignificant negative relationship with instructional practice. This finding implied that the more inservice teachers were constructivist in the instructional practice scale, the less sophisticated

they were in the source, justification and attainment of truth dimensions of their epistemological beliefs. Based on the three dimensions that had insignificant relationships, it could be inferred that there was the possibility that inservice teachers had problems deciding whether to believe knowledge was based on an external figure and had to be transmitted or knowledge resided in themselves, which could be constructed through interaction (source). It also meant that their ability to discriminate between knowledge claims was somewhat at the elementary level (justification). At a time when teachers and researchers are still divided between the use of transmission, and construction as a way of helping students better retain information, inservice teachers should be given the needed training as well as extensive practice in order for them to have a refined beliefs on the process of knowing.

Previous literature indicated that teachers were trained in a constructivist environment but ended up using traditional methods (McKinney & Frazier, 2008; Smeaton & Waters, 2013). On the contrary, this finding suggested the opposite. In this case, both preservice and inservice teachers indicated a somewhat average epistemological beliefs but adopted more constructivists learning approaches in their classrooms. Chai (2010) found evidence that inservice teachers, who believed in knowledge transmission, made students passive recipients of information in their respective classrooms. Therefore, preservice and inservice teachers, showing negative insignificant relationships between the source, justification and attainment dimensions against instructional practice, were likely to believe more in external knowledge and make their students passive learners. Eventually they use observation as basis to check the accuracy or correctness of knowledge. The preservice and inservice teachers in the present study demonstrated something different, based on the data. Instead, where inservice teachers' instructional practice was more constructivists, they had a somewhat average epistemological beliefs system.

The correlational statistical procedure among all four epistemological dimensions indicated three main relationships among the dimensions. These were certainty/simplicity of knowledge with source of knowledge; certainty/simplicity of knowledge with attainment of truth; and attainment of truth with source of knowledge. As indicated above, all these significant correlations were positive in nature, and for that matter, it can be concluded that an increase in anyone of the dimensions mentioned led to a corresponding growth in the other dimension. Since positive significant correlational relationships were not reported among all the four dimensions of epistemological beliefs, it was a demonstration that between some dimensions, there was not a corresponding growth as the other dimension developed.

Hofer (2000) also reported three significant positive correlations among first year psychology students. Interestingly, two of these three significant correlations were between certainty/simplicity of knowledge against source of knowledge and attainment of truth as reported in this study. Apart from the consistency of this finding with Hofer (2000), the findings indicated a stronger statistical power of the certainty/simplicity dimension over the other dimensions. Such result is not a big surprise to the researcher since the certainty/simplicity dimension alone had eight out of eighteen items of the discipline-focused epistemological beliefs questionnaire. The need exists for further studies to explain why preservice and inservice teachers with somewhat average epistemological beliefs could still demonstrate more constructivist' instructional practice.

Implications for Practice

From the findings and discussions, it was identified that preservice teachers indicated being more constructivist in their projected instructional practice and, therefore, confirming the first part of this theoretical framework. However, data from the inservice teachers in this study

indicated that they still continued to use more constructivist instructional practice despite somewhat average epistemological beliefs. The next section is the discussion of the overall implications of the study.

Epistemological beliefs and teacher education. Despite the groundbreaking work by Perry (1970) and the popularity of the concept of epistemological beliefs, there seems to be an inadequate coordination between researchers in the epistemological beliefs' area and teacher education. In all the literature reviewed for this study, there was no evidence where state or a school district was incorporating the concept of epistemological beliefs into its teacher preparation programs or professional development curricula. Looking at those who have done extensive research in this area, it is likely that the concept of epistemological beliefs is popular in the psychology discipline. The popularity of the concept among psychologists seems to suggest that personal epistemology might still be a new concept to superintendents, principals, and educators as well as inservice teachers. For example, in one of the schools, one principal mentioned that it was his first time of hearing the term *epistemology*. There might be several others who are yet to become familiar with their own epistemological beliefs system and how that relates to their instructional practice.

Based on the significant correlational relationship between epistemological beliefs and instructional practice, the need exists for a conversation to begin among teacher educators and the school districts' leadership on how they could possibly identify and nurture both preservice and inservice teachers' epistemological beliefs as well as align them to their instructional practice. Kienhues, Bromme, and Stahl (2008) stated that many studies have reported that the more sophisticated teachers were in terms of their epistemological beliefs, the more they were capable of adopting positive instructional practices that translated into better student learning and

development. The need exists for practitioners of teacher education to liaise with researchers in this field of epistemology and identify possible ways to design interventions to benefit inservice teachers.

This study revealed that constructivist inservice teachers were not likely to practice, based on their epistemological beliefs since there was no correlational relationship between their epistemological beliefs and instructional practice. In all of the standards and benchmarks at the K-12 setting, they are designed based on constructivist philosophical principles. For this reason, if inservice teachers are not able to organize their teaching and learning environment based on constructivist principles, it is more likely that the goals and objectives for these standards and benchmarks might not be achieved. Hence, the need exists for a discussion and investment in the epistemological beliefs of the inservice teachers.

Inconsistencies in beliefs and instructional practice. One of the major findings identified in this study was that there was no significant difference between the overall epistemological beliefs of preservice and inservice teachers. The preservice teachers had slightly more advanced epistemological beliefs over the inservice teachers. Contrary to the expectation of the researcher, inservice teachers reported a somewhat average epistemological beliefs' development. The finding implied that several years of teaching and interaction with different stakeholders of education were possibly not an important factor in improving upon the epistemological beliefs of inservice teachers.

Since previous research has reported that epistemological beliefs filter the decisions of the teacher (Brownlee, 2003b), the need exists to help preservice and inservice teachers become conscious of their epistemological beliefs system and how that impacts their decisions. At the same time, preservice and inservice teachers should engage in academic activities that will help

to improve their epistemological beliefs. For example, Muis, Franco and Gierus (2011) used six repeated test sessions to measure how the epistemological beliefs of statistics students improved overtime. Moreover, educators can possibly try unguided teaching and learning strategies such as problem-based learning for the preservice and inservice teachers to reconsider how they perceive the nature of knowledge.

The comparison of each of the epistemological beliefs dimensions for both preservice and inservice teachers revealed a significant difference in only the certainty/simplicity of knowledge dimension. The certainty/simplicity of knowledge represents the nature of knowledge aspect of epistemology (Hofer & Pintrich, 1997). This finding means that the preservice and inservice teachers are distinct groups, based on the belief that knowledge is ever-changing and interrelated. From the data, it is likely that some of the inservice teachers might not believe that knowledge is fast changing and interrelated as well. Such belief of inservice teachers will not help in preparing students to face the challenges of tomorrow. Therefore, inservice teachers' beliefs about the nature of knowledge should be a matter of concern to educators.

The second part of the findings indicated that both preservice and inservice teachers had partially-developed epistemological beliefs system. The four dimensions, as explained in the third chapter, come together to form preservice and inservice teachers' overall epistemological beliefs system. If only one out of the four dimensions had a significant difference between preservice and inservice teachers, it is an indication that the three other dimensions (source of knowledge, justification for knowing, and attainment of truth) were possibly not developing as they were supposed to develop. Where there was a significant difference between the preservice and inservice teachers on the belief about the nature of knowledge, there was no corresponding

advancement in the process of knowing (Hofer & Pintrich, 1997). However, the two aspects come together to form the epistemological beliefs system.

The problem with this finding is that both preservice and inservice teachers were likely to believe that knowledge “originates outside the self and resides in external authority, from whom it may be transmitted” (Hofer & Pintrich, 1997, p. 381). Also, both teachers were likely to use observation and what felt right in checking the accuracy or correctness of knowledge. Such frame of mind is likely to affect the teaching and learning process. Teachers will possibly see themselves as more knowledgeable and experienced than their students. As a result, they will be inclined to provide their students with all the information they will need. Therefore, the epistemological beliefs’ profile of teachers should be kept and periodically updated to identify possible interventions that are effective in developing the other three aspects of their epistemological beliefs. At the same time, the need exists for further research, which will make use of observation and interview to identify what could possibly account for the differences in their epistemological beliefs. With this qualitative data, it will be possible to triangulate the accuracy of preservice and inservice teachers’ epistemological beliefs and instructional practice.

Looking at the significant differences that were reported among the four dimensions of epistemological beliefs as well as the differences in response to item qua_3, the epistemological beliefs of teachers did not develop at the same rate. In other words, one should not expect all teachers to believe that knowledge is tentative, interrelated, constructed, and evidential at the same time. If this statement is valid, then it is likely that both preservice and inservice teachers have poorly developed epistemological beliefs system. By implication, they have poor beliefs about the nature of knowledge and process of knowing. Since epistemological beliefs relate to instructional practice, these poorly developed dimensions of epistemological beliefs (source,

justification, and attainment) are likely to affect the instructional process adversely. From previous research, the epistemological beliefs system has useful implications for a number of academic variables (Hofer, 2000). For this reason, it will be instructionally strategic to measure or be aware of the level of development of each epistemological belief's dimension and how it can be fostered to ensure the desired instructional practice for effective student learning and development. By looking at the differences in the years of teaching of preservice teachers (between 1 and 39), which could not lead to significant difference in epistemological beliefs, the need exists for well-structured interventions for inservice teachers.

Differences in reliability. One of the inconsistencies that manifested in preservice teachers' data was the poor reliability. Where preservice teachers had a Cronbach alpha ranging between .28 and .48 for the epistemological beliefs, the inservice teachers reported .59 to .71. Under certain circumstances, poor reliability is associated with poor construction of survey questions that combine to form a construct. In this particular situation, the discipline-focused epistemological beliefs questionnaire has been validated. With this, two reasons may possibly explain why there was poor reliability among the preservice teachers. First, it is possible that the preservice teachers were not well informed about their own epistemological beliefs and, for that matter, rated the survey questions without serious introspection of what they believed about the nature of knowledge and the process of knowing. Secondly, it was likely the preservice participants were merely completing the survey in order to make way for their seminar class since this survey was completed before the beginning of the seminar sessions. For example, it is common to find participants who will check random numbers on the Likert scale without necessarily paying attention to the demands of the survey.

The implication of this reliability issue is that it is likely to deny researchers from getting valid data that are representative of the studied population. These are just speculations, and there might be other possible reasons why preservice teachers had poor reliability coefficients. To overcome this problem, researchers should probably have a focused group interview with participants to make sure they understand the content of the survey questions in order to provide the best response. At the same time, researchers can give a general description of the study and the importance of subjects' participation to help solve a real life problem or gain deeper insight into the problem. Researchers should be emphatic on the rights of the participants not to take part in the research, so that those who decide to take part give honest information.

Inconsistencies in preservice and inservice teachers' data. Also, there was an inconsistency between the responses to item qua_1 (*I feel that I am not practicing the educational philosophy to which I subscribe to*), and qua_2 (*I am more inclined to educational philosophy of?*). For the first item, preservice and inservice teachers rated 58% and 59.2% respectively where the ratings for the second were 80% and 58% in favor of constructivism. The data were suggestive that the same percentage of preservice and inservice teachers felt they could practice, based on their educational philosophy. However, there was a major difference in the percentage ratings on their educational philosophy (80% against 58%). Where the inservice teachers had similar percentages for both items, preservice teachers had about 20% increases.

Again, eighteen percent (18%) of preservice rated as behaviorist with 34% from the inservice teachers. The results seemed to suggest that a third of inservice teachers who indicated being behaviorist were more likely to practice constructivist learning pedagogies since it did not reflect in the inservice teachers' instructional practice mean score. It can be inferred that inservice teachers within the behaviorist category might have rated themselves as more

constructivists. This finding does not support previous literature that people who believed in behaviorism were likely to use traditional learning pedagogies. Therefore, the need exists for further research with mixed methods to gain better understanding of how their educational philosophies influence their instructional practice.

Demographic characteristics of the participants. Further analysis of inservice teachers revealed that the correlational relationship between epistemological beliefs and instructional practice was due to the statistical power of inservice teachers who had taught for more than thirty years. Interestingly, none of the other categories (1-10, 11-20, and 21-30) or a combination of them had a significant correlational relationship. This finding brings an important point to researchers on the need to pay attention to the characteristics of the research participants. For example, if the participants were to be only inservice teachers with thirty years or less of teaching experience, it would be more likely that there would not be any relationship between the overall epistemological beliefs and instructional practice. In the same vein, if the research population was predominantly inservice teachers with more than thirty years of experience, it would not have come to light how certain categories of inservice teachers did not teach, based on their instructional practice. It will be appropriate for researchers to be mindful of the participants they use for various studies. Ideally, the need exists for a representative sample of the population to be used so that researchers will be more informed on how the population dynamics affect the final results of a study.

Influences on constructivist instructional practice. It was demonstrated in this research that teachers could not practice their epistemological beliefs due to certain factors such as workload, mandated standards, parental expectation, school culture, among others. In the first place, the availability of this evidence implies that there are possible threats that can constrain

the efforts of teachers in their attempt to provide student-centered instructional practice. However, this study indicated that these constraints were not likely to influence the preservice and inservice teachers to adopt less constructivist learning pedagogies. Looking at the nature of these constraints, there is the possibility that inservice teachers without the needed support system in their schools are likely to revert to the use of more traditional methods when they begin to feel such pressure. Liu and Ramsey (2008) reported that about 50% of inservice teachers return to the classroom after five years of teaching due to the job-related problems. Their findings imply that about half of beginning teachers might be lost if timely interventions are not put in place.

The Common Core Standard was adopted by different states in the United States in 2010. Regardless of the financial resources, quality of the human resource (teachers), performance of schools, nature of communities, and others, states departments of education have the responsibility to ensure that the teachers perform as expected. In the process, it is likely that certain instructional decisions of teachers might conflict with their personal epistemological beliefs. Such conflicts can possibly influence teachers to adopt traditional learning methods. As a result of the negative impact, inservice teachers and teacher educators should guard against tendencies that will force them to practice less constructivist pedagogies. Open communication on issues of this nature will help to bridge the gap between policy makers, curriculum designers and teachers. Conducting further studies on the impact of workload, mandatory standardized tests, school culture, etc. on instructional practice will help educators to have informed perspective on how to design a comprehensive curriculum to guard against such threats.

Differences in the dimensions. The analysis also revealed that there were several negative insignificant relationships among the dimensions of both preservice and inservice

teachers. Preservice and inservice teachers' epistemological beliefs and instructional practice gave some indications that certain dimensions (especially justification and attainment) did not have any corresponding increase while the certainty/simplicity and source of knowledge dimensions increased. The epistemological beliefs system comprises four dimensions. As discussed earlier, the development of each of the dimensions is important in ensuring overall sophisticated epistemological beliefs. If two of these dimensions were somewhat at the novice stage, it is an indication that the overall epistemological beliefs of preservice and inservice teachers did not develop as expected.

Based on the meaning of the justification of knowledge and attainment of truth dimensions, both preservice and inservice teachers were likely to struggle with finding the accuracy and correctness of knowledge. In such a situation, preservice and inservice teachers might not be able to use a rigorous process to discriminate between valid knowledge from an opinion. Such a tendency is likely to affect their students adversely. Though the researcher did not find a significant relationship, yet it is important for the attention of educators and teachers to be drawn to this possible downward trend in their epistemological beliefs. At the same time, the need exists to find strategic ways of approaching the teacher preparatory and professional development curriculum so as to address these differences in dimensions.

The negative relationships suggested that teachers were likely to take certain instructional decisions in their various schools that would not be necessarily connected to what they believe to be the best practice. For example, thirty-four percent (34%) of inservice teachers rated being behaviorists. However, this percentage did not have significant impact on the overall instructional practice of inservice teachers. This finding was an interesting finding that has to be studied closely in the near future research. Therefore, matters of epistemological beliefs and

instructional practice should form the bedrock of teacher education and professional development programs in order to overcome the situation that teachers trained in constructivist environments will not end up using traditional pedagogies (Brownlee, 2003b). If constructivism is enshrined in standards of education in the K-12 setting, the need exists to maintain the most popular learning pedagogy that best aligns with the standards.

Limitations and Future Research

One of the limitations of this study was that the researcher failed to gather data on other relevant demographic information (eg. age, gender, socio-economic status, and highest education) of the participants. Such information would have been helpful in trying to study the differences between the epistemological beliefs and instructional practice of preservice and inservice teachers from different perspectives. Because such data were not available, there were few independent variables that were available for statistical testing, analysis and interpretation. Future research can consider using other relevant demographic information (eg. gender, level of education, age, etc.) to test differences between epistemological beliefs and instructional practice.

Second, the use of one hundred and thirty-one participants (made up of fifty preservice and eighty-one inservice teachers) could have been increased. Large sample sizes are important, especially in order to report the effect sizes of the significant differences that are found in the study. Hofer (2000) used three hundred and twenty-six participants in the original study. The current study used less than half of her sample size, and as such, this small sample size could possibly explain why a confirmatory factor analysis was not considered as additional statistical test in this research. Again, with a small sample size, the findings would not have the needed

statistical power to be used as a basis to argue the findings reported by other researchers with larger sample sizes.

Third, unlike the inservice teachers, the reliability coefficients for the preservice teachers were generally low. With a range of .28 to .48, there might be serious issues that could possibly account for this poor Cronbach alpha scores among preservice teachers. Moreover, based on the responses by participants to item qua_3 (*Which of these are likely to cause discrepancies between what you believe and what you will practice when teaching?*), about 32.5% (13 out of 40) preservice teachers indicated inadequate knowledge on effective instructional practice. It is possible that preservice teachers, regardless of their epistemological beliefs system, did not know how to effectively organize their projected instructional environment to reflect their beliefs. Unfortunately, such investigations were not within the confines of the design of this research. It is unfathomable as to why inservice teachers had acceptable Cronbach alpha whereas preservice teachers did not. The researcher assumed that more preservice teachers did not reflect thoughtfully on the survey questions before answering them, or they were in a haste to complete the survey. There is the possibility that if a group of participants does not understand the meaning of survey items in a scale, it can affect the reliability of the scale. On this basis, the need exists for future researchers, using the same populations with this instrument, to look at what might possibly account for the generally low or poor Cronbach alpha values as reported in this research.

Last, the use of only a self-reported Likert scale made it difficult for the researcher to obtain some relevant information that would have shed more light on the epistemological beliefs and instructional practice of the participants. The use of self-reports has received negative reactions from several researchers (Hofer & Pintrich, 1997; Muis, 2008). For example, by using

interviews, focus groups and classroom observations would have brought out relevant questions for preservice and inservice teachers to respond. Also, it would have been visible for the researcher to see the kind of instructional practice that inservice teachers were adopting in the classroom. Since a provision was not made for other qualitative research instruments, there were issues in their responses that needed to have been examined in a more holistic way.

Conclusion

In conclusion, this quantitative research sought to identify the relationship between epistemological beliefs of preservice and inservice teachers. Previous literature indicated that the epistemological beliefs related to instructional practice. Also, inservice teachers, who were trained in constructivist learning environments, reverted to the use of traditional learning pedagogies. The current study indicated that both preservice and inservice teachers were not likely to revert to the use of more traditional learning pedagogies. However, further analysis revealed that the constructivist inservice teachers' epistemological beliefs did not have a correlational relationship with instructional practice due to some factors like workload, mandated testing, Common Core Standards, among others. There was a correlational relationship between epistemological beliefs and instructional practice of behaviorist inservice teachers. Thus, the significant positive correlational relationship between the overall epistemological beliefs and instructional practice was as a result of the impact of the behaviorist inservice teachers.

This study found that both preservice and inservice teachers had a somewhat average epistemological beliefs with slightly above average constructivist instructional practice. As a result of some challenges facing inservice teachers, which are yet to be experienced by preservice teachers after their teacher education program, constructivist inservice teachers are more likely to face difficulties in their attempt to teach, based on their educational philosophy.

Obviously, it is not the intention of teachers and teacher educators to revert to the use of more traditional learning pedagogies. Therefore, there is the need for conversation, collaboration as well as coordination among policy makers, faculty, researchers, teacher educators and curriculum designers on how both qualitative and quantitative data on the personal epistemological beliefs and instructional practice of inservice teachers can be used to help inservice teachers practice, based on constructivist learning pedagogies.

Appendix A

Code Book

Labels	Discipline-focused Epistemological Beliefs Questionnaire
	Certainty/Simplicity of Knowledge
certsim_1	Truth in the field of education is unchanging.
certsim_2	In the field of education, most work has only one right answer.
certsim_3	All professors in the field of education would probably come up with the same answers to questions in this field.
certsim_4	Most of what is true in the field of education is already known.
certsim_5	In the field of education, it is good to question the ideas presented (R).
certsim_6	Principles in the field of education are unchanging.
certsim_7	Answers to questions in the field of education change as experts gather more information (R).
certsim_8	All experts in the field of education understand the field in the same way
	Source of Knowledge
sour_1	Sometimes you just have to accept answers from the experts in the field of education, even if you don't understand them.
sour_2	If you read something in a textbook for this subject, you can be sure it is true.
sour_3	If my personal experience conflicts with ideas in the textbook, the book is probably right.
sour_4	I am most confident that I know something when I know what the experts think.
	Justification for Knowing
just_1	Correct answers in the field of education are more a matter of opinion than fact.

just_2 There is really no way to determine whether someone has the right answer in the field of education.

just_3 I am more likely to accept the ideas of someone with first-hand experience than the ideas of researchers in the field of education

just_4 First-hand experience is the best way of knowing something in the field of education.

Attainment of Truth

attain_1 If scholars try hard enough, they can find the answers to almost anything.

attain_2 Experts in the field of education can ultimately get to the truth.

Instructional Practice

instru_1 I see myself as a facilitator who helps students to construct their own knowledge (R).

instru_2 I think lectures are the most effective way for the students to learn a maximum amount of content knowledge.

instru_3 Group work has limited effects on learning. Students have to study individually in order to acquire important content knowledge.

instru_4 When appropriate, I will encourage my students to give their own opinions or viewpoints on the topic we are studying (R).

instru_5 It is important for me to make sure my students learn the correct facts and information from me.

instru_6 I will encourage my students to make sense of the knowledge with their own personal experience or real life situations (R).

instru_7 The most important thing for my students to learn is the definitions of the concepts

or principles that they are studying

instru_8 I will encourage group discussions in my class for the students to see different viewpoints (R).

Other Instructional Practice Items

qua_1 I feel that I am not practicing the educational philosophy to which I subscribe to.

qua_2 I am more inclined to educational philosophy of... (check either one)

- Constructivism
- Behaviorism

qua_3 Which of these cause(s) discrepancies between what you believe and what you practice in the classroom?

- Workload
- Mandated state standardized tests of my students
- The culture of the school where I work
- Common Core Standards
- Fear of trying something different
- I know the philosophy, but don't know how to do it in the classroom
- Government
- Parents' expectation of their children getting high scores on standardized tests
- Pressure from the school administration
- Others, please specify _____

Note: items with R were reverse coded.

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