

# A STUDY OF MATHEMATICAL BELIEFS AMONG SECONDARY SCHOOL TEACHERS



## DISSERTATION

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Under the Supervision of  
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BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY  
(A CENTRAL UNIVERSITY, NAAC ACCREDITATION 'A' GRADE)  
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## **DECLARATION**

I, Dinesh Kumar, hereby declare that this research work embodied in the M. Phil. dissertation entitled “**A Study of Mathematical Beliefs among Secondary School Teachers**” submitted in fulfillment of the award of the degree of Master of Philosophy in Education is an authentic record of original work carried out by me under the supervision of **Dr. Sangeeta Chauhan**, Assistant Professor, Department of Education, School of Education, Babasaheb Bhimrao Ambedkar University, Lucknow. I further declare that this is the original work and has not been submitted in part or full for the award of any other degree or diploma to this or any other University. I also declare that this dissertation is free from all kinds of plagiarism.

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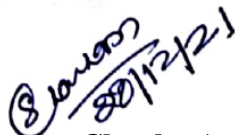
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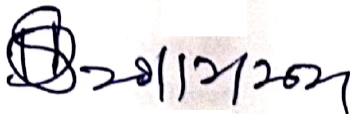
## **CERTIFICATE**

This is to certify that the M. Phil. dissertation entitled “**A Study of Mathematical Beliefs among Secondary School Teachers**” submitted by **Dinesh Kumar** 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.

This M. Phil. dissertation submitted to **Babasaheb Bhimrao Ambedkar University, Lucknow** satisfies all the requirements as stipulated in the Master of Philosophy (M.Phil.)/Doctor of Philosophy (Ph.D.) regulations amended in 2019 and it is fit for submission and evaluation for the award of the degree of Master of Philosophy in Education of the University.

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# **CHAPTER I**

## **THE PROBLEM AND ITS**

## **BACKGROUND**



# **THE PROBLEM AND ITS BACKGROUND**

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### **1.0 Introduction**

Education is that which serves as the main resource of human development. Education helps us to develop the inherent power of human beings, and change their knowledge, skills and behavior. Education makes a man civilized and a better citizen. In the primitive age, education was a process of exchange of knowledge through guru and disciple. Also, in the primitive age, education was knowledge-centered as the Guru's duty was to only inform and instruct. The disciples used to follow all the orders of the Guru and also followed all the rules of the Guru Kul or Ashram, but in the present day education means the process of learning and teaching and to bring out the inner potential of the children and the all-round development of the learner. All round development means mental, physical, moral, social and spiritual and development of the learners. Philosophers, sociologists, psychologists and scientists play an important role in explaining the form of education process and define their approach to education. The philosophical concept of Education is a resource to achieve the ultimate aim of human life. According to Swami Vivekananda, "Education is the expression of the perfection already present in man." In the words of Mahatma Gandhi, "Education means an all-round depiction of the best in children and in man—body, mind and spirit." Education is the creation of a healthy mind in a healthy body," Aristotle.

According to John Dewey, "Education is the development of all those capacities in the individual which enable him to control his environment and fulfill his possibilities." Sociological concept of Education is a social process in which two or more persons interact with each other and through conduct exchange language, ideas and influence and achieve their goals. Education is a mean to achieve the goals of an individual, society and nation. According to T. Raymont, "Education is that process of development which includes the passage of man from infancy to maturity; it is the process by which he gradually adapts himself in various ways to his physical, social and spiritual environment."

The political concept of Education is "Real education is that which builds a superior citizen".

The psychological concept of Education is- According to Pestalozzi, "Education is natural, harmonious and progressive development of man's innate powers". In the words of

Froebel, "Education is processed by which a child makes its internal –external”.

Herbert Spencer said that “Education is a lifelong process in a wider sense and is promoted by every experience in life. The main part of Education is teachers, learners, curriculum; teaching method; natural environment, social environment, and measurement and evaluation.”

Teachers have the following characteristics, such as, better mental and physical health, better sociability and cultural characteristics, mastery of the subject or skill specialist, an expert in teaching skills, confidence, general knowledge of various subjects and characteristics of ethics. According to Rayburn, “Education is a tripartite process involving teacher, learner and curriculum”. Hence education is the basis of development and empowerment of each nation and plays a vital role in understanding and participating in daily activities. Education transforms the Culture, beliefs and values of our society from one generation to another. Education plays an important role in daily life like when we go to the market to buy things like milk, food, and other goods, so calculation is important, Mathematics plays an important role to calculate money or things. First, to understand mathematics we study math concepts, or math discipline, and mathematics teaching and learning. Mathematics discipline numbers starting with numbers. It helps us to know the magnitude, direction and position of things. It helps us to calculate many numbers. The Oxford English Dictionary (1933) defines mathematics as "an abstract science which deals with spatial and numerical relations deductively examines the conclusions contained in the early concepts of mathematics and in which includes its main divisions of geometry, arithmetic, and algebra.”

Mathematics also begins with counting and counting requires a number system that includes numbers, alphabets and signs. It helps us to understand the science of space and numbers, the science of computation and the systematic, organized and precise branch of science. It provides to understand quantitative facts and relations about things. Mathematics is the abstract form of science and also the science of logical reasoning. It helps to convert abstract concepts into concrete form and also explains it. The basis of a mathematical discipline is our sense organs and includes one's language, mathematical terms, mathematical concepts, formulas, and principles. It helps us to understand to develop inductive, deductive and generalizing power or abilities in the learners. It helps in developing confidence and self- reliance in the learners and provides scientific approach to solve any mathematical problem among the learners. It helps in inculcating the characteristics of morality along with discipline and character building in the learners. It provides an opportunity for developmental abilities and to relate to important, abstract and

coherent structures. The study of mathematics develops observation power, logical power, decision-making power, thinking and reasoning power, concentration, memory and hardworking in the learners. It is essential for smooth running of household tasks, smooth running of market activities and smooth understanding of social activities in daily life. Every time like "When do we sleep? When do we get up? When do we go to office? And what work is done at what time, everything is based on mathematics, so every time we are around us mathematics. Without, feel the reaction of mathematics, our life is useless and boring. Mathematics helps us to know and understand the time management in daily life. Every person in society uses mathematics like engineers, businessmen, bank employees, doctors, mathematics teacher or general worker, auto driver, etc. We cannot imagine our life running smoothly without mathematics. It is impossible because everything around us is based on mathematics. Therefore mathematics is the life and backbone, which cannot be denied. Mathematics learners use logic bowers, patience and confidence before making any important decisions for profit or loss or for good or bad. Discipline of Mathematics precise, real and pure, therefore it develops a special discipline in learning reason of the mind. It is cleanliness, purity, honesty, and truthfulness, and justice, self-restraint, self-reliant, Self-respect helps to listen to others and respect learners and avoid gossip, flattery, slander and deceit.

To live life in Society, the discipline of mathematic is extremely necessary because in society any exchange, trade and industrial etc. profession depends on mathematics. According to Napolean and the accepted importance of mathematics said, "The progress and the improvement of mathematics are linked to the prosperity of the state." We use mathematics in our clothes design, beautiful garden and to build rooms or windows. The teaching of mathematics depends on different psychological theories and principles like learning by doing, learning by experience, and problem-solving. It helps us to know, what is the problem? What's finds? What is its objective? also thinking about the problem and solve the problem and also generalized the theories from results. Mathematics helps us to understand and explain physics, Chemistry, Astronomy, Biology, Medical science, Geology, and Astrology. It helps us to find and understand the area of volume; weight and density of things and we also find the weight of the human body. So the close and unbreakable relationship of mathematics to our life and makes it easy to our life to understand and explain any things related to measurement, evaluation, and calculations. Someone says Mathematics is boring and dull subject, but those who love mathematics feel enjoy and when find the solution to the problem then feel best and completely satisfied, As an example, Pythagoras discovers his theorem, sacrificing 100 oxen in happiness and after the discovery of his theory, Archimedes was delighted with the forgetting nakedness. To increase mathematics knowledge,

drill and Practice is play an important role, for through this achieving mastery knowledge and also explain theories and principles of mathematics. So the imagining life without mathematics is the same as imaginary life. If we understand the concept of mathematics completely, then beliefs play an important role in the path of success, so the beliefs are necessary for learners and teachers.

### **1.1 Beliefs**

Beliefs are generally defined as convictions that things held in the mind are true. If individuals think particular tenets are likely to be true, they are said to believe them. If individuals think particular tenets are unlikely to be true, they are said to disbelieve them. In their most basic form, beliefs are non-evaluative. Bandura (1986) argued that belief formation and subcontracting are generally too broad and context-free to be useful in research. Over the past two decades, research on the measurement of teacher beliefs in terms of content and context in teaching and learning has been prominent. In mathematics, many researchers have developed measures of epistemological beliefs in mathematics in general and teachers' pedagogical content beliefs with respect to certain subjects.

Beliefs are important foundations of attitudes and behavior, but they can be extremely difficult to change. Often, people will vehemently maintain their beliefs even in light of disconfirming evidence. This phenomenon is known as belief perseverance. Belief perseverance typically occurs because people base their beliefs on information that they find logical, compelling, or attractive in some way. Therefore, even when beliefs are seemingly disconfirmed by new evidence, the foundation for what the person believes may still exist. Understanding how beliefs form and how they underlie subsequent attitudes and behaviors is important because it can aid understanding of social phenomena like prejudice and discrimination, helping and aggressive behaviors, impression formation, obedience to authority, interpersonal attraction, and group decision making. In general, beliefs are the most basic type of social knowledge.

Beliefs are part of the affecting domain and the affecting domain contains or compositions of emotions, attitudes, and beliefs. Emotions contain feelings of consciousness that are different from cognition. Attitude is that which defines a person's manners of acting, thinking that about one's disposition or opinion beliefs are persons individual construct which describes his/her personal notions perceptions and conceptions of truth and reality. Every people perceive his/her environment according to their senses and meaning about the phenomenon under consideration generally, called as beliefs. Beliefs are a product of human activities and Cognitive and affecting aspects of learning. Wilson and Cooney (2003) mention that beliefs are usually

seen as constructs that have cognitive components but it is a weaker condition than knowing. Goldin (2003) argued that "beliefs are multiply encoded cognitive- affective configurations to which the holder attributes some kind of truth value. If students by teachers' beliefs are strong about mathematics then, they understand beliefs about the nature of mathematics. Mcleod (1992) and Goldin (2002) stated that beliefs are a part of the affecting domain besides feeling and mood. while Philipp (2007) contended that beliefs are a part of conception which is a mental structure covering beliefs, meaning, concept proposition, rule, picture, mental, and preference.

Beliefs are an affective construct and largely Cognitive in nature and are relatively stable and resistant to change. Beliefs are also developed over a long period of time. Epistemologically Beliefs are defined as the source of knowledge and justification and validation of knowledge. Psychologically and epistemologically beliefs helps us to understand and construct knowledge, concept, and perceptions for investigating teaching and learning in a specific school subject. Beliefs help to teachers' personal judgment and professional development, teacher deals how can be taught the learners effectively. Constructivism beliefs are that in which learners construct a piece of knowledge and concept to self-experience through the results. In Constructivism, students become active in learning, understanding, and applying their own point of view, thinking and analyzing self to construct concepts. Cross (2009) defines beliefs as "embodied conscious and unconscious idea and thoughts about oneself, the world and one's position in it, developed through membership in a various social group; these ideas are considered by the individual to be true". Further, it is necessary for teachers to understand mathematics concepts and teaching and learning of mathematics clearly, first of all, to understand mathematical beliefs. Now we explain what mathematical beliefs are; Mathematical beliefs tell us what is true about mathematics generally. It is based on teachers' individual experiences with mathematics. Mathematical beliefs help us to understand and explain the concepts and philosophy of Mathematics. Teachers' Mathematical beliefs refer to what are beliefs about mathematics and how mathematic teaching and learning occurs actually in the classroom. Beliefs about mathematics include what are facts, rules procedures, and concepts of mathematics. Many teachers tell us about mathematics, mathematics is a set of rules, formulae, skills, and procedures.

## **1.2 Conceptual Background of Mathematical Beliefs**

Mathematical beliefs tell the students how mathematics learn and understand easily. Teachers' mathematical beliefs are based on instructional practices. Instructional practices include teachers' internal factors and external factors. Teachers' internal factors contain teachers' own experience, pedagogical knowledge and skills, and any lack of confidence in teaching

mathematics. Teachers, external factors include teachers' accountability for students learning, availability of resources, assessment practices parental and pressure, textbooks, and time constraints. To enhance the quality and effectiveness of the teaching and learning of mathematics of teachers, mathematical beliefs are necessary. According to Leder et. al.(2003,) belief in mathematics is the summary of four beliefs, namely (i) Beliefs on mathematics a discipline (ii) Beliefs on learning mathematics (iii) Beliefs on teaching mathematics (iv) Beliefs in our self in the context where the mathematics learning. Mathematical beliefs according to Ernest (1989) are a view or conception of mathematics naturalness model or view of mathematics teaching naturalness, and model or view of the mathematics learning process.

Teachers' mathematical beliefs help to the professional development of teachers and to increase knowledge and teaching practices. Somewhere teachers beliefs about mathematics indirectly affect student achievement and, to understand student potential about mathematics teachers act as a facilitator and the students learn to solve problems independently, each student help one another to solve problem cooperatively and develop their skills and competencies about mathematics. Teachers' mathematical beliefs are their own experiences and perceptions about mathematics. Teachers' competencies and mastery knowledge of mathematics develop self-confidence, and satisfaction, and personal Judgment. It helps the teachers which opinion is the usefulness of mathematics and their perception of how the subject is presented. Teachers' mathematical beliefs provide students with interesting problems to investigate in small groups and this is an effective way to teach mathematics. Teachers' mathematical beliefs can recreate for all students to solve problems by supporting the learning environment. Teachers' beliefs about mathematics have an impact on student beliefs in their classroom and own instructional practices. Teacher beliefs focus on conceptual understanding about mathematics and the students are assessed by their ability to think, express, and figure out mathematical relationships teachers create a problem-solving situation to investigate the problem of mathematics and solve the problem by students by Cooperative learning. Teachers' mathematical beliefs show the students, mathematics is a way of thinking, dynamic and expanding. Teachers' beliefs, to learn mathematics problem-solving skills are important and reliable.

Teachers' mathematical beliefs are essential for the success of mathematics education, without beliefs about mathematics we cannot understand mathematics concepts, facts, and procedures. So the mathematical beliefs are the key to the success of mathematics education. Teachers' Mathematical beliefs able to understand children's interests, defects, and weaknesses will power to work and which topic is more difficult to understand as well as students mental, physical and intellectual level. Teachers' beliefs about mathematics are for children to develop

memory power, imagining power, habit to cookie speed and accuracy and usefulness in practical life. To improve mathematics teaching and learning we use an inductive, deductive laboratory. Heuristic and problem-solving methods, for these expert teachers of mathematics required who knows how could be taught and learned mathematics effectively. But in the present curriculum of mathematics, there are many defects, like there is no conformity with the aims and learning experiences of teaching and learning mathematics, it is subject-centered, tropical, and memory-based. The approach in Curriculum Construction is not pragmatic and a number of topics and problems in the curriculum are uninteresting and useless the present curriculum of mathematics emphasizes examination and no place is given to the practical work. As we know education is the most powerful weapon to develop the inherent potential of humans and increase knowledge, skills, understanding and help to modify human behavior. In the educational process, three components include generally teachers, learners and curriculum and all three components are closely interconnected to each other. The curriculum acts like a bridge that connects teachers and learners and learners are influenced by their teachers during the teaching-learning process. Generally, learners apply their knowledge in their practical life or solve their problems of daily life but when they are unable to solve their simple problems it shows many points like- they were not attentive in their class, teachers were not using effective instructional practices during teaching-learning process, the teacher was not aware of beliefs towards nature of his subject etc. In the whole process, the main point which we should keep in our mind is belief. Belief is a mental reliance or acceptance of a particular concept, which is arrived at by weighing external evidence, facts and personal observation and experience. Belief is essentially a subjective feeling about the validity of an idea or set of facts. Every teacher should know about belief towards his particular subject. Since mathematics is one of the fundamental skills that an individual of modern societies require in sustaining their daily life. Mathematics is taught to all students from elementary school to equip students with the skills of logical, analytical, systematic, critical, and creative thinking. These competencies are required so that learners can have the ability to acquire, manage, and utilize information to survive in ever-changing circumstances and competitive life, for this it is necessary that mathematics teachers should have positive beliefs towards mathematics so that they will be able to represent mathematics as an interesting and challenging subject, applicable in many areas and can be learned by everyone; and not as a difficult subject which is abstract and only for high cognitively able students because of teachers' beliefs directly influence their future teaching practice.

Since, at the secondary level, most of the students avoid taking mathematics, therefore, at this level, it is compulsory that teachers should have positive beliefs about their profession; their

students, how learning takes place and the subject areas they teach, and their practices should flow from these beliefs. Teachers' beliefs about mathematics include beliefs about the nature of mathematics, beliefs about mathematics learning, and beliefs about mathematics teaching. Teachers' beliefs about the nature of mathematics refer to teachers' views regarding the discipline of mathematics as a whole (Ernest, 1989). Beliefs about mathematics learning include perceptions about students' roles and how students learn effectively (A. G. Thompson, 1992). Thompson describes beliefs about mathematics teaching as teachers' views about their own role in the classroom, and their choice of classroom activities, and instructional strategies they prefer. If a mathematics teacher contains positive beliefs about mathematics, it means he believes in constructivist beliefs he will adopt the constructivist approach in his class and he will give opportunity and platform to construct new ideas to the learners and students can learn mathematics without any textbooks or worksheets. Many of the researches have been conducted on mathematics education to improve the teaching-learning process, to improve the quality of the product (learners), to reduce the anxiety of the students towards mathematics etc. but first of all, it is important to be aware of the teachers about their beliefs towards mathematics. Therefore, the researcher is interested to know the mathematical belief of the secondary school teachers as well as their elevation towards mathematics teaching. For this purpose, the researcher has been chosen this topic.

In psychology, prejudices are related to how a person feels about something i.e. prejudices are related to one's feelings. Stereotypes or beliefs are associated with one's conscious thoughts about something. They are related to cognition. How one feels about something and how one thinks about something, both affect how one acts towards that thing. Since achievement is strongly linked to a student's actions in relation to a particular subject, such as study habits, interest in the subject, and effort put into the assignment, it can be very enlightening to look at the student's beliefs and feelings about that topic. The subject of interest in this study is Mathematics. The next logical question is how to change students' feelings and beliefs about mathematics so that students act more positively in relation to mathematics and reach higher levels of achievement. It is well known that good teachers have a great impact on student understanding, learning quality and student achievement. It has been told in various researches that how to teach students, how well the material should be explained while some teaching practices produce higher levels of student achievement, others promote more positive student beliefs about math, and others generate more positive attitudes about math. This research is an attempt to show that the beliefs that teachers hold about the nature of mathematics and the nature of doing mathematics, through surveys, influence their teaching practices in a different and measurable

way. Using this information about teachers' beliefs about math and how they affect teachers' classroom practices, one can address the question of whether these beliefs and practices affect student beliefs. If students' beliefs can be positively influenced by their teachers, then student actions can also be positively influenced, which means that student achievement in mathematics can be improved. The present study will explore how students' beliefs about mathematics change over time after being influenced by a particular mathematics teacher and also will explore the levels of mathematical beliefs of secondary school teachers of CBSE and U.P. Board with respect to gender, their teaching experiences and educational qualifications.

### **1.3: Significance of the Study**

Knowledge of mathematics at the primary and secondary school level has been recognized as an issue for a long time and proper knowledge of the mathematics of the students is totally depend on the teachers' mathematical beliefs towards the nature of the mathematics, towards the instructional practices and towards the learning of the students. Mathematical knowledge helps not only to solve problems of daily life but also it is very fruitful to understand the relationship between the others discipline. If the children have good mathematics skills then they can present their high performance in cognitive tasks. Teachers' mathematical beliefs are necessary to develop their reasoning power and critical thinking since teachers help to develop students' inherent potential. Mathematical beliefs play an important role in formulating instructional practices and their pedagogical knowledge and are positively correlated with the teaching experience of educators. (Hofer, 2001; Muis Bendixen and Haerle, 2006; Pajares, 1992).

If the teacher's mathematical beliefs are strong then their instructional practices will be good (Thompson, 1992; Beswick, 2006; Stipek et al., 2001). Other studies show that understanding teachers' beliefs will be essential to improving teachers' professional preparation and their practice. (Beswick, 2005; Muis & Foy, 2010; Pajares, 1992). On the basis of numerous researches, it is found that the social usability and acceptability of teachers' mathematical beliefs are very important and play a vital role to develop critical thinking, mastery knowledge of the subject, logical thinking, problem solving and analytical thinking in learners. Hence, seeing the importance, social usability and acceptability of teachers' mathematical belief, the researcher has chosen this topic- "A Study of Mathematical Beliefs among Secondary School Teachers."

### **1.4 Rationale of the Study**

The studies on teachers' mathematical beliefs which have been done in this field show those mathematical beliefs give opportunities to develop intellectual skills for the learners and also provide the situations for professional development of the teachers. The role of secondary

school mathematics teachers is very crucial to the economic growth and the continued prosperity of our nation and also for the development of fundamental knowledge of the mathematical applications among the learners. If a teacher believes that mathematics is a difficult and boring subject, it is obvious that he thinks about how he will present his mathematical problems in front of the students. Since, at the secondary level, students often avoid taking mathematics because of the difficulties and it is a very serious issue that teachers are mostly unable to know that children are not comfortable applying mathematical knowledge in their real life situations, which they have learned in the class. Therefore, it is very necessary for all teachers of different disciplines to know about the concept “Beliefs”. Having a proper understanding of belief, every teacher can develop not only their professional abilities in their respective disciplines but also can increase the ratio of active participation and engagement of the learners in the teaching-learning process.

The reason this research is needed is that although there has been much research on mathematical beliefs in general, there has been very little done on the mathematical beliefs of secondary school teachers of CBSE and U.P. Board. A lot of the research that has been done in this area has focused on the effect: how students and teachers feel about certain aspects of mathematics and how those feelings impact performance in terms of teaching and learning. This research focuses specifically on beliefs, which is the more cognitive area of this topic of interest. This study is important because it involves only teachers, and the goal is to examine what is the difference between secondary school teachers of U.P. Board and CBSE with respect to their mathematical beliefs thus adding to the research on how mathematical beliefs are changed. Also, much of the research in the past has focused on the relationship between the effect of mathematics and student achievement in mathematics, or how beliefs about mathematics affect student achievement. From that information, it may be possible to determine how to change student beliefs in the most positive direction possible: to lead students to the mathematical beliefs that correlate with the highest mathematical achievement. In terms of teachers, this research is important in determining to what extent a teacher’s beliefs are displayed through their classroom practices and how well these beliefs are translated to students. This research will give the mathematics education community more insight into how to better plan lessons that embody a teacher’s mathematical beliefs in a reasonable and consistent manner that will not negatively affect the teaching of mathematical content. Thus teachers will be able to also teach mathematical beliefs to their students that will help them be more successful mathematics students now and in the future. However, without the research on how student beliefs are formed and influenced and changed, this goal of positively influencing student learning will not be possible.

Most of the researches on mathematical beliefs in relation to other educational variables have been conducted at different levels but there is a strong need to explore the mathematical beliefs of secondary teachers of U.P. Board. Therefore, the researcher has identified this problem

and has chosen this topic for his research.

### **1.5 Research Questions**

1. What are the levels of mathematical beliefs of secondary school teachers of CBSE and U.P. Board?
2. What are the levels of mathematical beliefs of secondary school teachers of CBSE and U.P. Board with respect to gender, teaching experience and educational qualification?
3. Is there any difference in mathematical beliefs of secondary school teachers of CBSE and U.P. Board?
4. Do the mathematical beliefs of secondary school teachers of CBSE and U.P. Board are affected by their gender, teaching experience and educational qualification?
5. Is there any association between gender and mathematical beliefs of secondary school teachers of CBSE and U.P. Board respectively?
6. Is there any association between teaching experience and mathematical beliefs of secondary school teachers of CBSE and U.P. Board respectively?
7. Is there any association between educational qualification and mathematical beliefs of secondary school teachers of CBSE and U.P. Board respectively?
8. Is there any association between gender and teaching experience of secondary school teachers of CBSE and U.P. Board-wise with respect to their mathematical beliefs?
9. Is there any association between gender and educational qualification of secondary school teachers of CBSE and U.P. Board-wise with respect to their mathematical beliefs?
10. Is there any association between teaching experience and educational qualification of secondary school teachers of CBSE and U.P. Board-wise with respect to their mathematical beliefs?

### **1.6 Statement of the Problem**

Education is compulsory for everyone. Without education, life is meaningless and aimless and we cannot solve our day-to-day problems like- counting money, the measure of the quantity and not performing better in life. Mathematics education helps to develop problem-solving skills in learners. For it, mathematics teachers should have proper knowledge of mathematics and for this teacher should be devoted to the field of mathematics. Therefore, the teachers' mathematical beliefs play an important role to enhance the problem-solving skills in learners and the

professional development of teachers. Since, the development of the mathematical beliefs of students is important and it is only possible through teachers' mathematical beliefs. Hence, the researcher has sought this topic – “A study of mathematical beliefs among secondary school teachers.”

### **1.7 Objectives**

The researcher has constructed following objectives for the present study-

1. To explore the levels of mathematical beliefs of secondary school teachers of CBSE and U.P. Board.
2. To explore the levels of mathematical beliefs of secondary school teachers of CBSE with respect to their gender, teaching experience, and educational qualification.
3. To explore the levels of mathematical beliefs of secondary school teachers of U.P. Board with respect to their gender, teaching experience, and educational qualification.
4. To study the mathematical beliefs of secondary school teachers of CBSE and U.P. Board.
5. To study the mathematical beliefs of secondary school teachers with respect to their gender, teaching experience, and educational qualification.
6. To study the mathematical beliefs of secondary school teachers of CBSE with respect to their gender, teaching experience, and educational qualification.
7. To study the mathematical beliefs of secondary school teachers of U.P. Board with respect to their gender, teaching experience, and educational qualification.
8. To study the association between gender and mathematical beliefs among secondary school teachers.
9. To study the association between gender and mathematical beliefs among secondary school teachers of CBSE.
10. To study the association between gender and mathematical beliefs among secondary school teachers of U.P. Board.
11. To study the association between teaching experience and mathematical beliefs among secondary school teachers.
12. To study the association between teaching experience and mathematical beliefs among secondary school teachers of CBSE.

13. To study the association between teaching experience and mathematical beliefs among secondary school teachers of U.P. Board.
14. To study the association between educational qualification and mathematical beliefs among secondary school teachers.
15. To study the association between educational qualification and mathematical beliefs among secondary school teachers of CBSE.
16. To study the association between educational qualification and mathematical beliefs among secondary school teachers of U.P. Board.
17. To study the association between gender and teaching experience of secondary school teachers with respect to their mathematical beliefs.
18. To study the association between gender and teaching experience of secondary school teachers of CBSE with respect to their mathematical beliefs.
19. To study the association between gender and teaching experience of secondary school teachers of U.P. Board with respect to their mathematical beliefs.
20. To study the association between gender and educational qualification of secondary school teachers with respect to their mathematical beliefs.
21. To study the association between gender and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs.
22. To study the association between gender and educational qualification of secondary school teachers of U.P. Board with respect to their mathematical beliefs.
23. To study the association between teaching experience and educational qualification of secondary school teachers with respect to their mathematical beliefs.
24. To study the association between teaching experience and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs.
25. To study the association between teaching experience and educational qualification of secondary school teachers U.P. Board with respect to their mathematical beliefs.

### **1.7.1 Concomitant Objective**

Construct and standardize the tool on mathematical beliefs for secondary school teachers.

### **1.8 Research Hypotheses**

The researcher formulated the following research hypotheses:

- H<sub>R1</sub>: There is significant difference between mathematical beliefs of secondary school teachers of CBSE and U.P. Board.
- H<sub>R2</sub>: There is significant difference between mathematical beliefs of secondary school teachers with respect to their gender, teaching experience, and educational qualification.
- H<sub>R3</sub>: There is significant difference between mathematical beliefs of secondary school teachers of CBSE with respect to their gender, teaching experience, and educational qualification.
- H<sub>R4</sub>: There is significant difference between mathematical beliefs of secondary school teachers of U.P. Board with respect to their gender, teaching experience, and educational qualification.
- H<sub>R5</sub>: There is significance association between gender and mathematical beliefs among secondary school teachers.
- H<sub>R6</sub>: There is significance association between gender and mathematical beliefs among secondary school teachers of CBSE.
- H<sub>R7</sub>: There is significance association between gender and mathematical beliefs among secondary school teachers of U.P. Board.
- H<sub>R8</sub>: There is significance association between teaching experience and mathematical beliefs among secondary school teachers.
- H<sub>R9</sub>: There is significance association between teaching experience and mathematical beliefs among secondary school teachers of CBSE.
- H<sub>R10</sub>: There is significance association between teaching experience and mathematical beliefs among secondary school teachers of U.P. Board.
- H<sub>R11</sub>: There is significance association between educational qualification and mathematical beliefs among secondary school teachers.
- H<sub>R12</sub>: There is significance association between educational qualification and mathematical beliefs among secondary school teachers of CBSE.
- H<sub>R13</sub>: There is significance association between educational qualification and mathematical beliefs among secondary school teachers of U.P. Board.
- H<sub>R14</sub>: There is significance association between gender and teaching experience of secondary school teachers with respect to their mathematical beliefs.
- H<sub>R15</sub>: There is significance association between gender and teaching experience of secondary school teachers of CBSE with respect to their mathematical beliefs.

HR16: There is significance association between gender and teaching experience of secondary school teachers of U.P. Board with respect to their mathematical beliefs.

HR17: There is significance association between gender and educational qualification of secondary school teachers with respect to their mathematical beliefs.

HR18: There is significance association between gender and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs.

HR19: There is significance association between gender and educational qualification of secondary school teachers of U.P. Board with respect to their mathematical beliefs.

HR20: There is significance association between teaching experience and educational qualification of secondary school teachers with respect to their mathematical beliefs.

HR21: There is significance association between teaching experience and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs.

HR22: There is significance association between teaching experience and educational qualification of secondary school teachers U.P. Board with respect to their mathematical beliefs.

## **1.9 Operational Definitions of the Terms**

**1.9.1 Mathematical Beliefs** – Mathematical beliefs refer to a highly personalized mental construct that is developed by prior own experiences about mathematics, through communication with others and upgraded by the environment.

**1.9.2 Secondary Schools Teachers**- In the present study, secondary schools teachers are defined as those teachers who are teaching in class 9<sup>th</sup> and 10<sup>th</sup> of CBSE and U.P. Board.

### **1.10 Delimitations of the Study**

This study has been limited as follows-

1. Present study was restricted to the secondary school teachers of U.P. Board and CBSE.
2. Present study was restricted to Lucknow city.
3. Present study was limited to know the mathematical beliefs of secondary school teachers.



**CHAPTER II**  
**REVIEW OF RELATED**  
**LITERATURE**



### **REVIEW OF RELATED LITERATURE**

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Review of related literature is an integral part of the research study due to the immense contribution of the significant findings. As a result of continuous efforts, various researchers accumulated in the past have imparted knowledge to provide direction for new researches. A continuum exists between the previous theories and the latest ones. Thus, it is essential for a researcher to have a careful review of the theses, dissertations, research journals and books and additional sources of information on the problem for proper planning of research work. In order to solve the research problem, the investigator may streamline the efforts through proper exploration of previous studies. Review of related literature emerges new ideas and curiosities, removes misconceptions and possibilities of repetition. Review of literature allows the researcher to acquaint himself with the current knowledge in the field or area in which, he is going to conduct the research (Best, 2007).

In the absence of this researcher cannot move even in the right direction for a moment. Therefore, the review of literature plays an important role to the study. Review of related studies is the foundation to plan effectively for the future. It paves the present investigation by eliminating unintentional duplication of established findings. This section reveals a review of various previous studies that have been described under the following headings:

#### **2.0 Studies Related to Mathematical Beliefs**

**Shaw (1990)** conducted a qualitative study with three middle school teachers to determine the difference between teachers' ideal beliefs and actual beliefs about understanding, and try to know that how these factors affect teachers' instructional practices. In this study, normative beliefs represented what teachers like to teach for students to learn; Actual beliefs represented how teachers actually taught based on contextual factors. The results indicated that teachers had a system of beliefs about mathematics teaching and learning that differed from their actual teaching beliefs and implemented classroom practices. Teachers were led by their real beliefs rather than their ideal beliefs. Shaw concluded that many relevant factors are responsible for the way teachers define their beliefs, such as how they learn math, the background of math students, students' goals for learning math, textbooks, and time.

**Sosnial et al. (1991)** Analyzed mathematical assumptions and self-perceptions of practice teachers representing typical eighth-grade classes. Based on those responses, the researchers attempted to profile teachers as total predictors of instructional behavior because beliefs seem to mediate between theory and practice as a powerful interface. Mathematical beliefs are a system that is progressive. Teaching promotes and, in fact, helps to maintain traditional beliefs and practices. It has also been argued that by the time one enters a teacher's education program, these traditional concepts become firm and established in their individual form. Converting philosophy to alternative beliefs is difficult, though not possible.

**Raymond (1993)** investigated beliefs and Practices of six beginning monetary mathematics teachers and found diverse degrees of Consistency. Two teachers displayed a high degree of Correspondence between beliefs and practice, two teachers showed a moderate level, while the other two showed a low level. Reasons for the inconsistencies were found to be a lack of resources, time limitations, discipline, and pressure to conform to standardized testing. The author concluded that there is a dialectical relationship between beliefs and practice. According to the researcher, teachers' mathematical beliefs influenced their practice more than their instructional Practices influence their mathematical beliefs. The researcher also found that previous school experiences, teachers' current practice and importantly teacher education courses also influence teachers' mathematical beliefs. Teachers also identified their own mathematical beliefs, students' abilities, the particular topic to teach, the school culture, as well as the mathematics curriculum as factors that influence their instructional practice.

**Erickson (1993)** conducted a study with two experienced middle school math teachers and it was concluded that teachers' ideal beliefs have a strong influence on their teaching practice – however, barriers to fully implementing their ideas include lack of preparation time and Includes a lack of cooperation between cuttings; room size; Requires the availability of technology, materials, and funds and individual opportunities for development.

**Van Zoest; Jones, and Thornton (1994)** interviewed and observed six pre-primary service math teachers participating as students in an intervention program to enhance their teachers' mathematical beliefs. The researcher found that participants acquired beliefs consistent with socio-constructive ideas about learning and teaching math, although they were not able to put these ideas into practice in the early stages of instructional episodes. The reasons for this inconsistency were found that the teachers' lack of academic skills to guide students through the entire process of problem-solving.

**Benbow (1995)** conducted an intervention program to deliberately modify the beliefs and instructional practices of 25 pre-service mathematics elementary teachers. The finding showed that there was no change in teachers' mathematical beliefs at the end of the program however, the researcher stated that instructional behavior in terms of selection of curriculum content and learning activities, teachers, role and teachers' beliefs on self-efficacy were modified as a result of the program. Lack of Pedagogical knowledge and subject-based content were found in some cases to be an obstacle to transforming progressive-oriented beliefs into practice.

**Brown & Rose (1995)** conducted an interview study with elementary mathematics teachers to determine their theoretical orientation. Teachers' responses showed a diverse range of principles of mathematics teaching and learning. Teachers also said that this orientation influenced their instructional behavior. Analysis of the data revealed that teachers do not fully implement their ideal concepts of mathematics education due to perceived pressure from parents and school administrators to implement traditional teaching.

**Foss and kleinsasser (1996)** studied the behavior and instructional practice of 20 elementary mathematics pre-service teachers. At the end of a one-semester methods course, participants had not changed their beliefs about teaching and learning mathematics, which were found to be traditional-oriented and heavily influenced by previous traditional learning experiences in diverse educational settings. Participants' instructional behavior replicated or modeled activities learned in the methods course, but not to the extent that reflected an adoption of innovative approaches to teaching and learning mathematics in an articulated and consistent way.

**Physick, M.D. (1999)** conducted a study on "A Study on the Exploration of Belief Systems Related to Mathematics". The aim of this study was to explore students' math-related belief systems and the use of a "mathematics-related belief questionnaire" (MRBQ) to measure such systems. 73 students of three mathematics classes were used as subjects for study. The results of Part One of this study support the existence of three subcategories of math-related beliefs including beliefs about self-mathematics, the object and the context in which they learn math – an exploratory factor analysis of the MRBQ identified five factors. Determined those are fit into it. Analysis of correlations between factors suggests a "core" set of beliefs with strong interrelationships that can be used to classify students' mathematical disposition and which may be associated with achievement in mathematics.

**Nisbet, S. and Wanen, E. (2000)** conducted a study on "A study of the beliefs of primary school teachers related to the teaching and evaluation of mathematics and the factors influencing these beliefs". The purpose of this study was to examine the beliefs of primary school teachers on teaching, learning, and assessment of mathematics. Specifically, this study was conducted by questionnaire, a method appropriate to examine the relationship between assessment and instruction. However, one of the limitations of the survey method was its reliance on self-reporting, hence the need for results. This was taken into account in the Interpretation. The 56 items Likert Scale Survey was designed for a large comprehensive study.

**Stipek, D. J. et al. (2001)** conducted a study on "A Study on Beliefs and Practices of Teachers Related to Mathematics Instruction". The aim of this study was to measure teacher beliefs about mathematics instruction that directly contrasts with more traditional practices. 20 sixth-grade teachers from elementary schools throughout Los Angeles County participated in this study as participants. At the beginning and end of the school year, teachers believe about (i) the nature of mathematics (ii) learning mathematics (iii) which students should control, mathematical activity (iv) the nature of mathematical ability (v) students learning mathematics Assessment of the value of external rewards for engaging in activities of Analyzes were conducted to assess the coherence between these beliefs and the relationship between teachers' beliefs and the class they viewed. The findings of practices and self-reported assessment criteria showed substantial coherence between teaching their beliefs and a sustained association between their beliefs and their practices. Teachers' confidence as math teachers was also significantly associated with the mathematical learners' confidence in their students.

**Nisbet S. et al. (2001)** had investigated "Primary school teachers' belief relating to mathematics, teaching and assessing mathematics and factors that influence these beliefs". The purpose of this study was to examine Primary teachers' beliefs on teaching, learning, and assessing mathematics. The quantitative methods were used for large samples of teachers. This study was conducted by questionnaire. A 56 item Likert-scale survey was designed for a large Comprehensive study fifteen hundred survey forms were sent to a random selection of grades of teachers representing different grade levels (lower middle, upper primary) school systems, socio-economic areas, and geographic locations. This study had provided significant evidence for the structure of teachers' beliefs relating to mathematics, and teaching and assessing mathematics.

**Boris Handel (2003)** studied the article on "Teachers' math beliefs: A review. This paper examines the nature and role of teachers. this paper suggests that teachers' mathematical beliefs can be classified into several dimensions. Once the learning experiences are acquired during

traditional primary schooling, teachers' beliefs are eventually reintroduced into classroom instruction. It has also been argued that, due to their conservative nature, educational environments are traditionally prescriptive. It promotes and reinforces that the development of beliefs although there is evidence that teachers' beliefs influence their prescriptive behavior, the nature of the relationship is complex and mediated by external factors.

**Yates, S. M. (2006)** conducted a study on "A study on primary teachers' mathematical beliefs, teaching practices, and curriculum reform experiences". The purpose of this study is to investigate the relationship between teachers' beliefs about mathematics and the teaching and learning of mathematics, their pedagogical Practices in mathematics, and their experiences of Curriculum reforms in mathematics. The study took place in South Australian Dept. of Education and Children's Services (DECS) primary schools and involved teachers with 10 or more years of teaching mathematics. 127 experienced primary teachers in 21 DECS schools participated in the study. The 29 male and 98 female teachers ranged in age from 30 to 62 years with a median age of 51 years. The survey method is used to measure teachers' age, gender, qualifications, year of teaching mathematics, beliefs and practices in mathematics, and experience of curriculum reforms. The findings showed that teachers' beliefs about the nature of mathematics measured in the survey were not statistically significantly related to their beliefs about the teaching and learning of mathematics. However, for the majority of teachers, there was no statistically significant relationship between their beliefs about the nature of mathematics and their reported pedagogical practices and also that teachers' age, qualifications, and length' of mathematics teaching experience were not statistically significantly related to their teaching practices was somewhat unexpected, the statistically significant relationship between the sheer number of reforms experienced by teachers. This study identified some statistically significant relationships between teachers' experience of curriculum reforms in mathematics and their beliefs and practices at the primary level.

**White, A. L. et al. (2006)** study was conducted on "A Study on Mathematical Attitudes, Confidence and Achievement in Primary Pre-Service Teachers", a total of 83 pre-service math teachers were taken as participants and they gave their undertaking that the maths subject was theirs. The first was the teaching subject. Western Sydney University and they provided responses to it. They completed three surveys; an achievement test of the mathematics they will be expected to teach; a survey of their beliefs, beliefs about mathematics and mathematics teaching and learning; and a survey of their attitudes towards mathematics. The above analysis reveals a lack of relationship between beliefs and attitudes, contrary to expectations, indicating the only statistically significant relationship between insecurity about teaching mathematics in

the behavioral scale and the transmission factor in the belief scale.

**Jang, H. (2010)** Conducted a study on "Measuring teachers' beliefs about mathematics: an object response theory approach". The aim of this study was to develop a tool that could qualitatively measure the teacher's belief about mathematical discourse as a continuum by discovering and describing it. Teachers have different levels of confidence, i.e., univocal, partial univocal, emerging dialogue and dialogue. A total of 168 people participated in the study. While the results show generally positive evidence for the validity and reliability of measurements for addition, the findings of this study suggest that mathematical discourse (BMD) beliefs about measurement are a key factor in informing and designing introductory mathematics methodology course was a potentially promising tool.

**Zakaria, Effandi and Musiran, Norul Paziana (2010)** conducted a study on beliefs about the nature of mathematics, mathematics teaching and learning among apprentice teachers. The aim of this study was to examine beliefs about the nature of mathematics. The sample included learning in Selangor, Malaysia. 100 teacher trainees from two U.S. higher institutions used the Mathematical Confidence Questionnaire that covers three dimensions; beliefs about the nature of mathematics, beliefs about teaching, and beliefs about learning mathematics and summarize the data and the t-test were used to test the hypothesis, the findings indicated that the beliefs of math trainee teach us positive towards the constructivism approach. The teacher trainees also believed that teaching math should include the opportunity to use math in daily situations. The finding also found that there were significant differences between beliefs about the nature of math and beliefs about learning math by gender.

**Ruhan Kayan (2011)** conducted a study on "A study construction of a math-related confidence scale for primary pre-service math teachers". The aim of this study was to build a valid and reliable mathematics-related confidence scale to determine the mathematics of pre-service elementary mathematics teachers- related mathematics-related beliefs of pre-service mathematics teachers and pre-service mathematics teachers in Turkey. To study the effect of gender and year level on Overall, the Mathematics Related Confidence Scale (MRBS) for the first purpose was developed on a combination basis had gone. Data were analyzed by descriptive and inferential data. The results showed that the MRBS was a valid and reliable scale that measured beliefs related to pre-Turkish mathematics service teacher. The two components of mathematics and teaching mathematics in MRBS were "constructive belief" and "traditional belief". The finding revealed that gender had a significant impact on pre-service teachers' math beliefs. No significant difference was found in the mathematics beliefs of pre-service teachers with respect to year level in teacher education program. The MRBS was used to examine the

mathematics beliefs of pre-service teachers to determine the experiences of an effective teacher education program.

**Adnan, M. et al. (2012)** conducted the study about mathematical assumptions and conceptual knowledge and found that mathematical experience plays an important role in enhancing the quality and effectiveness of teaching and learning mathematics. Thus, this study was conducted with the aim of delineating these three core constructs, namely mathematical belief, conceptual knowledge and mathematical experience, among pre-service teachers. 317 pre-service teachers from six institutions of higher education were randomly selected to participate in this study. Mathematical Confidence, Conceptual Knowledge, and Mathematical Experience, Mathematical Confidence Questionnaire (MBQ), A Test of Conceptual Knowledge (TCK), Mathematical Experience Questionnaire (MCQ) were used. Findings showed that overall teachers have high mathematical beliefs and teachers have a good average score of conceptual knowledge while mathematical experience is moderate. Further analysis showed that a significant correlation exists between these three variables. Implications and suggestions are made for a better understanding of mathematical assumptions, conceptual knowledge and mathematical experience, particularly in the context of mathematics teaching and learning.

**Memnun, D. S. et al. (2012)** studied on the topic "A research on mathematical problem-solving assumptions of mathematics, science and primary pre-service teachers in Turkey in the context of different variables". The researcher studied to know the effect of elementary school pre-service teachers' mathematical problem solving, gender and teaching area on their problem-solving beliefs. A total of 567 math, science and elementary school pre-service teachers participated in the research. The Mathematical Problem Solving Confidence Tool was used on these pre-service teachers. In conclusion, no significant differences were found between the beliefs of pre-service teachers and their gender or the education field they were studying. It is understood that pre-service teachers need to develop beliefs about mathematical problem-solving.

**Zakaria, E. et al. (2012)** observed the relationship between Mathematics teachers' beliefs and teaching practice and found that the connection between teachers' beliefs and their practices was inconsistent. The purpose of this study was conducted to determine the mathematics secondary School teachers' beliefs and teaching practices. A total of 51 teachers from seven schools in Selangor which are located in a rural area of the 51 teachers, 44 were females and 7 were males. These teachers were grouped according to the number of years of teaching experience and a set of questionnaires were given to them in order to get their responses on mathematics beliefs and their teaching practice. The dimensions of mathematics beliefs consist of

beliefs towards, the nature of mathematics beliefs towards mathematics teaching, and beliefs towards mathematics learning. The result revealed no difference between the less-experienced and more experienced teachers in the aspects of mathematics beliefs. There was a moderately significant correlation between their mathematics beliefs and teaching practices. In this study, it was found that good mathematical beliefs would lead teachers to positive and effective teaching practices.

**Adam, M. S. (2012)** conducted a study on "A Study on the Mathematical Assumptions and Practices of Primary Teachers in the Maldives". This study examined the factors influencing the mathematical beliefs and practices of eight primary teachers selected from four schools in two different regions of the Maldives. The research used a multi-case study approach under the qualitative method. A questionnaire, semi-structured interview and observation were used to collect data about the teacher's beliefs and practices. Teachers' lesson notes, worksheets, student work samples and test papers were used to understand teachers' behavior. Data were analyzed in all cases using a thematic approach. The results showed that teachers exhibited a variety of beliefs that included both constructivist and traditional elements to varying degrees. The practice of teachers showed some consistency with their beliefs about the nature of mathematics, mathematics teaching and learning. Overall, the findings indicated that there are many factors influencing teacher practice including the method of evaluation, teacher's accountability for student outcomes, limited time to cover the syllabus, lack of resources and the use of textbooks.

**Haclomeroglu, G. (2013)** conducted a study on "mathematics anxiety and mathematical beliefs; what is the relationship in elementary pre-service teachers?" The participants were 301 pre-service teachers enrolled in the elementary, pre-service teacher education program. The sample consisted of 200 females' and 101 males. Results of this study revealed that there were significant differences between third-year and fourth-year pre-service teachers regarding their mathematical anxiety and mathematical beliefs. They held strong beliefs about teaching and learning mathematics that were aligned with the teacher education program. The results suggested that the pre-service teachers who held stronger beliefs and felt less anxious were more confident about their abilities to teach mathematics effectively. Thus, the significant relationship between mathematics anxiety and mathematical belief should be acknowledged.

**Yuniarti, S. et al. (2014)** conducted a study on "Relationship between mathematical beliefs and mathematics anxiety, among pre-service elementary school teachers in East Borneo, Indonesia." The study used non-experimental quantitative research using a cross-sectional survey. A total of 374 respondents were chosen using stratified random sampling. The sample of

this study was pre-service elementary school teachers. The data obtained from the questionnaire used in the study was analyzed via SPSS 21.0. The finding showed that there was no significant relationship between beliefs about the nature of mathematics and mathematics anxiety and between beliefs about mathematics learning and mathematics anxiety. However, findings indicated that there was a relationship between beliefs about mathematics teaching and mathematics anxiety. Furthermore, there was found the negative significant relationship between mathematical beliefs and mathematics anxiety among pre-service elementary school teachers when combining the dimensions of mathematical beliefs.

**Huges, P.T. (2016)** found in his research "A study on the relationship of mathematics anxiety, mathematical beliefs and instructional practices of elementary school teachers". The purpose of this quantitative survey study was to explore the relationships among mathematics, anxiety mathematical beliefs, and instructional practices of practicing elementary teachers as they relate to the mathematics reforms effort promoted by the National Council of Teachers of Mathematics. The study included 153 practicing elementary teachers who teach mathematics to students in Pre-k-5. These teachers completed the following online surveys; mathematics anxiety scale, the teaching beliefs survey, and the self-report: Elementary Teachers Commitment to mathematics Education reform survey. Quantitative data analysis methods included descriptive statistics, correlation analysis, and multiple regression analysis was used to analyze the data. Results indicated statistically significant correlation relationship between mathematics anxiety, mathematical beliefs, and instructional practices. Regression analyses were conducted to identify mathematics anxiety and mathematical beliefs as a predictor of instructional practices. Results were significant for mathematical beliefs as predictors, but not Significant for mathematics anxiety as a predictor of instructional Practices.

**Minarni, B. W. et al. (2018)** conducted a study on "Mathematics teachers' beliefs and its contribution toward teaching practice and student achievement". The purpose of this study was to discuss the relation between (1) Mathematics teacher beliefs and teaching practice (2) teaching practice and student achievement (3) mathematics teachers' beliefs and student achievement. The method of narrative review was selected for the synthesis of findings. Case study of nine pre-service teachers from the faculty of education at the University of Lativin was conducted. The researcher found that there was consistent association between beliefs and teaching practice in a classroom-based setting. Furthermore, a Survey of 53 elementary school teachers from seven schools in Selangor. The finding represented that there was a positive relationship between the teachers' beliefs and teaching practice. Data was collected by a Survey of 20 respondents, and Data was analyzed by CFA and EFA using SPSS and AMOS. The result showed that the

teaching practice influenced positively the students' achievements when the data was collected by a survey of 190 mathematics teachers and their students from different regions of Latvia. The result showed that there exists a correlation between teachers' beliefs on teaching mathematics and their students' achievement. In addition, data collected by a survey of 103 teachers and over 2000 students from 36 schools data analyzed by SEM - Finding, showed that there was an indirect relationship between the teacher beliefs and student achievement.

## **2.1 Conclusion of the Review of Related Literature**

The researcher has seen that the teachers' mathematical beliefs play a vital role in the professional development of the teachers. Also, the reviews presented here suggested a wide array of tools and techniques to evaluate the teachers' mathematical beliefs. However, no such study had been found which was carried for the teachers of U.P. and CBSE. The majorities of the reviewed studies were explanatory in nature and were based on the previous studies. Also, most of them have been conducted using either online surveys or interviews and focus group discussions. The majorities of the studies which have been conducted previously were quantitative and mixed in nature. But in the present study, the researcher aims to study the mathematical beliefs of secondary school teachers of U.P. Board and CBSE so, that further studies could be based upon the exploratory findings of the present study.



**CHAPTER III**  
**RESEARCH**  
**METHODOLOGY**



**RESEARCH METHODOLOGY**

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This chapter discusses the following points: research design, population, sample and sampling technique, variables of the study, analysis of the sample, used tools, experimental procedure, administration of the tools, collection and tabulation of data, and statistical techniques used.

Research methodology or research design is a plan to organize research in a logical manner to achieve the stated objectives of the study. Many earlier types of research were found to be worthwhile because they were conceived with an important purpose. In order to solve a hypothetical idea or problem scientifically, it is important to carefully plan the investigation.

In the field of education, there are numerous problems to be investigated and solved which seems to be in a rising phase every day. It is not easy for any research to get a successful solution to problems by a scientific and logical study. Any educational research is successful by depending on the methodology followed for conducting the research. The methodology of the research includes proper selection of samples, proper selection of measurement methods and instruments, etc. Any research not only follows the prescribed sequence to achieve the objectives but also includes many interrelated activities to achieve the objectives. Each step or aspect of the methodology or research design has an impact on the quality of the research which subsequently affects the apparent results of the research. Any minor omission or mistake in the methodology adversely affects the quality of the study.

Successful execution of research requires careful planning for all stages of conducting academic research. The initial step in planning any academic research is to outline the methodology to be followed by the sampling process. The next step is the selection of instruments or devices for fabrication and measurement of the variables.

In the next phase of research, the equipment must be justified based on the standardization and reliability of the equipment. It helps the researcher to collect data objectively. If the researcher builds a self-made research tool for data collection, detailed steps for fabrication and standardization should be followed that should be described in the research methodology. The final step of the research methodology is to explain the statistical tools used to test the hypotheses of the study.

Therefore after the identification of research problems and the brief description of previous researches related to them, there is a need to explain the method and process of research presented by the researcher. Therefore, the present chapter describes the tools and techniques of data collection, the method and procedure of the study are as follows:

### **3.0 Type of the Research**

The nature of the present study is descriptive survey research. The descriptive research focuses on knowing and describing things related to the present situations rather than those belonging to the past. According to the Landman (1988) “Descriptive research is thus a type of research that is primarily concerned with describing the nature or conditions and degree in detail of the present.” The main purpose of this type of research is to find answers to questions like who, what, where, when and how of a current event and then describe it in the form of report writing.

According to Best and Kahn (2002) “A descriptive study describes and interprets what is. It is concerned with the conditions or relationships that exist, opinions that are held, processes that are going on, effects that are evident or trends that are developing. It is primarily concerned with the present, although it often considers past events as they relate to current conditions.”

### **3.1 Research Design**

The research design is the coherent structure within which any research is conducted. Through this, the researcher constitutes the blueprint for the collection, measurement, and analysis of data. The design provides an outline from writing the research hypothesis and its rationale and implications of the research in the specific area. The research design adopted for the present study is cross sectional survey design.

### **3.2 Population of the Study**

Population is a whole set of essentials (persons or objects) that have some common features defined by the sampling criterion recognized by the researcher.

#### **3.2.1 Target Population**

A target population is a group of people, objects or events to which the researcher wishes to generalize the study findings and encounter the standards of concern to the researcher.

#### **3.2.2 Accessible Population**

Accessible population is that part of the population to which the researcher has reasonable access to each subject, it is a subset of the target population, and may be restricted to region,

state, city, country or institution.

The target population of the present study is defined as the secondary schools teachers of CBSE and U.P. Board within the country and accessible population is defined as the secondary schools teachers of CBSE and U.P. Board of Lucknow city.

### 3.3 Sample

The sample is the selected component (people, objects or events) chosen to take part in a study, and people are mentioned to as subjects or participants. Sampling is the process of selecting a group of people, events, behaviors, or other elements with which to study. While the sampling frame is the list of all the elements in the accessible population from which the sample is taken.

Due to pandemic, the survey was conducted through online mode and 80 secondary schools teachers of CBSE and U.P. Board have been chosen as the sample of present study.

### 3.4 Sampling Technique

In view of the COVID-19 pandemic situation, the researcher did not have sufficient resources to select adequate samples by using probability sampling. So, researcher used non-probability sampling technique to select the sample for the present study.

Researcher used Purposive Sampling technique to identify the schools and teachers.

**Table 3.1: Distribution of the Sample**

Board	Teaching Experience			Educational Qualification		Gender		Total
	Below than 5 years	From 5 to 10 years	Above than 10 years	U.G	P.G	Female	Male	
U.P. Board School	16	14	14	22	22	26	18	44
CBSE School	14	10	12	18	18	16	20	36

### **3.5 Variables of the Study**

#### **3.5.1 Independent Variable**

1. Board of the institutions (U.P. Board and CBSE)
2. Gender
3. Teaching Experience
  - a) Below 5 years (beginning teachers)
  - b) From 5 to 10 years (middle teachers), and
  - c) Above 10 years (veteran teachers)
4. Educational qualification
  - a) Bachelor's degree (U.G)
  - b) Master's degree (P.G)

#### **3.5.2 Dependent Variable**

Mathematical Beliefs (MB)

### **3.6 Tool of the Study**

**Teachers Mathematical Beliefs Scale (TMBS)** - It was constructed and standardized by the researcher with the help of experts' opinion.

#### **3.7 Standardization of Teachers Mathematical Beliefs Scale (TMBS)**

##### **3.7.1 Initial Tryout**

The researcher constructed a mathematical beliefs scale based on the summative rating scale (Likert scale). The scale contained 59 items with five choices each. Items described as favorable or positive, 5 points were awarded for strongly agreeing, 4 for agreeing, 3 for uncertain, 2 for disagreeing, and 1 for strongly disagreeing. An unfavorable statement was psychologically equivalent to agreeing with a favorable statement. Thus, for the unfavorable statements, score of 1 was given for strongly agreeing and 5 for strongly disagreeing. The highest possible score was 5 and the lowest possible score was 1.

##### **3.7.2 Expert's Tryout**

The researcher distributed a few copies of the scale to the experts to find out linguistic errors/ suitability of language on the scale made and to get experts' opinions about the appropriateness of the statements. The researcher collected the opinion of 05 experts and based

on the opinion of the experts, the researcher modified some ambiguous statements and dropped 05 items.

### **3.7.3 Individual Tryout**

After modifying the items as per the experts' tryout, the researcher selected 10 teachers and distributed them the scale to know their opinion about the suitability of items with respect to language. On the basis of the individual tryout, the researcher tried to find out the items where modifications are required and modified the items and 04 items were dropped.

### **3.7.4 Group tryout**

After the individual tryout, the researcher applied the mathematical beliefs scale on 70 secondary school teachers of U.P Board and CBSE Board in Lucknow city. 35 teachers were of CBSE Board and 35 teachers were of U.P. Board. For this, the Researcher selected purposively 08 schools of U.P. Board and 08 schools of CBSE.

### **3.7.5 Scoring for Final Tryout**

After expert tryout and individual tryout, the scale contained 50 items with five choices each. For items described as favorable or positive, 5 points were awarded for strongly agreeing, 4 for agreeing, 3 for uncertain, 2 for disagreeing, and 1 for strongly disagreeing. An unfavorable statement was psychologically equivalent to agreeing with a favorable statement. Thus, for the unfavorable statements, the score of 1 is given for strongly agreeing and 5 for strongly disagreeing. The highest possible score was 5 and the lowest possible score was 1. Similarly, the scoring of the whole data on the final draft of the scale was completed. For the item analysis, the t-test was computed between the upper and lower group. The selection and rejection of the items were accomplished on the basis of obtaining the t-value on the df 68 at the 0.05 significance level.

Here,

$M_H$  = Mean of the raw scores of higher group

$N_H$  = Number of top 27% students from the higher group

S. D. $_H$  = Standard deviation of the raw scores of upper group

$M_L$  = Mean of the raw scores of lower group

$N_L$  = Number of 27% students from bottom to top from the lower group.

S. D. $_L$  = Standard deviation of the raw scores of upper group  $df = 6$

**Table 3.2: Selection/Rejection of Items on ‘Five Point Likert Scale’**

Statement No.	Higher Group N <sub>H</sub> = 19		Lower Group N <sub>L</sub> = 19		t- Value	Significance Level 0.05	Select/Reject Items
	M <sub>H</sub>	S.D. <sub>H</sub>	M <sub>L</sub>	S.D. <sub>L</sub>			
1	3.037	1.4268	1.963	1.7317	2.4874	t(0.05)= 1.68	<b>S</b>
2	2.3333	1.7847	1.9259	1.8242	0.8295	t(0.05)= 1.68	<b>R</b>
3	0.8889	1.663	2.037	1.8556	-2.3943	t(0.05)= 1.68	<b>S</b>
4	3.0741	1.5853	1.593	1.6835	3.3291	t(0.05)= 1.68	<b>S</b>
5	2.8889	1.4229	2.3333	1.633	1.3328	t(0.05)= 1.68	<b>R</b>
6	1.1481	1.2968	2	1.5635	-2.1791	t(0.05)= 1.68	<b>S</b>
7	1.593	1.5217	2.3704	1.519	-1.8797	t(0.05)= 1.68	<b>S</b>
8	2.8519	1.6489	1.963	1.7947	1.8952	t(0.05)= 1.68	<b>S</b>
9	3.1852	1.4666	1.8148	1.7221	3.148	t(0.05)= 1.68	<b>S</b>
10	1.1852	1.4916	1.4444	1.3426	-0.6713	t(0.05)= 1.68	<b>R</b>
11	2.963	1.7529	1.1481	1.7149	3.8454	t(0.05)= 1.68	<b>S</b>
12	2.7778	1.7069	1.8148	1.9059	1.9557	t(0.05)= 1.68	<b>S</b>
13	2.3704	1.5904	1.4074	1.8511	2.0503	t(0.05)= 1.68	<b>S</b>
14	2.7037	1.5108	1.9259	1.5135	1.8898	t(0.05)= 1.68	<b>S</b>
15	3.0741	1.5135	2	1.7213	2.4349	t(0.05)= 1.68	<b>S</b>
16	2.7037	1.6059	1.8519	1.7364	1.8715	t(0.05)= 1.68	<b>S</b>
17	2.963	1.5511	2.1852	1.5878	1.8207	t(0.05)= 1.68	<b>S</b>
18	2.037	1.7332	1.6293	1.567	0.9065	t(0.05)= 1.68	<b>R</b>
19	1.3333	1.3878	2.037	1.5748	-1.742	t(0.05)= 1.68	<b>S</b>
20	2.6667	1.587	2.4815	1.5956	0.4276	t(0.05)= 1.68	<b>R</b>
21	3.037	1.4268	2.2963	1.5591	1.8213	t(0.05)= 1.68	<b>S</b>
22	2.6296	1.3917	1.3333	1.6102	3.1649	t(0.05)= 1.68	<b>S</b>
23	1.4815	1.6187	2.2593	1.734	-1.7037	t(0.05)= 1.68	<b>S</b>
24	2.1481	1.7149	2	1.7638	0.3129	t(0.05)= 1.68	<b>R</b>
25	3.037	1.4268	2.4815	1.4999	1.3945	t(0.05)= 1.68	<b>R</b>
26	1.6296	1.519	2.3333	1.4657	-1.7323	t(0.05)= 1.68	<b>S</b>
27	3.5926	0.6242	2.2593	1.8377	3.5697	t(0.05)= 1.68	<b>S</b>
28	2.7778	1.6405	1.7407	1.7762	2.2286	t(0.05)= 1.68	<b>S</b>

29	1.4074	1.6613	2.2222	1.6405	-1.8134	t(0.05)= 1.68	<b>S</b>
30	1.4444	1.3426	2.1481	1.6489	-1.7197	t(0.05)= 1.68	<b>S</b>
31	2.2963	1.6059	1.5185	1.4999	1.8392	t(0.05)= 1.68	<b>S</b>
32	2.5556	1.5947	1.6667	1.6778	1.9954	t(0.05)= 1.68	<b>S</b>
33	3	1.4142	1.8148	1.6563	2.8276	t(0.05)= 1.68	<b>S</b>
34	1.4444	1.3426	2.2963	1.5108	-2.19	t(0.05)= 1.68	<b>S</b>
35	2.2593	1.5774	1.9259	1.5378	1.7862	t(0.05)= 1.68	<b>S</b>
36	3	1.4402	2.2593	1.6464	1.7596	t(0.05)= 1.68	<b>S</b>
37	3.037	1.4268	1.8519	1.6932	2.7813	t(0.05)= 1.68	<b>S</b>
38	2.7778	1.2273	2.7037	1.4093	0.206	t(0.05)= 1.68	<b>R</b>
39	2.5556	1.663	1.7778	1.5713	1.7664	t(0.05)= 1.68	<b>S</b>
40	3.1481	1.2968	2.2963	1.6956	2.0735	t(0.05)= 1.68	<b>S</b>
41	2.6154	1.3889	1.8148	1.7646	1.839	t(0.05)= 1.68	<b>S</b>
42	2.7778	1.3426	1.963	1.4778	2.1206	t(0.05)= 1.68	<b>S</b>
43	3.0741	1.245	3.037	1.0709	0.1172	t(0.05)= 1.68	<b>R</b>
44	2.7778	1.6405	2.2593	1.7762	1.1143	t(0.05)= 1.68	<b>R</b>
45	2.963	1.4268	1.8148	1.611	2.7723	t(0.05)= 1.68	<b>S</b>
46	2.6296	1.6136	1.6296	1.567	2.3102	t(0.05)= 1.68	<b>S</b>
47	1.5926	1.4468	2.5556	1.499	-2.4018	t(0.05)= 1.68	<b>S</b>
48	2.7037	1.6059	2.0741	1.5853	1.4499	t(0.05)= 1.68	<b>R</b>
49	2.8889	1.3966	1.7778	1.5713	2.7462	t(0.05)= 1.68	<b>S</b>
50	1.1481	1.2968	2.3333	1.633	-2.9533	t(0.05)= 1.68	<b>S</b>
Total Rejected Items							<b>11</b>
Total Selected Items							<b>39</b>

Therefore, the 39 items were selected and 11 items were rejected out of all 50 items on the basis of the t-value 1.68 at df 68 at 0.05 level of significance.

Selected items were used to establishing reliability, validity and Norms.

### 3.7.6 Final Tryout

The researcher administered the tool and collected the data from 100 secondary school teachers of U.P. Board and CBSE by using stratified random sampling. The researcher randomly selected 10 schools of U.P Board from the list provided by D.I.O.S and randomly selected 10 schools of CBSE from the website

### 3.7.7 Reliability

#### Spearman-Brown Coefficient

The reliability of the ‘Teachers’ Mathematical Beliefs Scale’ expressed by Split- Halves reliability in which researcher used Odd-Even Split-Halves method and First Half- Second Half method to know the correlation coefficient between two sets of scores and to know the reliability of whole test researcher used Spearman-Brown Prophecy Coefficient of correlation.

**Spearman-Brown Coefficient**

$$r_{SB} = \frac{2r}{1+r}$$

$r_{SB}$  = Spearman-Brown Coefficient  
 $r$  = Pearson product moment correlation between the split-half test-scores or the odd-even test scores of the scale.

Researcher found The Pearson correlation by using First Half- Second Half method is 0.7126 and Spearman-Brown Prophecy Coefficient is 0.8322. Therefore, by using First Half-Second Half method, the reliability of the scale was found 0.8322.

Similarly, the Pearson product moment correlation by using Odd-Even scores of the scale was found 0.7018 and Spearman-Brown Prophecy Coefficient was 0.8239. Therefore, the Odd-Even Split Halves reliability of the scale was found 0.8239. These both reliabilities are significant for  $df = 98$  at 0.01 level of significance.

**Table 3.3: Reliability of Teachers’ Mathematical Beliefs Scale**

RELIABILITY	OBTAINED VALUE
First Half-Second Half	0.8322
Odd-Even Split Halves	0.8239

### 3.7.8 Validity

The validity of the scale is defined by face validity.

#### A) Face Validity

The researcher distributed few copies of the scale to some experts in order to gather opinions about whether the instrument was serving the purpose for which it was designed or not. The researcher collected the opinion of five experts regarding the face validity of the scale.

#### B) Intrinsic Validity

Garrett (1967) stated that Index of Reliability can also be taken as measure of validity. Intrinsic validity of the scale was found by the formula given below:

Intrinsic validity =  $\sqrt{\text{reliability}}$  The index of validity (first half-second half method) is 0.9122 The index of validity (Odd-Even method) is 0.9077

The intrinsic validity of the tool was found to be based on split half method and is significant at 0.01 level of significance.

### 3.7.9 Norms

Norms of the Mathematical Beliefs Scale was made on the basis of z-scores.

**Table 3.4: Norms of Teachers' Mathematical Beliefs Scale**

S.N.	Z -Scores	Limit
1	+1Z to +3Z	Above 170
2	-1Z to +1Z	130-170
3	-1Z to -3Z	Below 130

### 3.7.10 Final Draft

Final Draft of the scale was attached in the appendices of the study.

### 3.8 Rationale of the Tool

The Mathematical Beliefs Scale was constructed by the researcher and supervisor. This tool is developed to know the opinion regarding Mathematical Beliefs among secondary school teachers of CBSE and U.P. Board and also to know the level of awareness towards mathematical beliefs and find out the reasons where improvement is needed for the enrichment of mathematics teaching.

### **3.9 Collection of the Data**

In this quantitative study due to pandemic, the researcher used a survey method to collect data from teachers of various selected secondary schools through online mode. For conducting an online survey and reaching out to the participants, the researcher has used the email addresses of the faculty members provided on some schools' websites. All teachers were informed by email and asked to participate in the study. Each participant had the option to refuse to participate in the study. The researcher sent the Mathematical Belief Scale (MBS) to the total of 109 teachers, who agreed to fill out the scale through email and other social networking platforms, but the researcher received only 89 responses from the participants in which 09 forms were incomplete and the researcher was not considered incomplete form in the study. Therefore, the sample identified for this study consists of 80 secondary school teachers. Thus, total 80 participants have completed this online survey.

### **3.10 Statistics used in the Study**

To test the null hypotheses of independent distribution, the Mann-Whitney U-Test, Kruskal-Wallis H-Test and Chi-Square Test are used to analysis the data.



**CHAPTER IV**  
**DATA ANALYSIS AND**  
**INTERPRETATION**



**DATA ANALYSIS AND INTERPRETATION**

**4.0 Analysis of the Data to know the Mathematical Beliefs of Secondary School Teachers**

In order to achieve the objectives of the study, the data so collected were recorded in tabular form for statistical analyses. Mean, median, mode, standard deviation, percentage were calculated. The Mann-Whitney U-Test and Kruskal-Wallis H-Test and Chi-Square Test were employed to find out the statistical significance of the differences between the respective groups. Analysis of data was interpreted under the following headings:

**4.1 Results based on Percentage Analysis**

**4.1.0 Explore the levels of mathematical beliefs of secondary school teachers of CBSE and U.P. Board**

**Objective 1:** To explore the levels of mathematical beliefs of secondary school teachers of CBSE and U.P. Board.

**Table 4.1: Levels of mathematical beliefs of secondary school teachers of CBSE and U.P. Board**

<b>Board</b>	<b>Level of Mathematical Beliefs</b>	<b>Frequency</b>	<b>Percent</b>
<b>CBSE</b>	<b>High</b>	20	55.6
	<b>Average</b>	14	38.9
	<b>Low</b>	2	5.6
	<b>Total</b>	36	100.0
<b>U.P. Board</b>	<b>High</b>	14	31.8
	<b>Average</b>	17	38.6
	<b>Low</b>	13	29.5
	<b>Total</b>	44	100.0

Above Table no. 4.1 indicates that high, average and low levels of mathematical beliefs of secondary school teachers of CBSE are 55.6%, 38.9% and 5.6% respectively. Similarly, high, average and low levels of mathematical beliefs of secondary school teachers of UP Board are 31.8%, 38.6% and 29.5% respectively.

**4.1.1 Explore the levels of mathematical beliefs of secondary school teachers of CBSE with respect to their gender, teaching experience, and educational qualification**

**Objective 2:** To explore the levels of mathematical beliefs of secondary school teachers of CBSE with respect to their gender, teaching experience, and educational qualification.

**Table No.4.2: Levels of mathematical beliefs of secondary school teachers of CBSE with respect to their gender, teaching experience, and educational qualification**

Secondary School Teachers of CBSE				
Group	Particular	Level of Mathematical Beliefs	Frequency	Percent
Gender	Female	High	8	50.0
		Average	8	50.0
		Total	16	100.0
	Male	High	12	60.0
		Average	6	30.0
		Low	2	10.0
		Total	20	100.0
Teaching Experience	Less than 5 Years	High	8	57.1
		Average	6	42.9
		Total	14	100.0
	From 5 to 10 Years	High	5	50.0
		Average	4	40.0
		Low	1	10.0
		Total	10	100.0
	More than 10 Years	High	7	58.3
		Average	4	33.3
		Low	1	8.3
		Total	12	100.0
	Educational Qualification	U.G.	High	9
Average			7	38.9
Low			2	11.1
Total			18	100.0
P.G.		High	11	61.1
		Average	7	38.9
		Total	18	100.0

Above Table no. 4.2.1 indicates that high and average levels of mathematical beliefs of secondary school female teachers of CBSE are 50% and 50% respectively. Similarly, high, average and low levels of mathematical beliefs of secondary school male teachers of CBSE are 60%, 30% and 10% respectively.

It can also be say that high and average levels of mathematical beliefs of secondary school teachers of CBSE with less than 5 years teaching experience are 57.1% and 42.9% respectively. Secondary school teachers having teaching experience from 5 to 10 years contains high, average and low levels of mathematical beliefs are 50%, 40% and 10% respectively. Teachers of CBSE having more than 10 years contains high, average and low levels of mathematical beliefs are 58.3%, 33.3% and 8.4% respectively.

Further, it can be stated that the teachers of CBSE whose educational qualification is U.G contains high, average and low levels of mathematical beliefs are 50%, 38.9% and 11.1% respectively. Also, the teachers whose educational qualification is P.G contains high and average levels of mathematical beliefs are 61.1%, and 38.9% respectively.

#### **4.1.2 Explore the levels of mathematical beliefs of secondary school teachers of U.P. Board with respect to their gender, teaching experience, and educational qualification**

**Objective 3:** To explore the levels of mathematical beliefs of secondary school teachers of U.P. Board with respect to their gender, teaching experience, and educational qualification.

**Table No.4.3: Levels of mathematical beliefs of secondary school teachers of U.P. Board with respect to their gender, teaching experience, and educational qualification**

<b>Secondary School Teachers of UP Board</b>				
<b>Group</b>	<b>Particular</b>	<b>Level of Mathematical Beliefs</b>	<b>Frequency</b>	<b>Percent</b>
Gender	Female	High	9	34.6
		Average	10	38.5
		Low	7	26.9
		Total	26	100.0
	Male	High	5	27.8
		Average	7	38.9
		Low	6	33.3
		Total	18	100.0
Teaching Experience	Less than 5 Years	High	6	37.5
		Average	5	31.3
		Low	5	31.3
		Total	16	100.0
	From 5 to 10 Years	High	6	42.9
		Average	4	28.6
		Low	4	28.6
		Total	14	100.0
	More than 10 Years	High	2	14.3
		Average	8	57.1
		Low	4	28.6
		Total	14	100.0
Educational Qualification	U.G	High	5	22.7
		Average	11	50.0
		Low	6	27.3
		Total	22	100.0
	P.G	High	9	40.9
		Average	6	27.3
		Low	7	31.8
		Total	22	100.0

Above Table no. 4.3.1 indicates that high, average and low levels of mathematical beliefs of secondary school female teachers of U.P. Board are 34.6%, 38.5% and 26.9% respectively. Similarly, high, average and low levels of mathematical beliefs of secondary school male teachers of U.P. Board are 27.8%, 38.9% and 33.3% respectively.

It can also be said that high and average levels of mathematical beliefs of secondary school teachers of U.P. Board with less than 5 years teaching experience are 37.5%, 31.3% and 31.2% respectively. Secondary school teachers having teaching experience from 5 to 10 years contains high, average and low levels of mathematical beliefs are 42.9%, 28.6% and 28.5% respectively. Teachers of U.P. Board having more than 10 years contains high, average and low levels of mathematical beliefs are 14.3%, 57.1% and 28.6% respectively.

Further, it can be stated that the teachers of U.P. Board whose educational qualification is U.G contains high, average and low levels of mathematical beliefs are 22.7%, 50% and 27.3% respectively. Also, the teachers whose educational qualification is P.G contains high, average and low levels of mathematical beliefs are 40.9%, 27.3% and 31.8% respectively.

## 4.2 Results based on Mann-Whitney U-Test

### 4.2.0 Study the mathematical beliefs of secondary school teachers of CBSE and U.P. Board

**Objective 4:** To study the mathematical beliefs of secondary school teachers of CBSE and U.P. Board.

**Null Hypothesis  $H_{01}$ :** There is no significant difference between mathematical beliefs of secondary school teachers of CBSE and U.P. Board.

**Table 4.4: Board-wise N, Mean Rank, Sum of Ranks and Mann-Whitney U-value of Mathematical Beliefs**

Board	N	Mean Rank	Sum of Ranks	Mann-Whitney U-value	Z-Value	Remark
CBSE	36	46.99	1691.50	558.50	2.259	p(0.024) < 0.05
U.P. Board	44	35.19	1548.50			

Above table no. 4.4.1 indicates that the Mann-Whitney U-value is 558.50 which is significant at 0.05 level of significance, since p-value (0.024) of Mann-Whitney U-Test is less than 0.05. It means that the mean ranks of mathematical beliefs of secondary school teachers of

CBSE and U.P. Board differ significantly. Thus, the null hypothesis that there is no significant difference in mean ranks of mathematical beliefs of secondary school teachers of CBSE and U.P. Board is rejected. Further, the mean rank score (46.99) of CBSE teachers which is significantly higher than the mean rank score (35.19) of U.P. Board teachers. Therefore, the CBSE teachers were found to have better mathematical beliefs than secondary school teachers of U.P. Board.

#### 4.2.1 Study the mathematical beliefs of secondary school teachers with respect to their gender, teaching experience, and educational qualification

**Objective 5:** To study the mathematical beliefs of secondary school teachers with respect to their gender, teaching experience, and educational qualification

**Null Hypothesis H<sub>02</sub>:** There is no significant difference between mathematical beliefs of secondary school teachers with respect to their gender.

**Table 4.5.1: Gender-wise N, Mean Rank, Sum of Ranks and Mann-Whitney U-value of Mathematical Beliefs**

Gender	N	Mean Rank	Sum of Ranks	Mann-Whitney U- value	Z- Value	Remark
Female	42	40.38	1696.00	793.00	0.048	p(0.962) >0.05
Male	38	40.63	1544.00			

Above table no. 4.5.1 indicates that the Mann-Whitney U-value is 793.00 which is not significant at 0.05 level of significance, because p-value (0.962) of Mann-Whitney U-Test is greater than 0.05. It means that the mean ranks of mathematical beliefs of female and male teachers at secondary level do not differ significantly. Thus, the null hypothesis that there is no significant difference in mean ranks of mathematical beliefs of female and male teachers at secondary level is not rejected. It may be said that both female and male teachers at secondary level were found to have mathematical beliefs to the same extent.

**Null Hypothesis H<sub>03</sub>:** There is no significant difference between mathematical beliefs of secondary school teachers with respect to their teaching experience.

**Table 4.5.2: Teaching Experience-wise N, Mean Rank, Sum of Ranks and Kruskal-Wallis H-value of Mathematical Beliefs**

Teaching Experience	N	Mean Rank	Kruskal- Wallis H- value	Df	Chi- Square $\chi^2$ - value	Remark
Less than 5 Years	30	42.30	0.525	2	0.525	p(0.769) > 0.05
From 5 to 10 Years	24	41.08				
More than 10 Years	26	37.88				

Above table no. 4.5.2 indicates that the size of groups is greater than 5, therefore, significance of calculated Kruskal-Wallis H-value will be tested on the basis of Chi-Square  $\chi^2$ -value. The Chi- Square  $\chi^2$ -value is 0.525 which is not significant at 0.05 level of significance, because p-value (0.769) of Chi-Square Test is greater than 0.05. It means that the mean ranks of mathematical beliefs of teachers those teaching experience belonging to less than 5 years, from 5 to 10 years and more than 10 years do not differ significantly. Thus, the null hypothesis that there is no significant difference in mean ranks of mathematical beliefs of secondary school teachers with respect to their teaching experience is not rejected. Therefore, it was found that there is no significant difference in mathematical beliefs of secondary school teachers with different teaching experience.

**Null Hypothesis H<sub>04</sub>:** There is no significant difference between mathematical beliefs of secondary school teachers with respect to their educational qualification.

**Table 4.5.3: Educational Qualification-wise N, Mean Rank, Sum of Ranks and Mann-Whitney U-value of Mathematical Beliefs**

<b>Educational Qualification</b>	<b>N</b>	<b>Mean Rank</b>	<b>Sum of Ranks</b>	<b>Mann- Whitney U- value</b>	<b>Z- Value</b>	<b>Remark</b>
<b>U.G</b>	40	39.45	1578.00	758.00	0.404	p(0.686) >0.05
<b>P.G</b>	40	41.55	1662.00			

Above table no. 4.5.3 indicates that the Mann-Whitney U-value is 758.00 which is not significant at 0.05 level of significance, because p-value (0.686) of Mann-Whitney U-Test is greater than 0.05. It means that the mean ranks of mathematical beliefs of secondary school teachers having U.G and P.G educational qualification do not differ significantly. Thus, the null hypothesis that there is no significant difference in mean ranks of mathematical beliefs of secondary school teachers with respect to their educational qualification is not rejected. It may be said that the secondary school teachers having U.G and P.G educational qualification were found to have mathematical beliefs to the same extent.

#### **4.2.2 Study the mathematical beliefs of secondary school teachers of CBSE with respect to their gender, teaching experience, and educational qualification**

**Objective 6:** To study the mathematical beliefs of secondary school teachers of CBSE with respect to their gender, teaching experience, and educational qualification.

**Null Hypothesis H<sub>05</sub>:** There is no significant difference between mathematical beliefs of secondary school teachers of CBSE with respect to their gender.

**Table 4.6.1: Gender-wise N, Mean Rank, Sum of Ranks and Mann-Whitney U-value of Mathematical Beliefs of Secondary School Teachers of CBSE**

<b>Gender</b>	<b>N</b>	<b>Mean Rank</b>	<b>Sum of Ranks</b>	<b>Mann- Whitney U- value</b>	<b>Z- Value</b>	<b>Remark</b>
<b>Female</b>	16	18.03	288.50	152.50	0.239	p(0.811) >0.05
<b>Male</b>	20	18.88	377.50			

Above table no. 4.6.1 indicates that the Mann-Whitney U-value is 152.50 which is not significant at 0.05 level of significance, since p-value (0.811) of Mann-Whitney U-Test is greater than 0.05. It means that the mean ranks of mathematical beliefs of female and male teachers at

secondary level of CBSE do not differ significantly. Thus, the null hypothesis that there is no significant difference in mean ranks of mathematical beliefs of female and male teachers at secondary level of CBSE is not rejected. It may be said that both female and male teachers at secondary level of CBSE were found to have mathematical beliefs to the same extent.

**Null Hypothesis H<sub>06</sub>:** There is no significant difference between mathematical beliefs of secondary school teachers of CBSE with respect to their teaching experience.

**Table 4.6.2: Teaching Experience-wise N, Mean Rank, Sum of Ranks and Mann-Whitney U-value of Mathematical Beliefs of Secondary School Teachers of CBSE**

Teaching Experience	N	Mean Rank	Kruskal- Wallis H- value	Df	Chi- Square $\chi^2$ - value	Remark
Less than 5 Years	14	16.89	1.313	2	1.313	p(0.519) > 0.05
From 5 to 10 Years	10	17.35				
More than 10 Years	12	21.33				

Above table no. 4.6.2 indicates that the size of groups is greater than 5, therefore, significance of calculated Kruskal-Wallis H-value will be tested on the basis of Chi-Square  $\chi^2$ -value. The Chi- Square  $\chi^2$ -value is 1.313 which is not significant at 0.05 level of significance, because p-value (0.519) of Chi-Square Test is greater than 0.05. It means that the mean ranks of mathematical beliefs of teachers of CBSE those teaching experience belonging to less than 5 years, from 5 to 10 years and more than 10 years do not differ significantly. Thus, the null hypothesis that there is no significant difference in mean ranks of mathematical beliefs of secondary school teachers of CBSE with respect to their teaching experience is not rejected. Therefore, it may be said that secondary school teachers of CBSE with various teaching experience were found to have mathematical beliefs to the same extent.

**Null Hypothesis H<sub>07</sub>:** There is no significant difference between mathematical beliefs of secondary school teachers of CBSE with respect to their educational qualification.

**Table 4.6.3: Educational Qualification-wise N, Mean Rank, Sum of Ranks and Mann-Whitney U-value of Mathematical Beliefs of Secondary School Teachers of CBSE**

<b>Educational Qualification</b>	<b>N</b>	<b>Mean Rank</b>	<b>Sum of Ranks</b>	<b>Mann-Whitney U-value</b>	<b>Z-Value</b>	<b>Remark</b>
U.G	18	17.94	323.00	152.00	0.316	p(0.752) >0.05
P.G	18	19.06	343.00			

Above table no. 4.6.3 indicates that the Mann-Whitney U-value is 152.00 which is not significant at 0.05 level of significance, because p-value (0.752) of Mann-Whitney U-Test is greater than 0.05. It means that the mean ranks of mathematical beliefs of secondary school teachers of CBSE having UG and PG educational qualification do not differ significantly. Thus, the null hypothesis that there is no significant difference in mean ranks of mathematical beliefs of secondary school teachers of CBSE with respect to their educational qualification is not rejected. It may be said that the secondary school teachers of CBSE having U.G and P.G educational qualification were found to have mathematical beliefs to the same extent.

#### **4.2.3 Study the mathematical beliefs of secondary school teachers of U.P. Board with respect to their gender, teaching experience, and educational qualification**

**Objective 7:** To study the mathematical beliefs of secondary school teachers of U.P. Board with respect to their gender, teaching experience, and educational qualification.

**Null Hypothesis H<sub>08</sub>:** There is no significant difference between mathematical beliefs of secondary school teachers of U.P. Board with respect to their gender.

**Table 4.7.1: Gender-wise N, Mean Rank, Sum of Ranks and Mann-Whitney U-value of Mathematical Beliefs of Secondary School Teachers of U.P. Board**

<b>Gender</b>	<b>N</b>	<b>Mean Rank</b>	<b>Sum of Ranks</b>	<b>Mann-Whitney U-value</b>	<b>Z-Value</b>	<b>Remark</b>
Female	26	23.58	613.00	206.00	0.669	p(0.504) >0.05
Male	18	20.94	377.00			

Above table no. 4.7.1 indicates that the Mann-Whitney U-value is 206.00 which is not significant at 0.05 level of significance, since p-value (0.504) of Mann-Whitney U-Test is greater than 0.05. It means that the mean ranks of mathematical beliefs of female and male teachers at

secondary level of U.P. Board do not differ significantly. Thus, the null hypothesis that there is no significant difference in mean ranks of mathematical beliefs of female and male teachers at secondary level of U.P. Board is not rejected. It may be said that both female and male teachers at secondary level of U.P. Board were found to have mathematical beliefs to the same extent.

**Null Hypothesis H<sub>09</sub>:** There is no significant difference between mathematical beliefs of secondary school teachers of UP Board with respect to their teaching experience.

**Table 4.7.2: Teaching Experience-wise N, Mean Rank, Sum of Ranks and Mann-Whitney U-value of Mathematical Beliefs of Secondary School Teachers of U.P. Board**

Teaching Experience	N	Mean Rank	Kruskal- Wallis H- value	Df	Chi- Square $\chi^2$ - value	Remark
Less than 5 Years	16	25.38	3.653	2	3.653	p(0.161) > 0.05
From 5 to 10 Years	14	24.61				
More than 10 Years	14	17.11				

Above table no. 4.7.2 indicates that the size of groups is greater than 5, therefore, significance of calculate Kruskal-Wallis H-value will be tested on the basis of Chi-Square  $\chi^2$ -value. The Chi-Square  $\chi^2$ -value is 3.653 which is not significant at 0.05 level of significance, because p- value (0.161) of Chi-Square Test is greater than 0.05. It means that the mean ranks of mathematical beliefs of teachers of U.P Board those teaching experience belonging to less than 5 years, from 5 to 10 years and more than 10 years do not differ significantly. Thus, the null hypothesis that there is no significant difference in mean ranks of mathematical beliefs of secondary school teachers of U.P Board with respect to their teaching experience is not rejected.

It may be said that secondary school teachers of U.P. Board with various teaching experience were found to have mathematical beliefs to the same extent.

**Null Hypothesis H<sub>010</sub>:** There is no significant difference between mathematical beliefs of secondary school teachers of U.P. Board with respect to their educational qualification.

**Table 4.7.3: Educational Qualification-wise N, Mean Rank, Sum of Ranks and Mann-Whitney U-value of Mathematical Beliefs of Secondary School Teachers of U.P. Board**

Educational Qualification	N	Mean Rank	Sum of Ranks	Mann-Whitney U-value	Z- Value	Remark
U.G.	22	22.36	492.00	239.00	0.070	p(0.944) > 0.05
P.G.	22	22.64	498.00			

Above table no. 4.7.3 indicates that the Mann-Whitney U-value is 239.00 which is not significant at 0.05 level of significance, because p-value (0.944) of Mann-Whitney U-Test is greater than 0.05. It means that the mean ranks of mathematical beliefs of secondary school teachers of U.P. Board having U.G and P.G educational qualification do not differ significantly. Thus, the null hypothesis that there is no significant difference in mean ranks of mathematical beliefs of secondary school teachers of U.P. Board with respect to their educational qualification is not rejected. Therefore, it may be said that the secondary school teachers of U.P. Board having U.G and P.G educational qualification were found to have mathematical beliefs to the same extent.

### 4.3 Results based on Chi- Square Test

#### 4.3.0 Association between gender and mathematical beliefs among secondary school teachers

**Objective 8:** To study the association between gender and mathematical beliefs among secondary school teachers.

**Null Hypothesis H<sub>011</sub>:** There is no significance association between gender and mathematical beliefs among secondary school teachers.

**Table No. 4.8: Gender and Mathematical Beliefs-Wise Observed Frequencies and Chi-Square Value**

Gender	Level of Mathematical Beliefs			Total	Chi-Square Value	Remark
	High	Average	Low			
Female	17	18	7	42	0.675	p(0.714)>0.05
Male	17	13	8	38		
Total	34	31	15	80		

From Table No. 4.8.1 indicates that the Chi-Square value is 0.675 which is not significant at 0.05 level of significance with  $df=2$ , since the p-value (0.714) of Chi-Square test is greater than 0.05. It shows that mathematical beliefs of female and male secondary school teachers do not differ significantly. So, there is no significant association between gender and mathematical beliefs of secondary students teachers. Thus, the null hypothesis that there is no significant association between gender and mathematical beliefs among secondary school teachers is not rejected. It may be said that the mathematical beliefs of secondary school teachers and their gender were found to be independent to each other.

#### 4.3.1 Association between gender and mathematical beliefs among secondary school teachers of CBSE

**Objective 9:** To study the association between gender and mathematical beliefs among secondary school teachers of CBSE.

**Null Hypothesis  $H_{012}$ :** There is no significance association between gender and mathematical beliefs among secondary school teachers of CBSE.

**Table No. 4.9: Gender and Mathematical Beliefs of Secondary School Teachers of CBSE- Wise Observed Frequencies and Chi-Square Value**

Gender	Level of Mathematical Beliefs of Secondary School Teachers of CBSE			Total	Chi-Square Value	Remark
	High	Average	Low			
Female	5	8	3	16	1.512	$p(0.812) > 0.05$
Male	6	10	4	20		
Total	11	18	7	36		

From Table No. 4.9.1 indicates that the Chi-Square value is 1.512 which is not significant at 0.05 level of significance with  $df=2$ , because the p-value (0.812) of Chi-Square test is greater than 0.05. It shows that mathematical beliefs of female and male secondary school teachers of CBSE do not differ significantly. So, there was no significant association between gender and mathematical beliefs of secondary students teachers of CBSE. Thus, the null hypothesis that there is no significant association between gender and mathematical beliefs among secondary school teachers of CBSE is not rejected. Therefore, it may be said that the mathematical beliefs of secondary school teachers of CBSE and their gender were found to be independent to each other.

### 4.3.2 Association between gender and mathematical beliefs among secondary school teachers of U.P. Board

**Objective 10:** To study the association between gender and mathematical beliefs among secondary school teachers of U.P. Board.

**Null Hypothesis  $H_{013}$ :** There is no significance association between gender and mathematical beliefs among secondary school teachers of U.P. Board.

**Table No. 4.10: Gender and Mathematical Beliefs of Secondary School Teachers of U.P. Board-Wise Observed Frequencies and Chi-Square Value**

Gender	Level of Mathematical Beliefs of Secondary School Teachers of U.P. Board			Total	Chi-Square Value	Remark
	High	Average	Low			
Female	10	12	4	26	1.451	p(0.769)>0.05
Male	7	7	4	18		
Total	17	19	12	44		

From Table No. 4.10.1 that the Chi-Square value is 1.451 which is not significant at 0.05 level of significance with  $df=2$ , because the p-value (0.769) of Chi-Square test is greater than 0.05. It shows that mathematical beliefs of female and male secondary school teachers of U.P. Board do not differ significantly. So, there was no significant association between gender and mathematical beliefs of secondary students teachers of U.P. Board. Thus, the null hypothesis that there is no significant association between gender and mathematical beliefs among secondary school teachers of U.P. Board is not rejected. It may be said that the mathematical beliefs of secondary school teachers of U.P. Board and their gender were found to be independent to each other.

### 4.3.3 Association between teaching experience and mathematical beliefs among secondary school teachers

**Objective 11:** To study the association between teaching experience and mathematical beliefs among secondary school teachers.

**Null Hypothesis  $H_{014}$ :** There is no significance association between teaching experience and mathematical beliefs among secondary school teachers.

**Table No. 4.11: Teaching Experience and Mathematical Beliefs-Wise Observed Frequencies and Chi-Square Value**

Teaching Experience	Level of Mathematical Beliefs			Total	Chi-Square Value	Remark
	High	Average	Low			
Less than 5 Years	14	11	5	30	1.277	$p(0.865) > 0.05$
From 5 to 10 Years	11	8	5	24		
More than 10 Years	9	12	5	26		
<b>Total</b>	34	31	15	80		

From Table No. 4.11 indicates that the Chi-Square value is 1.277 which is not significant at 0.05 level of significance with  $df=4$ , because the p-value (0.865) of Chi-Square test is greater than 0.05. It shows that mathematical beliefs of secondary school teachers with different teaching experiences do not differ significantly. So, there is no significant association between teaching experience and mathematical beliefs of secondary students teachers. Thus, the null hypothesis that there is no significant association between teaching experience and mathematical beliefs among secondary school teachers is not rejected. It may be said that the mathematical beliefs of secondary school teachers and their teaching experience were found to be independent to each other.

#### 4.3.4 Association between teaching experience and mathematical beliefs among secondary school teachers of CBSE

**Objective 12:** To study the association between teaching experience and mathematical beliefs among secondary school teachers of CBSE.

**Null Hypothesis  $H_{015}$ :** There is no significance association between teaching experience and mathematical beliefs among secondary school teachers of CBSE.

**Table No. 4.12: Teaching Experience and Mathematical Beliefs of Secondary School Teachers of CBSE-Wise Observed Frequencies and Chi-Square Value**

Teaching Experience	Level of Mathematical Beliefs of Secondary School Teachers of CBSE			Total	Chi-Square Value	Remark
	High	Average	Low			
Less than 5 Years	8	6	0	14	1.534	$p(0.821) > 0.05$
From 5 to 10 Years	5	4	1	10		
More than 10 Years	7	4	1	12		
<b>Total</b>	20	14	2	36		

From Table No. 4.12.1 indicates that the Chi-Square value is 1.534 which is not significant at 0.05 level of significance with  $df=4$ , because the p-value (0.821) of Chi-Square test is greater than 0.05. It shows that mathematical beliefs of secondary school teachers of CBSE with different teaching experiences do not differ significantly. So, there was no significant association between teaching experience and mathematical beliefs of secondary students teachers of CBSE. Thus, the null hypothesis that there is no significant association between teaching experience and mathematical beliefs among secondary school teachers of CBSE is not rejected. Therefore, it may be said that the mathematical beliefs of secondary school teachers of CBSE and their teaching experience were found to be independent to each other.

### 4.3.5 Association between teaching experience and mathematical beliefs among secondary school teachers of U.P. Board

**Objective 13:** To study the association between teaching experience and mathematical beliefs among secondary school teachers of U.P. Board.

**Null Hypothesis  $H_{016}$ :** There is no significance association between teaching experience and mathematical beliefs among secondary school teachers of U.P. Board.

**Table No. 4.13: Teaching Experience and Mathematical Beliefs of Secondary School Teachers of U.P. Board-Wise Observed Frequencies and Chi-Square Value**

Teaching Experience	Level of Mathematical Beliefs of Secondary School Teachers of U.P. Board			Total	Chi-Square Value	Remark
	High	Average	Low			
Less than 5 Years	6	5	5	16	3.910	$p(0.418) > 0.05$
From 5 to 10 Years	6	4	4	14		
More than 10 Years	2	8	4	14		
<b>Total</b>	14	17	13	44		

From Table No. 4.13.1 indicates that the Chi-Square value is 3.910 which is not significant at 0.05 level of significance with  $df=4$ , because the p-value (0.418) of Chi-Square test is greater than 0.05. It shows that mathematical beliefs of secondary school teachers of U.P. Board with different teaching experiences do not differ significantly. So, there was no significant association between teaching experience and mathematical beliefs of secondary students teachers of U.P. Board. Thus, the null hypothesis that there is no significant association between teaching experience and mathematical beliefs among secondary school teachers of U.P. Board is not rejected. It may be said that the mathematical beliefs of secondary school teachers of U.P. Board and their teaching experience were found to be independent to each other.

### 4.3.6 Association between educational qualification and mathematical beliefs among secondary school teachers

**Objective 14:** To study the association between educational qualification and mathematical beliefs among secondary school teachers.

**Null Hypothesis  $H_{017}$ :** There is no significance association between educational qualification and mathematical beliefs among secondary school teachers.

**Table No. 4.14: Educational Qualification and Mathematical Beliefs-Wise Observed Frequencies and Chi-Square Value**

Educational Qualification	Level of Mathematical Beliefs			Total	Chi-Square Value	Remark
	High	Average	Low			
U.G	14	18	8	40	1.932	p(0.381)>0.05
P.G	20	13	7	40		
<b>Total</b>	34	31	15	80		

From Table No. 4.14.1 indicates that the Chi-Square value is 1.932 which is not significant at 0.05 level of significance with  $df=2$ , because the p-value (0.381) of Chi-Square test is greater than 0.05. It shows that the mathematical beliefs of secondary school teachers with educational qualification UG and PG do not differ significantly. So, there was no significant association between educational qualification and mathematical beliefs of secondary students teachers. Thus, the null hypothesis that there is no significant association between educational qualification and mathematical beliefs among secondary school teachers is not rejected. It may be said that the mathematical beliefs of secondary school teachers and their educational qualification were found to be independent to each other.

### 4.3.7 Association between educational qualification and mathematical beliefs among secondary school teachers of CBSE

**Objective 15:** To study the association between educational qualification and mathematical beliefs among secondary school teachers of CBSE.

**Null Hypothesis  $H_{018}$ :** There is no significance association between educational qualification and mathematical beliefs among secondary school teachers of CBSE.

**Table No. 4.15: Educational Qualification and Mathematical Beliefs of Secondary School Teachers of CBSE-Wise Observed Frequencies and Chi-Square Value**

Educational Qualification	Level of Mathematical Beliefs of Secondary School Teachers of CBSE			Total	Chi-Square Value	Remark
	High	Average	Low			
U.G	9	7	2	18	2.200	p(0.333)>0.05
P.G	11	7	0	18		
<b>Total</b>	20	14	2	36		

From Table No. 4.15.1 indicates that the Chi-Square value is 2.200 which is not significant at 0.05 level of significance with  $df=2$ , because the p-value (0.333) of Chi-Square test is greater than 0.05. It shows that mathematical beliefs of secondary school teachers of CBSE with educational qualification U.G and P.G do not differ significantly. So, there was no significant association between educational qualification and mathematical beliefs of secondary students teachers of CBSE. Thus, the null hypothesis that there is no significant association between educational qualification and mathematical beliefs among secondary school teachers of CBSE is not rejected. It may be said that the mathematical beliefs of secondary school teachers of CBSE and their educational qualification were found to be independent to each other.

#### 4.3.8 Association between educational qualification and mathematical beliefs among secondary school teachers of U.P. Board

**Objective 16:** To study the association between educational qualification and mathematical beliefs among secondary school teachers of U.P. Board.

**Null Hypothesis  $H_{019}$ :** There is no significance association between educational qualification and mathematical beliefs among secondary school teachers of U.P. Board.

**Table No. 4.16: Educational Qualification and Mathematical Beliefs of Secondary School Teachers of U.P. Board-wise observed Frequencies and Chi-Square Value**

Educational Qualification	Level of Mathematical Beliefs of Secondary School Teachers of U.P. Board			Total	Chi-Square Value	Remark
	High	Average	Low			
U.G.	5	11	6	22	2.690	p(0.260)>0.05
P.G.	9	6	7	22		
<b>Total</b>	14	17	13	44		

From Table No. 4.16.1 indicates that the Chi-Square value is 2.690 which is not significant at 0.05 level of significance with  $df=2$ , because the p-value (0.260) of Chi-Square test is greater than 0.05. It shows that the mathematical beliefs of secondary school teachers of U.P. Board with educational qualification U.G and P.G do not differ significantly. So, there was no significant association between educational qualification and mathematical beliefs of secondary students teachers of U.P. Board. Thus, the null hypothesis that there is no significant association between educational qualification and mathematical beliefs among secondary school teachers of U.P. Board is not rejected. Therefore, it may be said that the mathematical beliefs of secondary school teachers of U.P. Board and their educational qualification were found to be independent to each other.

**4.3.9 Association between gender and teaching experience of secondary school teachers with respect to their mathematical beliefs**

**Objective 17:** To study the association between gender and teaching experience of secondary school teachers with respect to their mathematical beliefs.

**Null Hypothesis H<sub>020</sub>:** There is no significance association between gender and teaching experience of secondary school teachers with respect to their mathematical beliefs.

**Table No. 4.17: Gender and Teaching Experience-wise Observed Frequencies of Secondary School Teachers with respect to their Mathematical Beliefs and Chi-Square Value**

Gender	Teaching Experience of Secondary School Teachers with respect to their Mathematical Beliefs			Total	Chi-Square Value	Remark
	Less than 5 Years	From 5 to 10 Years	More than 10 Years			
Female	14	11	17	42	2.568	p(0.277) >0.05
Male	16	13	9	38		
Total	30	24	26	80		

From Table No. 4.17.1 indicates that the Chi-Square value is 2.568 which is not significant at 0.05 level of significance with  $df=2$ , because the p-value (0.277) of Chi-Square test is greater than 0.05. It shows that teaching experience of secondary school female and male teachers with respect to their mathematical beliefs do not differ significantly. So, there was no significant association between gender and teaching experience of secondary school teachers with respect to their mathematical beliefs. Thus, the null hypothesis that there is no significant association between gender and teaching experience of secondary school teachers with respect to their mathematical beliefs is not rejected. Therefore, it may be said that the gender and teaching experience of secondary school teachers with respect to their mathematical beliefs were found to be independent to each other.

#### 4.3.10 Association between gender and teaching experience of secondary school teachers of CBSE with respect to their mathematical beliefs

**Objective 18:** To study the association between gender and teaching experience of secondary school teachers of CBSE with respect to their mathematical beliefs.

**Null Hypothesis  $H_{021}$ :** There is no significance association between gender and teaching experience of secondary school teachers of CBSE with respect to their mathematical beliefs.

**Table No. 4.18: Gender and Teaching Experience-Wise Observed Frequencies of Secondary School Teachers of CBSE with respect to their Mathematical Beliefs and Chi- Square Value**

Gender	Teaching Experience of Secondary School Teachers of CBSE with respect to their Mathematical Beliefs			Total	Chi-Square Value	Remark
	Less than 5 Years	From 5 to 10 Years	More than 10 Years			
Female	6	4	6	16	0.244	p(0.885) >0.05
Male	8	6	6	20		
Total	14	10	12	36		

From Table No. 4.18.1 indicates that the Chi-Square value is 0.244 which is not significant at 0.05 level of significance with  $df=2$ , because the p-value (0.885) of Chi-Square test is greater than 0.05. It shows that teaching experience of secondary school female and male teachers of CBSE with respect to their mathematical beliefs do not differ significantly. So, there was no significant association between gender and teaching experience of secondary school teachers of CBSE with respect to their mathematical beliefs. Thus, the null hypothesis that there is no significant association between gender and teaching experience of secondary school teachers of CBSE with respect to their mathematical beliefs is not rejected. It may be said that the gender and teaching experience of secondary school teachers of CBSE with respect to their mathematical beliefs were found to be independent to each other.

#### 4.3.11 Association between gender and teaching experience of secondary school teachers of U.P. Board with respect to their mathematical beliefs

**Objective 19:** To study the association between gender and teaching experience of secondary school teachers of U.P. Board with respect to their mathematical beliefs.

**Null Hypothesis H<sub>022</sub>:** There is no significance association between gender and teaching experience of secondary school teachers of U.P. Board with respect to their mathematical beliefs.

**Table No. 4.19: Gender and Teaching Experience-Wise Observed Frequencies of Secondary School Teachers of U.P. Board with respect to their Mathematical Beliefs and Chi-Square Value**

Gender	Teaching Experience of Secondary School Teachers of U.P. Board with respect to their Mathematical Beliefs			Total	Chi-Square Value	Remark
	Less than 5 Years	From 5 to 10 Years	More than 10 Years			
Female	8	7	11	26	3.223	p(0.200) >0.05
Male	8	7	3	18		
Total	16	14	14	44		

From Table No. 4.19.1 indicates that the Chi-Square value is 3.223 which is not significant at 0.05 level of significance with  $df=2$ , because the p-value (0.200) of Chi-Square test is greater than 0.05. It shows that teaching experience of secondary school female and male teachers of U.P. Board with respect to their mathematical beliefs does not differ significantly. So, there was no significant association between gender and teaching experience of secondary school teachers of U.P. Board with respect to their mathematical beliefs. Thus, the null hypothesis that there is no significant association between gender and teaching experience of secondary school teachers of U.P. Board with respect to their mathematical beliefs is not rejected. It may be said that the gender and teaching experience of secondary school teachers of U.P. Board with respect to their mathematical beliefs were found to be independent to each other.

**4.3.12 Association between gender and educational qualification of secondary school teachers with respect to their mathematical beliefs**

**Objective 20:** To study the association between gender and educational qualification of secondary school teachers with respect to their mathematical beliefs.

**Null Hypothesis H<sub>023</sub>:** There is no significance association between gender and educational qualification of secondary school teachers with respect to their mathematical beliefs.

**Table No. 4.20: Gender and Educational Qualification-Wise Observed Frequencies of Secondary School Teachers with respect to their Mathematical Beliefs and Chi-Square Value**

Gender	Educational Qualification of Secondary School Teachers with respect to their Mathematical Beliefs		Total	Chi-Square Value	Remark
	U.G	P.G			
Female	19	23	42	0.802	p(0.370) >0.05
Male	21	17	38		
Total	40	40	80		

From Table No. 4.20.1 indicates that the Chi-Square value is 0.802 which is not significant at 0.05 level of significance with  $df=1$ , because the p-value (0.370) of Chi-Square test is greater than 0.05. It shows that educational qualification of secondary school female and male teachers with respect to their mathematical beliefs do not differ significantly. So, there was no significant association between gender and educational qualification of secondary school teachers with respect to their mathematical beliefs. Thus, the null hypothesis that there is no significant association between gender and educational qualification of secondary school teachers with respect to their mathematical beliefs is not rejected. It may be said that the gender and educational qualification of secondary school teachers with respect to their mathematical beliefs were found to be independent to each other.

### 4.3.13 Association between gender and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs

**Objective 21:** To study the association between gender and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs.

**Null Hypothesis  $H_{024}$ :** There is no significance association between gender and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs.

**Table No. 4.21: Gender and Educational Qualification-Wise Observed Frequencies of Secondary School Teachers of CBSE with respect to their Mathematical Beliefs and Chi-Square Value**

Gender	Educational Qualification of Secondary School Teachers of CBSE with respect to their Mathematical Beliefs		Total	Chi-Square Value	Remark
	U.G	P.G			
Female	7	9	16	0.450	p(0.502) >0.05
Male	11	9	20		
Total	18	18	36		

From Table No. 4.21.1 indicates that the Chi-Square value is 0.450 which is not significant at 0.05 level of significance with  $df=1$ , because the p-value (0.502) of Chi-Square test is greater than 0.05. It shows that educational qualification of secondary school female and male teachers of CBSE with respect to their mathematical beliefs do not differ significantly. So, there was no significant association between gender and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs. Thus, the null hypothesis that there is no significant association between gender and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs is not rejected. It may be said that the gender and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs were found to be independent to each other.

#### 4.3.14 Association between gender and educational qualification of secondary school teachers of U.P. Board with respect to their mathematical beliefs

**Objective 22:** To study the association between gender and educational qualification of secondary school teachers of U.P. Board with respect to their mathematical beliefs.

**Null Hypothesis  $H_{025}$ :** There is no significance association between gender and educational qualification of secondary school teachers of U.P. Board with respect to their mathematical beliefs.

**Table No. 4.22: Gender and Educational Qualification-Wise Observed Frequencies of Secondary School Teachers of U.P. Board with respect to their Mathematical Beliefs and Chi-Square Value**

Gender	Educational Qualification of Secondary School Teachers of U.P. Board with respect to their Mathematical Beliefs		Total	Chi-Square Value	Remark
	U.G	P.G			
Female	12	14	26	0.376	p(0.540) >0.05
Male	10	8	18		
Total	22	22	44		

From Table No. 4.22.1 indicates that the Chi-Square value is 0.376 which is not significant at 0.05 level of significance with  $df=1$ , because the p-value (0.540) of Chi-Square test is greater than 0.05. It shows that educational qualification of secondary school female and male teachers of U.P. Board with respect to their mathematical beliefs do not differ significantly. So, there was no significant association between gender and educational qualification of secondary school teachers of U.P. Board with respect to their mathematical beliefs. Thus, the null hypothesis that there is no significant association between gender and educational qualification of secondary school teachers of U.P. Board with respect to their mathematical beliefs is not rejected. It may be said that the gender and educational qualification of secondary school teachers of U.P. Board with respect to their mathematical beliefs were found to be independent to each other.

#### 4.3.15 Association between teaching experience and educational qualification of secondary school teachers with respect to their mathematical beliefs

**Objective 23:** To study the association between teaching experience and educational qualification of secondary school teachers with respect to their mathematical beliefs.

**Null Hypothesis  $H_{026}$ :** There is no significance association between teaching experience and educational qualification of secondary school teachers with respect to their mathematical beliefs.

**Table No. 4.23: Teaching Experience and Educational Qualification-Wise Observed Frequencies of Secondary School Teachers with respect to their Mathematical Beliefs and Chi-Square Value**

Teaching Experience	Educational Qualification of Secondary School Teachers with respect to their Mathematical Beliefs		Total	Chi-Square Value	Remark
	U.G	P.G			
Less than 5 Years	15	15	30	1.282	$p(0.527) > 0.05$
From 5 to 10 Years	14	10	24		
More than 10 Years	11	15	26		
<b>Total</b>	40	40	80		

From Table No. 4.23.1 indicates that the Chi-Square value is 1.282 which is not significant at 0.05 level of significance with  $df=2$ , because the p-value (0.527) of Chi-Square test is greater than 0.05. It shows that educational qualification of secondary school teachers with different teaching experiences do not differ significantly. So, there was no significant association between teaching experience and educational qualification of secondary students teachers with respect to their mathematical beliefs. Thus, the null hypothesis that there is no significant association between teaching experience and educational qualification among secondary school teachers with respect to their mathematical beliefs is not rejected. It may be said that the educational qualification of secondary school teachers and their teaching experience were found to be independent to each other.

#### 4.3.16 Study the association between teaching experience and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs

**Objective 24:** To study the association between teaching experience and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs.

**Null Hypothesis  $H_{027}$ :** There is no significance association between teaching experience and educational qualification of secondary school teachers of CBSE with respect to their mathematical beliefs.

**Table No. 4.24: Teaching Experience and Educational Qualification-Wise Observed Frequencies of Secondary School Teachers of CBSE with respect to their Mathematical Beliefs and Chi-Square Value**

Teaching Experience	Educational Qualification of Secondary School Teachers of CBSE with respect to their Mathematical Beliefs		Total	Chi-Square Value	Remark
	U.G	P.G			
Less than 5 Years	7	7	14	2.122	p(0.369) >0.05
From 5 to 10 Years	5	5	10		
More than 10 Years	6	6	12		
<b>Total</b>	18	18	36		

From Table No. 4.24.1 indicates that the Chi-Square value is 2.122 which is not significant at 0.05 level of significance with  $df=2$ , because the p-value (0.369) of Chi-Square test is greater than 0.05. It shows that educational qualification of secondary school teachers of CBSE with different teaching experiences do not differ significantly. So, there was no significant association between teaching experience and educational qualification of secondary students teachers of CBSE with respect to their mathematical beliefs. Thus, the null hypothesis that there is no significant association between teaching experience and educational qualification among secondary school teachers of CBSE with respect to their mathematical beliefs is not rejected. Therefore, it may be said that the educational qualification of secondary school teachers and their teaching experience were found to be independent to each other.

**4.3.17 Association between teaching experience and educational qualification of secondary school teachers U.P. Board with respect to their mathematical beliefs**

**Objective 25:** To study the association between teaching experience and educational qualification of secondary school teachers U.P. Board with respect to their mathematical beliefs.

**Null Hypothesis  $H_{028}$ :** There is no significance association between teaching experience and educational qualification of secondary school teachers U.P. Board with respect to their mathematical beliefs.

**Table No. 4.25: Teaching Experience and Educational Qualification-Wise Observed Frequencies of Secondary School Teachers of U.P. Board with respect to their Mathematical Beliefs and Chi-Square Value**

Teaching Experience	Educational Qualification of Secondary School Teachers with respect to their Mathematical Beliefs		Total	Chi-Square Value	Remark
	UG	PG			
Less than 5 Years	8	8	16	2.286	$p(0.319) > 0.05$
From 5 to 10 Years	9	5	14		
More than 10 Years	5	9	14		
<b>Total</b>	22	22	44		

From Table No. 4.25.1 indicates that the Chi-Square value is 2.286 which is not significant at 0.05 level of significance with  $df=2$ , because the p-value (0.319) of Chi-Square test is greater than 0.05. It shows that educational qualification of secondary school teachers of U.P. Board with different teaching experiences do not differ significantly. So, there was no significant association between teaching experience and educational qualification of secondary students teachers of U.P. Board with respect to their mathematical beliefs. Thus, the null hypothesis that there is no significant association between teaching experience and educational qualification among secondary school teachers of U.P. Board with respect to their mathematical beliefs is not rejected. It may be said that the educational qualification of secondary school teachers of U.P. Board and their teaching experience were found to be independent to each other.



**CHAPTER V**  
**FINDINGS,**  
**CONCLUSIONS,**  
**IMPLICATIONS AND**  
**SUGGESSTIONS**



***FINDINGS, CONCLUSIONS, IMPLICATIONS AND  
SUGGESTIONS***

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In this study, researcher has used self-made Mathematical Beliefs Scale (MBS) to collect the data from secondary school teachers of CBSE and U.P. Board and to analyze the data, researcher used SPSS. In this chapter, researcher described the findings and also discussed the conclusion.

**5.0 Major Findings of the Study**

**Finding-1:** It was found that the percentage of the secondary school teachers of CBSE on the scores of mathematical beliefs is higher than the percentage of the secondary school teachers of U.P. Board.

**Conclusion:** The possible reason for this may be teaching techniques, teaching methods, environment and financial resources and physical resources of the CBSE Board is better than the U.P. Board.

**Finding-2:** It was found that the percentage of the secondary school teachers of CBSE on the scores of mathematical beliefs is nearly equal to the percentage of the secondary school teachers of U.P. Board with respect to gender, their teaching experiences and their educational qualification.

**Conclusion:** The possible reason for this may be the awareness of the teachers towards mathematics and beliefs. Researcher found that Gender, teaching experience and educational qualification of the teachers are not important parameters to take the decision about teachers' mathematical beliefs in the present study.

**Finding-3:** Secondary school teachers of CBSE were found to have better mathematical beliefs than U.P. Board teachers of secondary level.

**Conclusion:** The possible reason may be that the secondary school teachers of CBSE achieve better facilities with comfortable and supportive environment; they participate in the training programme to know the new techniques and teaching methods and different activities to communicate the study material with students in effective manner.

**Finding-4:** It was found that secondary school teachers have similar mathematical beliefs with respect to their gender, teaching experiences and educational qualification.

**Conclusion:** Perhaps the reason for this result is that girls' interest in mathematics has increased and family members are now more aware than before, so they support girls' education. Today boys and girls get mathematics related same supportive environment to study mathematics individually. There can be many other reasons for this result like internet facilities, knowledge of effective teaching methods, good books on mathematics teaching etc.

In addition, it was found that there is no difference in the mathematical beliefs of secondary school teachers with different teaching experiences. This may be because of teaching experience has nothing to do with mathematical beliefs and that mathematical beliefs have nothing to do with mathematics. Faith has the effect of understanding the importance of mathematics. No difference was found in the mathematical beliefs of secondary school teachers with respect to their educational qualifications, such as U.G and P.G degrees, because mathematical beliefs are influenced by the use of mathematics in daily life and not by academic ability.

**Finding-5:** It was found that there is no difference in mathematical beliefs of secondary school teachers of U.P. Board with respect to their gender, teaching experiences and educational qualification

**Conclusion:** It might be said that the mathematical beliefs of secondary school teachers are not affected by gender, teaching experiences and educational qualification. Also, no difference was found in U.P. Board and CBSE. Hence it may be concluded that beliefs are directly related to the values and attitudes of the person. Gender and educational qualification are not important parameters in the beliefs system. Both male and female teachers are aware of the concept of beliefs. Since the same work culture is given to both teachers. Less experienced teachers and more experienced teachers both are well-known about the concept of beliefs.

**Finding-6:** It was found that there is no association between gender and mathematical beliefs among secondary school teachers.

**Finding-7:** It was found that there is no association between gender and mathematical beliefs among secondary school teachers of CBSE Board.

**Finding-8:** It was found that there is no association between gender and mathematical beliefs among secondary school teachers of U.P. Board.

**Conclusion:** It may be said that the mathematical beliefs of secondary school teachers are not affected by gender. Also, no effect was found of U.P. Board and CBSE on this result. Hence it may be concluded that beliefs are directly related to the values and attitudes of the person and

gender is not an important parameter in the beliefs system. Both male and female teachers are aware of the concept of beliefs and also aware of the importance of beliefs in our daily life. Since the same work culture is provided to both teachers.

**Finding-9:** It was found that that there is no association between teaching experiences and mathematical beliefs among secondary school teachers.

**Finding-10:** It was found that that there is no association between teaching experiences and mathematical beliefs among secondary school teachers of CBSE.

**Finding-11:** It was found that that there is no association between teaching experiences and mathematical beliefs among secondary school teachers of U.P. Board.

**Conclusion:** The reason for this result may be that the mathematical beliefs of secondary school teachers are not influenced by their teaching experiences. There was no effect in U.P. Board and CBSE on this result. Hence, it can be concluded that beliefs are directly related to the values and attitudes of the individual and educational qualifications are not important parameters in the belief system. Less experienced teachers and more experienced teachers both know about the concept of trust. Confidence in mathematics will come by using mathematics in daily life and not from teaching experiences.

**Finding-12:** It was found that that there is no association between educational qualification and mathematical beliefs among secondary school teachers.

**Finding-13:** It was found that that there is no association between educational qualification and mathematical beliefs among secondary school teachers of CBSE Board.

**Finding-14:** It was found that that there is no association between educational qualification and mathematical beliefs among secondary school teachers of U.P. Board.

**Conclusion:** It may be said that the mathematical beliefs of the secondary school teachers are not affected by their educational qualifications. Also no effect was found of U.P. Board and CBSE on this result. Hence it may be concluded that beliefs are directly related to the values and attitudes of the person and educational qualifications are not important parameter in the beliefs system.

**Finding-15:** It was found that there is no association between gender and teaching experience of secondary school teachers with respect to their mathematical beliefs.

**Finding-16:** It was found that there is no association between gender and teaching experience of secondary school teachers of CBSE with respect to their mathematical beliefs.

**Finding-17:** It was found that there is no association between gender and teaching experience of

secondary school teachers of U.P. Board with respect to their mathematical beliefs.

**Conclusion:** It may be said that the mathematical beliefs of the teachers are not affected by their teaching experiences and gender. Also no effect was found in U.P. Board and CBSE on this result. Hence, it may be concluded that the male and female both teachers are equally aware about the importance of mathematics in the life and their mathematical beliefs and also found that less experienced teachers and more experienced teachers both have equal knowledge about their mathematical beliefs.

**Finding-18:** It was found that there is no association between gender and educational qualification of secondary school teachers with respect to their mathematical beliefs.

**Finding-19:** It was found that there is no association between gender and educational qualification of secondary school teachers of CBSE Board with respect to their mathematical beliefs.

**Finding-20** It was found that there is no association between gender and educational qualification of secondary school teachers of U.P. Board with respect to their mathematical beliefs.

**Conclusion:** It may be said that the mathematical beliefs of the teachers are not affected by their educational qualifications and gender. Also no effect was found of U.P. Board and CBSE on this result. Hence, it may be concluded that the male and female both teachers are equally aware about the importance of mathematics in the life and their mathematical beliefs.

**Finding-21:** It was found that there is no association between teaching experience and educational qualification among secondary school teachers with respect to their mathematical beliefs.

**Finding-22:** It was found that there is no association between teaching experiences and educational qualification among secondary school teachers of CBSE with respect to their mathematical beliefs.

**Finding-23:** It was found that there is no association between teaching experiences and educational qualification among secondary school teachers of U.P. Board with respect to their mathematical beliefs.

**Conclusion:** It may be said that the mathematical beliefs of the teachers are not affected by their teaching experiences and their educational qualifications. Also no effect was found in U.P. Board and CBSE on this result.

## **5.1 Educational Implications of the Study**

### **For Learners**

We study that mathematical beliefs are those that lead to beliefs about the nature of mathematics, teaching mathematics, and learning mathematics. Students apply and develop various values in their lives if they clearly know the concept of mathematical assumptions that mathematics is what activates the mind of the learners and develops intellectual abilities. If a student is faced with a mathematical problem, then the mental work of solving that problem and understanding the problem also starts. Every math problem occurs sequentially which is essential for a creative and creative process. It emphasizes the development of the learner's observation power, logical power and concentration, originality, search power, thinking and reasoning power, hard work, problem-solving skills and creative and critical thinking. It helps the learners to understand and explain the function of daily life, like the house, market etc. Without its knowledge, we cannot run our family smoothly. It emphasizes understanding and explaining the measurements and calculations of the learners. The use of mathematics becomes necessary after waking up in the morning and before going to sleep at night, it also imports qualities like seriousness, discretion and contemplation in the personality. Interest and seriousness towards mathematics in students can arise only when the teacher is serious and they also have full knowledge of the importance of mathematics and at the same time they have a high level of mathematical confidence. If the mathematical confidence of the teachers is low, then they cannot inculcate interest and seriousness towards mathematics in their students. Many researchers found that there is the direct relationship between teachers' mathematical beliefs and beliefs of students towards mathematics and students' achievement in mathematics.

This research will provide the mathematics education community with information on how to create a better plan for teaching-learning by incorporating a teacher's mathematical beliefs in an appropriate and coherent manner with a good lesson plan that negatively impacts the teaching of mathematical content. Don't impress. Thus teachers will be able to teach their students mathematical assumptions that will help them become more successful students of mathematics now and in the future. However, without research into how student beliefs are formed and how they affect and change, this goal of positively influencing student learning would not be possible.

Therefore, this research will be fruitful the students to make their bright future in the field of mathematics.

## **For Teachers**

Teachers should teach in a way that builds confidence and competence in the students. This, in part, requires a teacher who is knowledgeable and enthusiastic about the subject and has appropriate pedagogical knowledge. It should be noted that the ability to create a classroom environment conducive to promoting self-efficacy and cognitive development depends greatly on the teacher's self-efficacy. Therefore teachers should use multiple cognitive and metacognitive learning strategies in the classroom so that their teaching becomes enjoyable and informative for students. For this, it is necessary that the mathematical confidence of the teachers should be of high level. To take the mathematical confidence of the teachers to a higher level, adequate facilities should be provided by the institutions to the teachers so that the students can benefit and their achievement can be high.

Therefore, high achievement in mathematics for students is directly affected by the mathematical belief of the teachers. Teachers' educational experience, gender educational qualification also affects their belief in some way which makes them effective teachers. For the high achievement of students in mathematics, it is necessary that the students have knowledge about mathematical beliefs and this information can be given to the students by the teacher in the right way.

Group education is needed for some low achievers. These students feel more comfortable speaking in small groups. In groups, students can receive emotional support and academic support. More structured group activities reduce math anxiety, students with high math anxiety do not rely on themselves to obtain math answers, often prefer not to work alone, and do not necessarily enjoy discovery learning. So by using peer learning strategy students feel more comfortable and enhance their learning.

Teachers should help students store information in long-term memory by creating internal connections between the objects they learn, then helping them achieve their goals. To fulfill this objective, it is first necessary that teachers should have sufficient knowledge of their mathematical beliefs. When their mathematical confidence is of a high level, then only they will be able to generate interest in mathematics in the students. For this, it is necessary that teachers should be given adequate training to increase their mathematical confidence and they should be made aware of the new research happening so that they can become aware of new methods of teaching mathematics.

Therefore, there is a need to do research on the mathematical belief of teachers so that students can develop an interest in mathematics and self-confidence can be developed in them.

This study will also help teachers to properly implement the curriculum and constructivist practice.

The current study recommends that more research should be done in this area, and this study can be used to guide further research for more successful ways of capturing student and teacher beliefs.

## **5.2 Suggestions for further Research**

Meaningful research always provides reason and paves the way for further investigation. Also, each investigator may feel motivated to do more research after completing his or her work with their - own efforts. The researcher feels very motivated to guide the future researchers to new areas of research.

Therefore, on the basis of this research, the following suggestions are made for further work.

1. The present study was confined only to Lucknow city, so it cannot claim to have comprehensiveness. Conclusions may not be universally valid. It is therefore suggested that study may be conducted on other cities and states also to establish the results fairly.
2. The study was conducted only on 80 teachers of secondary school. It may be conducted on the primary teachers and on the higher education teachers.
3. The study was conducted only on 80 teachers of secondary school. It may be conducted on the large sample of students also.
4. In the present study the sample taken was rather small. The study may be carried out with a large sample to make broader generalizations.
5. More psychological variables could be included in the study as the present study is confined to few variables such as mathematical beliefs and secondary school teachers.



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## **APPENDIX**

# **Final Draft of the Teachers' Mathematical Beliefs Scale**



Confidential

(Only for Research Work)

## TEACHERS' MATHEMATICAL BELIEFS SCALE (TMBS)

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### Please fill the following information:

Name :.....

Age :.....

Educational Qualification: 1) Under Graduate  2) Post Graduate

Teaching Experience: 1) Less than five years  2) From five to ten years  3) More than ten years

Name of the School:.....

Board of the School:.....

## Instructions:

### Respected Teachers,

This scale is a part of psychological study. Its aim is to measure the beliefs of secondary school teachers about Mathematics. I am requesting you to fill up this Scale. There are some options in front of the questions. Tick (✓) on the answer that you think is the best according to you by keeping the various options in your mind. The topic of my research work is entitled "**A Study of Mathematical Beliefs among Secondary School Teachers**". The information provided by you will be kept completely confidential and will only be used for research work. The researcher will always be grateful for your cooperation.

1. Mathematics teachers try to solve mathematical problems effectively in different ways.

A. Agree a lot

B. Agree a little

C. Undecided

D. Disagree a little

E. Disagree a lot

2. It is the responsibility of the teachers to try to explain the solution of the mathematical problems to the children in a clear and concise manner.

A. Agree a lot

B. Agree a little

C. Undecided

D. Disagree a little

E. Disagree a lot

3. I like mathematics since it is very useful not only in school but also in our daily life.

A. Agree a lot

B. Agree a little

C. Undecided

D. Disagree a little

E. Disagree a lot

4. I want to encourage students to use mathematics properly by defining their mathematical ideas for other students.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                E. Disagree a lot
5. I like to encourage students when they solve math problems and put more emphasis on getting them the right answers.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                E. Disagree a lot
6. Teachers should provide opportunities for students to solve mathematical problems in their own way.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                E. Disagree a lot
7. Group work together during the mathematics class is highly productive for students.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                E. Disagree a lot
8. I want my students to familiarize themselves with the concepts of mathematics before solving complex mathematical problems.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                E. Disagree a lot
9. Mathematics teachers' beliefs that mathematics is the only option to understand real-world problems.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                E. Disagree a lot
10. Mathematics teacher should allocate time to the students to discuss the mathematical problems.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                E. Disagree a lot
11. In my classes, every student feels that mathematics is an interesting logical and creative discipline to develop the mind.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                E. Disagree a lot
12. Many concepts in mathematics are simply accepted and remembered as true.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                E. Disagree a lot
13. A conducive environment should be created by the teachers to increase the curiosity of the children towards mathematics and to learn mathematics.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                E. Disagree a lot

14. Mathematics is useful to human endeavor because it is a way of knowing and thinking.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                      E. Disagree a lot
15. Mathematics has a definite body of knowledge and set of processes but it is infinite.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                      E. Disagree a lot
16. I like mathematics because it's also help to understand Sciences and technology.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                      E. Disagree a lot
17. The teaching of mathematics for teachers is a basic computational skill that is clear and concise.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                      E. Disagree a lot
18. Mathematics teachers teach students the exact way to answer a question that can be tested.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                      E. Disagree a lot
19. Mathematics teachers help students achieve major mathematics goals and develop their beliefs about the nature of mathematics.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                      E. Disagree a lot
20. Mathematics teachers' beliefs that mathematics learning is enhanced by using textbooks and worksheets.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                      E. Disagree a lot
21. When students themselves explain and demonstrate their problem-solving method to teachers their learning increases and improves.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                      E. Disagree a lot
22. Learning can be enhanced by activities that are built from the students' own experiences.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                      E. Disagree a lot
23. Teachers believe that students learn maths when teachers tell them the proper way to solve math problems.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                      E. Disagree a lot
24. Mathematics teachers' beliefs that repeated practice is compulsory in learning mathematics.
- A. Agree a lot                      B. Agree a little                      C. Undecided  
D. Disagree a little                      E. Disagree a lot
25. Mathematics teachers help students develop their ability to think, understand and express their point of view and understand mathematical relationships

- A. Agree a lot**                      **B. Agree a little**                      **C. Undecided**  
**D. Disagree a little**                      **E. Disagree a lot**
- 26.** A good mathematics teacher listens to students and seeks elaboration of learners' responses.  
**A. Agree a lot**                      **B. Agree a little**                      **C. Undecided**  
**D. Disagree a little**                      **E. Disagree a lot**
- 27.** Learning mathematics is very useful for every person in daily life.  
**A. Agree a lot**                      **B. Agree a little**                      **C. Undecided**  
**D. Disagree a little**                      **E. Disagree a lot**
- 28.** Mathematics requires the correct application of the steps to solve any mathematics problems.  
**A. Agree a lot**                      **B. Agree a little**                      **C. Undecided**  
**D. Disagree a little**                      **E. Disagree a lot**
- 29.** To improve and develop understanding in mathematics active participation is necessary for learners to create their own version of knowledge.  
**A. Agree a lot**                      **B. Agree a little**                      **C. Undecided**  
**D. Disagree a little**                      **E. Disagree a lot**
- 30.** The curriculum of mathematics should be taught as a collection of ideas and skills.  
**A. Agree a lot**                      **B. Agree a little**                      **C. Undecided**  
**D. Disagree a little**                      **E. Disagree a lot**
- 31.** When students solve mathematical problems, I encourage them to justify their solutions, conjectures and thinking.  
**A. Agree a lot**                      **B. Agree a little**                      **C. Undecided**  
**D. Disagree a little**                      **E. Disagree a lot**
- 32.** Many teachers understand mathematics as a boring and mechanical discipline and have a difficult concept.  
**A. Agree a lot**                      **B. Agree a little**                      **C. Undecided**  
**D. Disagree a little**                      **E. Disagree a lot**
- 33.** Teachers' responsibility to enhanced learning mathematics for students.  
**A. Agree a lot**                      **B. Agree a little**                      **C. Undecided**  
**D. Disagree a little**                      **E. Disagree a lot**
- 34.** A good mathematics teacher focuses on conceptual understanding and to explore mathematical ideas.  
**A. Agree a lot**                      **B. Agree a little**                      **C. Undecided**  
**D. Disagree a little**                      **E. Disagree a lot**
- 35.** Boys like mathematics more than girls and the performance of boys is also better.  
**A. Agree a lot**                      **B. Agree a little**                      **C. Undecided**  
**D. Disagree a little**                      **E. Disagree a lot**
- 36.** Students can learn mathematics best by actively participating in teacher's explanations.  
**A. Agree a lot**                      **B. Agree a little**                      **C. Undecided**  
**D. Disagree a little**                      **E. Disagree a lot**

**37.** Constructivist method is best suited for students to learn mathematics.

- A.** Agree a lot                      **B.** Agree a little                      **C.** Undecided  
**D.** Disagree a little                      **E.** Disagree a lot

**38.** Mathematics is considered a more difficult subject than other subjects.

- A.** Agree a lot                      **B.** Agree a little                      **C.** Undecided  
**D.** Disagree a little                      **E.** Disagree a lot

**39.** To learn mathematics, more logical intelligence is required than other subjects.

- A.** Agree a lot                      **B.** Agree a little                      **C.** Undecided  
**D.** Disagree a little                      **E.** Disagree a lot