STUDY OF EPISTEMIC BELIEFS OF PRE-SERVICE TEACHERS

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DECLARATION

I, Shraddha Dwivedi, hereby declare that the work embodied in the M. Phil. dissertation entitled ***"Study of Epistemic Beliefs of Pre-Service Teachers"*** submitted in fulfillment for the award of the degree of Master of philosophy in Education is an authentic record of original work carried out by me under the guidance of **Prof. Arbind Kumar Jha**, Department of Education, School of Education, Babasaheb Bhimrao Ambedkar University. I further declare that this is the original work and has not been submitted in any university or institution for the award of any other degree. I also declare that this dissertation is essentially free from all kinds of plagiarism.

Place: Lucknow (Shraddha Dwivedi)

Date:

CERTIFICATE

This is to certify that the M. Phil. dissertation entitled ***"Study of Epistemic Beliefs of Pre-Service Teachers"*** submitted by **Ms. Shraddha Dwivedi** is an original research work and has not been previously submitted in part or full for the award of any other degree or diploma to this or any other university.

The M. Phil. dissertation submitted to Babasaheb Bhimrao Ambedkar University, Lucknow satisfies all the requirements as stipulated in the Master of Philosophy (M. Phil.) regulations amended in 2017 incorporating the provisions of the University Grant Commission Regulations, 2016 and it is fit for submission and evaluation for the award of the degree of Master of Philosophy in Education, Department of Education, School of Education, of the University.

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(Shraddha Dwivedi)

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1.0 Introduction

The prime concern of epistemology is the study of knowledge and knowing. Epistemology is the philosophical study of knowledge, and what knowledge means for someone to know something. The field of epistemology is related to the nature of truth, the nature of development, and types of knowledge, for example, knowledge about how (related to skills) or knowledge about that (related to facts). Where, knowledge is uncontroversial and pre-philosophical. Also, knowledge is that education, which aims at the imparting of sagacity where students are educated in part so that they may come to know something about surroundings. Epistemology is all about personal conceptions of knowledge. Thus, the study of such personal conceptions of knowledge is commonly referred to as the personal epistemology of epistemic beliefs. Beliefs about knowledge and knowing are coherent with the teacher and his/her teaching. Teaching strategies and learning outcomes of pre-service teachers and/or in-service teachers are influenced by their beliefs. As there are several kinds of researches conducted regarding the relationship between pre-service teachers and their beliefs about teaching and learning. Pre-service teachers' personal beliefs about the nature of knowledge influence his/her learning outcomes and classroom performance. These beliefs are derived from epistemology and introduced as *Epistemological Beliefs*. In the context of Philosophy and education, personal epistemological beliefs are how individuals acquire knowledge about something and develop their beliefs and the pattern in which such epistemological beliefs influence the cognitive processes of thinking and reasoning.

1.1 Epistemic beliefs

Beliefs, about knowledge and knowing, have direct influence on teaching strategies and learning outcomes of pre-service teachers (Green & Hood, 2013). These beliefs are concerned with several terms, but, the most popularly as epistemological beliefs (EB) that may vary across individuals and various disciplines such as science, arts and humanities. The study of epistemic beliefs (EB) is logically important to philosophical studies, academics, and applied psychology. Other related terms and concepts for EB include 'personal epistemologies', 'epistemic beliefs', 'epistemic cognition', and 'epistemological resources' (Green & Hood, 2013). Hofer & Pintrich (1997) define epistemic beliefs, as *beliefs about knowledge and knowing,*

within an individual. These beliefs provide a lens to understand the entire process of developing and delivering knowledge. A teacher's identity is the result of his/her knowledge and knowing in general, and beliefs, about knowledge and knowing in particular, which is called the epistemic beliefs of a teacher. Beliefs of the teacher particularly pre-service teachers, deliver their mastership as a lens through which they may understand their teaching material and demands of learning, and then may able to interpret their teaching strategies and learning outcomes.

There are several pieces of evidence regarding the direct effect of EB on motivation, achievement, ICT, text comprehension, learning strategies, learning outcomes, teaching conceptions, and additional constructs (Green & Hood, 2013). These findings emphasize the contingency power of epistemic beliefs for understanding learning phenomena. In the beginning, researchers believed that persons' core beliefs are very sophisticated. The concept of epistemic beliefs (EB) has been changed within ten years. Nowadays, instead of sophisticated beliefs, researchers assumed only general beliefs describing persons' ideas about knowledge and knowing across contexts, situations, domains, and topics. Buehl and Alexander (2006) identify EB into two domains, general epistemic beliefs and domain-specific epistemic beliefs while Muis et al. (2006) postulate three levels of general, academics, and domain-specific beliefs. Braten et al. (2008) develop a fourth level of topic-specific beliefs within a domain, based on Muis et al.'s (2006) model. In present, on the other hand, some researchers postulate a multi-level conception (Berding et al., 2017). General-beliefs found in all generally, and have the least influence on teaching and learning outcomes than domain-specific epistemic beliefs. Buehl & Alexander (2006) and Muis et al. (2006) argued that domain-specific beliefs have a stronger impact on the process of learning and its consequences. The reason behind the stronger impact of domain-specific beliefs is that it develops through the interaction of specific knowledge, specific problem, and its solution. General beliefs are developing in a general way. A new term, topic-specific beliefs, introduce by Braten et al. (2008). They argued that topic-specific beliefs are more important in learning than domain-specific beliefs. Topic-specific beliefs are more concentrated on effective learning than domain-specific beliefs. Mokwinski (2011) compare general and domain-specific beliefs with Vocational Education and Training (VET). Other researchers studied these two levels but reviews show that most studies focused on only one level of epistemic beliefs during the study of its impact on learning (Berding

et al., 2017). Thus, there are no pieces of evidence that may provide information regarding different levels of epistemic beliefs to understand the teaching and learning process and its result. Furthermore, as a result of concentrating only on one level of epistemic beliefs at a time, studies provide only limited information on the structure of epistemic beliefs across levels. Some researchers investigate whether individuals from different fields of study differ in their epistemic beliefs (between-subject design) (Berding et al., 2017). Studies of Buehl, Alexander, & Murphy (2002) and Schommer-Akins et al. (2003) investigate whether individuals have different epistemic beliefs for specific fields of study (within-subject design). As they did not manifest different levels of epistemic beliefs, and also these studies provide hardly evidence about beliefs within an individual. Thus the different levels of epistemic beliefs and its contribution to understanding teaching and learning abide ambiguously. The present study basically differentiates two closely related concepts:

Epistemology: It is related to the philosophical analysis and conceptualization of curriculum content and assessment for knowledge.

Epistemic Beliefs: It is related to the intrapersonal, psychological conceptualizations that individuals hold regarding knowledge and knowing.

1.2 Epistemic Beliefs of pre-service teachers

Several factors have a great influence on the way of the teaching behaviour of a teacher; Epistemic Belief (EB) is one of them. Therefore, it is very important to understand the educational development and the beliefs of a pre-service teacher. The content of knowledge and the influences of that content on teachers' behaviour, the developed beliefs of a teacher have an important role in teaching (Geometry & Analysis, n. d.). Pre-service teachers' beliefs may concern, that it "consists of person's core beliefs about the knowledge and knowing and also the process of acquiring knowledge and beliefs about learning" (Brownlee, Boulton-Lewis, & Purdie, 2002; Hofer and Pintrich, 1997). Many researchers have cited teachers' beliefs and stated that "epistemic beliefs influence the reasoning, interpretation of knowledge and monitoring capacity of cognition of a teacher" (Brownlee et. al., 2002; Hofer & Pintrich, 1997; Pajares, 1992).

Epistemic beliefs are beliefs about the nature of knowledge and knowing. At the end of 1980s Schommer (1990) studied epistemic dimensions and received them as in the form of a system of independent beliefs which meant there are multiple beliefs, which compose a person's personal beliefs. In other words, it may be said that multiple beliefs are developed by the combination of a person's personal beliefs. The studies of teachers' beliefs are more common among pre-service teachers. These beliefs are directly proportional to the efficacy of pre-service teachers. As Bandura (1997) defined term self-efficacy, as beliefs in one's capabilities to organize and execute the courses of required actions. Efficacy beliefs influence a teacher's effort. "Beliefs in ones' capabilities or efficacy beliefs are the other name of epistemic beliefs that greatly influence how a teacher teaches" (Smith, 2005; Wallace & Kang, 2004). Due to the influence of epistemic beliefs of the way of teaching of a pre-service -teacher, it is important to value how teaching occurs and how they consider in a problem in their way (Lenderman, 2004).

A teacher's beliefs may consider it into two aspects, one is the personal aspect (outside the classroom) and another one is a practical aspect (inside the classroom), both are experienced as, collectively. As both have a strong effect on teachers' thoughts and actions (Cornett, 1990). It was always a part of interest for researchers that how the different aspect of teachers beliefs are interconnected structurally and how it form a belief system that helps to form teachers' decision (Nespor, 1987). The epistemic beliefs of a pre-service teacher are also concerned with personal epistemology. There are five dimensions to understand the nature of knowledge, which are:

1. Knowledge organization,
2. Certainty of knowledge,
3. Source of knowledge,
4. Control of knowledge and
5. Speed of acquiring knowledge (developed by Schommer, 1990).

On the basis of different studies on epistemic beliefs of pre-service teachers, there can be at least two sides identified in the area of personal beliefs: one focuses on the developmental aspect of personal epistemological theories of pre-service teachers

and the other one is concerned with the dimensional structure of epistemic beliefs (Chan & Elliot, 2004; Hofer, 2001).

1.3 The genesis of Epistemic Beliefs

Epistemic belief (EB) is a branch of philosophy that is concerned with the questions related to knowledge: like what is knowledge? What are its sources? How is it acquired? How it structured, and what are its limits? As a human being, all individuals are unique and have their own set of beliefs about knowledge and knowing, which are termed as epistemic beliefs or personal epistemology. Such a set of beliefs is purely subjective, remains static to that person and does not necessarily reflect the actual nature of knowledge. The term Epistemology was inscribed first by Scottish philosopher James Frederick Ferrier (1854) (Tali & Dar, 2019). To describe the theory of intellectual development, Piaget (1950) used the term genetic epistemology. By using this term he succeeded to drag the attention of psychologists in the intersection of philosophy and psychology. He became able to initiate the interest in term genetic epistemology. These interests were proven an important phase in growing reaction to the dominating behaviorism. Knowledge and knowing initially was central to emerging theories of moral judgment and development (Hofer & Pintrich, 1997). The study of epistemic beliefs began with the work of William Perry, Jr. (1968). Their research team interviewed Harvard undergraduate students and shares their four-year experiences within the college. Perry (1968) concluded that most of the students in first-year believe that simple, unchangeable knowledge is handed down by omniscient authority. As time passed students reached in senior classes they believe that complex and tentative knowledge derived from logical reasoning and empirical inquiry. Perry (1968) formulate nine developmental positions that served as the path from being a dualistic thinker in the early years of college to being a realistic thinker at the end of the four-year course of college with lots of personal experiences. From the work of Perry, many researchers inspired to investigate epistemic beliefs in different aspects. For example, King and Kitchener (1994), investigate the conceptions of knowledge and reality about true knowledge. King and Kitchener proposed a seven-stepped theory of the reflective judgment model. In the early stages of development of knowledge, individuals believe that knowledge is simple and a direct reflection of reality with no need for justification of

knowledge. As individuals grew up, they develop their beliefs and begin to recognize the uncertainty of knowledge but they able to see this uncertainty only as a temporal state, believing that the time authority can determine the ultimate facts. At the later stages of devolvement, individuals clasp the tentativeness of knowledge and believe that knowledge must be understood in its contexts and can be re-evaluated.

Other researchers influenced by Perrys' work, they focused their work on gender differences (Baxter Magolda, 1998) and some have studied ways of knowing of women. Belenky et al. (1986) unwind the complicacy and social relationships with persons' beliefs about the nature of knowledge. In the early stages of developing core beliefs, women view the process of learning as simply receiving true knowledge that is handed down by omniscient authority. Women are the passive receivers of knowledge while men in their early stages come off to see learning as mastering true knowledge that is handed down by omniscient authority; as men are active receivers of knowledge.

The belief system is differing from the knowledge system, its validity and appropriateness do not require consensus in general or group. A persons' belief also not require internal consistency within the whole system of belief. This non-consensuality allude that the belief systems are moot, less flexible, and less dynamic than the knowledge system. Now the reason and pieces of evidence indicate that beliefs are unchangeable, and when it changes, no argument or reason alters them but formerly it will a conversion or gestalt shift.

1.4 Epistemic Belief System

Schommer (1990) stated that epistemic beliefs are a more or less independent belief system. She explores the concept of personal epistemology as multiple beliefs compare personal epistemology. She introduced a quantitative approach to evaluate the EB. Schommer proposed that the EB system is interconnected to other systems and gave an embedded system model: the epistemological belief system embedded within another system-embedded systemic model.

1.4.1 The Epistemological Belief system embedded within other system—Embedded System Model:

Schommer's (1990) work contributes to the understanding of persons' beliefs. According to her, the research focuses on personal epistemology that has a narrow scope at that time. There was a need to clear the concept of epistemic beliefs and to study its effect on other systems. For this purpose concept of the embedded model of epistemic beliefs within other systems came to know. The reason besides developing an embedded system model of epistemic beliefs, is, "it is a model that includes many other aspects of cognition and affect on learning processes, this model comes from the assumption that epistemic beliefs do not function in a vacuum. As it is known that, at any given moment, persons' thinking ability, actions, his/her decision-making behavior or motivation represents the bunch of multiple systems". According to Schommer the idea of an embedded model of EB among other systems is not new. Further, she pointed her with an example, that, Bronfen Brenner (1979) proposed an ecological system theory of human development. In this theory he trying to indicate that development is influenced by multiple levels of environment and cognition. The innermost (first) level of influence includes schools, peers, and family; the next level of influence includes neighborhood and community; and the outermost level of influence is culture. Lerner (1995) proposed a somehow similar concept, that is, the developmental contextualism that brings changes in human development. An intimate hitch between social relationships and epistemic beliefs was manifested in the work of Belenky et al. (1986). It is well known that, among men and women, the idea of how knowledge is negotiated or how one judges the knowledge is directly or indirectly affected by how one belongs to the other people including his/her teachers, experts, and peers. Galotti et al. (1999) explore the work of Belenky et al. (1986) on "womens' ways of knowing", by developing an instrument that evaluates the connected knowing and separate knowing. A learner with a strong belief in connected knowing belongs to the knowledge source. After understanding the perspective of sources of knowledge, the learner becomes more critical and logical. In contrast, learners with a stronger belief in separate knowledge, having an adversarial perspective. Here learners are functioning as knowledge seeker; they question, doubt, and wait for evidence before trusting on information that has been logically proven. Based on the work conducted

by De Corte, Op't Eynde, and Verschaffel (2002) three categories should be considered:

(a) Beliefs about subjective education,

(b) Beliefs about self in relation to regarding subject, and

(c) Beliefs about the social context of regarding subject learning and problem-solving.

Work of De Corte et al. (2002) was based on epistemic beliefs concerning mathematical learning. Furthermore, they wrote about students' beliefs for mathematics, that the beliefs are situated at the hack of the cognitive and motivational domain. It is more synthesized but the general model in which the different results can be placed and understood to each. And thus, an ambient model is lacking. Winnes' (1995) model of self-regulated learning provides another reason behind the development of an embedded system model for further research. Winne (1995), proposed an inherent details of self-regulated learning by combining two systems, Metacognition (including selection and use of different strategies for study and epistemic beliefs), and knowledge (knowledge of topic and knowledge of strategies). Although model Winne (1995) was thoughtful and detailed but, it seems incomplete model in itself. Alexander (1995) and Corno (1995) also suggest a system of social situation, domain specificity model and multiplicity of goals of monitoring and multiplicity of self- regulatory forms (Perssley, 1995; Schunk, 1995). The more complex model provides more explanatory power. Schommer (2004) proposed an embedded system model of EB that was stimulated from other researches. This proposed model was based on interactions among six systems as such:

(a) Cultural relational views,

(b) Beliefs about "ways of knowing,"

(c) Beliefs about knowledge,

(d) Beliefs about learning,

(e) Classroom performance, and

(f) Self-regulated learning.

Let's see figure for the broad overview of the proposed embedded systemic model:

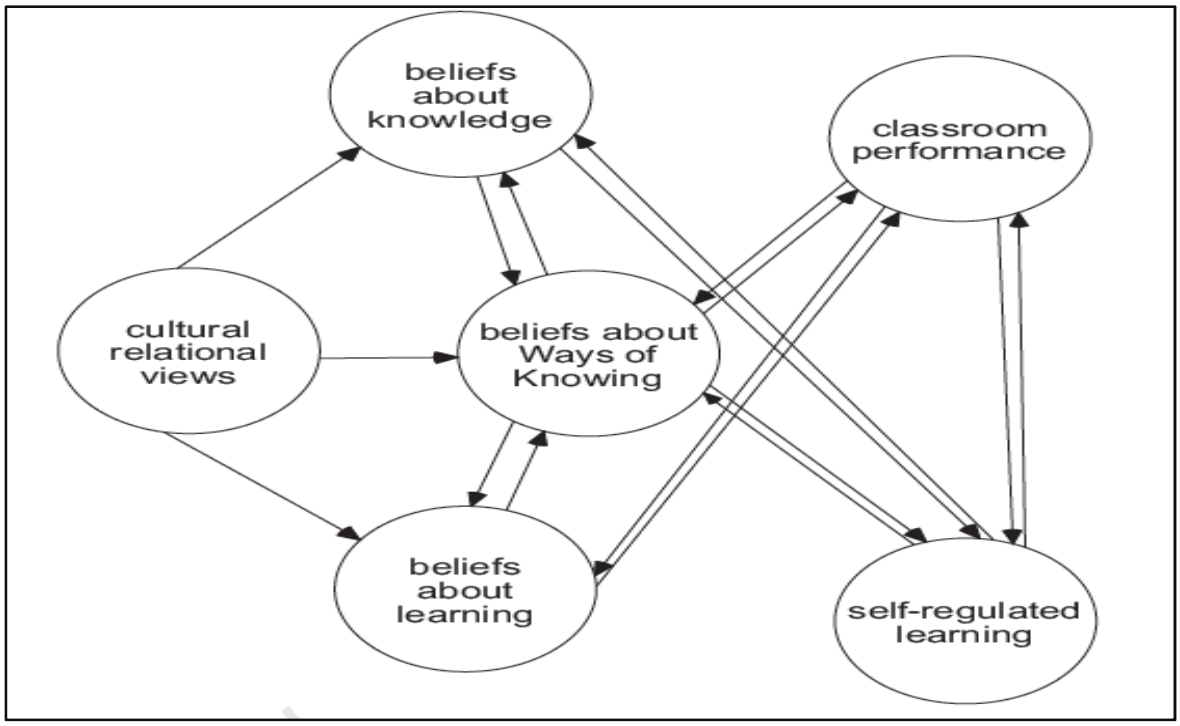


Figure 1.4.1: Embedded system model of Epistemic Beliefs: An overview of an initial embedded systemic model of epistemological beliefs illustrating the interplay among systems of culture, ways of knowing, epistemological beliefs, and consequential learner self-regulation and performance picked up from Schommer's article (2004).

1.5 Dimensions of epistemic beliefs

After the work of Perry (1968) and Belenky et al. (1986), a controversy arises towards the development of epistemic beliefs. Schommer's work (1990, 1993 and 1998) revealed that epistemic beliefs were multidimensional. She adopted the Epistemological Beliefs Questionnaire (EBQ, 1998) and investigates those beliefs about learning and knowing may vary based on five dimensions. These dimensions were the starting point for further studies including five dimensions (Brownlee et al. 2001):

1. Source of knowledge
2. Certainty of Knowledge
3. Structure of knowledge
4. Speed of knowledge

5. Acquisition of knowledge (beliefs about capacity for learning; Schommer, 1990; Brownlee et al., 2001).

Other researchers such as Hofer and Pintrich (1997), Muller (2009), and Zinn (2013), proposed another model regarding dimensions of EB and differentiate these dimensions into five. Work, done by Hofer and Pintrich (1997) gave a platform for the multidimensionality of epistemic beliefs. Their model provides a base for others to work on epistemic beliefs.

The outlines of epistemic beliefs of other model are as follows:

- **Structure of knowledge:** This dimension shows the structure of knowledge as it is simple or complex (sophisticated). Beliefs about the structure of knowledge range from 'knowledge are consists of different isolated elements' (absolute view as knowledge is simple) to 'knowledge is composed of highly interrelated concepts' (sophisticated view as knowledge is complex) as proposed by Hofer & Pintrich, (1997).
- **Certainty of knowledge:** This dimension shows the certainty of knowledge as it is certain or uncertain. Thus the beliefs about the certainty of knowledge range from 'knowledge are certain and unchanging' (absolute view as knowledge is certain) to 'knowledge is changeable and continuously developing'' (sophisticated view) as proposed by Hofer & Pintrich, (1997). This dimension in, other words, is related to the reliability of knowledge.
- **Source of knowledge:** This dimension shows the sources of knowledge as from where it comes and the acquired knowledge has authentication or not. Beliefs about the source of knowledge range from 'knowledge come from outside the individual i.e. surroundings' (absolute view) to 'knowledge is individually constructed inside a person' (sophisticated view) as proposed by Hofer & Pintrich, (1997). Knowledge is that expressed by omniscient authority and thus this dimension is related to the validity of the source of knowledge.
- **Justification of knowledge:** Beliefs about the justification of knowledge explored the entire process of acquiring knowledge and form a notion regarding particular knowledge. King and Kitchener, (1994) proposed that the justification of knowledge ranges from 'justification by authorities' (absolute view) and justification by "what an individual belief itself" (absolute view) to 'justification by reasoning, arguments, evidence, authorities and expertise' (sophisticated view) (Berding, Rolf-Wittlake, & Buschenlange, 2017).

- **Applicability of knowledge:** This dimension of EB, proposed by Zinn, (2013). This dimension based on professional development and ranges from 'acquired knowledge is unnecessary and impractical to manage professional situations' (absolute view) to 'knowledge is necessary and provide a practical condition to fulfill professional requirements' (sophisticated view).

Mason, Ariasi and Boldrin, (2011) proposed a table that indicates four dimensions of epistemic beliefs for which there is a general agreement across the various model of beliefs. These dimensions are useful to consider the relationship of student's understanding of knowledge domains. For example, in the context of searching tasks, "epistemic beliefs are considered as a lens for learners' view on what is to be learned" (Bromme, Pieschl & Stahl, 2009). In such tasks, students (pre-service teachers) search activity may be analyzed by using the dimensions of given table (Mason, Ariasi & Boldrin, 2011) that will provide a lens onto students' understanding of their learning strategies, learning outcomes, their tasks demand, and how they meet those demands. Epistemic beliefs are thus one example of the type of construct that analyze learning and may quest; however, they are also a particularly good example given their relationship to our everyday dealings with the world of information, and their relationship to teaching-learning strategy, learning outcomes and classroom practices (Hofer,2001).

Table 1.5.1: Dimensions of Epistemic Belief (adapted from Mason, Boldrin & Ariasi, 2009)

Dimensions	Description
Certainty of knowledge	The degree to which knowledge is conceived as stable or changing, ranging from absolute to the tentative and evolving pattern of knowledge.
Simplicity of knowledge	The degree to which knowledge is conceived as compartmentalized or interrelated, ranging from knowledge as made up of discrete and simple facts to knowledge as complex and comprising interrelated concepts.
Source of knowledge	The relationship between the knower and known, ranging from the beliefs that knowledge resides outside the self and is transmitted, to the belief that it is constructed by the self.
Justification for knowledge	What makes a sufficient knowledge claim, ranging from the beliefs in observation or authority as sources, to the beliefs in the use of rules of inquiry and evaluation of expertise.

1.6 Levels of epistemic beliefs

In the past, researches modeled, epistemic beliefs as general beliefs (Schommer, 1990). Empirical studies, however, report evidence that individuals hold different beliefs for different domains (Buehl & Fives, 2009), and models for describing epistemic beliefs in academic contexts differentiate at least between general and domain-specific beliefs (Berding et al., 2017). Some researchers add a more detailed and more explored level within a domain representing individuals' beliefs about concrete topics (Berding et al., 2017). This supplement is reasonable since reporting a massive variation of 79% on the level of specific topics, whereas only 21% of the variance occurs at the level of personal differences (general epistemic beliefs) (Berding et al., 2017).

As a consequence, the model distinguishes between general epistemic beliefs representing the beliefs about knowledge and knowing in non-professional contexts, and domain-specific epistemic beliefs modeling the beliefs about knowledge and knowing in professional contexts. At the domain level, these contexts are structured into groups of professions. For example, the model postulates the existence of a commercial context because the analysis of the curricula of 55 commercial professions by the German Federal Institute for Vocational Education and Training (BIBB) indicates that these professions share about 69% of the same knowledge (Berding et al., 2017). These strong similarities, therefore, justify the grouping of the 55 professions into a commercial context. Further contexts can be built by creating groups for technical professions (e.g., fireman) or by forming groups for social professions (e.g., teacher). The professional contexts are made more specific by introducing generic topics for the professions. According to the German Federal Institute for Vocational Education and Training (BIBB), the two most important topics here in the commercial context are accounting and marketing, respectively representing 22% and 21% of the professions' shared knowledge (Berding et al., 2017). These topics forms, the starting point for the topic-specific epistemic beliefs. Several pieces of research emphasize the role of epistemic beliefs for learning processes and outcomes. For example, Paulsen and Feldman (1999) found that students believing in complex knowledge show a stronger intrinsic goal orientation and weaker test anxiety than students believing in simple knowledge. Mokwinski (2011) reports that students believing in complex knowledge on a general level show

less intrinsic motivation and interest than students believing in simple knowledge. In contrast, the fewer students believe in authorities transmitting knowledge, the more interest they show. For apprentices in the field of technical VET, believing in authorities transmitting knowledge is associated with a greater extrinsic motivation on the domain-specific level. The study by Ricco et al. (2010) shows that beliefs about the certainty, the developmental character of knowledge, the reliance on authorities, and the belief in the need for justification are associated with task value, self-efficacy, mastery, and performance goals. Thus, epistemic beliefs influence learners' motivation.

Furthermore, several studies report an impact of epistemic beliefs on learning outcomes. For example, Cano (2005) reports that, the beliefs about the structure and the certainty of knowledge predicts academic achievements. The analysis by Mason et al. (2011), shows that beliefs about the certainty and justification of knowledge influence scientific achievements. Ricco et al. (2010) found among other things that beliefs about the certainty of knowledge predict science grades over and above motivational constructs. Another model assumes that the more concrete levels of epistemic beliefs predict instruction, learning processes, and success more strongly than the general level (Berding et al., 2017). The reason for this is that the domain- and topic-specific beliefs refer more strongly to the concrete content of knowledge to be learned and the corresponding learning activities.

1.7 Theories and models concerning Epistemic Beliefs

Most of the theories and models related to epistemic beliefs are directly interfuse with epistemic beliefs' narration as subjective concepts about the nature of knowledge and development of knowledge. It is assumed that the epistemic beliefs of students will change and become more complex over time. Epistemic beliefs may be differentiated into domain-specific or domain-general beliefs and they may be based on the one-dimensional model or multi-dimensional model. The detail descriptions of domains and dimensions are given below:

1.7.1 A comparison between domain-specific vs. domain-general models:

Within the reference of domain specificity of epistemic beliefs, there are various dimensions identified: one hypothesis state that epistemic beliefs are completely independent of knowledge dimensions (Moore, 2002; Perry, 1970;

Schommer-Aikins, 2002). The other hypothesis states that there is a domain specificity according to which individuals in different domains or specialist areas may have different epistemic beliefs (Hofer and Pintrich, 1997).

Another view is that there is a core area of domain-general beliefs which are complemented by domain-specific beliefs (Berding et al., 2017). Various dimensions of epistemic beliefs can be activated based on the knowledge domain. The empirical studies put forward the statement that students not only have general, (domain-general) epistemic beliefs, but also domain-specific (Magolda, 2010). However it is not clear how these assumptions are different in levels and how they interact to each other (Hofer, 2000).

1.8 Statement of the Problem

"Study of Epistemic Beliefs of Pre-Service Teachers"

1.9 Terms Defined

Epistemic Belief: The study of knowledge is called epistemology, derived from the Greek word episteme, meaning to know or to understand. The epistemologists asked some questions as what we can know, what the limits of knowledge are, and how the knowledge is attained. Empiricists argued that knowledge is attained from the sensory experiences which become the foundation of one's epistemic beliefs; where the knowledge is the product which is evolved through a process called knowing. Hence in this study, *Epistemic Belief is considered as individuals' beliefs about knowledge and knowing, acquired from their surroundings*.

Pre-Service Teacher: Pre-service teachers are considered as those would-be teachers who are receiving their education before their teaching profession at the secondary level or who are studying in Batchelor of Education (B.Ed.).

1.10 Aim of the study

This study aims to gain a better understanding of the beliefs of pre-service teachers, the changes, occurs during development of their epistemic beliefs and the sources that help in developing the beliefs of pre-service teachers. And also the study aims to find the dimensions that would help to clarify the basic concepts related to knowledge and knowing.

1.11 Need and Significance of the Study

Epistemic beliefs are that which deals with the nature of knowledge and knowing. These beliefs affect interpretation and process of learning tasks and comprehension. In the field of education, epistemic belief is an important construct and is frequently used to predict the learning strategy and achievement of the pre-service teachers. Epistemic beliefs are considered to be a lens through which individuals interpret information, set standards, and decide on an appropriate course of action. There is an increased need to recognize the pre-service teachers' beliefs about the knowledge that influences their behavior and way of delivering their knowledge through cognitive, self-regulated learning strategies and decision-making skills. Teachers with developed epistemic beliefs can apply their plan for instruction based on students' level of epistemology. These beliefs are likely to influence how pre-service teacher as a student learn, how teachers instruct and subsequently how teachers modify their epistemic beliefs. Various studies have highlighted the importance of motivation, reinforcement, intelligence and interest in teaching strategies and learning outcomes. However, evidence concerning the significance of the set of beliefs in teaching and learning process is very diminutive. There are very few reviews related to EB of pre-service teachers, especially in the Indian context. Based on the literature review of the research, a gap recognized for examining EB of pre-service teachers. Studies reviewed in pre-service teacher concerning EB, investigation about the impact of EB on teaching strategies and learning outcomes. All studies were focused on pre-service teachers at the secondary level. Fang, (1996) observed that few studies have examined teachers' beliefs on higher secondary level, and a review of the literature recognized that no study examines teachers' beliefs, especially on middle, secondary and higher secondary level. With the help of present study we would be able to know that how pre-service teachers develop their beliefs and how does it matter for developing their knowledge and knowing. It will help us to find out the evolving patterns and the way he/she would use their epistemic beliefs in their academic life. This study, explicitly may define multiple levels of epistemic beliefs.

1.12 Rationale of the study

All the studies are based on the developing epistemic beliefs of a person, and are concentrated only one level epistemic beliefs, that is, the impact of epistemic

beliefs on teaching and learning (Braten et. al. 2008), but no study has viewed that really provides any information on the contingency of different levels, for understanding effect of teacher learning process on the academic achievement and outcomes of students. Few studies consider multiple levels of epistemic beliefs in their research design (Schommer-Aikins and Dull, 2013). No study suggests a solution of following questions:

- How does a teacher can explore his/her beliefs and how a "teacher education program" will be lucrative for him/her?
- How does a teacher promote his simple epistemic beliefs towards sophisticated beliefs?
- What are the changes occurs in developing teachers' core beliefs?

1.13 Objectives of the study

Objectives of the study are as follows:

1. To explore the multiple dimensions of Epistemic Beliefs (EB).
2. To find out the various sources to develop the Epistemic Beliefs of pre-service teachers (EB).
3. To find out changes in beliefs during the development of Epistemic Beliefs (EB).
4. To explore the influences of Epistemic Beliefs on teaching and learning outcomes of pre-service teachers.
5. To find out the evolving patterns of Epistemic Beliefs of the pre-service teacher.
6. To have a better understanding of Epistemic Beliefs of pre-service teachers regarding teaching and learning conceptions.

1.14 Research questions

1. What are the multiple dimensions of Epistemic Beliefs (EB)?
2. What are the various sources to develop the Epistemic Belief (EB) of pre-service teachers?
3. How the beliefs change during the development of Epistemic Beliefs (EB) in pre-service teachers?

4. How does the Epistemic Beliefs (EB) of pre-service teachers influence their teaching strategies and learning outcomes?
5. How do pre-service teachers develop their Epistemic Beliefs (EB)?
6. What is the basic understanding of EB, regarding teaching and learning conceptions of pre-service teachers?

1.15 Delimitations of the study

- The study was delimited to the pre-service teachers at B.Ed. level.
- The study was delimited to the Lucknow city only.

Chapter 2
Review of Related Literature

2.0 Review of Related Literature

The review is one of the most significant parts of the study. It does not only provide the direction but also helps to refine the study. In order to maintain clarity and the direction of the study the researcher reviewed some related literature,

Oderman, Dale B. (1992) conducted a study, entitled: *The Basic Epistemological Questions--Are There Also Valid Answers?*. In this study researcher analytically briefed that show various views of worlds like Judeo-Christian, Bible, Rationalism, and Pragmatism could be the way to find two basic Epistemological questions that are-- how do we know? And how do we know we know? But he supported the Judeo-Christianistic view to seeking the answer to these questions. Further, he analyzed and suggests that adopting the Judeo-Christian view will be a panacea, a quick pill which causes everything to end "happily ever after". People are still finite, imperfect and different from one another. People will differ on the particulars, but there is room for disagreement while staying within the broad Judeo-Christian world view. The search for knowledge will still require hard work. However, you can reason, you can sense, you can live through experiences in anticipation of discovering something true. Mankind and the physical universe are in correlation. The bottom line is this: the Judeo-Christian world view gives valid answers to the basic metaphysical, moral and epistemological questions – no other system does. And these answers can strengthen the whole of' life including education.

Barbara K. Hofer and Paul R. Pintrich (1997) conducted a study, entitled: *The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning.* This study is based on reviews regarding the development of theories of epistemology. This study aimed to explore the definition of knowledge and knowing and the process of knowledge construction and how it evaluated. In this study, researchers explore the ideas regarding epistemology as when it comes from and how it develops. First of all Piaget (1950) used the term *genetic epistemology* to explain his theory of intellectual development. But the research began in this area by Perry (1970). Balenky et al. (1986) and other researchers conducted their study based on Perrys' work. These works were gender-based especially on women's views based. Baxter Magolda (1992) identified a gap in the previous study and thus she attempts her work to explore the development of gender-related patterns

of epistemology in both men as well as women. Progressively study of epistemic beliefs in different aspects of life proceeds and introduced in different terms as judgmental epistemology, epistemological understanding, epistemological beliefs and so on. Personal epistemology theory made up of multiple dimensions. Finally, both researchers suggested that this study would help to further researchers to understand students' and teachers' beliefs about knowledge and knowing. This will provide a better platform to understand the teaching and learning outcomes in and out of the classroom.

Barbara K. Hofer (2001) conducted a study regarding teaching and learning entitled: *Personal Epistemology Research: Implications for Learning and Teaching.* It was a review-based study. In this study, she found that epistemic beliefs are an important component of students learning. She found a relationship between epistemic beliefs and teaching and the relationship between epistemic beliefs and the learning of students. In this study, the researcher found answers to some questions as to why some students have high academic records and others are not. As epistemic beliefs of students have a strong relation with learning, the researcher found various facts regarding beliefs that affect the process of learning. Researcher correlates all dimensions of EB with learning and found that those students who believe that knowledge is certain were generating an absolute conclusion. Who believed in quick learning, gave a very simplified conclusion and have a low test score. The performance of students is negatively related to beliefs in simple knowledge. Here epistemological thinking is related not only to school learning but lifelong learning in and out of school. Further, she said that epistemological studies give the answer about critical thinking and how an individual evaluates new information, formulate new ideas and affect their lives and lives of others.

Anne Marie M. Conley, Paul R. Pintrich, Ioanna Vekiri, and Delena Harrison (2004) conducted **a** very interesting study, entitled: *Changes in epistemological beliefs in elementary science students*. This study aimed to examine the changes in epistemic beliefs over time occurs or not and also to examine the role of gender, ethnicity, SES, and achievement in the development of students. The study was administered on 187, fifth-grade students. A self-report questionnaire with four dimensions of beliefs (source, certainty, development, and justification), were given to the students. More significantly suggestion came from this study was that most of

the studies on epistemic beliefs have focused on old age populations especially on high school and college students. The reason behind this was the epistemic beliefs were hard to identify among younger students (Kuhn, 1988). Research on children's' theory of mind (Wellman, 1992) however, says that the precursors to epistemic beliefs begin at an early age that may as young as four years old. In this study, the cognitive-domain of students was followed and examines four dimensions of epistemological beliefs in the science-domain. Further, in this study, it was observed that young childrens' epistemic beliefs about science, changed over-time. As for young children, knowledge is not certain and there may not be just one right answer in science and also the personal characteristics of gender, ethnicity, SES, and achievement are not related to change in beliefs about the source of knowledge and certainty of knowledge. A more significant suggestion from this study is that gender and ethnicity do not play an important role in epistemic beliefs and thinking as in achievement and SES. The teacher and the classroom environment may influence the development of these beliefs.

Barbara K. Hofer (2004) conducted a study, entitled: *Epistemological Understanding as a Metacognitive Process: Thinking Aloud During Online Searching.* In her work, she explores the paradigm of personal epistemology into the following approaches: epistemological development, epistemic beliefs, epistemological theories, and epistemological resources. She introduces a new emerging paradigm, *the epistemic metacognition and* represents personal epistemology as an aspect of metacognition: *a knowing about knowing,* suggested by K. S. Kitchener (1983). In her investigation about metacognition during online searching, she found that epistemic cognition present at the time of online learning. Next, she found that there was evidence regarding all dimensions of EB as an aspect of metacognition. Her findings were based on the dimensions of EB. Students initially learn by trial and error method. Students like to choose library access than a general search engine. When they able to search for their relevant information they evaluate that matter whether it is useful or not.

Barbara K. Hofer (2005) conducted her study based on contribution of Paul R. Pintrich, entitled*: The Legacy and the Challenges: Paul Pintrich's Contributions to Personal Epistemology Research*. Barbara here, introducing the contribution of Pintrich in the field of psychology, especially in epistemology. As

Pintrich, worked to develop a better understanding of individuals' conceptions about knowledge and knowing. His major work was on various areas of motivation, self-regulation and conceptual changes. Barbara finds out some challenges that may be a topic for research such as teachers' beliefs, affective aspects of personal epistemology, application to education and cultural research. In these areas Barbara and Pintrich, both argued for further research. Here Pintrichs' contributions in personal epistemology are conceptual, theoretical and methodological. Barbara shows her gratitude to Pintrich and wrote, Pintrich (2002) noted: "as we come to better understand how individuals think and reason about knowledge and knowing, we should not only be able to improve learning and instruction, but also better understand ourselves."

Barbara K. Hofer (2006) conducted again, a study in response to Muis et al.s' work entitled*: Beliefs About Knowledge and Knowing: Integrating Domain Specificity and Domain Generality: A Response to Muis , Bendixen and Haerle.* This paper is purely based on the review. This paper evaluates the work of those who examine the nature of the interaction between domain specificity of EB and domain generality of EB and its relation to learning outcomes. In this article, Barbara wrote that Muis et al. (2006) provide valuable suggestions to investigate epistemological issues. As there are methodological rigors in epistemological researches. Using a questionnaire may not be very useful. Suggestions for improvement in the existing questionnaire are it should be cognitive interviews instead of paper-pencil work.

Sarah Muller, Dr. Karin Rebmann and Elisabeth Liebsch (2008) conducted a new and very interesting study, entitled: *Trainers' beliefs about knowledge and learning-a pilot study*. In this study, researchers tried to drag attention towards the personal beliefs of business trainers. As there are numerous empirical studies focused on the epistemic beliefs of students, the beliefs of a teacher but the beliefs of the business trainer and their practices related to business training has been neglected. This research shows the result of a pilot study conducted with 52 business trainers by using a questionnaire (Epistemic Belief Inventory, EBI). Further, researchers try to say that, in the business field, there are several questions an individual faced related to their epistemic beliefs. As such, he thinks and may have questions-

How can I say that I know something better than experts?

Are the opinions of experts are more significant than my own opinion?

Thus the epistemic beliefs are always personal and subjective. This outcome raises the question that, the persons' set of assumptions, suppositions, ideas, and cognition are connected with subjective theories and also related to his view of himself and the world (Christmann, Groeben & Schreier, 1999). Subjective theories are general belief systems whereas; epistemic beliefs are related to a specific belief system of a person, as stated in this study. Researchers assumed that the teachers' epistemological beliefs-often unconscious, that controls their teaching practices in class or business training situations. Findings indicate that the teachers' epistemic beliefs are important not only to understand the beliefs of students but also to enable the teachers to help their students.

Ayse Ayspay (2010) had done his work on the topic: *Teacher education students' Epistemological Beliefs and their Conceptions about teaching and learning.* The main purpose of his study was to determine the relationship between teacher students' epistemic beliefs and their approaches to teaching-learning. The result was based on 341 student-teachers. In this study the "Epistemological Beliefs Questionnaire, EBQ" was used (Chan and Elliot, 2004). The instrument was adopted into Turkish by Ayspay (2009). The epistemological beliefs questionnaire includes 30 questions. He used Likert type scaling. The data in this study supported a two-factorial structure like Chan Ve Elliot's (2004), teaching and learning conceptions questionnaire, namely constructivist and traditional. Their findings indicated that the Turkish student teachers were strongly preferred constructivist conception in teaching and learning than the traditional conceptions.

Jackson, Dionne Bennett (2010) conducted a study, entitled: *The Impact of Science Teachers' Epistemological Beliefs on Authentic Inquiry: A Multiple Case Study* reviewed and this study contributes to the literature regarding teacher beliefs about knowledge and learning. Most interesting about this study is the examination of these beliefs at the middle, secondary and post-secondary levels and the study focus on a specific aspect of science education, Authentic Inquiry. The findings of this study support the literature on the influence of contextual factors and professional development on teacher beliefs and practice. The findings support and contradict

literature relevant to the consistency of teacher beliefs with instruction. This study's findings revealed that the use of reform-based instruction, or Authentic Inquiry, does not occur when science teachers do not have the beliefs and experiences necessary to implement this form of instruction. This investigator hopes that future studies will continue to provide insight into these beliefs and how to develop science teachers prepared to provide the types of reform-based instruction necessary to develop students with inquiring minds.

M. N. Hennessy, P.K. Murphy, and J.M. Kulikowich (2012) conducted a study, entitled: *Investigating teachers' beliefs about the utility of epistemic practices: a pilot study of a new assessment*. The main objective of this study is to investigate the beliefs of pre-service teachers and in-service teachers. In this study researcher used term pedagogical practices instead of teaching practices and showed that there is a great need for new researches to investigate teachers' beliefs about the utility of pedagogical practices that can be used to teach student methods to justify their new knowledge. The purpose of this study is to investigate teachers' beliefs about the utility of pedagogical practices that are specially designed to help students in providing different forms of justifications of new knowledge. He uses the pilot study method as the sample participants have training in teaching and have been exposed to their suitable areas. The researcher tried to divide the justification condition of epistemic beliefs into three epistemic frameworks- *foundationalism, coherentism, and reliabilism.* In *foundationalism,* the knowledge or structure of beliefs is hierarchical but some believe that the knowledge may be gathered through perceptual experience. And all beliefs regarding structure of knowledge are justified equally within the system which is called *coherentism.* Another frame of epistemic beliefs is *reliabilism*. *Reliabilism* stated that a person using the *foundationalistic* or *coherentistic* method of justification only has his knowledge by coincidence because these epistemic frameworks do not require observation outside the knower for justification (Gettier, 1963) and thus it has no guarantee for truth towards the system of beliefs. The researcher tries to explore his opinion by an example of Chris and the Pool. In *reliabilism*, the beliefs only justified based on the collection of data and were produced through a reliable cognitive process (Goldman, 1994). Participants for this study consisted of 54 pre-service and 16 in-service elementary-teachers. This study is

purely based on philosophical literature and psychology and the findings are very interesting as no teacher exhibited the foundationalistic method of pattern in teaching.

Takayoshi et al. (2012) conducted a study, entitled: *Thai University Student's Scientific Epistemic Beliefs: Relationships with Past Learning Experiences.* This study was conducted on 388 students studying at undergraduate degree programs in Thailand. The purpose of their study was to investigate the effect of past experiences of students on the learning outcomes and developing students' beliefs. Nature if personal epistemic beliefs are affected by gender, age, ethnicity, and cultural differences. The study was focused on the beliefs of students about biology and their learning strategies. As core classes are taught in the Thai language in Thailand but researchers used English as the medium of instruction. This study was based on five-factor dimensions of epistemic beliefs that were used as the dependent variable. While gender, age, subject major, type of high school, interest in biology and liking of biology were the independent variables. The first findings of the factorial structure have been identified at two disciplines-- general and specific (Schommer 1998, Schommer-Aikins, 2004). The second findings suggest that past learning experiences influence forming and developing their epistemic beliefs about biology. Out of the four demographic characteristics, the level of interest in biology and the level of liking of biology are profoundly more powerful than the age and subject major. The result of this study suggests that the level of interest and the level of liking biology are more powerful and helpful to develop the beliefs students.

Dr. Prakash Chandra Jena (2013) conducted a study, entitled: *Epistemological Beliefs of Teacher Trainees in Relation to their Gender and Academic Achievement: An Explorative Study.* In this study, the researcher identifies the different levels of epistemic beliefs, EB of primary school teacher trainee. As the researcher stated that thinking ability, as well as problem-solving ability changes as a persons' epistemic beliefs, change. The researcher has investigated the impact of EB on learning outcomes in a normal classroom. Different studies show that if a teacher is highly aware of his/her epistemic beliefs, can engage his/her student in high achievement task and orient their students towards epistemic maturity. Finding shows that male teacher trainee has more mature beliefs compared to female. Findings on epistemic beliefs in terms of academic achievements show that high achiever trainee has more sophisticated beliefs on a simple form of knowledge than low achievers.

There is a significant difference found among teacher trainees between the dimension of certain knowledge, innate learning, and academic achievements. No significant difference found between the quick learning dimension of EB and the academic achievement of teacher trainees.

Heather J. Green and Michelle Hood, (2013) made a study to understand significance of epistemic beliefs entitled: *Significance of epistemological beliefs for teaching and learning psychology: A review*. In this study researchers aimed to explore the significance of epistemic beliefs and how they influence teachers in their teaching and learning phenomenon. They argued the constructivist approach for learning. That constructivist approach came from the 'constructivist epistemology' proposed by Perry (1968). Researchers distinguish dimensions of knowledge, based on beliefs, into two: what knowledge is in particular and the process of knowledge in general. What knowledge is, related to certainty and simplicity of knowledge and the process of knowledge belongs to the source of knowledge and justification of knowledge. The researcher argued that sophisticated EB is beneficial for psychology students. Epistemic belief developed gradually. If teachers deliver their knowledge explicitly, the student will have an opportunity to develop their beliefs over time. Researchers further argued that teaching strategies can encourage students to use EB resources present in surroundings, to optimize their learning. For measuring EB, more relevant responses needed from students. A single response is not sufficient to measure EB. In this article, the researcher reports the implication and direction of teaching and learning for psychology students concerning higher education.

P. Sarantos (2013) conducted a study, entitled: *Exploring the Effects of the Computational Experiment Approach to the Epistemic Beliefs, the Motivation, the use of Modeling Indicators and Conceptual Understanding in Three Different Computational Learning Environments.* Like Boulton Lewis et al. (2001) and Dionne Bennet Jackson (2010); Sarantos Psycharis (2013) explored categorizing conceptions of science, learning, and motivation but instead of working with pre-service teachers the researcher used K-12 standard students. The central aim of this study was to investigate and demonstrate the impact of a computer-based experimental approach on epistemic beliefs, motivation modeling factors and learning outcomes for computer tools that are used as software tools. Using questionnaires, this study examined a strong impact of the computational approach on students' epistemic beliefs, as well as

their motivation at two levels, intrinsic and self-efficacy level. The findings indicate a positive and strong impact on students' core beliefs, EB and also on their motivation, as Druger (2006) infer that self-motivated students have an idea about science learning as it is very interesting, they enjoy learning science and can understand science.

Feng Deng et al. (2014) conducted a study, *entitled: The Relationships among Chinese Practicing Teachers' Epistemic Beliefs, Pedagogical Beliefs and their Beliefs about the use of ICT.* That aimed to investigate the relationships among practicing teachers' epistemic beliefs, pedagogical beliefs and their beliefs about the use of ICT through survey methodology. Participants were 396 high school practicing teachers from mainland China. The path analysis results analyzed via structural equation modeling technique indicated that the systemic relationships among these three types of beliefs were nested. Specifically, teachers' sophisticated beliefs about the source of knowledge were aligned with constructivist pedagogical beliefs and constructivist use of ICT, with one belief highly related to another.

John W. White and Richard H. Chant (2014) conducted a study, entitled: *Challenging Idealism: Pre Service Teachers' Core Beliefs Before, during, and after an Extended Field Based Experience.* The study aimed to pay attention to the teachers in many aspects as to how a teacher learns from his practices and how he learns by the interactions of students, environment, and knowledge. The most interesting fact he raised that teachers' beliefs differ from teacher knowledge as the teacher's beliefs are grounded in personal understanding and maybe subjective while knowledge is grounded in the factual understanding that may be objective (Pajare,1992). John and Richard organize a specific course and field experience within a structured plan and used four domains: teacher, instruction, classroom, or students to examine how the experiences are made subjective or objective, how influences students and their beliefs within the field or classroom. The participants were 28 university students of two different courses (15 in English and 13 in social studies). The findings suggest that the pre-service teachers were focused especially on the teacher-centered and instructional context of the teaching and learning than in on classroom context and the students' nature and also on their learning. They explore the query that how students' beliefs changed over the end of the course of the semester and how it is directly influenced by the teachers. Findings showed that some

beliefs of the students and some beliefs of the teachers were changed, some beliefs strengthened while some weakened and develop a new belief with time.

Epistemological and Pedagogical Beliefs are different from each other or there is a relationship between them? To find out this query researcher **Msendekwa, Michael B. (2015)** conducted their study, entitled: *Epistemological and Pedagogical Beliefs of Pre-service and In-service Teachers in a Tanzanian Context*. The sample size was 1000 pre-service and in-service teachers from the first and third years of the graduate-level programs. The motives behind this study had two ways-- The first was to apprized if student-teachers' epistemological and pedagogical beliefs varied based on their year of study and type of teacher. The second was to inquire about the relationships of epistemological and pedagogical beliefs of both pre-service teachers and in-service teachers at St. the John's University of Tanzania. A total of 702 pre-service and in-service teachers from year one and three participated in the study out of the selected sample. Two kinds of questionnaire was used, one teaching and learning conceptions and other for epistemic beliefs. Findings indicate that in the first year pre-service teachers have a constructivist approach towards EB and third-year pre-service teachers show a neutral attitude towards the traditional approach. In-service teachers were closer to neutral than the pre-service teacher. There is was a significant interaction between teachers and the year of study.

Are there a relationship between epistemological beliefs and gender? To find its answer a research conducted by **Aaghizade, E. & Jadidi, E. (2016),** entitled: *The Impact of Translators' Epistemological Beliefs and Gender on Their Translation Quality.* This study aimed to determine the relationship between translators' EB and gender on their translation quality from the Persian language to the English language. The sample was drawn from the Islamic Azad University of Marvdasht. It was 12 male and 41 female students out of 53 MA students. Participants were selected by convenient sampling method. Researchers use EBI (epistemic beliefs inventory), adapted by Schraw, Bendixen, and Dunkle, (2002). The findings were based on five dimensions of EB. Among five, quick learning (QL) affects translation quality. Here the researcher claimed that translation quality is not affected by EB, significantly, except quick learning. The effect of gender on translation quality seems one-directional, as findings prove that males translated better than females. The findings show that EB and gender affect translation quality.

***Albert Tarmo* (2016)** has done his work entitled: *Pre-service science teachers' epistemological beliefs and teaching reform in Tanzania*. In his studies, he explored the beliefs of pre-service teachers about science knowledge and their teaching practices. The researcher took 6 pre-service science teachers to observe and interview them. During this study, he notifies that the teacher should be a facilitator, motivator, a promoter of learning in the classroom and develop a planned environment that will let students question, critically think and create artifacts. He further notifies that when a teacher trainees (pre-service teacher) join the teaching profession he has developed his personal beliefs by his own schooling experiences while beliefs about science knowledge have already been developed (kagan, 1992; Levin, 2008). Teachers' beliefs once developed are often hard to change because they form the core of a teachers' identity (Helms, 1998; Kagan, 1992). Further, he specifies the epistemic beliefs and teaching practices involving pre-service or in-service science teachers that have consistently established a connection between teachers' beliefs about scientific knowledge and their teaching practices. His study shows that a pre-service science teacher has a direct correlation between their science knowledge and teaching practices. A multidimensional approach of epistemic beliefs was adopted to understand the pre-service science teachers' beliefs about scientific knowledge and teaching practices. He used all dimensions of beliefs (structure, stability, source, and speed of ability to know) developed by Schommer. This multidimensional model adopted by Schommer (1990) often used by others as mentioned by the researcher. The researcher conducts a semi-structural interview in which questions were set by him, based on the insight from the literature on teacher beliefs about knowledge & knowing (Chan & Elliot, 2004; Schommer, 1990; Tsai 2006). The participants were pre-service science teachers at the University of Dar Es Salaam, Tanzania. In his result, he found that teachers believed each science question has a single correct answer and the teacher preferred textbook-based science ideas. Pre-service science teachers believed that the learning ability of science is innate he tried to emphasize the point that some learner is born capable of learning science while others are not. These results are compatible with the result of Kang and Wallace (2004) who calculated that the beliefs of teachers related to science are seen in their teaching practices. He also proves that science teaching as probably learner-centered rather than the teacher-centered. The beliefs developed in pre-service science teachers are resisted to change.

Anthony A. De Mauro & Patricia A. Jennings (2016) conducted a study entitled: *Pre-service teachers' efficacy beliefs and emotional states.* In this study, researchers suggested that teachers' efficacy beliefs play an important role in how they create quality learning environments. When pre-service teachers develop strong efficacy beliefs, they can be confident in their abilities to be successful teachers once they enter the field. One way pre-service teachers obtain efficacy information is through their emotional states. Positive emotional experiences like joy and satisfaction may enhance a teacher's sense of efficacy, while undesirable emotions such as fear and worry could be debilitating to efficacy beliefs. The current study investigated how feelings of depression, anxiety, and stress contributed to efficacy beliefs among a sample of 297 American pre-service teachers. Results from regression analysis showed that depressive symptoms negatively predicted teacher efficacy beliefs. However, reports of anxiety and stress did not significantly predict efficacy. Student teaching experience also did not significantly predict teacher efficacy. The findings of this study offer new insights into the field of pre-service teacher efficacy and pre-service teacher mental and emotional health. The participants in this sample reported less depressive symptoms generally reported higher efficacy beliefs. These findings can be particularly informative for teacher preparation programmers to draw awareness to the importance of emotional health in candidates' perceptions about their future careers. Given that efficacy beliefs contribute to a young teacher's effort and persistence in a challenging profession, fostering emotional well-being and efficacy will likely pay long-term dividends in that teacher's future.

Florino Berding, Katharina Rolf-Wittlake and Janes Buschenlange (2017) conducted their study, entitled: *Impact of Different Levels of Epistemic Beliefs on Learning Processes and Outcomes in Vocational and Training* Epistemic beliefs are usually persons' core beliefs about knowledge and knowing. Their study contributes to the modeling of persons' core beliefs which are based on two assumptions. First, the epistemic belief is a multi-level construct. Second, the concrete level of persons' beliefs influenced the learning process and outcomes more strongly. The aim of this study to find a superiority of domain and topic-specific epistemic beliefs compared to general epistemic beliefs. As the domain-specific beliefs developed through interaction with domain-specific knowledge and problems. A very few studies consider multiple levels of beliefs, in their research design. While most of

the studies are concentrated only on one level of epistemic beliefs influencing learning outcomes. Epistemic belief can be differentiated into a general and domain-specific level (Buehl and Alexander, 2006). They define general epistemic beliefs as it develops informally in the environment of home, in peer-interaction, in the workplace and other non-academic environments (Muis et. al., 2006). While the academic beliefs about knowledge and knowing to develop when the individual enters an educational system (Muis et. al., 2006). The concrete levels of epistemic beliefs develop from general levels, and it will more important for dealing with domain-specific issues. Finally, the findings show that the levels of the domain and topic-specific epistemic beliefs provide a stronger prediction of the learning process and outcomes.

Chin Hai Leng, Nabeel Abedalaziz, Antriman Vipinosa Orleans, Zahra Namie and Atiquil Islam (2018) conducted a study, entitled: *Teaching Practices of Malaysian Science Teachers: Role of Epistemic Beliefs and Implicit Intelligence* This study aimed to investigate how science teachers' beliefs for intelligence and their beliefs about knowing and knowledge acquisition affect their teaching practices. This study was a combination of three research traditions, *Epistemological Beliefs* (EPIST), *Implicit Theories of Intelligence* (IMPLS), and *Teaching Practices* (TPRACT). The cognitive learning theories are focused on psychological constructs such as attention, perception, encoding storage and retrieval of knowledge (Shunk, 2006). According to Muis and Foy (2010), EPIST influences the cognitive process and also teaching and learning. The study of teachers' beliefs provides vast information towards the relationship between beliefs and student outcomes and it also provides insight into teachers' classroom practices (Kagan, 1992; Muis & Foy, 2010). Kagan (1992) reported that "a teacher's beliefs usually reflect the actual nature of the instruction the teacher provides to his students". The number of participant science teachers was 285. The result of this study showed that the Malaysian teachers hold more eclectic beliefs in which they viewed teaching as a combination of student-oriented along with teacher-centered learning. These results interpret the teachers' beliefs about science curriculums as what to teach and what to be learned and beliefs about how to teach or classroom environment. For epistemological beliefs, Malaysian science teachers were holding their sophisticated beliefs about learning and nature of knowledge acquisition. As such, knowledge is complex and the ability to learn is acquired and learning is

gradual. The Malaysian education system had gone through countless changes and the teachers tend to share authority with their students in two ways communication and play an important role as facilitators of knowledge. The result of this study support Chan & Elliot's (2004) views about epistemic beliefs and the teaching practices of a teacher. As they said that the teaching practices are derived from their epistemic beliefs. It is importantly clarified the relationship and each dimension of epistemic beliefs (developed by Schommer, 1990) and implicit theories of intelligence (entity ability and incremental ability) have a great influence on teaching practices.

Leila and Jo Brownlee (2018) conducted a recent study, entitled*: An investigation of Pre service Teachers, Beliefs about the Certainty of Teaching Knowledge*. In this study researchers divide their work into three parts as Epistemic Belief Research, Certainty of Knowledge Beliefs and Learning and Certainty of Knowledge Beliefs and their Teaching. As they have done their best effort to understand the area of the EB system related to the pre-service teacher. This work is focused on pre-service teachers' core beliefs and their effect on the process of delivery of knowledge. The researcher explored their work conducted on EB. They describe the dimensions differently as—certainty of knowledge may be considered as foundational beliefs while tentativeness of knowledge is a foundation of scientific thinking and the certainty dimension is a core component of probable all conceptions of epistemological reasoning. Three main approaches were defined as—General Developmental Approach, Multidimensional Approach and a fixed of Epistemic Cognition Approach. These approaches explore different aspects of persons' core beliefs. The researcher conducts their work in the context of teacher education and teacher knowledge. This work contributes a better understanding of pre-service teachers' assessment of degree. This work also emphasizes the contextual analysis of EB. The researcher conducts their work on sixty-six pre-service teachers, studied in south-east Norway University College. It was mixed-method research. Their result was based on quantitative measures and showed that pre-service teachers have specific beliefs about the certainty of teaching knowledge that was developed during their course. The qualitative measure showed that the pre-service teachers' beliefs for the certainty of knowledge change by time.

Latief Ahamd Tali and Irshad Ali Dar (2019) conducted a study, entitled: *A Study of Epistemological Belief of Senior Secondary Students.* The main

purpose of this study was to find out the differences among senior secondary students about epistemic beliefs and their gender. Researchers also support the fact behind effective teaching and learning that teachers directly influence the development of EB through their instructions that are influenced by their own epistemic beliefs. The researchers paid their attention to the development and successful implementation of the curriculum based on the epistemic beliefs of both teachers as well as students. In this study, the investigator found that the level of EB of the senior secondary school of different districts of Kashmir can be divided into three: mature level of EB, moderate level of EB, and naïve level of EB. The investigator found that 62% of students have a moderate level of EB, 21% mature level of EB while 17% of students have their developed their beliefs at the initial stage i.e. naïve EB. The male and female students don't differ concerning certain knowledge, quick learning and innate ability dimensions of EB. Male students have more developed beliefs concerning females.

2.1 Summary of the review related literature

There is some definite reason to conduct this study. As in review, different studies done differently. Reviews indicate the bright path of epistemological studies. Researchers identify some issues and gave their suggestions for future research. In the first review, the researcher identifies various schools of philosophy that have epistemological questions. But there is no suggestions are given for pre-service teachers' beliefs. This study talks about universal Epistemic Beliefs (EB) but no idea given about beliefs of pre-service teachers. Next, Hofer and Pintrich provide a basic understanding of epistemology and epistemic beliefs. As there are various aspects of life where the study is needed regarding the beliefs of an individual. Hofer again pointed out that, most of the studies regarding EB conducted on teaching and learning. But there is no more work on other aspects of academics. The result of Conley et al.'s, study, shows that the different groups may have different ways of expressing knowledge and ways of thinking that could create group differences in epistemic beliefs. This result may be an important avenue for future research. The personal effects involved such as prior knowledge in science, except gender, Ethnicity, SES, and achievement that should be investigated in the future. Hofer introduced some emerging paradigm named epistemic metacognition. She fined the relationship between epistemic metacognition and online searching. This study may

fruitful for other countries. But in the Indian context, online learning is not much relevant to other countries. Hofer introduced the contribution of Pintrich in the realm of psychology, especially in knowledge and knowing. Based on this paper, in the field of culture, applications to education and in other, different aspects of personal epistemology further research is needed. Hofer again responded on Muis et al.'s study. In her article, she raised an issue of domains regarding EB and told that researchers noted that there are two main domains identified. Further researches in these two domains are needed. The study in these two was conducted in the psychology discipline. The study of Sarah et al. is based on Business Trainers' EB. Both trainers and teachers have a specific belief system, the EB. But in this study, the only belief of trainers included. These beliefs unconsciously control the business training situation as well as the teaching practices of a teacher.

The study of Ayspay identifies the approaches of teaching. Their study shows that two kinds of teaching practices are adapted by teachers—constructivist approach as well as the traditional approach. Teachers preferred constructivist conception (approach) than traditional. This study is based on a specific culture of Tanzania. Bennet conducts her study on biology students. It was purely qualitative. Her study suggests that there is a relationship between teaching and authentic inquiry whereas authentic inquiry is developed by developing the EB of a science teacher. This study is limited to science teachers and their authentic inquiry only. Hennessy et al. studied the philosophical approach of EB. They introduced three epistemic frameworks. Takayoshi et al. studied the factors affecting the EB of biology students. The experience related to biology might not be sufficient to develop the beliefs about the subject and learning of the subject. This study was restricted to biology students. Dr. Prakash studied on EB of trainee students at the primary level. His study was delimited on three different districts of Jammu & Kashmir in India. Green and Hood's study was conducted to investigate the relationship between gender and academic achievement concerning epistemic beliefs. Further study may consider socioeconomic status, the status of the family their culture and so on. P. Sarantos studied computational approach towards EB, purely based on the use of computer applications by science students especially physics educators at the secondary level. This study indicates the way of the influence of expertise and other sources on changing EB. In Feng Deng et al'.s study, Survey methodology is used. Epistemic beliefs (EB), Pedagogical Beliefs and the constructivist use of ICT are highly

correlated. This study along with survey interviews would also be used to get a deep understanding of pre-service teachers' EB. The findings of White and Chant's study shows that the pre-service teachers are focused on the teacher-centered and instructional context of teaching and learning rather than on classroom context, the students' nature, and their learning. In the present study, the researcher will try to understand the beliefs of pre-service teachers in the context of students' nature and their learning. The study of Michael examined the relationships between pre-service and in-service teachers' epistemological and pedagogical beliefs. In this study, only teachers' pedagogical beliefs were examined. It sounds very interesting to find that teaching-learning conception (TLCQ) worked better in the Tanzanian context and not the epistemic beliefs questionnaire (EBQ). So, there is a need to develop a questionnaire of epistemological beliefs that fits the Tanzanian context to be used in Tanzania and may generalize in other countries. Aaghizade and Jadidi indicate that a single study cannot determine the effect of epistemic beliefs (EB) and gender on translation quality. Findings of the study of Albert highlight the need for teacher education programs framed in light of its design to explore challenges & transform pre-existing beliefs. There is a need for a teacher education program to develop more sophisticated epistemic beliefs. The sample size was very small as it was only six that is not sufficient to represent a large population. The study was restricted to science teachers only. Antony and Jennings raised the issue of efficacy beliefs and emotional states of teachers. In this study, emotional states like joy, satisfaction, anxiety, depression, and stress on the efficacy beliefs of pre-service teachers, play an important role, in creating a quality learning environment. The researcher suggests future work on EB, to understand the effect of interest in a particular subject or a particular teaching method of pre-service service teachers. Berding et al. suggest a need for concentrated research on domain-specific and topic-specific levels of epistemic beliefs and the learning process and outcomes. The study was limited to the business administrator as retailers, wholesalers, industrial assistants, etc. In the study of Chin et al., a school-based curriculum is utilized in the education system of Malaysia. Epistemic beliefs and incremental theories are used to adopt student-teaching practices. The questionnaire was composed of 8 items and the 6-point Likert scale item response format. Researchers follow different research traditions in their study and find out that knowledge is complex and learning is a gradual process. Leila and Brownlee identified different kinds of approaches but they did not explore them

very well. Thus, they leave a clue for further study to explore all kinds of approaches, for developing a better understanding regarding epistemic beliefs (EB).

2.2 Conclusion

The summary indicates that there is a research gap that has been identified. To fulfill that gap present study is conducted. The present study is purely based on beliefs of 'Pre-Service Teachers'. This study will recognize the way of thinking, way of making strategies, their learning and so on. This study is dedicated to exploring the beliefs of pre-service teachers within or out of the classrooms.

Chapter 3

Methodology

3.0 Methodology

This study aims to measure the effect of pre-service teachers' core beliefs on their learning outcomes, learning approaches and teaching strategies. In order to achieve the desired objectives of this study, a systematic procedure was followed:

3.1 Research design

A research design is a framework of methods and techniques; it is a plan, structure and a strategy of investigation chosen by researcher to combine various component of research inevitably, to obtain answers of research questions or research problems. A research design primarily concerns with aims, uses, purpose, and a definite plan within a particular time at a particular place.

Thus, the Research design can be defined as a conceptual structure within which research will likely be done. It includes an outline of what the researcher will do from writing the research questions and their operational implications to the final analysis of data (Kothari, 2004). Thus the research design may defined as it is the blueprint that is followed by researchers to complete their study and it ensures that the study is relevant to the problem and will use economical procedure.

Nature of the present study demanded the *Survey Research Design*, so the study was designed and conducted under *Descriptive Survey Method* to meet the objectives. Survey research is non-experimental and can be qualitative, quantitative or the combination of both. It is not concerned with characteristics of individuals as individuals. Hypotheses and research questions both are used in survey research. The samples are usually selected to represent a larger population. The major source of data collection is an individual itself. Data have collected directly or indirectly from the target population. Findings are presented in an explicative way, enhanced by numerical, categorical and graphical depictions. The core of survey design is to describe the characteristics of population.

Epistemic beliefs are meaningful and significant consequences of teachers' knowledge that focus on life experiences and learning phenomenon. Recent studies support that the EB held by teachers, have direct influence on their decisions and teaching strategies, they formulate regarding classroom instructions (Geometry &

Analysis, n.d.). Many of the research concerns in pre-service teachers relate to lack of deep study. These concerns include the lack of teacher educator engagement in asking questions and argumentation, in addition to the lack of their participation in all kind of investigation initially. Epistemological Beliefs (EB) serve as a factor that has an influence on how a teacher teach, how learning occurs after an instruction within class.

3.2 Why mixed method

The investigator of this study did not choose to conduct a qualitative, quantitative or both kinds of methods; the study chooses the investigator. In this study investigators' questions in the field have begun with term *How* or *Why.* As this investigator began to read and review more literatures related to her study and interact and observe pre-service teachers, she felt that the sole use of quantitative or qualitative method is not appropriate for her study. As investigator wants to seek in-depth information related to beliefs of pre-service teachers. So investigator adopted mixed method research instead of these two. Mixed method research is known as the third methodological movement. Its emergence was in response to the limitations of the sole use of these two quantitative and/or qualitative methods and is now considered as equitable alternative to these two traditions. Mixed method research is an, "empirical research that involves the collection and analysis of both qualitative and quantitative data"(Almalki, 2016). Thus mixed method research is, *a research in which the researcher collects and analyses data, calculates the findings and draw conclusions of present study by using both qualitative and quantitative approaches in a single study (Creswell, 2007).*

3.3 Population

A population for research is a large collection of individuals or subjects. This population is the main focus of a scientific query. It is for the benefit of the population that researches are done. However, due to the large size of population, a researcher cannot test every individual in the particular population because it may too expensive and time-consuming. This is the reason why researchers use different sampling technique. A research population is also known as a well-defined collection of individuals or subjects known to have similar and desired characteristics. All

individuals or subjects within a definite population usually have a common, interconnected characteristics or a common and definite trait.

A population is defined as a group of individuals with at least one common characteristic which differentiate that group from other individuals. It consists of all the individuals who make up a designated group with desired features. From which a researcher is interested in studying and ultimately, drawing conclusions about. Here the population of the study is pre-service teachers of different university or colleges, studying in Lucknow city. To narrow the topic in order to make it more pin-pointed the target population was the pre-service teachers of last year or B.Ed. 4thsemester.

Table 3.1: Participant's Demographics

S. No.	No. of pre-service teachers	Gender	Course/Semester	College/university
1	40	Male	B.Ed./4th sem.	B.B.A. University, Lucknow
2	40	Female	B.Ed./4th sem.	B.B.A. University, Lucknow
3	30	Male	B.Ed./4th sem.	Lucknow University
4	30	Female	B.Ed./4th sem.	Lucknow university
5	30	Male	B.Ed./4th sem.	Aryavart Degree College, Lucknow
6	30	Female	B.Ed./4th sem.	Aryavart Degree College, Lucknow

3.4 Sample & sampling technique

A sample is a small proportion of the target population that is selected for observation and analysis that will relevant to current study. By observing the characteristic of the sample, one can make certain inferences about the characteristics

of the population from which it was drawn. One can also infer changes observed in the sample to changes that would likely have occurred in the population. The sample should be true representative of the population, so it could not be selected haphazardly. There is a systematic way to choose the sample to maintain representativeness, and that systematic way is known as Sampling Technique. Total 200 data were collected from the target population. The aim of the selection of target population was equal participation (50% each) of both genders, male and female. But due to inappropriate size of both samples from target population, the actual participation of male was 46% and female was 54%.

So the expected data= 200 (100=male; 100 female)

And observed data = 200 (93=male; 107 female)

These pre-service teachers, as a sample, were selected by using ***purposive method of sampling*** under *non-probability sampling technique*. Purposive sampling is a type of Non-probability sampling technique in which data is collected from the population having rich information. Thus a purposive sample is that selected arbitrarily and is very representative of the total population. This sampling method is also called "judgmental sampling" because the selection of sample from target population is based on choice of investigator. The sample was drawn from different universities and colleges. Most of the participants were studied at the government body including university campus and government colleges.

3.5 Data collection

Researcher used so many items from different sources. As, from a questionnaire consisting 63-items, adapted by Schommer (1990), an inventory (32 items) by Schraw, Bendixen and Dunkle, (2002) and a survey (38 items) by P. Wood & C. Kardash's, (2002). 50-items were drawn out of these sources. The 50 EBQ consists of five factors, namely structure of knowledge as they are simple or complex (10items), certainty of knowledge as changeable or certain (9 items), control of knowledge as fixed or innate (12 items), source of knowledge as authority or expert (11 items), and development of knowledge as quick learning or not (8 items). Each of the 50 EBQ items was rated on a 5-point Likert scale. Where, 1 stands for strongly disagree and 5 for strongly agree. The scores of five dimensions were recorded. As a

result, for all five factors, higher points indicate more sophisticated epistemic beliefs of concerning dimensions. At the time when EBQ was adapted, pre-service teachers were sitting in the examination of final or last semester yet all gave their full cooperation and thus EBQ was handed over.

The need for in-depth exploration of pre-service teachers' thinking obligated the adaptation of an interpretive approach in which semi-structured interview conducted. This interview was done using a set of guiding questions. Questions were set by the researcher based on the insights gained from the literature reviews on pre-service teachers' beliefs about knowledge and knowing (Debacker, Crowson, Andrea, Thoma, & Hestevold, 2018). These all guiding questions were able to explore the beliefs of a pre-service teacher regarding all five dimensions as such structure of knowledge, the certainty of knowledge, control of knowledge, source of knowledge and development of knowledge.

3.6 Tools

There were two kinds of tools, adapted to meet the entire knowledge of a persons' core beliefs, questionnaire and semi structured interview. 20 participants were drawn randomly from the target population for interview (10 male and 10 female). Most of the participants were taken from BBAU. While 200 sample (93 male and 107 female) from the target population were drawn for questionnaire, from different universities and colleges. The whole study was based on a mixed method of research. This method was adapted for dealing with a better understanding of Epistemic Beliefs, (EB) of pre-service teachers.

3.7 Data analysis

Data collection and data analysis have done simultaneously. The data analysis was based on statistical procedure. Factor analysis, Mean of the scores and Standard deviations are used in statistical analysis.

3.8 Procedure

Investigator recruited students from bachelor of education (B.Ed.) courses from different colleges as well as universities of Lucknow city. Students received booklet of questionnaire related to epistemic beliefs, with full information. This

questionnaire instructed to complete within 60 minutes. Investigator first introduces the term epistemic beliefs (EB) and then the purpose of this study, to all participants. The reason behind this was to have active participation of them and to draw more accurate result. Students were free to contact if needed, via mobile phone or email. In the case of interview, students from a single class were selected randomly. Semi-structured interview completed in a single setting. It was a digitally voice recorded interview and taken by direct, face to face and/or indirect, by mobile.

Chapter 4

Data Analysis & Interpretation

4.1 Data analysis and its Interpretation

Objective 1: To explore the multiple dimensions of Epistemic Beliefs (EB).

Research question 1: What are the multiple dimensions of Epistemic Beliefs (EB)?

On the basis of reviewed literature, personal epistemological theories are made-up of multiple dimensions. These dimensions appear explicitly in some of the developmental process (Buehl & Fives, 2009). All the models include nature of knowledge and process of knowing. The specific content somehow may vary in others' model. The reviewed researches suggested that epistemological beliefs are relatively developing late and gradually. The epistemological theory is different from a childrens' theory of biology or physics. There are different models representing the dimensions of EB. Hofer and Pintrich (1997) represent components of various models, given by various researchers.

Components from existing models (dimensions) of epistemic beliefs: Presented by Barbara K. Hofer & Paul R. Pintrich (1997)

Core dimension of epistemic theories			**Peripheral beliefs about learning, instruction and intelligence**	
Researcher (s)	**Nature of knowledge**	**Nature of knowing**	**Nature of learning instructions**	**Nature of intelligence**
Perry	Absolute vs contextual Relativism	Received vs constructed Outside the self vs self maker of meaning		
Baxter Magolda	***Certainty of knowledge:*** Absolute vs contextual	***Source of knowledge:*** Reliance vs self	Role of learner Evaluation of learning Role of peers Role of instructor	
		Justification of knowledge: Reliance authority vs self		

King & Kitchner	***Certainty of knowledge:*** Certain, right or wrong vs uncertain contextual	***Justification of knowledge:*** Knowledge requires no justification vs knowledge is constructed & Judgments are critically revaluated		
	Simplicity of knowledge: Simple vs Complex	***Source of knowledge:*** Reliance on authority vs Knower as constructor of meaning		
Kuhn	***Simplicity of knowledge:*** Absolute right or wrong answers vs knowledge evaluated on relative merits	***Justification of knowledge:*** Acceptance of facts, unexamined expertise vs Evaluation of expertise		
		Source of knowledge: Experts vs experts critically evaluated		
Schommer	***Certainty of knowledge:*** Absolute vs tentative and evolving	***Source of knowledge:*** Handed down from authority vs derived from reason	Quick learning	Innate ability
	Simplicity of knowledge: Isolated unambiguous bits vs interrelated concepts			

There are various models regarding to epistemic beliefs. Previous researches and reviews explored that there are mainly four dimensions which are as:

Certainty of knowledge: The degree to which a person sees knowledge as fixed or changes over time. At lower level truth exists with certainty while at higher level, knowledge is tentative and evolving.

Simplicity of knowledge: As stated by Schommer knowledge is viewed on a continuum as an accumulation of facts or as highly interrelated concepts. At lower level view of knowledge is a discrete, concrete, knowable fact; at higher level individual see knowledge as relative, contingent and contextual.

Source of knowledge: Perry (1970) described that the source of knowledge is the evolving conception of self as knower, with the ability to construct knowledge in interaction with others. Further Perry said that "the person previously a holder of meaning, become a maker of meaning." Schommer (1990, 1994b) has postulated source of knowledge as a fifth dimension in her study, although its existence has not been demonstrated empirically. She has attempted to measure in a more limited fashion, focusing on beliefs about authority.

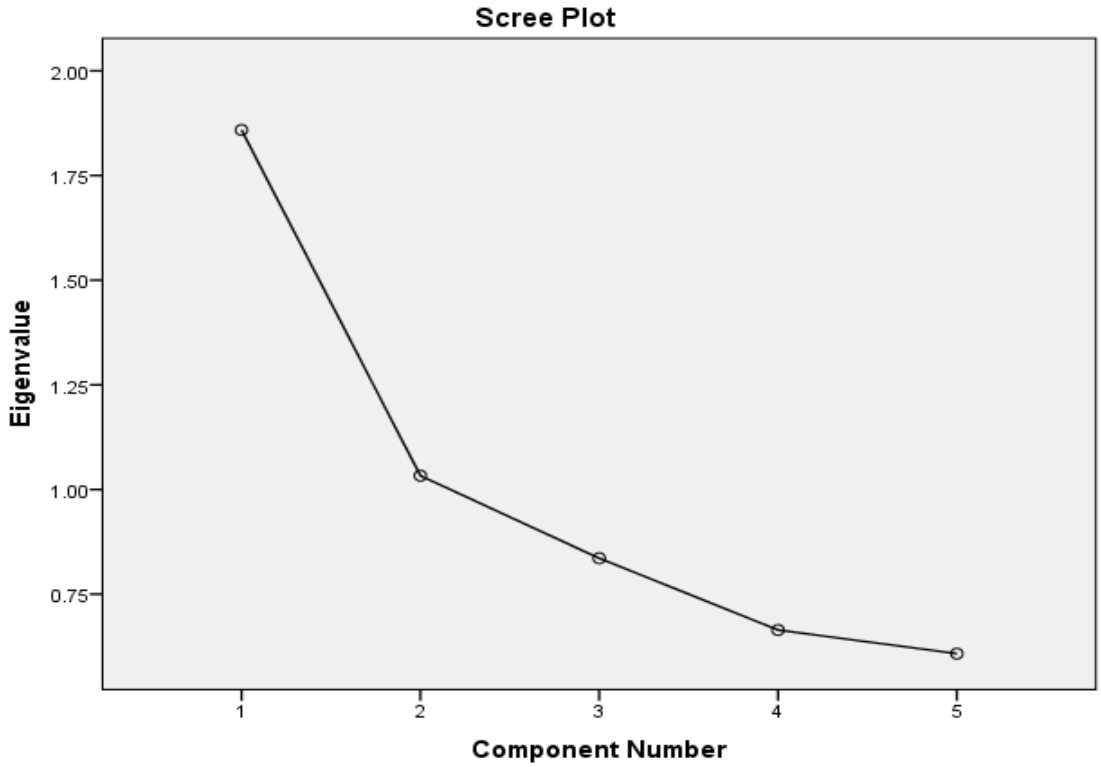
Justification of knowledge: This dimension includes how individual evaluate their knowledge claim based on reasoning and evidences, knowledge delivered by authority and expertise, and by the evaluation of experts. As individuals evaluate evidence and to substantiate and justify their beliefs, they move through dualistic beliefs to realistic beliefs.

Hofer & Pintrich (1997) divide knowledge and knowing into two: nature of knowledge including certainty of knowledge and simplicity of knowledge while nature of knowing including source of knowledge and justification of knowledge. But Schommer (1994) proposed that the dimension about learning might be included, as it is also a part of knowledge and knowing process. Schommer (1990, 1994) proposed two new dimensions: control of knowledge and speed of learning. These two dimensions may used instead of justification of knowledge. Most of other studies have evidence that there are five dimension of epistemic beliefs including—simple knowledge, certain knowledge, innate ability, omniscient authority and quick learning as identified by Schommer (1990).

Table 4.1: Extraction of multiple dimensions of Epistemic Beliefs

	Initial	**Extraction**
Structure of knowledge (SK)	1.000	.758
Certainty of knowledge (CK)	1.000	.509
Control of knowledge (CoK)	1.000	.429
Source of knowledge (SoK)	1.000	.518
Development of knowledge (DK)	1.000	.678

Figure 4.1: Scree plot graph depicting Eigen values

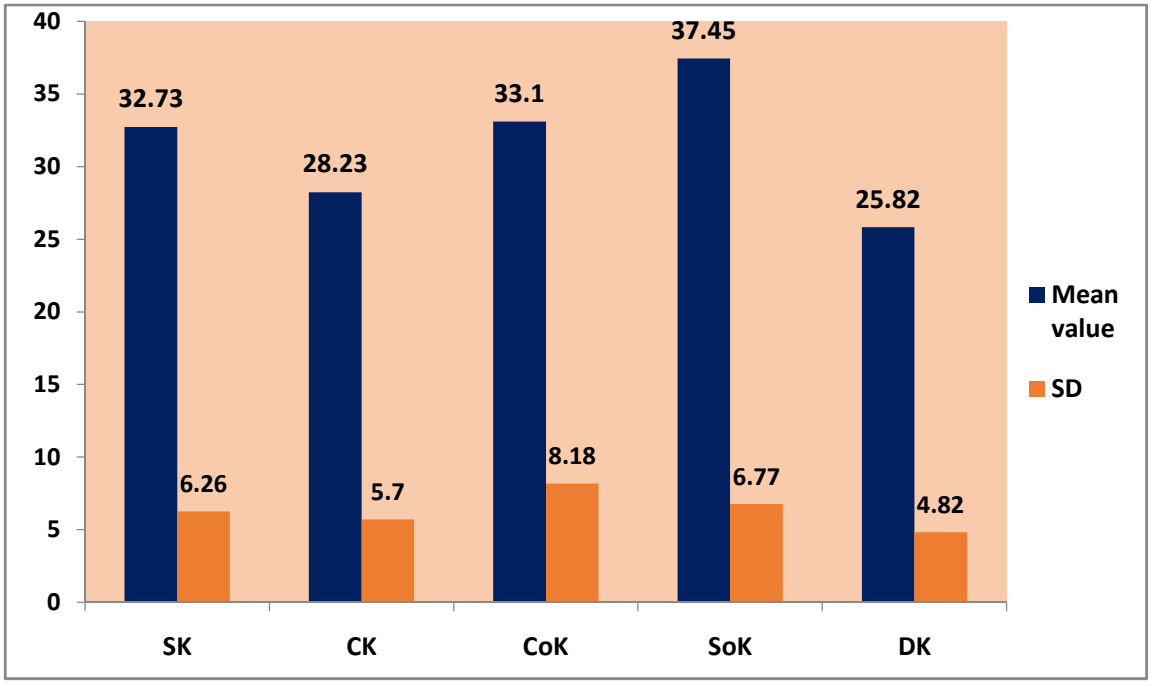


The present study was made on the basis of questionnaire and semi-structured interview. Schraw and his colleagues (2002) developed the Epistemic Belief Inventory (EBI) to investigate the dimensions of epistemic beliefs. The EBI is modeled on Schommers' (1990) four factor instrument, Epistemic Belief Questionnaire (EQ). The questionnaire is also influenced by a survey on epistemic

beliefs adopted by P. Wood & C. Kardash, (2002). The current version of EBQ comprises five factors. Each factor represents one facet of epistemic beliefs: simple knowledge (SK), certain knowledge (CK), control of knowledge (CoK), Source of knowledge (SoK) and development of knowledge (DK), structured on a five point likert scale that ranges from 1 to 5 corresponding to strongly disagree to strongly agree.

As first objective is based on exploring the dimensions of epistemic beliefs. To extract dimensions of epistemic beliefs factor analysis was applied to EBQ items. Only items with factor loading greater than or equal to 0.3 was retained. Here maximum Eigen value is 1. Based on this 5 factors were extracted representing the dimensions of epistemic beliefs within the sample of 200 pre-service teachers in Lucknow city. These items were labeled as: structure of knowledge (SK), certainty of knowledge (CK), control of knowledge (CoK) Source of knowledge (SoK) and development of knowledge (DK). These findings are similar to the findings of Schommer (1990): structure of knowledge, stability of knowledge, source of knowledge, control and knowledge acquisition (Aypay, 2010)(Tarmo, 2016) .

Bar Graph 4.2: Mean value and standard deviation of multiple dimensions of EB



Structure of knowledge: First dimension is identified as structure of knowledge. Its mean value is 32.73 among pre-service teachers and standard deviation (SD) is 6.26.

Certainty of knowledge: Second dimension is identified as certainty of knowledge. Its mean value is 28.23 among pre-service teachers and SD is 5.70.

Control of knowledge: Third dimension is identified as control of knowledge. Its mean value is 33.10 among pre-service teachers and SD is 8.19.

Source of knowledge: Fourth dimension is identified as source of knowledge. Its mean value is 37.45 among pre-service teachers and SD is 6.77.

Development of knowledge: Fifth dimension is identified as development of knowledge. Its mean value is 25.82 among pre-service teachers and SD is 4.82.

If these findings are arranged in a sequence, based on mean value and SD of scores of multiple dimension of EB, it would be arranged in following hierarchy:

1. Source of knowledge (SoK)
2. Control of knowledge (CoK)
3. Structure of knowledge (SK)
4. Certainty of knowledge (CK)
5. Development of knowledge (DK)

These findings indicate that pre-service teachers have strong beliefs regarding source of knowledge (SoK) while least beliefs in development of knowledge (DK).

Objective 2: To find out the various sources to develop the Epistemic Beliefs of pre-service teachers (EB).

Research question 2: What are the various sources to develop the Epistemic Belief of pre-service teachers (EB)?

The source of knowledge regarding epistemic beliefs (EB) is a basic epistemic question that has been considered by various researchers (Hofer & Pintrich, 1997a). Schommer (1990) also included the source of knowledge and knowing as one of the five epistemological belief dimensions in her multidimensional conceptualization of beliefs. Although Schommer (1990, 1993) did not identify source as a coherent factor when she did factor analysis of data from her belief measure while other researchers have identified the source of knowledge as a kind of belief factors (Debacker et al., 2018). In different reviews, the investigations related to source of EB, the beliefs are conceptualized along a continuum. At one end of the continuum, knowledge is viewed

as developing with and delivered by authority expertise, and at the other end, knowledge is viewed as being actively constructed by the individual self on the basis of his or her personal experience and logics (Buehl & Fives, 2009).Beliefs about the source of epistemic beliefs have differed on the basis of students' academic experiences (for example, graduate students vs. undergraduate students; (Buehl & Fives, 2009) as well as the academic instruction under the teachers' consideration (Buehl & Fives, 2009). Although beliefs about the source of knowledge have not been found, having any relation to learning outcomes like other dimensions (certainty and simplicity of knowledge), there are some evidences about the source of knowledge that it is important to learning outcomes and to teaching practices also. In particular, reviews pointed that stronger belief in authority as the source of knowledge is related to lower levels of motivation, teaching strategies are at surface-level and students are cognitively engaged at lower levels (Günes, Bati, & Katranci, 2017), (Buehl & Fives, 2009). If similar belief relations exist among pre-service and teachers under training, these teachers may be more engaged in traditional mode of teaching while less in reflective teaching. Reason behind this is that they may not consider themselves as subsidiary of knowledge in their teaching profession. The role of beliefs about the source of knowledge is also acknowledged in the teacher education literature in empirical studies (Buehl & Fives, 2009) and in more conceptual and theoretical discussions. For example, Shulman (1987) provided a categorization of the knowledge base for teaching and here presented the four stages of sources of knowledge:

1. Scholarship in the content disciplines;
2. Content and settings of the educational process in institutions;
3. Researches on school settings, social organizations, human nature, teaching-learning and development process regarding knowledge; and
4. The wisdom of practice itself.

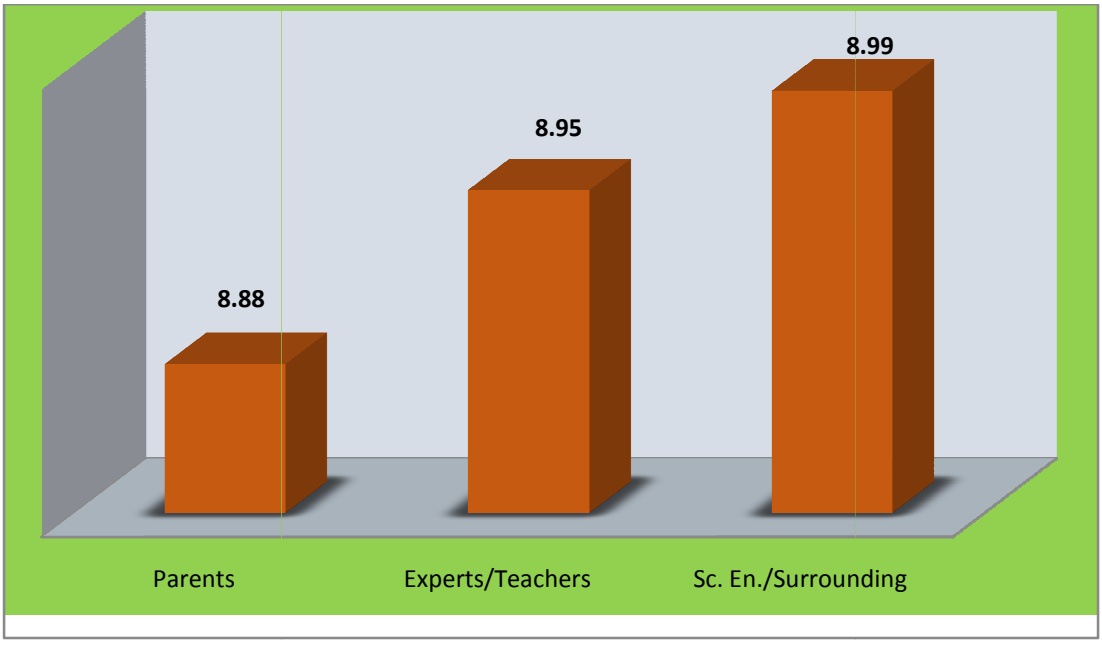
Shulman's (1987) description suggests that the source of epistemic beliefs related to teaching is external for a pre-service teacher. Shulman (1987) emphasized craft knowledge, or the "wisdom of practice," and as such recognized the experiences of pre-service teachers. However, he also noted that craft knowledge is a vanishing source of knowledge that needs to be codified for future generations. Therefore, this

craft knowledge is viewed as an external source or body of knowledge. In contrast, Richardson (1996) emphasized the role of experience in her categorization of influences on teaching practices and beliefs (i.e., personal experience, experience with schooling, and experience with formal knowledge). Although we may expect the sources articulated by Shulman (1987) and Richardson (1996) to be common themes among pre-service teachers' beliefs about the source of epistemic beliefs related to teaching, pre-service and practicing teachers may also endorse additional sources of teaching knowledge. Further, justification of different sources of epistemic beliefs may be related to different reactions to or perceptions of teacher education and development. In the present investigation, we wanted to uncover pre-service teachers' beliefs about the source of knowledge and knowing to better understand how these varied beliefs may influence the teaching strategies and learning outcomes out of the class or within the classroom.

Table 4.2: Mean value of source of knowledge

	Mean	**Std. Deviation**	**Sample size, N**
Source of knowledge (SoK)	37.45	6.77	200

Bar graph 4.3: Degree of acceptance of authorities (Sc. En. Indicates school environment)



To achieve the second objective, mean value of source of knowledge, in the given table is M=37.45. It indicates that pre-service teachers develop their beliefs regarding knowledge and knowing from various sources. Pre-service teachers' beliefs about the source of knowledge were analyzed by coding the ideas represented in each response to Items 32 to 42 in the given questionnaire. Through this analysis, we found that participants viewed knowledge as coming from various sources. Specifically, the coding process resulted in 32, 34, 37, 38 and 39 items collectively. However, only 11 of the given items were related to beliefs about the source of knowledge, with the remainder representing beliefs about the structure of knowledge and control of knowledge. Here the mean score of various authorities provide evidences for role of sources in development of EB of pre-service teachers. There are three main and omniscient authorities have recognized—parents (M=8.88), experts/teachers (M=8.95) and school environment/surrounding (M=8.99). The given figure indicates that most of participants strongly agree on the item that they must learn from their parents and surroundings before entering in to the classroom. Majority of participants agree that a teacher have great influence on his or her students and a student can learn lot from their teachers. Scores of these authorities indicate that pre-service teachers believed more on the knowledge delivered by school environment or surrounding. All participants are at least graduates before coming to the B.Ed. course. The scores of these three indicate that beliefs of pre-service teachers shifted towards general to specific or sophisticated. As they believe more on enriched surrounding and teachers than parents. Items no. 33, 35 and 36 give the idea about participants' believe, that the knowledge from expertise or authority may be questionable. They also believe that the knowledge delivered from expertise or authority may change their value along the time.

Objective 3: To find out changes in beliefs during the development of Epistemic Beliefs (EB):

Research question 3: How the beliefs change during the development of Epistemic Beliefs (EB) in pre-service teachers?

There are several researches on students in which personal epistemology has examined. Most of researches are investigating the nature of development of epistemic beliefs and change in their thinking about knowledge and knowing, especially in college students. There many researches also that investigate the effect

of epistemic beliefs, as, how these beliefs facilitate students' understanding, reasoning, thinking, learning and achievement (Hofer & Pintrich, 1997). The work of Perry (1970) with college students in 1960s to 1970s, on the changes and development regarding to EB, has been proved paramount in research (Hofer &Pintrich, 1997; Pintrich, 2002). There are basically two important points to address the changes in epistemic beliefs:

(1) What changes may occur, and
(2) How can be described the nature of those changes.

In terms of first point, there has been debate about changes, and thus various models and theories related to changes in epistemic beliefs came to know, and those have ranged from proposing one general dimension of epistemic beliefs related to thinking and reasoning, that changes over time in a stage like manner (Perry, 1970), to model that propose some finite number of dimensions (Hofer & Pintrich, 1997; Schommer, 1990), to models that propose many different epistemic resources (Hammer & Elby, 2002). Pintrich (2002) accept that there is a lack of consensus about the number of dimensions, but he also suggested that the models that propose finite number of dimensions may offer the best compromise. In particular, models that offer more than one dimension, are better able to take into account the domain specificity of epistemic thinking in comparison to stage like models that are more domain general (Hofer & Pintrich, 1997; Pintrich, 2002).

However, if there are multiple dimensions of epistemic beliefs, then, what about the nature of dimensions, debate remains. Schommer (1990) worked at the development regarding a set of distinct beliefs that developed more or less independently to one another. She assumed five dimensions of epistemic beliefs such as: Stability of knowledge (tentative to unchanging), Structure of knowledge (isolated to integrated), Source of knowledge (authority to reason), Speed of knowledge (quick or gradual), and Control of knowledge (innate or lifelong). She also provides evidences for all regarding to college students. Schommer (1993), again replicate the four factor structure with high school students. Other researchers have found evidences for five dimensions with revised version of Schommers' instrument. Bendixen, Schraw & Dunkle (2002) developed an inventory, the Epistemic Beliefs Inventory (EBI) and conducted their study to measure the dimensions similar to those, proposed by Schommer (1990). The result of that EBI yielded five reliable factors

(dimensions) that matched Schommers' dimensions, those are: certain knowledge (stability of knowledge), simple knowledge (structure of knowledge), omniscient authority (source of knowledge), quick learning (speed of knowledge), and innate ability (control of knowledge). Besides theses evidences, Hofer and Pintrich (1997) argued that the two dimensions out of five, quick learning and innate learning, are not epistemological dimensions, as they do not focused on nature knowledge, they focused on nature of learning. Now, it has been proved that there is a correlation between individuals' beliefs about knowledge and knowing and beliefs about learning; however, they are not same. Now, it has been proved that there is a correlation between individuals' beliefs about knowledge and knowing and beliefs about learning; however, they are not same. Most of the studies conducted on older students (students at high school or college level), because it was assumed that epistemic beliefs was hard to identify among younger students (Kuhn, 1988). Wellmans' (1992) work on childrens' theory of mind suggests that at least the harbinger of epistemic beliefs begin at an early age that may be as young as four years old. After this study, Chandler, Hallett, & Sokol (2002), continued the study in development the relationship between theory mind and epistemic beliefs. If we see the changes in epistemic beliefs during the development of students, it may observe that the students' beliefs move from simple knowledge to sophisticated knowledge. Soloman et al. (1994) studied the beliefs of 11 to 14 year old student. To explicit their goal and to reach their desired objectives, they interviewed those students in relation to scientific ideas and their experiments, and the nature of science theories. Soloman et al. (1994) argued that it was difficult to discriminate the description and explanations regarding science theories by those students. Those younger students are least able to think about scientific experimentation and its goal. Further, Soloman et al. (1996) use the same process and questionnaire with larger age group, ranged from 13 to 18 years old students. The researchers found that older students' beliefs showed a significant progression toward a sophisticated understanding of science rather than simple understanding. Further, Pintrich (2002) has pointed out, all the researches in the area of changes in epistemic beliefs, assumes that the nature of development is proceed from less sophisticated beliefs to more sophisticated beliefs. Most of the researches on epistemic beliefs, logical reasoning and thinking have examined stage-like changes over fairly long periods of time, (Perry, 1970). There is no review, that provide much information about the nature of knowledge and knowing, changing over

the shorter periods of time. The present study is based on beliefs about knowledge and knowing of pre-service teachers. Above description came from the arena of changes in epistemic beliefs of younger as well as older students. The present study demands changes about different dimensions of epistemic beliefs, especially in pre-service teachers regarding their teaching and learning outcomes. As Kagan (1992) stated that, teachers' beliefs lie, "at the very heart of teaching". This statement explicit the significance of teachers' beliefs in regarding teaching. Although, the beliefs of pre-service teachers with respect to teacher education and learning practices has been discussed by researchers (Buehl & Fives, 2009), by using same multidimensional framework, used with students' beliefs previously. Different studies have investigated that the changes in epistemic beliefs of pre-service teachers may occur into different ways:

(1) Beliefs may change according to context,
(2) Beliefs may change in response to proper instruction,
(3) Beliefs may change accordingly teaching strategies and/or by the impact of their teachers.

In many reviews it is evidenced that the teachers' knowledge is complex and multidimensional. The knowledge of how to teach is very specific to the teaching profession, and beliefs about the nature of this knowledge regarding teacher education and development. Several reviews shows that most of pre-service teachers expressed their beliefs about source of teaching knowledge in concrete form for example books, class lectures, observation etc., while some are believe in multiple resources related to teaching knowledge (Buehl & Fives, 2009). The beliefs of pre-service teachers, about teaching and learning may change when they use multiple sources of teaching knowledge. They again stated that pre-service teachers could not fully explain that how they acquire and construct their knowledge of teaching from those materials and classroom experiences. When researchers directly asked about change in epistemic beliefs, some participants referred to knowledge as become more complex over time.

Table 4.3: Mean value and std. deviation of dimensions of nature of knowledge and knowing

Dimensions	Mean	Std. deviation	Sample size, N
SK	32.73	6.26	200
CK	28.23	5.70	200
SoK	37.45	6.77	200

Bar graph 4.4: Mean value and std. deviation of dimensions of nature of knowledge and knowing

In order to achieve third objective, findings of five dimensions indicate that beliefs changes according to time. Score of Structure of knowledge (SK), (M=32.73, SD=6.26); Certainty of knowledge (CK), (M=28.23, SD=5.70) and Source of knowledge (SoK), (M=37.45, SD=6.77) shows that pre-service teachers' beliefs changes as they progressed towards last semester or end of the course and source of knowledge (SoK) have great influence on changes in beliefs during development of EB. As, Hofer and Pintrich differentiate the beliefs into two: nature of knowledge and nature of knowing. Structure of knowledge (SK) and certainty of knowledge (CK) belongs to nature of knowledge while source of knowledge (SoK) comes along with

nature of knowing. The highest mean score of SoK indicate the major influence of authorities like parents, surrounding and experts or teachers on the development of beliefs of pre-service teachers. These authorities play a vital role in changing the beliefs of pre-service teachers. Score of SoK also indicate that pre-service teachers have strong belief on the process of knowing rather than nature of knowledge. Score of certainty of knowledge (CK) indicate that pre-service teachers believe in tentative nature of knowledge. They deny the fact that knowledge is certain and believe, what is true today will not be true tomorrow. Score of SK provides evidence about complexity of knowledge. Pre-service teachers believe that knowledge is not simple but being complex by the day.

Objective 4: To explore the influences of Epistemic Beliefs on teaching strategies and learning outcomes of a pre-service teacher.

Research question 4: How do the EB of pre-service teachers influence their teaching strategies and learning outcomes?

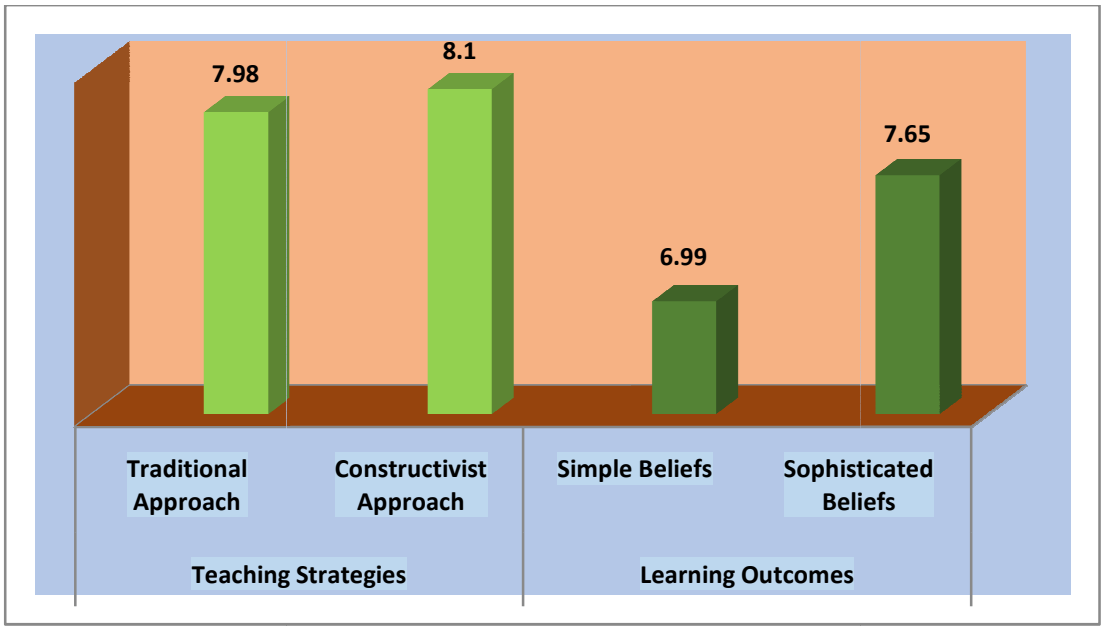
Researchers stated that the epistemic beliefs may influence the learning outcomes of pre-service teachers with different learning approaches (Green & Hood, 2013). Such as "Surface learning" focuses on achievement goals e.g. obtaining good marks or qualification, further, a "Deep approach" for learning involves internal motivation and meaning related to essence. Whereas, "Strategic approach" involves Endeavour for high achievement in all fields by organizing time proficiently (Green & Hood, 2013). Some differentiated that the beliefs without experiences (Naïve beliefs) is associated with surface learning approaches whereas beliefs developed from experiences (sophisticated beliefs), have been associated with deeper approach. Some investigated that students who believe that learning is being about transforming or creating knowledge, based on understanding, have self-regulated learning approach (Green & Hood, 2013). Whereas, students who believe that learning is being about memorizing fact–based knowledge, have most probably, surface level learning approach and memorizing strategies. Muis (2007) reviewed that EB have direct relation to self-regulated learning. Some studied on students of different aspects and found that the frequency of surface learning was stable from the first to third semester of course, whereas, deep learning strategies increased progressively. Phan (2008) found that the beliefs are affected by both approaches of learning, deep as well as surface, but these learning approaches did not affect students' later epistemic beliefs.

Some found that the significance of surface learning approach is lower than the constructivist learning approach.

Above description is based on the epistemic beliefs and learning approaches. Epistemic beliefs and learning approaches are closely related to academic achievement of pre-service teachers. Evidences show that the sophisticated EB are associated with high achievement and better performance in both theoretically as well practically. Schommer (1990) worked with undergraduate students and find out that, students, who believe that knowledge is certain, they also believe that knowledge are simple. Thus higher certainty beliefs of knowledge are strongly associated with absolute knowledge. Whereas students in last semester of course or at completion of university courses have beliefs about knowledge that it is changeable with time (tentative) and reflecting more sophisticated epistemic beliefs (EB). Schommer-Aikins and Easter (2008) studied epistemic beliefs of business students and concluded that, students who believed in quick learning was not good in academic achievements as they had poor reading comprehension and course grades. Hofer and Pintrich (1997) opposed the concept of quick learning as they believe that quick learning of knowledge is associated with learning rather than knowledge, and suggested that quick learning has no concern on methodological and conceptual grounds. Trautwein and Ludtke (2007) worked with high school students and found that the students with higher certainty of knowledge beliefs in final year have lower grades or poor academic achievement. Similar work conducted by Phan (2008) and the conclusion was, epistemic beliefs (EB) and learning approaches predict the academic performance at university level. May and Etkina (2002) found that students, who have higher academic achievement at first year, have more sophisticated epistemic beliefs (EB). Muis and Franco (2009) studied on pre-service teachers and found that pre-service teachers' sophisticated EB and higher course grade was mediated by higher achievement goals and learning strategies. Several reviews related to EB and academic achievement shows that the students with more sophisticated EB have higher academic achievements. Pre-service teachers' beliefs are associated with their course grades, academic achievements, their learning strategies, learning outcomes and also with their teaching strategies. Entwistle and Peterson (2004) found that the Pre-service teachers in their classroom, prefer their teaching approaches aligned with their beliefs and believe that the learning outcomes may enhanced by challenging students' existing ideas. Lea et al. (2003) suggested that teachers who believe in

student–centered approaches have constructivist epistemic beliefs. Lea et al., (2003) further suggested that student centered teaching approach would be more motivative and effective than teacher centered teaching approach, but there will be a need to support students than being left them to learn themselves. Lonka and Ahola (1995) have a comparative study on constructivist and traditional learning approach and concluded that the teachers having constructivist approach of teaching or constructivist epistemology, play role in improving their students' understanding, learning outcomes, academic grades besides traditional teacher centered teaching approaches.

Bar graph 4.5: Beliefs regarding teaching strategies and learning outcomes



In order to achieve fourth objective, items are selected from all dimensions representing beliefs concerning teaching strategies and learning outcomes of pre-service teachers. Item no. 1,9,10 (SK), 12, 16 (CK), 21, 24, 25, 26 (CoK), 34, 37 (SoK) and 44 (DK) represent traditional approach (TA) in teaching while item no. 3, 5 (SK), 11, 15 (CK), 22 (CoK), 35 (SoK), 47, 48, 49 AND 50 (DK) represent constructive approach (CA) in teaching. The mean score of TA is 7.98 which indicate that pre-service teachers believe in traditional approach of teaching. As they believe that traditional mode of teaching is good for exam preparation. Mean score of CA is 8.10 which indicate that pre-service teachers also believe in constructive mode of

teaching. Comparatively they believe more in constructive approach for teaching (as represented in graph). Reason behind this mode of teaching is that pre-service teachers seeking something new to be more exploratory and innovative. More no. of items in TA lie in dimension CoK, which indicate, pre-service teachers believe in fact that knowledge and capability to learn is fixed by birth. While in CA, more no. of items belong to dimension DK. Which indicate that pre-service teachers believe in constructive mode of teaching are also believe in fact that learning is a gradual process and can be improve progressively.

Items regarding learning outcomes also come from all dimensions of beliefs. As such item no. 5, 7, 8, 10 (SK), 13, 28 (CK), 33, 35, 36 (SoK), 47, 49 and 50 (DK) indicate the beliefs regarding learning outcomes. Higher scorer in these items indicates that they having sophisticated beliefs as they think that knowledge are complex. While low scorer, has develop their beliefs towards simplicity of knowledge. In the learning outcome, no items are found in dimension CoK. It indicates that pre-service teachers believe in the complexity of knowledge, certainty of knowledge, source of knowledge and progressive development of knowledge but they do not believe in the fact that learning is controlled by birth.

These findings indicate that the beliefs of pre-service teachers have a direct influence on their teaching strategies and learning outcomes. As pre-service teacher believes in the traditional approach of teaching, he will promote rote learning and the least interaction between teacher and students. While those who believe, in the constructivist approach of teaching will promote their students on experiments, logical and reflective thinking.

Objective 5: To find out the evolving patterns of Epistemic Beliefs of the pre-service teacher.

Research question 5: How do pre-service teachers develop their Epistemic Beliefs (EB)?

All the reviews and evidences related to epistemic beliefs reflects the idea that a growing person have a critical contribution towards their beliefs and academic performances (Stacey, Brownlee, Thorpe, & Reeves, 2011). A question regarding to development of epistemic beliefs of pre-service teachers become very significant and interesting as it may have their potential of teaching and learning influenced by their

developing beliefs day by day. The research question is how to best develop mature epistemic beliefs. Perry (1970) & Belenky et al. (1986) provided first insight to researchers that pre-service teachers progressed towards higher level of thinking & Meta cognition. As they suggested that pre-service teachers progressed in an order form, from dualistic knowledge, per-service teachers progressed towards multiplism or subjective. Here they got mastery in their subjective knowledge then they turn to progress procedural knowledge and finally to commitment or constructivism. Perry (1970) and Belenky et al. (1986) assumed that this progression was one sided and linear. Kuhn & Weinstock (2002) support the statement of Perry (1970) and Belenky et al. (1986), as epistemic beliefs (EB) develop from objectivist to subjectivist and then finally to constructivism or evaluativism. Barten Magolda (2004) demonstrated gender differences and its effect in the stages of development of EB. In the investigation of Goldberger (1996) it was recognized that sometimes the way of developing knowledge may be culturally inappropriate and thus its way of development may not be universally accepted.

Schommer (1990, 1993, and 1998) investigate and use multivariate quantitative method to measure the nature and changes in epistemology. Scommers' work revealed that EB is multidimensional. Factor analysis of Schommers' EBQ (1998) enlighten the idea of five dimensions on which beliefs about learning and knowing vary.

1. Omniscient Authority (beliefs about the validity of the source of knowledge);
2. Certain Knowledge (beliefs about the reliability of knowledge);
3. Simple Knowledge (beliefs about the structure of knowledge);
4. Quick learning (beliefs about the speed of learning);
5. Innate Ability (beliefs about capacity for learning by Schommer, 1990; Brownlee et al., 2001).

Schommer (1994) also suggested that a student may hold beliefs and thoughts full of competition and these beliefs and thoughts might be represented in its complementary continuum. Let's understand it by an example, a person may have beliefs that are sophisticated predominantly about the certainty of knowledge that is evaluativistic in nature and then it maintains the beliefs that knowledge is utter in a little bit. In other side, a person having predominantly naïve beliefs may consider that knowledge is absolute, sometimes it may be evaluativistic. Like Perry (1970),

Schommer (1998) identifies that a set of persons' core beliefs may characterized as the learners' approach to learning and illustrating information. Schommer also designed her questionnaire to explore different dimensions of epistemic beliefs.

To achieve fifth objective, responses on EBQ represent that individuals initially think generally or may said that they show dualism beliefs and as their beliefs develops progressively, their beliefs show complexity in thinking and show multiplism/specific beliefs (item no. 3, 5, 11, 35, 45, 47, 48). The response of these items show that the individual first think superficially but their beliefs changes day by day and become more specific or subjective. And as they have mastery on their subject, they start to think in multiple directions and become expert with constructivist approach. Findings show that several factors are influencing the way of teaching and learning of pre-service teachers. These teaching and learning processes interconnected with the core beliefs of pre-service teachers. And these beliefs are developed in five different dimensions of epistemic beliefs. Findings of this objective are correlated to finding of fourth objective. Pre-service teachers' beliefs developed from traditional to constructive approach in teaching. While general to sophisticated in learning.

Objective 6: To have a better understanding of Epistemic Beliefs of pre-service teachers regarding teaching and learning conceptions.

Research question 6: What is the basic understanding of EB, regarding teaching and learning conceptions of pre-service teachers?

The conceptions about teaching and learning are dealing with the beliefs, held by teachers regarding their way of teaching and learning. Chan and Elliot (2004) clarify the concept of conception, as it includes the meaning of teaching and learning outcomes and also the role of teachers and students in classroom activity. In many reviews, it is found that there are two main conceptions, traditional as well as constructivist, both are contradictory in their nature. Constructivist conception concept came from the work of Piaget (1950) and Vygotsky (1962). Both psychologists emphasize the role of experiences and active participation of students in their learning process at the time of construction of knowledge. Vygotsky (1962), in his social learning theory, have a clear crystal about the interaction of individual to his/her surroundings during the construction of knowledge as stated by Miller (1997).

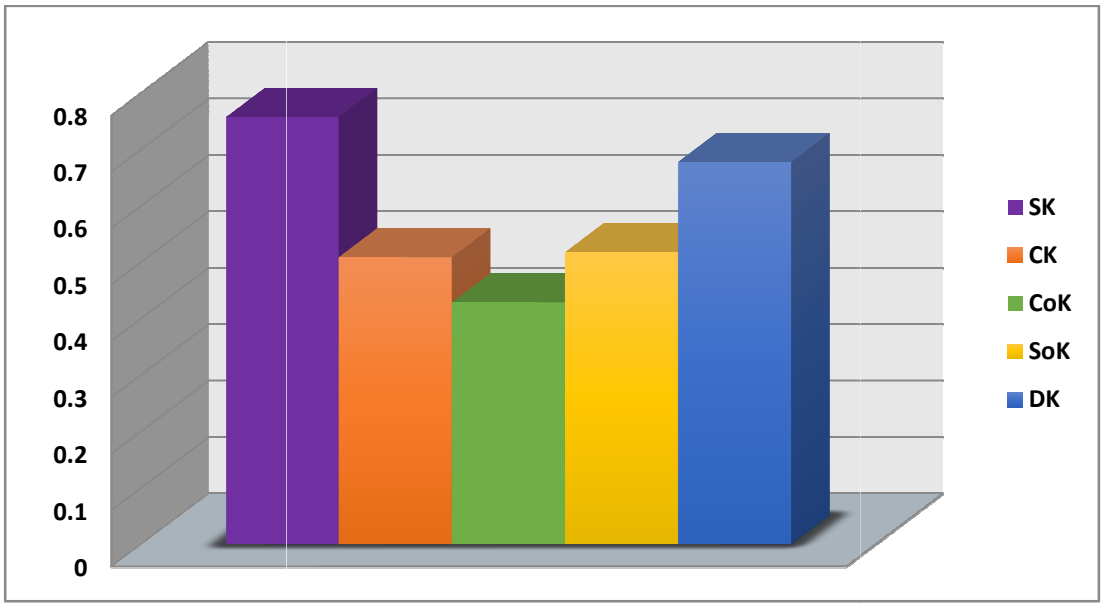
Other researchers also support the fact that the learning is a social process in its extent in which an individual grows under his/her surroundings, intellectually. Traditional conception is related with teacher-centered teaching whereas constructivist conception is related with student-centered teaching. In traditional teaching conception, teacher is considered as the source of knowledge and the student as the passive receiver of knowledge, provided by teachers while in constructivist conception, student-centered teaching strategies are used where students are as knowledge seeker. Constructivist approach helps students to develop their logical and critical thinking and also make them able to interact with their environment actively. There are different cause behind the development of effective teaching strategies and learning outcomes. Out of them epistemic beliefs and conceptions related to teaching strategies and learning outcomes are more significant. Where, epistemic beliefs are the beliefs about nature of knowledge and attaining of knowledge. Schommer (1990) define five dimensions of personal epistemology, nature of knowledge, source of knowledge, certainty of knowledge, control of knowledge and speed of knowledge. Further she told that these personal beliefs have a correlation with cognitive and meta-cognitive development. Cognition and meta-cognition (regarding teaching strategies), both are influenced by epistemic beliefs. Schommer (1990) told that these beliefs also have a great impact on learning outcomes. Thus, the beliefs regarding teaching and learning of a teacher play an important role in development of their conceptions. Chan & Elliot (2004) told that epistemic beliefs of a teacher influence their process of conceptualization concerning teaching and learning. Like Chan & Elliot, Cheng et al. (2009) also argued that the epistemic beliefs are related to teaching strategies and learning outcomes and the whole process of conceptualization are influenced by beliefs of a teacher. Different studies show that the process of knowledge acquisition plays an important role in learning outcomes. Teaching strategies formulated in such a way that a teacher may believe that the expert knowledge should be questioned and also knowledge may change by time. Whatever, the work of Kwok-wai Chan (2004) clarifies the view about teaching and learning conceptions and told that these conceptions developed within two dimensions—traditional as well as constructivist conception. Chan further said that in beginning students did not developed their conceptions about teaching and learning and thus they did not believe in traditional or constructivist conception. Conceptions of students (pre-service teachers) developed gradually and influenced by interaction of previous learning experiences and new educational perspectives.

Reviews and surveys show that teachers, during their internship believe in traditional conception. They develop habit of rote learning and memorization to fulfill their assessment needs. Some believe that learning traditionally is useful in passing exams. While for some, it might be boring and need something new and active way of learning. With increased exposure to society, mass media and education, they tend to believe in constructivist conception. Development of these conceptions may independent from age, gender or SES. Most probably traditional conceptions used at elementary level while at university level constructivist conceptions needed. Epistemic development proceeds in healthy educational environment. Most of students from different culture when come together develop their conceptions from traditional to constructivist. Various studies provide evidences that teachers' conceptions developed from their life experiences and class teaching and both are derived from their beliefs. If pre-service teachers' explicitly explore their beliefs, they would able to use effective teaching strategies and would help their students during cognitive and meta-cognitive development (for e.g.; in critical thinking and reasoning). They also can help students to develop and aware of their beliefs. Conceptions regarding teaching and learning and beliefs of teachers are entangled. Various support found that the epistemic beliefs are significant in effective teaching and learning outcomes as these beliefs influences the performance of both teacher as well as students. These beliefs are also significant for development of conceptions regarding teaching strategies and learning outcomes.

Table 4.4: Extraction of multiple dimensions of EB in Factor Analysis

Dimensions	Initial	Extraction
Structure of knowledge (SK)	1.000	.758
Certainty of knowledge (CK)	1.000	.509
Control of knowledge (CoK)	1.000	.429
Source of knowledge (SoK)	1.000	.518
Development of knowledge (DK)	1.000	.678

Bar graph 4.6: Beliefs in different dimensions of EB of pre-service teachers regarding teaching and learning conceptions (based on factor analysis)



To achieve sixth objective t-test and confirmatory factor analysis (CFA) was applied. The findings of this study from the confirmatory factor analysis indicate that, beliefs about structure of knowledge and development of knowledge are strong factor in pre-service teachers. In factor analysis two factors (structure of knowledge and development of knowledge) indicate that pre-service teachers have very strong beliefs in these two (SK & DK). Pre-service teachers show least dependency on the fact that 'learning is innate', they believe that every one born with their learning ability. This ability can be improved with hard work and practices, though it is not fixed by birth. The findings indicate that pre-service teachers believe in complexity of knowledge and progressive development of learning capabilities. Pre-service teachers believe in constructive approach of teaching while in learning their beliefs are shifted towards general to sophisticated.

Table 4.5: t-test for structure of knowledge between male and female pre-service teachers

Gender	N	Mean	SD	Std error
Male	93	31.75	6.05	.628
female	107	33.57	6.34	.613

Mean differences between two genders, male (M=25.05) and female (26.48) shows that both genders have almost equal beliefs in that: knowledge is complex and knowledge can acquire by multiple sources. But comparatively, female have more developed beliefs regarding structure of knowledge. Highest factor, Structure of knowledge indicates that pre-service teachers believe reasoning and evidences (item no. 9).

Table 4.6: t-test for development of knowledge between male and female pre-service teachers

Gender	N	Mean	SD	Std error
Male	93	25.05	5.77	.598
female	107	26.48	3.71	.359

Male (M=25.05) and female (M=26.48), both participants believe that knowledge can be acquired progressively. Female participants show more developed beliefs in the gradual development of knowledge than male participants. They also believed that their learning ability can improve by their learning efforts. The process of learning is gradual. Item coded for 43, 45, 49 shows that learning can be held by repetition of task. Most of pre-service teachers are disagreed that, for success being quick learner is fruitful (item no. 43). Thus they believe in hard work and think that everything can be learn progressively with its continuum.

4.2 Interpretation of interview

Question (1): Some people think that "scientists can ultimately discover the truth". What is your opinion about this statement?

More than half of the sample population accepts that science declares result based on evidences. Therefore the conclusions brought by scientists can rely to some extent on. But if we talk about truth, then almost all participants believed that the discovery made by scientists would be true, is not necessary. They give the logic that if scientists only discover the truth, then the rules and principles made by them would not change from day today. Some pre-service teachers gave an example that, even when science was not developed, some truths had been correctly predicted. Not only this, some accepted that not even science is considered to have discovered the

intangible truth. They told again, not only in science but in other fields new rules and principles are coming out every day. And other fields can also reveal the truth. In such a way, completely dependent on the scientifically qualified search for truth is not right. Thus everyone accepts the truth after some extent, but scientists should always search for the truth, it is not necessary. Here almost all pre-service teachers accept the relation of certainty of knowledge with the structure of knowledge. As they talked about scientific discoveries and truths which indicate that their beliefs about knowledge and knowing have been developed from general to sophisticate. Again, they talked about the change in rules and principles which show that they believe in fact "knowledge is changeable."

Question (2): What would you say about the statement, "what is true today will be true tomorrow"?

All participants considered that truth is changeable. According to them, except universal truth, the remaining truth is considered to change according to time and situation. Some said with an example that, it is not necessary that what is true for me today can also be true for others. As time changes our concepts change. In this way, the structure of truth also changes for us. Here participants accept that knowledge is not definite, it is tentative. The participants of both classes (male and female) admitted that first, we accept the power of traditional knowledge and then as our level of knowledge increases, life-related experiences are also developed. And jointly they develop our own beliefs that move us from traditional to the constructivist approach. In other words, our experiences are formed based on the expansion of our knowledge and our beliefs develop based on experiences and knowledge. Almost all the participants accept the change and said nothing is certain. Whatever, rules and principles are prevalent in the world, one day must change. Believing the change is to be the law of nature, some considered it as very important.

Question (3): During learning about something that you really want to know, what would be the role of an expert?

Everyone accepted the role of an expert in learning. All participants considered that the expert plays the role of guide and facilitator in learning. But everyone disagreed by relying solely on experts to learn. Most participants believed that the learner is in the main role during learning. Some giving an example of teacher and

students and said that if a learner does not want to learn, the teacher can never teach them. Thus, the participants here accepted the traditional approach of teaching and show general epistemic beliefs. Here pre-service teachers show contradiction for experts. As some believe that the role of the expert is specialized in learning but the role of the learner is more important. This does not mean that, if the learner is not ready to learn, even then the expert cannot teach anything. Some believed that if expert adopts the constructivist approach then it can generate interest to learn in different ways to their learner, although will be slow. Both male and female pre-service teachers seem to agree that learners need to expert to reduce the chance of trial and error and to learn with more precision in less time. Thus the participants support the development of beliefs from general to a specific domain. Participants, while talking about the speed of knowledge, believe that experts play an important role in learning. Beliefs regarding teaching and learning conceptions of pre-service teachers have developed here.

Question (3) a: What do you do when you discovered that experts disagree with each other?

The participants agreed that all the experts gained knowledge from different sources after the experts disagreed on something. Their beliefs develop based on their prior life experience and work experience in concerning field. Everyones' view of seeing the same is different. Some believe that the reason for disagreeing could be lack of or not being a smart learner. Here pre-service teachers considered that an expert with traditional approach could be a better teacher but to be a smart learner one should have a constructivist approach. Here the pre-service teachers accepted the various dimensions of epistemic beliefs and the role of authority in the development of EB. Highlighting how changes happen during its development, and by various examples, the participants believed that the persons' surrounding, culture different forms of authorities has a special role in being an expert in their field. All these are considered to be the basis for the development of persons' core beliefs. Based on this, the perception of the expert admitted to being different and justified own disagreement. In the event of the disagreeing on something, C.P.Mishra said that "it would provide them a base for knowledge." He also believed that the views of "the expert should be carefully listened and come to a comparative conclusion. Experts have a solid foundation if they disagree on something." Mahesh said that "if the

expert proves their point to be true by evidence, then their decision will be considered respectable." Refusing any expert right wrong, almost said no expert should develop any assumption without any basis because every expert must have some knowledge. In this way, the participants considered the position of the expert to disagree on something would be full of resources for learning.

Question (3) b: How do you know that someone is an expert?

Participants considered that to be an expert it is not necessary to be a very popular person. Everyone from parents to others in life can be considered as an expert. Some believe that who clear all the doubts and satisfy the learner with their answer will be called an expert. Some participants considered that a single person is not necessarily in the role of expert for all. While Anupam said that "the person the person who has faith in himself and the society accepts him as an expert, that person can be considered as an expert". Some said that we become biased when we call someone an expert. For example, Sanjeev accepts that "we become prejudiced about the experts, we see the goodness inside the person we like and assume that he is the expert of that particular field." Almost everyone accepted that as the level of knowledge increases and experiences in life, so also experts change. Everyone believed that the knowledge received earlier can be questioned and the information received by the experts can also be questionable. Male and female both considered that the knowledge is gradually developed from general to a specific level. Thus they accepted that knowledge changeable which goes from simple to complex or sophisticated. Aarti admitted that "based on trial and error, any person becomes experienced and the same experience makes him a specialist in that field. She further said that in the matter of experts, we cannot call anyone 100% expert. Someone makes thousand of mistakes and learns by reducing their mistakes, and then he becomes an expert." Aarti while talking about the development of knowledge believed that "knowledge and experiences are developed gradually. Based on which our beliefs are also developed and then we come to the role of experts." Some considering age and experiences as the basis of being an expert, said that it is not necessary for knowledge that the expert should be associated with any authority. Any older person must have some experience which can be the basis of knowledge for learner. Whoever is more knowledgeable will be more experienced and he can be called an expert for that time. Here, while talking about the source of knowledge, the

participants believed that experts keep changing according to the time and situation. The knowledge of one expert cannot always be trusted. Who is capable of answering all the knowledge related questions in the present time, will be called an expert.

Question (4): Do you agree, if two people are arguing something, at least one of them must be wrong?

Pre-service teachers give a mixed answer to this question. Some people believe that if two people argue then they cannot be called wrong. Because both persons have developed their conceptions behind the reason to reasoning. Reason for reasoning between them may be to see the same thing from their perspective. Giving an example, Jayati said that "if we talk about number 6. We find that it looks 6 from one side but it appears 9 from the opposite side. If two people stand opposite to each other and look at the digit 6 then one will considered it 6 while others will see 9 from his side. In this way, both are right in their place and it is not right to call anyone wrong." At the same time, the other participants believed that the topic of reasoning should be considered before calling anyone wrong. Aneeta said, "if the topic of argument is relevant then both will be correct but if it is not relevant, both will wrong." Vindresh gave the example of the glass and said "if some water is poured in the empty glass. Some people will call the same glass half empty and some people half full. Everyone is right here it is just the difference of attitude which becomes the reason behind the argument. Therefore, no one can be called right or completely wrong." Alka justified the position of reasoning by saying that "the reason behind the reasoning is that we can know more than what we know." Thus the participants considered the development of beliefs based on the development of knowledge. Individual difference is also considered as a reason for the argument. Most of the participants accepted different dimensions of epistemic beliefs in knowledge, believing that, practically everyone is right in their place.

Question (5): Do you believe that your efforts lead you to improve your learning ability?

Everyone gave an equal answer to this question. Each pre-service teacher considered that learning efforts could improve learning ability. Also, everyone seems to agree that learning ability can be improved only when efforts are made in the right direction. Accepting the omniscient authority, the participants believed that the efforts

made without any supervision would we the only effort which could result in a different form the corrective process. While accepting the role of both omniscient authority and personal, self-effort and motivation are important for personal growth. Varsha said that "the higher trial and error the higher learning capacity." Emphasizing her point, Varsha further said that "while trying, we reach the result through various efforts. When we get the desired results, we learn two things, one by which one effort or action we can reach the goal and second which action takes us away from the goal." Pre-service teachers accept the process of knowing. Here, the source of knowledge, control of knowledge and speed of knowledge accepted from the five dimensions of EB.

Chapter 5

Findings

5.0 Epistemic beliefs

Beliefs, about knowledge and knowing have direct influence on teaching strategies and learning outcomes of pre-service teachers (Green & Hood, 2013) These beliefs are concerned with several terms, but, the most popularly as epistemological beliefs (EB) that may vary across individuals and various disciplines such as science, arts and humanities. Study of epistemic beliefs (EB) is logically important to philosophical studies, academics, and applied psychology. Other related terms and concepts for EB include 'personal epistemologies', 'epistemic beliefs', 'epistemic cognition', and 'epistemological resources' (Green & Hood, 2013). Hofer &Pintrich (1997) define epistemic beliefs as*, beliefs about knowledge and knowing, within an individual*. These beliefs provide a lens to understand the entire process of developing and delivering knowledge. A teachers' identity is the result of his/her knowledge and knowing in general, and beliefs, about knowledge and knowing in particular, that is called epistemic beliefs of teacher. Beliefs of a teacher particularly pre-service teacher, deliver their mastership as a lens through which they may understand their teaching material and demands of learning, and then may able to interpret their teaching strategies and learning outcomes.

5.1 Findings

As per the objective one, which was '*to explore the multiple dimensions of Epistemic Beliefs (EB)'* and the research question one was *'What are the multiple dimensions of Epistemic Beliefs (EB)?'* answered. *Its findings* are as follows:

- On the basis of various literature reviews like Hofer & Pintrich (1997) and Schommer (1990), different dimensions were found. Though in the present study five dimensions of EB were found. Which are source of knowledge (SoK), control of knowledge (CoK), structure of knowledge (SK), certainty of knowledge (CK), and development of knowledge (DK). Having the mean value of 37.45, 33.10, 32.27, 28.23, and 25.82 respectively among 200 pre-service teachers. All the dimensions deviated (SD) with 6.77, 8.18, 6.26, 5.70, and 4.82 respectively with their mean among pre-service teachers.
- Here, first dimension is SoK. This dimension indicates the genesis path of the knowledge. This path can be originated from the surroundings of an individual or

insight. It also emphasize on the ability to question the knowledge and to check the validity of the source.

- Second dimension of EB is CoK. This dimension indicates the control and ability to excel the knowledge of pre-service teachers.
- The third dimension of EB is SK, indicates complexity, subjectivity and self reliance of knowledge of pre-service teachers. Who scored well in this section do believe that knowledge can be excelled or retained with the efforts of knower.
- The fourth dimension of EB is CK emphasized on dynamic nature of knowledge. It does not believe static nature of knowledge and those pre-service teachers, who scored high in this section, do believe in the nature of change of the knowledge. It shows their scientific temperament and progressive behavior regarding knowledge.
- The fifth dimension of the EB is DK, concerned with the nature of knowing and it also indicates readiness to acquire knowledge and how fast an individual could gain, not only factual knowledge but also understanding of the phenomenon.
- Score of this dimension shows that the scorers believe, on logic, argument and evidences to generate knowledge. Scorers also believe to testify the knowledge on the ground of rationality.

As per the objective two, which was '*to find out the various sources to develop the Epistemic Beliefs of pre-service teachers (EB)* and the research question was *'what are the various sources to develop the Epistemic Belief of pre-service teachers (EB)?'* answered. Its findings are as follows:

- There are so many kinds of sources from which individuals progress their beliefs from simple (naïve) to sophisticated. Like Shulman (1987) emphasized on craft knowledge or wisdom of practice; Buehl & Fives (2009) emphasize on personal experience and logic.
- The present study found that there are various categories of sources under which an individual develops his/her EB. Such as literary and non-literary contents, human nature, social interactions, personal experiences, formal and non-formal environment, experts, culture, logic, arguments, rationale, surroundings and many more.

- These sources tend to be changed with the course of development of beliefs and become questionable with increasing degree of complexity of knowledge. According to Anoop, "like, I do not know about anything and someone is telling, then he knows more than me, so he is an expert. According to time expert may change so that I may become knowledgeable and want to know more about something. I will need a more knowledgeable person or authority than previous. Thus the perception about the previous expert will change for me." This statement was supported by other participants, as Divakar said, "the knowledge imparted by experts (authority) may be questionable. As our experiences grow, our need in life increases, so the role of experts also changes."
- Need and importance of sources of individual changes concerning time and situation. As Prince said, "it is not necessary that whatever is true, will be true tomorrow. Because of truth changes according to time, situation and place."
- Form of complexity and need of the sources may differ from person to person. Jayati said, "It is not necessary that the need and circumstances, that are for me remain the same for others."
- Arguments, debates, and discussions could also lead to the source of the knowledge according to pre-service teachers. Here, C. P. Mishra said, "if two peoples are disagree with each other it may be beneficial for us because in this way we can cross-examine their knowledge and extract the best thing from it.

As per the objective three, which was '*to find out change in beliefs during the development of the Epistemic Beliefs (EB) of pre-service teachers* and the research question was *'How the beliefs change during the development of Epistemic Beliefs (EB) in pre-service teachers?'* answered. Its findings are as follows:

- Participants accept that knowledge is not definite, it is tentative. C. P. Mishra said, "Empirical and reasonable thinking continues to evolve and the concepts that have in the social change, thus we can say truth is changeable."
- Pre-service teachers admitted that first, we accept the power of traditional knowledge and then as our level of knowledge increases, life-related experiences are developed and jointly they develop our own beliefs that move us from traditional to the constructivist mode of thinking.

- As pre-service teachers progress in their course, they admitted that their beliefs changes and they tend from simple to sophisticated.
- At the beginning of the course scorer has the least information about the course but along with time, as they move towards the end of the course, the beliefs change from general to a specific domain. As knowledge and experience increases, they become more topic-oriented.
- Scorer believes in change and accepts that nothing is certain. They also believe in the change of knowledge and it becomes more complex over time.
- Classroom instruction, teaching material, the impact of expertise and many other multiple sources play an important role in the change of beliefs of pre-service teachers.
- Experiences along with age also contribute to change of beliefs during the development of the EB of pre-service teachers. Varsha said, "If someone is older than me even one year, he has more experience than me and one step ahead of me."

As per the objective four, which was '*To explore the influences of Epistemic Beliefs on learning outcomes of a pre-service teacher* and the research question was *'How do the EB of pre-service teachers influence their teaching strategies and learning outcomes?'* answered. Its findings are as follows:

- In the beginning, pre-service teachers believe in the traditional mode of teaching for better performance in the examination. As they think that traditional approaches are good for better academic records but at the end of the course they believe that innovative and constructive mode of teaching is more powerful for their motivation and self-development. Alka supports the practical knowledge and experiments (constructive mode) and said, "There are some things in the society about which they have to think practically. Common people in the society live in a limited range and think in the same scope but the person who has scientific thinking can tells things more gracefully."
- As they admitted that their beliefs tend to develop from simple to sophisticated mode of thinking, their score shows that an individual with simple beliefs has a low score and poor academic records but the individuals with sophisticated

beliefs, are highly motivated towards their goal and have high academic achievements.

- Classroom instruction, teaching-learning materials, self-motivation and advice of expertise have a direct impact on learning outcomes. Aarti said, "self-motivation is needed for specific knowledge, you have to be ready for learning new things, then an expert can teach you."
- Findings indicate that participants believe in trial and error and hard work. They also believe that efforts can improve their learning ability, teaching strategies, and learning outcomes. As Varsha said, "learning ability can be improved through efforts. The higher trial and efforts the greater the ability to learn."
- Content of classroom lectures, availability of other sources of knowledge also influence the teaching strategies and learning outcomes of pre-service teachers.

As per the objective five, which was '*to find out the evolving patterns of Epistemic Beliefs of the pre-service teachers'* and the research question was *'how do pre-service teachers develop their Epistemic Beliefs (EB)?'* answered. Its findings are as follows:

- Scores indicate that pre-service teachers tend towards a higher level of thinking and Metacognition.
- In the beginning, they show a dualistic approach in thinking. They believe in a dual-mode of knowledge but as their beliefs progressed day by day, they think in multiple directions and have many more solutions for a particular problem. Thus they show a multidisciplinary approach in thinking.
- Individual show the realistic approach of knowledge as he/she evaluates their ability and achievements and many more.
- Individuals' thinking full of competitions in class or particular field makes his/her performance more evolved and reliable.
- Scores indicate that an individual evolves their beliefs in multiple dimensions. These findings are the same as the finding of Schommer (1990). That multiple dimensions are:
    - Structure of knowledge (SK)—simple to complex.
    - Certainty of knowledge (CK)—certain or tentative.
    - Control of knowledge (CoK)--fixed by birth/innate ability.
    - Source of knowledge (SoK)—acceptance of authority.

- Development of knowledge (DK)—speeds of knowledge acquisition.

As per the objective six, which was '*to have a better understanding of Epistemic Beliefs of pre-service teachers regarding teaching and learning conceptions'* and the research question was *'what is the basic understanding of EB, regarding teaching and learning conceptions of pre-service teachers?'* answered. Its findings are as follows:

- Findings indicate that there are five dimensions of EB. These dimensions show the process of knowledge and knowing in pre-service teachers. As the beliefs are correlated to cognition and metacognition. Teaching strategies depend on cognition and metacognition. Thus the teaching strategies are influenced by personal beliefs (EB) of an individual and teaching strategies have a direct impact on learning outcomes (Schommer, 1990).
- Findings indicate that beliefs in two factors, out of five dimensions (EB), structure of knowledge (SK) and development of knowledge (DK) are more developed within 200 pre-service teachers.
- Male and female both have strong beliefs in SK and DK. The mean score of them indicates that females have stronger beliefs in SK and DK than males.
- Scorers believe in both the traditional teaching approach as well as the constructivist approach. According to Arti, "the role of experts is very important in learning, but sometimes we see that some people are inborn talented but still need guidance" (traditional approach).
- Score of SK and DK indicate that pre-service teachers believe in changes and follow different teaching strategies according to need.
- Pre-service teachers believe to adopt a constructivist teaching approach, as they believe in change and think that everything can be learned by efforts and hard work.
- Scorers believe more in a constructivist teaching approach as it would help students to develop their beliefs in logical and critical thinking.
- In dimension control of knowledge (CoK) have the least scoring, it indicates that most of the pre-service teachers do not believe in the fact that learning is fixed by birth. They believe that learning outcomes can be enhanced progressively through multiple efforts, motivation and hard work.

5.2 Conclusion

The views of the pre-service teachers who participated in the questionnaire and interview are under five dimensions of EB, which are similar to the dimensions of Schommer (1990). As she proposed a multidimensional model of epistemic beliefs in which beliefs about knowledge and knowing have five independent dimensions (structure of knowledge, the certainty of knowledge, source of knowledge, and the control and speed of knowledge acquisition). Based on the responses of pre-service teachers, it can be said that their beliefs have been developed from simple to sophisticated levels. As Schommer (1990) observed, individuals' beliefs regarding knowledge and knowing vary between naïve beliefs to sophisticated beliefs (Tarmo, 2016). Where, naïve beliefs can be called simple, clear and specific. A person having naïve belief considers knowledge is certain, unchangeable and dependent on experts. They believe knowing is to be "quick learning" and the ability to know something is innate. On the contrary, people possessing a sophisticated belief consider knowledge to be uncertain, tentative and complex. Knowledge can be acquired through progressive learning, reasoning, and evidence (Tarmo, 2016). Based on Schommers' (1990) study, it can be said that all participants have developed sophisticated beliefs in all five dimensions.

Pre-service teachers believe that developments of their personal beliefs are interconnected with their surroundings, culture and influenced by experts. They also believe that as age and experiences increase their beliefs also change. The smarter and effortful person will have a strong EB about knowledge and knowing. Participants agree that a teacher should have a constructivist approach instead off traditional approach, to make their teaching strategies and learning outcomes more effective. They also agreed that for exam preparation and to do well in academic performance, traditional teaching strategies may be good but in higher studies, there should be a teacher with constructive and innovative. To be a good teacher, along with the knowledge we should also be a smart learner. Pre-service teachers considered the situation of disagreement or contradiction as a repository of knowledge and whenever there is a possibility of getting any information related to their work, they would also like to take full advantage of it. Almost all pre-service teachers believed that everyone has their vision and beliefs for the same thing. They considered teachers (expert) as a

guide and facilitator in teaching and learning. Although the learner self is in the main role of his/her learning. If the teacher adopts different teaching strategies then he/she can enhance the learning outcomes of the learner. By reducing learners' mistakes, a teacher can give more output in less time.

5.3 Educational implications of the study

Findings of this study have important implications regarding multiple factors of epistemic beliefs (EB)—the study will provide a better understanding of the developmental process of students' beliefs that would help in adopting new teaching strategies and thus their learning outcomes may enhanced adapting different ways. Findings of this study indicate the utmost importance of teachers/experts. This study would provide a platform for teachers to develop their conceptions towards teaching-learning process. This study might help teachers to understand individual differences and thus teachers would be able to contribute their efforts towards the development of students in all aspects of learning outcomes. This study is hoped to help, to adapt different teaching approaches by teachers. A classroom is full of differences as the difference in IQ level, culture, parenting etc. as all students are not the same in that way and thus, their needs are also not the same. This study will provide the insight to develop a new methodology of teaching and resourceful environment for students, accordingly. This study made a sincere effort to underline the individual's learning capabilitie and these capabilities may improve through several efforts. Teachers may understand the learning process of average students and would help them in improving their abilities. This study will provide a better understanding of importance of external factors such as parents, surroundings, teachers and classroom environment and how these factors influence the learning abilities of students. It would be helpful to understand the needs of students in learning. This study is based on examining pre-service teachers' beliefs. It will provide a mean for understanding the relationship between the beliefs of teachers and students and also the learning outcome of students.

5.4 Suggestions for further research

Reviews show that no research is complete in its way. More work is done to clear some doubts, more remain unclear. More answers obtained from various

questions, more questions raised. The epistemic beliefs (EB) have a vast area in its own. Beliefs are developed in various aspects of the life of an individual. This study was delimited to the pre-service teachers of the various institutions of Lucknow city. Future research could shed the light on beliefs of an individual in different aspects of life regarding culture, physical and mental health, lifestyle, online resources and so on. The present study is based on pre-service teachers' responses, future research needed to study the beliefs of in-service teachers. These teachers may belong to an elementary level, secondary level, and higher secondary and/or to higher education. This study, as delimited to Lucknow City, further study may be made on populations of other cities of the country. This study touches the only surface of issues, a deep and more concise study is needed.

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Appendices

Appendix-1

Questionnaire regarding Epistemic Beliefs of Pre-service Teachers

S.NO.	STATEMENTS	SD	D	N	A	SA
•	**Structure of knowledge**					
1.	You can believe almost everything you read.					
2.	Too many theories just complicate the things.					
3.	Instructors should focus on facts instead of theories.					
4.	It is annoying to listen to a teacher who doesn't tell students the answers to complicated problems.					
5.	When I study, I look for specific facts.					
6.	I really appreciate teachers who organize their teachings carefully and then stick to their plan.					
7.	It is a waste of time to work on problems that have no possible solutions.					
8.	The more you know about a topic, the more there is to know.					
9.	If scientists try hard enough, they can find the truth to almost anything.					
10.	Learning means remembering what the teacher has taught.					

•	**Certainty of knowledge**					
11.	I like teachers who present several competing theories and let their students decide which is best.					
12.	If two people are arguing something, at least one of them must be wrong.					
13.	What is true today will be true tomorrow.					
14.	Sometimes there are no right answers to life's big problems.					
15.	Science is easy to understand because it contains so many facts.					
16.	Scientific knowledge is certain and does not change.					
17.	Nothing is certain but death.					
18.	Being a good student generally involves memorizing facts.					
19.	The best thing about science subjects is that most problems have only one right answer.					
•	**Control of knowledge**					
20.	Smart people are born that way.					
21.	Some people are born with special gifts and talents.					
22.	Everyone needs to learn how to learn.					
23.	The ability to learn is innate / inborn.					
24.	Some people are born good learners; others are just stuck with limited ability.					
25.	The really smart (intelligent) students don't have to work hard to do well in school.					
26.	Some people will never be smart no matter how hard they work.					
27.	Genius is 10% ability and 90% hard work.					

28.	The most successful people have discovered how to improve their learning ability.					
29.	Students who are average in school will remain average for the rest of their life.					
30.	Our abilities to learn are fixed at birth.					
31.	Some people just have a knack for learning and others don't.					
•	**Source of knowledge**					
32.	Parents should teach their children all there is to know about life.					
33.	Children should be allowed to question their parent's authority.					
34.	When someone in authority tells me what to do, I usually do it.					
35.	Sometimes, I don't believe the facts in text books written by authorities.					
36.	Even advice from experts should often be questioned.					
37.	I believe there should be a special teaching method applicable to all learning situations.					
38.	I still believe in what experts say even though it differs from what I say.					
39.	How much a person gets out of school mostly depends on the quality of the teacher.					
40.	A good teachers' job is to keep his or her students from wandering off the right track.					
41.	Whenever I encounter a difficult problem in life, I consult my parents.					
42.	Sometimes you have to accept teachers' answer although you do not understand them.					

•	**Development of knowledge**					
43.	Quick learners are the most successful students.					
44.	If you don't learn something quickly, you won't ever learn.					
45.	If you haven't understood a chapter the first time through, going back over it won't help.					
46.	Working on a problem with no quick solution is a waste of time.					
47.	If a person cannot understand something in a short time, he or she should keep trying.					
48.	If a person forgot details but was able to come up with new ideas from a text, I would think they were bright.					
49.	If I find the time to re-read a textbook chapter, I get a lot more out of it the second time.					
50.	How much you get from your learning depends mostly on your efforts.					
				Total score:		

Appendix-2

Interview Schedule regarding Epistemic Beliefs of Pre-service Teachers

Question (1): Some people think that "scientists can ultimately discover the truth". What is your opinion about this statement?

Question (2): What would you say about the statement, "what is true today will be true tomorrow"?

Question (3): During learning about something that you really want to know, what would be the role of an expert?

Question (3) a: What do you do when you discovered that experts disagree with each other?

Question (3) b: How do you know that someone is an expert?

Question (4): Do you agree, if two people are arguing something, at least one of them must be wrong?

Question (5): Do you believe that your efforts lead you to improve your learning ability?

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Urkund Analysis Result

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