

**ACADEMIC ACHIEVEMENT IN MATHEMATICS AMONG
SECONDARY SCHOOL STUDENTS OF MIZORAM IN
RELATION TO THEIR MATHEMATICAL APTITUDE AND
SOCIO-ECONOMIC STATUS**

**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF DOCTOR OF
PHILOSOPHY**

L. NUNCHANGA

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**ACADEMIC ACHIEVEMENT IN MATHEMATICS AMONG SECONDARY
SCHOOL STUDENTS OF MIZORAM IN RELATION TO THEIR
MATHEMATICAL APTITUDE AND SOCIO-ECONOMIC STATUS**

By

L. NUNCHANGA

Department of Education

Supervisor

Prof. LYNDIA ZOHMINGLIANI

Submitted

**In partial fulfillment of the requirement of the Degree of Doctor of Philosophy in
Education of Mizoram University, Aizawl.**

MIZORAM UNIVERSITY
(Central University)
Tanhril, AIZAWL - 796004, MIZORAM

Prof. Lynda Zohmingliani
Department of Education

Phone: 9436145408
E-mail: Lynda.zohmingliani@gmail.com

Dated Aizawl, the 4th July, 2025

CERTIFICATE

This is to certify that the thesis entitled “*Academic Achievement in Mathematics among Secondary School Students of Mizoram in Relation to their Mathematical Aptitude and Socio-economic Status*” submitted by L. Nunchanga, Regn. No. MZU/Ph.D./ 1896 of 27.08.2021 for the Degree of Doctor of Philosophy in Education of the Mizoram University, Aizawl, India embodies the record of original investigation carried out by him under my supervision.

He has been duly registered and the thesis presented is deemed worthy of consideration for the award of a Ph.D. degree. This research work has not been submitted for any degree at any other university.

(Prof. LYNDA ZOHRMINGLIANI)
Supervisor

DECLARATION
MIZORAM UNIVERSITY
JULY, 2025

I **L. NUNCHANGA**, hereby declare that the subject matter of this thesis is the record of work done by me, that the contents of this thesis did not form basis of the award of any previous degree to me or to do the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other University/Institute.

This is being submitted to the Mizoram University for the **Degree of Doctor of Philosophy in Education.**

(L. NUNCHANGA)
Candidate

(Prof. LALBIAKDIKI HNAMTE)
Head of Department
Department of Education

(Prof. LYNDIA ZOHMINGLIANI)
Supervisor

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Dated: Aizawl
The 4th July, 2025

(L. NUNCHANGA)
Department of Education
Mizoram University

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CHAPTER I

INTRODUCTION

Mathematics is the foundation, the underlying principles and laws in which the universe was created. Every object in the universe was designed with mathematical principles, structures and patterns. Galileo stated that the universe is a book written in the language of mathematics. The laws of mathematics connect human with the universe; it is all around us, in many aspects of nature and man-made objects. As we discover and explore more and more about our surrounding, we see that mathematical pattern, symmetry and sequences are imprinted on each and every object. From the behavior of smallest particles to the motion of the biggest planet, mathematics provides the precise language and framework through which natural phenomena can be described, predicted, and explained. So, the underlying principles and laws of mathematics enables humans to understand the universe and the world around us. Mathematics is a science of concepts and relationships. As mathematical knowledge and skills has developed more and more, mathematics become more and more useful in human activities and everyday life.

Mathematics occupies an important position in curriculum and holds a central and foundational position in modern education systems worldwide due to its universal applicability, cognitive benefits, and role in scientific and technological advancement. It is a compulsory subject from Class - I to Class - X in Indian education system and it forms part of the core curriculum under all major educational boards (CBSE, ICSE, State Boards). Education is universally acknowledged as the cornerstone of societal advancement, fostering intellectual growth, social equity, and economic development. It serves as a catalyst for innovation, personal empowerment, and the promotion of a just and equitable society. Beyond individual enrichment, education drives collective progress, shaping communities and nations. Among various educational disciplines, mathematics holds a unique and indispensable position due to its universality and broad applicability. Mathematics forms the backbone of critical thinking, scientific discovery, and technological

progress, cementing its role as an integral component of modern education systems worldwide (NCERT, 2005).

One of the aims of education is to mould and develop a person so as to become a useful and productive human by inculcating creativity, problem solving skills, logical thinking, etc. Mathematics education is one of the most important tools for developing a child's thinking. According to NCF 2005, "The main goal of Mathematics education in schools is the 'mathematisation' of a child's thinking" (NCERT, 2005). Developing mathematics skills in child in an early stage helps in intellectual development which is necessary for the growth and development of a child in various aspect of life. The term education is derived from the Latin word 'Educere' which means "to bring up" or "to nourish". The ultimate aim of education is to bring up an individual for the betterment of the world, societies and for himself. By understanding mathematical patterns, conjectures, measurement, counting, shapes and size, averages etc helps a child in cognitive development, building up confidence, personality and social development. Learning mathematics helps a child to develop values such as rigor and integrity in communication and formulation of argument which is the aims of mathematics education according to NCF 2023. Mathematics education helps a child in socio-personal character development like curiosity, keen observation of people and objects that surrounds them, good discipline, exactness, precise expression of thoughts, logical approach to daily activities, use of appropriate language when interact with people.

1.1 MATHEMATICS

1.1.1 Meaning of mathematics

The word 'Mathematics' is derived from the Greek word 'mathema' which means 'that which is learnt'. According to Cambridge dictionary, "Mathematics is the study of numbers, shapes and space using reason, and usually a special system of symbols and rules for organizing them". Mathematics involves measurement, counting, calculation, imagination, thinking, analysis, structuring and arrangement of numbers, quantities and physical objects. It includes the study of relation, formulas, space, abstracts, structure and changes of quantities. Mathematics involves logical

reasoning which includes inductive and deductive reasoning. It uses creative thinking to create new knowledge and ideas. Mathematics can be considered as an art which is the expression of human mind by making use of numbers, symbols and logical reasoning. According to Courant and Robbins (1941), “Mathematics as an expression of the human mind reflects the active will, the contemplative reason, and the desire for aesthetic perfection. Its basic elements are logic and intuition, analysis and construction, generality and individuality”.

Mathematics is an exact science. It is traditionally defined as the science of measurement, quantity, numbers and relations. Webster dictionary defined mathematics as, “the science of numbers and their operations, interrelations, combinations, generalizations, and abstractions and of space configurations and their structure, measurement, transformations, and generalizations”. Some of the famous philosopher and mathematician give the definition of mathematics as follows:

Aristotle defined mathematics as “The science of quantity”.

August Comte defined mathematics as “The science of indirect measurement”.

Carl Friedrich Gauss referred to mathematics as “The Queen of Sciences”.

Benjamin Pierce called mathematics “The science that draws necessary conclusions”

From the above definition mathematics can be considered as science which deals with quantity, relations and reasoning which helps us to understand the world around us and to draw conclusion of certain problems.

Mathematics functions as both a subject and a universal language, elucidating relationships and structures essential for understanding natural and constructed phenomena (Courant & Robbins, 1941). Defined as the science of numbers, quantities, and space, it bridges theoretical constructs and practical applications, offering tools for solving problems and analyzing patterns. This dual nature underscores its relevance across domains such as engineering, medicine, economics, and artificial intelligence (Kumaravelu, 2018). The universality of mathematics

stems from its ability to describe phenomena that transcend cultural and geographical boundaries. Contributions from ancient civilizations—including those of Egypt, Mesopotamia, India, and Greece—have laid the foundation for contemporary mathematical theories and applications. The enduring significance of principles like the Pythagorean theorem highlights the timeless nature of mathematics (Courant & Robbins, 1941). Furthermore, mathematics acts as a unifying language for interdisciplinary collaboration, enabling scientists, engineers, and economists to interpret data, predict trends, and devise solutions to complex challenges, as exemplified by the application of calculus in physics and statistical methods in social sciences (Bloom, 1956).

1.1.2 Importance of mathematics

Mathematics is the most important subject in the school because of its utility values. Actually, modern life is not possible without basic knowledge of mathematics. Basic knowledge in mathematics like counting, measuring, weighing, simple calculation, reasoning and structuring is important in day-to-day life in various walks of life. Each and every person starts a day by using mathematics with knowing or without knowing it. Every person uses mathematics in their various occupations no matter what kind of job it is. From cook to engineer, rich and poor, low class and high class, literate and illiterate, mathematics is used in day-to-day interaction and it serve as a very important tool in various activities.

Mathematics helps a child to think logically, to reason mathematically, to perceive and visualize abstract structure and pattern. Developing mathematical thinking is the heart of mathematics education. Mathematics helps in the development of mental capacity and it sharpens the mind to think precisely, logically, analytically and creatively. Kothari Commission (1964 – 66) recommended that science and mathematics should be an integral part of general education and should be taught on a compulsory basis till the end of school stage. It is included in the school curriculum because of its importance in day-to-day life and in developing intellectual power. It also helps to study other subjects easier as it is related to various subjects. Mathematics is considered as an important tool for learning science

and it is the basis for all science. It helps in the development of scientific thinking. Learning mathematics in the school helps student to think decisively and rationally, and it inculcate problem solving skills among students to apply in their daily life.

Mathematics nurtures intellectual development by fostering logical reasoning, analytical thinking, and problem-solving skills—attributes essential for academic success and navigating everyday life. For instance, financial literacy concepts, such as interest rates and budgeting, hinge on basic mathematical knowledge (Pandey, 2017). The National Curriculum Framework (NCF, 2005) underscores the importance of "mathematizing" students' thinking to enable pattern recognition, argument validation, and engagement with abstract concepts. Such cognitive engagement cultivates higher-order thinking skills critical for innovation and decision-making in an increasingly complex world (Kothari Commission, 1966).

In the digital age, the significance of mathematics has grown exponentially. Algorithms underpinning computer science are rooted in mathematical logic and structures. Technological advancements in machine learning and artificial intelligence rely heavily on mathematical principles, including linear algebra, calculus, and probability theory (Warrier & Baron-Cohen, 2016). Additionally, the proliferation of data underscores the necessity of statistical literacy. From interpreting election polls to analyzing health metrics, the ability to apply statistical concepts is indispensable for informed decision-making. Mathematics empowers individuals to navigate the complexities of the information age, fostering a scientifically literate society (Mangal, 2019).

Furthermore, mathematics equips learners with tools to approach both theoretical and practical challenges methodically. As a vehicle for intellectual inquiry, it bridges diverse fields such as computational biology, quantitative finance, and advanced engineering design. These interdisciplinary connections showcase mathematics as a dynamic and evolving discipline that adapts to emerging societal needs. For instance, the use of mathematical algorithms in climate modeling has provided crucial insights into environmental change, emphasizing its application to global challenges (Pandey, 2017). Mathematics also plays a pivotal role in personal

development, cultivating self-discipline and resilience through structured problem-solving processes. These characteristics are instrumental in fostering a proactive and adaptive mindset, which is increasingly valued in today's workforce (Mangal, 2019).

1.1.3 The beauty of mathematics

Bertrand Russell, a philosopher and mathematician, often emphasized the aesthetic value of mathematics, comparing its beauty to that of classical art. He believed "Mathematics, rightly viewed, possesses not only truth but supreme beauty" (Russell, 1919, p. 60). Mathematics has always been a practical and useful subject having immense utility in everyday life. Even though it is often perceived as a rigid and utilitarian subject, but its true essence lies in its inherent beauty, which plays a crucial role in mathematics education. Recognizing and appreciating the aesthetic dimension of mathematics can transform how students perceive and engage with the subject, fostering deeper understanding, creativity, and lifelong appreciation. Hardy (1940), in his seminal work *A Mathematician's Apology*, argued that mathematical beauty is comparable to artistic beauty, describing proofs that are "serious as poetry." This aesthetic experience is not merely subjective but is supported by shared criteria within the mathematical community, such as simplicity, generality, and depth (Sinclair, 2004). According to Wordsworth (1802) Poetry is the spontaneous overflow of powerful feeling. Just like poets express their feelings, deep emotions and ideas in beautiful words, mathematicians often express their mathematical thoughts of natural world, relationships between quantities, numbers, and variables in beautiful mathematical language. Thus, mathematics is not only a tool for computing, measuring, and calculating in daily life application, but as an art like painting, music, sculpture, and poetry, mathematics can be beautiful. Thus, students should not only find its' utilitarian value but should also perceive it as a discipline rich with beauty and creativity.

Mathematicians like to emphasize the aesthetic values of mathematics and often talk about the beauty of mathematics. This beauty is seen in the harmony, patterns and structures of numbers and forms (Waggoner, 2019). Mathematicians often describe their work using aesthetic terms such as "elegance," "creativity,"

“simplicity” and “symmetry and pattern.” Elegance is a central concept in the appreciation of mathematical beauty. In mathematics, elegance refers to the simplicity, clarity, and depth of a theorem and proof. Mathematicians often describe proofs as “beautiful” when they are concise, insightful, and unexpected (Rota, 1997). An elegant theorem or proof is often one that achieves a beautiful solution and result creating a sense of intellectual satisfaction and aesthetic pleasure among mathematicians and students alike. For instance, Euler’s identity ($e^{\pi i} + 1 = 0$) is known for its simplicity and depth. This equation is celebrated not only for its correctness but also for its unifying elegance—it connects five fundamental constants $e, \pi, i, 1$ and 0 in a single equation. Introducing students to such elegant proofs can cultivate an appreciation for mathematical beauty. Creativity is an essential aspect of mathematical beauty. Mathematics is a creative endeavour where problem-solving involves intuition and imagination (Poincaré, 1913). Mathematical beauty often emerges through the creative process of discovering hidden pattern and structures, connecting relations between two or more identities which requires imagination, intuition, and aesthetic sensitivity. In mathematics education, fostering creativity helps students see beyond formulas and procedures. According to Leikin (2009), encouraging students to engage in mathematical creativity enhances not only their problem-solving skills but also their aesthetic appreciation, leading to more meaningful and joyful learning experiences. Emphasizing creativity in the classroom connects students with the human side of mathematics: its wonder, imagination, and beauty. Pattern and symmetry are also significant concept in the appreciation of mathematical beauty. Mathematics is deeply embedded in the natural world, manifesting in intricate patterns, symmetries, and structures. From the spirals of galaxies to the fractal branching of trees, nature exhibits mathematical beauty. Symmetry is a fundamental aspect of mathematical beauty, evident in geometric shapes, algebraic structures, and even fractals (Weyl, 1952). The Golden Ratio, Fibonacci sequences, and tessellations demonstrate how patterns in nature and art are deeply mathematical (Livio, 2002). For instance, the Fibonacci sequence (0, 1, 1, 2, 3, 5, 8...) appears frequently in biological growth patterns, such as in the arrangement of sunflower seeds, pinecones, and the spirals of nautilus shells. Hexagonal structure of honeycombs, radial symmetry in leaves and starfish reveal

fundamental mathematical principles which possess beauty. Recognizing these connections can make mathematics more engaging for students.

In the context of mathematics education, introducing students to the beauty of mathematics can significantly enhance their motivation and engagement. When students are exposed to the wonder of symmetrical patterns, fractals, or elegant proofs, they are more likely to develop a positive attitude toward mathematics (Zeki, 2014). Moreover, fostering an appreciation for mathematical aesthetics supports conceptual learning, as students come to see mathematics not merely as a set of procedures but as a coherent and meaningful discipline. Integrating beauty into mathematics education also supports inclusive education in learning mathematics where all students may feel that they have the chance to enjoy and learn it. By emphasizing creativity and exploration over rote memorization, educators can create a more inviting environment for diverse learners (Burton, 1999). This change in focus allows students who may not initially see themselves as "mathematics people" to find personal meaning, enlightenment and value in the subject.

1.1.4 Mathematics as a universal language

Mathematics is often regarded as a universal language due to its ability to transcend cultural, linguistic, and geographical barriers. It serves as a language capable of expressing complex ideas in a simple, precise and clear manner. Mathematics is the only language that everyone in the world understands, no matter their culture, religion, or gender (Lavoy, n.d.). Two groups whose languages were foreign to each other can communicate and understand to each other through the language of mathematics (Waller et al., 2016). Mathematics has its own standardized system of language which is explicate in symbol and notation. The expression of mathematical ideas through symbols and notations is universally understood and recognised. Spoken language may vary from region to region, but mathematics maintains a consistent structure and symbolism that is recognized across the world. A mathematical law or principle that is expressed in Beijing, Barcelona, Delhi or Nairobi conveys the same meaning and yields the same results when applied correctly. Mathematical concepts (e.g., numbers, equations, geometric shapes) mean

the same thing regardless of language or culture. For example, " $2 + 3 = 5$ " is universally true across all countries, cultures, and languages.

Mathematical expressions are flexible and can be put in various forms which makes it easy to understand for communication. Mathematics as a language needs to be understood and this understanding often means being able to translate a concept into multiple forms. Henri Poincaré (1908) viewed mathematics as the art of giving the same name to different things. He discussed how mathematical concepts and ideas can be expressed in different formulations, enabling mathematicians and scientists to describe the same phenomena in multiple languages. Language is a tool for communication of thoughts, ideas and feelings through signals such as voice, gestures or written symbols. Mathematics is a language that describes and expresses the nature and behaviour of everything around us. Poetry, as a language, employs heightened linguistic devices—such as metaphor, rhythm, and sound patterns—to evoke emotions, imagery, and deeper meaning (Eagleton, 2007). Just like poets use various poetic words to express their thoughts and emotions, mathematicians often use mathematical language such as symbols, notations, syntax, relations, operations and axioms to express abstract thoughts, logical reasoning, and laws of natural science. Thus, mathematics as a language describes the movement and working of natural things around us from dew drops to rotation of planets, from sound of guitar strings to flow of electromagnetic wave. The spread of diseases can be expressed in mathematical models which is considered as not only useful for medical science, but also a beautiful expression of facts as a language.

Mathematics is built on axioms, theorems, reasoning and logical deductions that remain unchanged across cultures. So, the universality of mathematics lies in its foundation of logic and abstraction. Ideas and concepts deduced from the foundation of mathematics can be shared and connected among different races and cultures. Numbers, symbols, and operations are used to represent quantities, relationships, and patterns in a way that is not dependent on spoken language. For example, the Pythagorean Theorem $a^2 + b^2 = c^2$ holds true regardless of who uses it or in what language it is written. The use of numbers, operators, and logical structures allows mathematicians and scientists from diverse backgrounds to collaborate without

linguistic barriers. Historically, different civilizations (e.g. Greeks, Indians, Mesopotamia and Chinese) developed mathematical ideas, concepts and principles independently yet arrived at similar results and conclusions (Joseph, 2011).

1.2 THEORETICAL PERSPECTIVES ON MATHEMATICS EDUCATION

The conceptualization of mathematics education is informed by various theoretical frameworks, each offering unique insights into how students learn and engage with the subject. Constructivist theories, advanced by Piaget and Vygotsky, emphasize active learning, where students construct knowledge through exploration, interaction, and reflection. Vygotsky's (1978) Zone of Proximal Development highlights the importance of scaffolding—structured guidance enabling learners to accomplish tasks beyond their independent capabilities. This approach fosters independent problem-solving and deeper comprehension.

Behaviorist theories, articulated by Skinner, underscore the role of reinforcement, practice, and feedback in mastering mathematical skills. Repetition and positive reinforcement, according to this perspective, are critical for developing proficiency in fundamental concepts (Bloom, 1956). Cognitive theories add another dimension by exploring the mental processes involved in learning mathematics. These theories advocate for strategies that enhance memory retention and problem-solving efficiency, such as the use of visual aids and mnemonics (NCERT, 2005). Bloom's Taxonomy delineates a hierarchical model for educational objectives, progressing from basic knowledge acquisition to higher-order thinking skills such as analysis, evaluation, and synthesis. This taxonomy underscores the necessity of curricula that balance foundational learning with opportunities for critical inquiry and creative exploration (Bloom, 1956).

Integrating these theoretical perspectives facilitates a holistic approach to mathematics education, addressing both cognitive and affective dimensions of learning. For instance, inquiry-based learning encourages students to pose questions, investigate solutions, and construct their understanding of mathematical principles. This methodology not only deepens comprehension but also nurtures curiosity and independent thinking (Vijaykumari et al., 2021). Technological advancements have

further transformed mathematics education, offering tools such as dynamic geometry software, graphing calculators, and online platforms for collaborative problem-solving. These innovations enhance engagement and mastery by providing interactive learning experiences and immediate feedback (Kumaravelu, 2018).

The insights derived from these frameworks have significant implications for curriculum design and pedagogy. Differentiated instruction, tailored to the diverse needs and abilities of students, is essential for fostering mathematical proficiency. Real-life applications, such as modeling economic scenarios or analyzing environmental data, make mathematics more relevant and engaging for learners (Maiti, 2017). Addressing socioeconomic disparities through equitable resource allocation—including quality textbooks, trained teachers, and extracurricular support—further bridges achievement gaps. Community-based initiatives and parental involvement strengthen the educational ecosystem, creating supportive environments for students to thrive (UNESCO, 2019).

Moreover, mathematics education must evolve to reflect the increasing interdependence of global economies and technologies. Emphasizing interdisciplinary approaches that integrate mathematics with fields such as bioinformatics and data science prepares students for future challenges. For example, teaching linear programming within the context of supply chain optimization illustrates how mathematics applies to real-world problem-solving (Warrier & Baron-Cohen, 2016). Professional development for educators is also critical. Training teachers to incorporate innovative methods such as flipped classrooms and blended learning ensures that mathematics instruction remains dynamic and responsive to students' needs (Narula, 2007).

1.3 AN OVERVIEW OF MATHEMATICS EDUCATION IN MIZORAM:

The state of Mizoram, situated at the foot of Northeastern India, has common international border with Myanmar on the east and with Bangladesh on its west. Its neighboring States are Assam, Manipur and Tripura. Majority of the people are Mizo tribal and they belong to Tibeto-Burman ethnic group. Mizo society is highly close-knit, characterized by strong community bonds, collective responsibility, and deep-

rooted traditions that foster unity. Influence by Christian culture, Church plays a central role—dictating social norms, education, and even political opinions.

Education in Mizoram began with the arrival of Christian missionaries in the late 19th century. The first formal school was established in 1894 by the British missionaries J.H. Lorrain and F.W. Savidge at Aizawl. Initially focused on religious instruction and literacy, education gradually expanded under British administration. Post-independence, the state saw rapid growth in educational infrastructure, leading to high literacy rates. Today, Mizoram boasts the first fully literate state in India (Ministry of Education, 2025). But, in spite of high literacy rate, the standard of mathematics education in the state remains a significant concern. Studies and local educational assessments have highlighted persistent challenges in mathematical understanding, problem-solving ability, and conceptual clarity among students at various levels.

During the past few decades, the status of mathematics education in Mizoram was generally poor. Academic achievement in mathematics was considerably low among students in Mizoram. Students were underperforming all kinds of assessment in mathematics subject in the school. Thanhawla (1983) found that the general standard of achievement in mathematics was 27.86 % which was extremely low. From the study of Thomas (1991) it was revealed that the level of achievement in mathematics subjects was between 33 and 50 percent only. There are only few people who have science and mathematics background, and most of the student opted for arts and humanities in the higher studies rather than science and mathematics. The reason for insufficient number of people who have science and mathematics background in Mizoram is due to the weak foundations of mathematics and science in the school system (Wangu, 1995). It has all started right from the school level where most of the students were not interested in mathematics which result in lack of mathematics graduate among the educated who could able to teach mathematics in the school. The number of school teachers with science and mathematics background is insufficient compared to the needs of the area. Thus, the state Government was forced to import and employ numerous science and mathematics teachers from outside the state.

The growth and progress of mathematics education can be seen since from the last few years. The number of science and mathematics graduate is gradually increasing driven by the growing demand in various Government jobs and private sector. Academic performance in mathematics continues to progress, and at the same time it also grows increasingly challenging due to various issues and problems. The state Government also spent huge amount of money for the development of mathematics education in Mizoram. Government-funded mathematics summer camps were occasionally held in different schools. Since 1978, the Mizoram government has awarded Incentive Cash Awards for Proficiency in Science and Mathematics to encourage student excellence in these subjects. As of 2024, a total of 6,685 students has received this recognition (SCERT, 2024). Lack of mathematics trained teacher has been one of the most crucial concerns and challenges in Mizoram. Recognizing the need for trained teachers, B. Ed Multimode Programme was implemented by Government of Mizoram in order to clear the backlog of untrained in-service teacher and to develop the quality of teachers. In-service mathematics teacher training, workshop and seminar were also regularly conducted emphasizing modern teaching methodologies.

With the passage of time, students are starting to learn mathematics with greater interest in the subjects and are beginning to find the study enjoyable. Academic marks and performance in mathematics continue to improve. But the percentage of failure in mathematics is still high compare to other subjects. The following are the academic performance of secondary school students in HSLC examination during the last 5 years:

Table 1: Performance of students in mathematics in HSLC examination between 2020– 2024.

Division	No. of Students	Percentage
Distinction	6237	6.94
First	12694	14.13
Second	16,899	18.82
Third	36,080	40.19
Fail	17,870	19.90
Total	88,913	100

Source: MBSE, Government of Mizoram

Table 1 shows that in five consecutive years, i.e. 2020 – 2024, there were 17,870 students who have failed in mathematics in the HSLC examination which comprised of 19 % and there were also 36,080 who have secured third division marks which comprises of 40.19%. Therefore, it can be seen that about 60% of the students have secured below second division marks in the HSLC examination for five consecutive years i.e. between 2020- 2024. It can be seen that there is a progression in the result, however, the result is still unsatisfactory since majority of the students were those who have failed and those who secured third division marks. This indicates that secondary school students of Mizoram have low academic achievement in Mathematics.

Attitude toward mathematics play a significant role in mathematics performance in Mizoram. Lalremmawii (2021) conducted a study on attitude of 600 secondary school students toward mathematics in Mizoram. The study found that 288 (48%) of the students showed negative attitude, 215 (35.8%) had neutral attitude, and 97 (16.2%) had positive attitude. Thus, majority of the students had negative attitude toward mathematics. Chuaungo (2016) also found that majority of students in Mizoram have negative attitude toward mathematics. Pramod (2015) conducted a study on Mizo students' perspectives of mathematics and he found that there were a high number of Mizo students who had low interest in mathematics, which shows that the education standard in terms of mathematics is still very poor.

The role of ICT in teaching and learning of mathematics has enhanced and proliferated drastically in the past few decades. Many studies have shown that the use of ICT tools such as computers, internet, video, overhead projector, etc. has improved the teaching and learning of mathematics. But there are still many challenges in the usage of ICT. Moreover, the use of ICT in mathematics education is highly depends on teachers. Thangmawia (2022) conducted a study on status of ICT usage in teaching learning mathematics in secondary school of Mizoram. From the respondent of 96 mathematics teachers, it was found that most of the school has no ICT enabled classroom where teachers can implement ICT in their school and ICT training programs does not reach to all teachers in the state. The findings shows that effective usage of ICT would not be possible in the current situation and ICT play a very less role in the teaching learning of mathematics.

In learning mathematics, there are something that need to be known first before learning something new. Many studies have shown that students' pre-requisite knowledge is the most important determinants of student achievement. Lalremruata (2011) conducted a study on the mathematics competency of Primary school students of Mizoram in relation to Minimum Levels of Learning (MLL), and he found that the mean score has average percentage of 34.67 only which was extremely poor. This study shows that elementary school students of Mizoram have poor level of competency in mathematics which indicates that they had not acquired necessary knowledge to have achievement in mathematics at secondary school. In the opinionnaires of mathematics teachers, Lalremmawii (2021) found that 93% of the mathematics teachers believes that students do not have pre-requisites knowledge in mathematics. Elementary school students in Mizoram need to acquire basic knowledge in mathematics as it provides the foundation for understanding new concepts introduced in their present class. In view of the importance of pre-requisite knowledge, it can be seen that the secondary school students' performance in mathematics depends on their performance at elementary stages. Moreover, if elementary students in Mizoram have acquired all the necessary mathematical knowledge, they will be more likely to have success in secondary stage.

1.4 ACADEMIC ACHIEVEMENT IN MATHEMATICS

Human beings are intended for progress and growth. Continuous learning is the intimate nature of man as it starts from birth and ends with death. Learning is both a process and product where changes in individual's behavior and performance takes place. The changes in performance and behavior towards accomplishing specific goal leads to growth and progress which we called achievement. Achievement is the product or outcome of learning in which an individual has accomplished specific goal in the learning environment. Studies have shown that feeling a sense of achievement is crucial for developing positive well beings in an individual. Academic achievement is considered as the most important criteria to judge the potential of an individual in modern society.

Academic achievement refers to the standard or level of success accomplish in a specific area of study. According to Good (1959), academic achievement is defined as "Knowledge attained or skills developed in school subjects usually designated by test score or by rank assigned by teacher or by both". Academic achievement may also be defined as the accomplished success in any educational task or an individual's ability to attain an established goal through hardworking, effort, skill, or courage within the school context (Hornby, 2006). Individuals who are successful in academic disciplines are more likely to be admitted to more reputable educational institutions, have better employment opportunities, have high salary and earn more money, and experience high life satisfaction (Liu et al., 2020). According to Bhat (2022) academic achievement have close relationship with student's growth and development in the academic discipline, facilitated by the classroom learning and teaching process. It develops career aspiration since it serves as an important element in building confidence and enhancing abilities. A person who has high academic achievement is also expected to have more abilities in doing certain tasks. Studies have also shown that academic achievement is correlated with future success.

Academic achievement in mathematics refers to the degree or level of success attain in mathematics. It is the result of acquired knowledge or information,

understanding, proficiencies or skills and techniques procured in mathematics in a particular stage (Pandey, 2017). It is the student score or marks obtained in mathematics during a specific period. Academic achievement in mathematics refers to which a student accomplishes the required knowledge, skills and competencies in mathematical concepts and application based on certain standards adopted by the institutions. It is typically evaluated by class test, examination or by asking certain questions by teacher during teaching learning process. It is also measured by using standardised test which is quantified through grades or point average. Academic achievement in mathematics in every stage of education is important. But secondary stage is crucial because it links between elementary education and higher education.

Academic achievement in mathematics reflects a student's ability to understand, apply, and innovate within the discipline. It serves as a critical indicator of educational progress, influencing students' future opportunities in education and employment (Pandey, 2017). Mathematics achievement encompasses dimensions, including computational skills, conceptual understanding, and problem-solving capacity. High achievers in mathematics demonstrate not only accuracy in calculations but also the ability to abstract, analyze, and synthesize information to address complex challenges (Kalsia, 2017).

The importance of academic achievement in mathematics extends beyond the classroom. Mathematics is often described as the "gateway subject" for STEM (Science, Technology, Engineering, and Mathematics) fields. Students excelling in mathematics are better positioned to pursue advanced studies in these areas, pivotal for innovation and economic growth. Furthermore, mathematical competence supports success in non-STEM fields by enhancing critical thinking, logical reasoning, and data analysis skills (Mangal, 2019). A myriad of factors influences students' performance in mathematics, including intrinsic abilities, educational environment, teaching methodologies, and socioeconomic background. Teachers play a pivotal role in fostering achievement by employing differentiated instruction, integrating technology, and contextualizing mathematical concepts through real-life applications. Formative assessments and personalized feedback help identify gaps in

understanding, enabling targeted interventions to enhance learning outcomes (NCERT, 2005).

Innovative pedagogical strategies, such as interdisciplinary learning and collaborative problem-solving, can improve mathematical achievement. For instance, integrating mathematics with art or using simulation software to model real-world scenarios fosters deeper engagement and understanding. These strategies align with broader educational goals, promoting equity, innovation, and societal advancement (Warrier & Baron-Cohen, 2016).

Moreover, integrating advanced assessments such as adaptive testing can help educators understand diverse learning needs, ensuring that students receive appropriate challenges and support. Collaborative projects that simulate real-life applications, such as developing algorithms for predicting financial trends or modeling pandemic spread, further encourage engagement while highlighting the relevance of mathematics to societal issues (Vijaykumari et al., 2021).

1.4.1 Factors Affecting Academic Achievement in Mathematics:

1. Mathematical Aptitude

Mathematical aptitude defined as an individual's inherent ability to understand and perform mathematical tasks has long been regarded as a key factor in mathematics learning. Students with high mathematical aptitude tend to exhibit superior abstract reasoning, pattern recognition, and quantitative reasoning skills, which are essential for mastering increasingly complex mathematical concepts (Wai et al., 2009). Numerous studies have shown that students with high mathematical aptitude tend to have better academic achievement in mathematics than their peers with low mathematical aptitude across multiple educational stages, which indicates that there is a significant relationship between the mathematical aptitude and mathematics achievement (Lubinski & Benbow, 2006; Murayama et al., 2013; Bala, 2014; Gupta & Kaur, 2015; Kumaravelu, 2018).

2. Teaching Methods

Teaching strategies and methods that provide students with learning environment where they can develop and apply higher-order thinking skills are important for mathematics achievement (Saritas & Akdemir, 2009). The methods used in teaching may vary from one school to another and from one state to another. Methods that encourage active participation and engagement, like constructivist approach, problem solving method, student centred method and hands-on activities are more effective than traditional lecture-based approaches. Usage of teaching learning materials also enhance learning that often leads to higher academic achievement. Teaching aids such as geometric shapes, algebra tiles, and number lines help students visualize abstract concepts, making them easier to grasp (Boggan et al., 2010).

3. Curriculum

Mathematics curriculum should be designed in such a way that children must learn how to think mathematically and how to analyze mathematical problems. Many mathematics curricula emphasized memorization of facts and figures, axioms and theorem without understanding the concept. Engaging students in real life application of mathematics, problem solving and inquiry-based activities improves critical thinking and motivation (Schoenfeld, 1992). Enriching mathematics curriculum beyond textbook is necessary to foster holistic development and to adopt joyful learning. Games, puzzles, and digital tools make mathematics fun and reduce anxiety (Ashcraft, 2002). The curriculum should be associated with learning that allow students to see that mathematics has powerful uses in modeling and predicting real-world application. School mathematics curricula should focus on mathematics content and processes that are worth the time and attention of students (NCTM, 2000). Analytical thinking, reasoning skills, logical and abstract thinking should be emphasized so that student could able to connect classroom mathematics with real-life experiences.

4. Prior Knowledge

Prior knowledge in mathematics refers to the foundational concepts and skills that students should already understand before learning new topics. This knowledge varies depending on the level of study. Prior knowledge in mathematics has significant effects on academic achievement in mathematics (Aubrey et al., 2006; Yuksel, 2014; Rianto et al., 2022). Mathematics education is a cumulative process where each new concept is built and connects by previously acquired knowledge. Wide gaps in foundational knowledge between previous knowledge and new concept learning can lead to persistent difficulties, contributing to mathematics anxiety and long-term academic struggles (Ashcraft & Krause, 2007).

5. Socioeconomic Status

Socioeconomic status (SES) is typically measured by family income, parental education, and occupational status. Numerous studies have shown that students from higher SES backgrounds tend to outperform lower SES in mathematics achievement (Sirin, 2005). This performance gap is attributed to a variety of factors, including disparities in access to educational resources, differences in early childhood learning environments, and variations in parental support and expectations. According to Mji and Makgato (2006), in some low-income areas, mathematics is perceived as a difficult subject, and there is a lack of confidence among students in their ability to succeed. Students from high SES often have access to private tutoring, extracurricular mathematics programs, and well-funded schools equipped with advanced mathematics learning facilities and high-quality teachers, while those from low SES may lack such opportunities.

Socioeconomic disparities significantly influence mathematical achievement. Students from higher SES backgrounds often have access to private tutoring, advanced resources, and extracurricular activities, which enhance their mathematical abilities. Conversely, students from underprivileged backgrounds face barriers such as inadequate infrastructure, limited parental support, and

financial constraints. Addressing these disparities requires targeted efforts to ensure equitable opportunities for all learners (UNESCO, 2019).

6. Parental involvement

Parental involvement plays a crucial role in shaping students' academic achievement in mathematics. Research shows that when parents actively engage in their children's mathematics learning whether through direct or indirect assistance, students tend to perform better in mathematics. When parents engage in numeracy activities at home like helping with mathematics homework or discussing mathematics-related topics, it enhances children's conceptual understanding and interest in mathematics. Even home interactions in the living room can motivate students and support early mathematical skills development and create positive attitudes toward mathematics learning. Parents who actively communicate with teachers and who participate in school activities like attending parent-teacher conferences, tend to have children with higher mathematics achievement (Epstein, 2011).

7. Attitude toward Mathematics

Students who possess a positive attitude toward mathematics are more likely to have an interest in mathematics, view it as a useful subject and have confidence in engaging in the subject (Mullis et al., 2020). A student's attitude towards mathematics significantly influences their academic achievement in the subject (Chaman, 2014; Chen et al., 2018; Dowker et al., 2019; Kiwanuka et al., 2020; Khaiwal & Gupta, 2025). A positive attitude, characterized by enjoyment, confidence, and value, is strongly correlated with higher achievement.

8. Social and Cultural Norms:

A common social and cultural norms on gender stereotype are that 'women are biologically not suitable for learning mathematics and are significantly worse than men'. These cultural norms and stereotype can negatively impact female students' confidence and performance in mathematics (Spencer et al., 1999). This, in turn, results in low self-efficacy, a loss of motivation to learn, and

ultimately poor performance in mathematics (Xie & Liu, 2023). Therefore, parents' gender stereotype and attitudes of teachers' gender bias toward mathematical abilities affects the academic marks of their children in mathematics. Some societies view mathematics as only relevant for highly intelligent individuals, creating a perception that it is inaccessible to average learners (Boaler, 2016). Some cultures undervalue mathematics learning and do not emphasize the real-world applicability of mathematics, leading students to low performance or disengage in mathematics (Moses & Cobb, 2001).

9. Study Habits, Diligence and Regular Practice:

Study habits have a profound impact on academic achievement in mathematics, influencing how effectively students acquire, retain, and apply mathematical knowledge. Good study habits—such as setting regular study times, using effective note-taking techniques, engaging in self-testing, and reviewing materials consistently—are positively associated with higher mathematics performance (Credé & Kuncel, 2008). Mathematics, being a cumulative and practice-intensive subject, diligence in study, hardworking and consistently following study routines lead to higher academic success in mathematics. Students who practice distributed learning (spacing their study sessions) and active problem-solving tend to perform significantly better on math assessments than those who rely on cramming or passive reading (Gettinger & Seibert, 2002).

1.5 APTITUDE:

The word aptitude is derived from the Latin word “Aptus” which means the state or quality of being fit or suit. Aptitude is the capacity or potential of an individual fit or suit to learn specific skill. According to Bingham (1937) “Aptitude, then, is a condition symptomatic of a person's relative fitness, of which one essential aspect is his readiness to acquire proficiency – his potential ability – and another is his readiness to develop an interest in exercising that ability” (p.18). Aptitude therefore can be defined as an innate capacity for learning and performing tasks in a specific area where one is in the state of readiness, relevant, and fitness to learn and

develop. Merriam Webster Dictionary described aptitude as a ‘natural ability’ and also ‘a capacity for learning’ in. Mangal (2019) described aptitude as a special ability or specific capacity distinct from general intellectual ability which helps a person to acquire the required degree of achievement or success in a specific area. Like a catalyst that speedup a chemical reaction, aptitude of an individual enhances learning in certain areas. Thus, aptitude is the unique characteristics of an individual such as his/her suitability, fitness, readiness, ability to adapt and appropriateness to do certain task and facilitate learning. It is an inborn ability of an individual to do certain task and activities. Aptitude is the ease with which a person will obtain a new skills or capacities. Aptitude therefore can be defined as an innate capacity for learning and performing tasks in a specific area where one is in the state of readiness, relevant, and fitness to learn and develop.

An individual is said to have an aptitude for a particular skill if he or she learns that skill more rapidly and with more ease than other persons with the same previous knowledge (Hayes & Straton, 2012). Some believes that aptitude refers to one’s inherited ability where as other believe that it refers to present ability or ease of acquisition of some skill (Chaubé & Chaubé, 2011). Some psychologists are of the view that aptitude does not mean only one’s potentiality. It also includes the individual’s preparedness and stability for some work or profession. Therefore, in testing one’s aptitude, we want to identify one’s characteristics which refers to one’s capacity to acquire a skill, interest in the particular work and reasonable ability after having received training. Aptitude points to a quality which refers to those characteristics which clarify that an individual will be able to learn satisfactorily when confronted with a problem. In aptitude test we do not measure the individual’s future progress. In facts we try to estimate the possibilities or potentialities.

Chugh (2012) argued that aptitude is the result of both heredity and environment. It means that innate do not solely responsible for an individual’s aptitude. Aptitude is an inborn as well as acquired. It can be acquired through training and learning, and also from activities that an individual has experienced in daily life. Therefore, aptitude is an innate ability that can be facilitate or enhance for the future success. A person may not have current abilities to perform certain task but

may have inborn ability to be successful in the future. For example, a person may not be able to play piano but may have an aptitude for playing piano or any musical instrument which makes him/her to be good musician in the future if he/she receives proper training and guidance. So, aptitude has future implication and tries to predict the possibility of an individual's success in the future in the specific areas. An individual may not have an ability to perform certain unfamiliar task but may have ability in performing others task which is related to previous task. This shows that there is a chance that he/she has an ability to perform that particular task.

Aptitude is often confused with interest when it comes to the selection of future career. An individual may have an interest in certain tasks but may not have an aptitude for it. Expert in career guidance often suggests that a person must have both interest and aptitude to be successful in that specific areas. A student often misunderstands his interest for particular task to be his talent and therefore choose for his future career. For example, an individual who are interest in mathematics may not have ability to learn mathematics properly. This may lead to failure in the future career.

1.5.1 Nature of Aptitude:

1. Aptitude is a unique combination of characteristics and capacities that makes a person distinct from others, and which incline to do some tasks better than others. (Kaur, 2016).
2. The concept of aptitude is broad and comprehensive. It is a mixture of different type of human personality such as intelligence, interest, analytic reasoning, diligence, ability to recognize pattern. It is not a single trait of personality.
3. Aptitude is an indicative of a person's capacities to do certain task. By observing the aptitude of an individual, one's can notice what they might be good at, even if they haven't fully developed those skills yet.
4. Both heredity and environment comprise of factors affecting aptitude. A person is born with certain abilities which is either enhance or hinder by environmental influences.

5. Aptitude is a predictor of future success. It has a future reference and tries to predict the degree of attainment of a person in certain area or task (Mangal, 2019).
6. Aptitude is the qualities of a person that can be developed, controlled and make useful by appropriate training.

1.6 MATHEMATICAL APTITUDE:

Mathematical aptitude is an inborn ability of an individual to perform various mathematical activities, to think mathematically and to understand mathematical concepts. Dhoundiyal and Rawat (2021) argued that mathematical aptitude is different from scoring good marks in mathematics. Mathematical aptitude is more than just memorizing formulas or performing calculations; it involves understanding the underlying mathematical concepts and principles. Mathematical aptitude encompasses a range of innate abilities and skills in the field of mathematics such as problem-solving skills, logical thinking, numerical ability, abstract reasoning, spatial ability and pattern recognition. According to Miller (1990) characteristics of highly mathematical aptitude are an unusual intense curiosity about numeric information, an unusual quickness in understanding and applying mathematical ideas, the ability to think abstractly and to see mathematical pattern and relationship. Mathematical aptitude is the ability of an individual that how quickly he/she can learn to meet and solve the mathematical problems (Kumar & Kumari, 2019), the ability to learn mathematical skills with relative ease (Pyari et al., 2016).

Mathematical aptitude is a natural ability that indicates a person's competency and proficiency in handling abstract mathematical ideas and it is an indicator of success in mathematics and other related field (Chauhan & Ranjan, 2024). So, mathematical aptitude refers to the qualities of an individual being able to learn mathematics or solve mathematical problem. It may be a natural ability or acquired capacity. According to Warrier & Baron-Cohen (2016), mathematical aptitude refers to normative variance in mathematical ability which includes several different components such as numerical ability and number processing, shape processing, mathematical modelling and non-numerical processes. As mentioned

before, to have high mathematical aptitude is not same as scoring good marks in mathematics. Student who scores good marks in mathematics may have low mathematical aptitude. High achievement in mathematics may depend on one's study habits, high computational skills, learning styles, completing all the require works, memorizing theorem etc. whereas mathematical aptitude depends on a person's inborn potential and ability toward mathematics. So, mathematical aptitude cannot be enclosed to only computational skills (Dhyani, 2014). It also includes an ability to visualize shape and structure, ability of abstraction to understand certain relationship, capacity of quick numerical calculation, logical thinking and reasoning.

1.6.1 Factors Affecting Mathematical Aptitude:

Since mathematical aptitude is both heredity and environment, it means it is both innate and acquired it from surrounding environment. Therefore, factors affecting mathematical aptitude comprised of both biological and environmental factors. Some of the factors affecting mathematical aptitude are:

1. Cognitive Factors:

Cognitive factors is one of the most important factors that effects mathematical aptitude which include working memory, numerical ability, intelligence and spatial reasoning. Working memory, spatial reasoning, and general intelligence play a significant role in mathematical performance (Geary, 2011).

- **Working Memory Capacity:**

Strong working memory aids in problem-solving and retaining intermediate steps (Ashcraft & Krause, 2007). Working memory capacity is crucial for complex mathematical problem-solving (Alloway & Alloway, 2010).

- **Numerical Fluency:**

The ability to quickly process and manipulate numbers impacts performance in mathematics (Dehaene, 1997).

Spatial Reasoning:

Helps in understanding geometric concepts and visualizing problems (Uttal et al., 2013).

- Intelligence:

Intelligence, particularly fluid intelligence (the ability to reason and solve novel problems), is a strong predictor of mathematical skills, and intelligence in childhood strongly predicts later mathematical achievement (Deary et al., 2007). High-IQ individuals tend to grasp abstract mathematical concepts more easily (Wai et al., 2009).

2. Biological and Genetic Factors:

Biological and genetic factors significantly influence an individual's mathematical aptitude. Research shows that certain brain structures, genetic predispositions, and neurodevelopmental profiles contribute to differences in mathematical ability from an early age.

- Innate Capacity:

Some individuals are genetically predisposed to have higher aptitude. Mathematical ability is heritable trait shaped by multiple genes that orchestrate protein expression in the brain (Skeide, 2020). Mathematical ability is determined by genetic and environmental factors which interact intricately, with genetic variance accounting for roughly 60% of behavioural variance (Rimfeld et al., 2018). According to a study conducted by Stanford University, mathematics abilities are fundamentally depended on an innate number sense (as cited in Finstad, 2022).

- Brain Development:

Differences in brain structure and function in the intraparietal sulcus (IPS) is specialized for numerical tasks, and its activation patterns predict mathematics performance (Dehaene et al., 2003). Infants with stronger activation in parietal regions show better early mathematics skills (Hyde et al., 2010).

3. Psychological Factors:

- Motivation and interest:

Research in educational psychology demonstrates that students with high intrinsic motivation and genuine interest in mathematics tend to develop stronger problem-solving skills, retain concepts longer, and perform better academically. Students who are intrinsically motivated in mathematics fosters deeper cognitive engagement and persistence in problem-solving tasks (Middleton & Spanias, 1999). Students with high interest are more likely to use deep learning strategies like critical thinking, logical reasoning and conceptual understanding rather than rote memorization (Schiefele, 2009). Interest enhances working memory and conceptual understanding by reducing cognitive load (Rotgans & Schmidt, 2014).

- Mathematics anxiety:

Mathematics anxiety which is a feeling of tension and fear of mathematics, has been shown to significantly impair mathematical aptitude across all age groups. Research demonstrates that this anxiety creates cognitive and affective barriers that reduce working memory resources, leaving less capacity for mathematical processing (Ashcraft & Krause, 2007; Beilock & Carr, 2005). High anxiety individuals show decreased activation in brain particularly dorsolateral prefrontal cortex during mathematical tasks (Young et al., 2012). Mathematics anxiety creates a vicious cycle where fear impairs mathematical ability, leading to further avoidance and skill deficits.

4. Environmental and Educational Factors:

- Socioeconomic Status and family background:

Studied in educational psychology and sociology, and cognitive development research have found that socioeconomic status and family background have influence mathematical aptitude. Fischer and Thierry (2021) found that family background of pre-school children effect both non-symbolic and symbolic mathematical skills where high-SES children consistently outperforming low-SES children. Higher-SES parents more frequently engage in numeracy-related activities fostering early mathematics skills (LeFevre et al., 2009).

Parental education is a significant component of family background that impacts children's mathematical development. Parents with higher levels of education are more likely to engage in numeracy-related activities at home, provide academic support, and communicate high expectations (Davis-Kean, 2005). Chronic financial stress in low-SES households can impair working memory and attentional control, critical for math learning (Blair & Raver, 2016). By influencing access to resources, cognitive stimulation, parental involvement, and emotional well-being, these factors can either enhance or inhibit a child's ability to succeed in mathematics.

- Curriculum design:

The design and implementation of mathematics curricula significantly influence the development of students' mathematical aptitude. When curricular content is either too advanced or not sufficiently challenging, it can hinder engagement and impede aptitude development. Research indicates that curriculum structure, content sequencing, and pedagogical approaches can either enhance or hinder mathematical understanding and problem-solving abilities (Schmidt et al., 2001). A well-sequenced curriculum supports the development of core competencies such as number sense, algebraic thinking, and spatial reasoning (Clements & Sarama, 2009). Inquiry-based or problem-centred curricula encourage critical thinking and exploration, which are key components of higher-order mathematical aptitude (Hiebert et al., 1997).

- Quality of Teaching and Instruction:

Mathematical aptitude can be enhanced and developed by using adaptive teaching methods which caters to different learning style and by adopting active learning technique that encourage critical thinking. This can be carried out by high-quality teaching of a skilled teachers. Inspiring teachers make mathematics interesting by linking to real life application and by incorporating puzzles, coding-decoding, number analogy, abstract formation of figures that can enhance mathematical thinking. Research demonstrates that effective teaching practices can enhance conceptual understanding, problem-solving skills, and positive

mathematical dispositions (Hattie, 2009; National Mathematics Advisory Panel, 2008). Inquiry-based learning improves problem-solving skills compared to traditional methods (Hiebert & Grouws, 2007).

5. Early Exposure, Practice and Development:

Early exposure to mathematics-related activities, consistent practice and personal development in mathematics enhance familiarity in mathematics, strengthening aptitude over time.

- Early Exposure to Mathematics:

Early exposure to mathematics plays a crucial role in shaping a child's mathematical aptitude, influencing cognitive development, problem-solving skills, and mathematical thinking skills. Early mathematics experiences, such as counting, sorting, and pattern recognition, strengthen foundational number sense (Duncan et al., 2007). Children exposed to mathematics at an early age show better performance in arithmetic and logical reasoning (Siegler & Ramani, 2009).

- Consistent Practice:

Research shows that consistent practice of mathematical tasks and regular engagement with mathematical problems strengthens cognitive skills, enhances problem-solving abilities, and improves long-term retention of mathematical concepts. Repeated practice helps automate basic arithmetic operations, enhancing cognitive abilities for higher-order problem-solving (Anderson, 1982).

- Persistence and Hard Work:

Persistence in learning mathematics means continuously struggling to master mathematics even when facing challenges or difficulties while hard work refers to the dedication and effort put into the learning process. Consistent practice and exposure to different mathematical concepts and problems can significantly enhance mathematical aptitude.

- Problem-Solving Strategies:

Learning and applying various problem-solving strategies can improve efficiency and effectiveness in tackling mathematical challenge.

1.7 SOCIOECONOMIC STATUS:

The position of an individual or family in the society, their economic condition and standard of living is known as socioeconomic status. It is usually measure by their income, occupation and educational background. Socioeconomic status (SES) is a relative term since the position of an individual is measured with respect to the position of others individual. It is compared socially and economically with the position of others in the society. SES of an individual is his position of powers, opportunities, prestige, respect and honour in the society. SES refers to the social and economic position of individuals or families in the society, encompassing dimensions such as income, education, occupation, and access to material assets and various kind of resources (Mistry et al., 2010). It is commonly used to categorize and analyse disparities in access to resources, opportunities, and privileges in a society. SES is not determined by a single factor; it is influenced by multiple interrelated factors. SES is a multidimensional construct that reflects an individual's or family's economic and social position relative to others, based on income, education, and occupation which is a key determinant of access to resources, opportunities, and overall quality of life (American Psychological Association [APA], 2023). Access to quality schools, hospitals, safety, and peer environments also factor into SES.

SES holds significant importance across various domains, especially in education, health, social mobility, and policy-making. Lower SES is linked to poorer health outcomes due to limited healthcare access and higher stress levels (Marmot, 2005). This is because higher SES groups have better access to healthcare facilities, preventive care, and health education. Children from higher SES backgrounds often have better academic performance due to enriched learning environments (Sirin, 2005). Higher SES parents are more likely to be involved in their children's education, which positively impacts academic performance. Children from higher

SES backgrounds often have access to better schools, private tutoring, educational materials, and extracurricular activities.

1.8 SOCIOECONOMIC STATUS AND EDUCATIONAL OUTCOMES

Socioeconomic status (SES) profoundly influences educational outcomes by shaping access to resources, opportunities, and support systems. Students from higher SES backgrounds benefit from enriched environments, including access to private tutoring, advanced learning materials, and extracurricular activities, which facilitate academic success (Maiti, 2017). Conversely, students from lower SES backgrounds often face challenges such as inadequate infrastructure, limited parental involvement, and financial constraints, hindering their academic progress (Pandey, 2017).

Interventions like free school meals, after-school programs, and equitable resource allocation can mitigate SES-related disparities (NCERT, 2005). Addressing the digital divide is also crucial in ensuring equitable access to technology and online learning resources (Dhoundiyal & Rawat, 2021). Promoting resilience and adaptability among students, particularly those from low-SES backgrounds, empowers them to overcome barriers and achieve academic success (UNESCO, 2019).

Socioeconomic status significantly influences educational experiences and outcomes, creating disparities that manifest in academic achievement, learning environments, and access to resources. Higher SES students generally have access to superior schools, advanced extracurricular programs, and extensive parental involvement, fostering a culture of academic excellence. For example, these students may participate in robotics clubs, advanced placement courses, or private tutoring sessions that enhance learning outcomes (Pandey, 2017). In contrast, lower SES students often attend underfunded schools with large class sizes, fewer experienced teachers, and limited technological resources. These disparities perpetuate systemic inequities, where lower SES students encounter barriers that limit their potential despite their aptitude (Maiti, 2017).

Neighborhoods also play a significant role in shaping the educational opportunities available to students. High-SES neighborhoods often provide enriched environments with access to libraries, safe recreational spaces, and community support programs, all of which contribute to academic growth. Conversely, low-SES neighborhoods frequently lack these essential amenities, further compounding educational disparities. The role of community engagement in bridging these gaps cannot be overstated. Initiatives like mentoring programs, after-school tutoring, and local educational workshops can create supportive ecosystems that enable students from low-SES backgrounds to thrive academically (UNESCO, 2019).

Digital inequality has emerged as a critical issue in SES-related educational outcomes. During the COVID-19 pandemic, students from lower SES backgrounds were disproportionately affected by the transition to online learning, as many lacked access to reliable internet, suitable devices, or quiet study spaces. This digital divide not only hindered their ability to participate in remote classes but also widened existing achievement gaps (Dhoundiyal & Rawat, 2021). Addressing digital inequality requires targeted policies, such as providing subsidized internet services and distributing devices to underprivileged students. Schools and governments must prioritize these initiatives to ensure equitable learning opportunities in an increasingly digitalized world.

Parental education and involvement are also integral to educational outcomes. Parents with higher educational attainment are more likely to value academic success, support structured learning environments, and engage in educational activities with their children. For instance, parents who are proficient in mathematics can help children with homework or introduce them to advanced mathematical concepts, fostering improved academic performance. In contrast, parents from lower SES backgrounds may face barriers such as limited time, financial stress, or lack of familiarity with educational content, which can impede their involvement in their children's education (Pandey, 2017).

Moreover, systemic factors such as school funding policies, teacher-student ratios, and curriculum design significantly influence how SES impacts educational

outcomes. Schools in low-income areas often struggle to attract and retain qualified teachers, leading to higher turnover rates and less consistent instruction. Implementing equitable funding models that allocate resources based on student need, rather than property taxes, can address these systemic disparities. Policymakers must also prioritize investments in teacher training, infrastructure, and extracurricular programs to create equitable learning environments (Maiti, 2017).

1.9 INTERRELATIONSHIP AMONG ACHIEVEMENT, APTITUDE, AND SOCIOECONOMIC STATUS

The interplay among academic achievement in mathematics, mathematical aptitude, and socioeconomic status (SES) is complex, reflecting a dynamic relationship between intrinsic abilities and extrinsic influences. Mathematical aptitude, defined as an individual's natural or developed capacity for understanding and applying mathematical concepts, serves as both a predictor and a determinant of academic achievement. However, the extent to which aptitude translates into measurable success often depends on SES, which moderates access to resources, opportunities, and support systems (Bloom, 1956).

Students with high mathematical aptitude generally excel in tasks requiring abstract reasoning, logical problem-solving, and quantitative analysis. However, SES plays a pivotal role in shaping the environments where these aptitudes can be nurtured. High-SES students typically benefit from enriched learning environments, including access to advanced learning materials, private tutoring, and extracurricular activities that amplify their potential. In contrast, low-SES students may struggle to realize their capabilities due to systemic barriers such as underfunded schools, inadequate infrastructure, and limited academic support (Maiti, 2017).

The interrelationship also encompasses motivational and psychological factors influenced by SES. High-SES students often exhibit greater self-efficacy and intrinsic motivation, fostered by stable home environments, parental encouragement, and access to role models. Conversely, low-SES students may face heightened stress, reduced confidence, and a lack of exposure to academic role models, which can hinder their ability to perform at their full potential (Dhoundiyal & Rawat, 2021).

Addressing these disparities requires targeted interventions that promote resilience, mentorship, and positive reinforcement among low-SES students.

Policy interventions aimed at bridging the gap between aptitude and achievement must address both intrinsic and extrinsic factors. For instance, providing equitable access to resources, such as advanced coursework and extracurricular opportunities, ensures that students from all SES backgrounds can nurture their mathematical potential. Community-based initiatives, including mentorship programs and after-school tutoring, can further support students in overcoming systemic barriers (UNESCO, 2019).

The integration of technology into mathematics education offers additional pathways for mitigating SES-related disparities. Digital tools, such as adaptive learning platforms and online tutorials, provide personalized instruction tailored to individual learning needs. However, ensuring equitable access to these technologies is crucial to prevent the digital divide from exacerbating existing inequities. By combining technological innovations with supportive policies, educators and policymakers can create a more inclusive educational landscape (Warrier & Baron-Cohen, 2016).

Ultimately, understanding the interrelationship among achievement, aptitude, and SES requires a holistic approach that considers cognitive, emotional, and environmental factors. By addressing systemic inequities and fostering inclusive practices, educators can create environments where all students, regardless of their socioeconomic background, have the opportunity to achieve their full potential in mathematics.

1.10 RATIONALE OF THE STUDY

The importance of mathematics in modern education cannot be overstated. Mathematics is integral to fostering logical reasoning, analytical thinking, and problem-solving skills, all of which are critical for academic success and daily life. Despite its significance, mathematics often poses challenges to students, parents, and educators. For many students in Mizoram, particularly at the secondary school level, low academic achievement in mathematics has been a persistent issue. This

underperformance is of particular concern given that mathematics serves as a foundational subject for numerous academic and professional disciplines, including science, technology, engineering, and mathematics (STEM). Failure in mathematics has far-reaching implications, limiting students' career opportunities and diminishing their prospects for higher education (Maiti, 2017).

One of the key factors influencing academic achievement in mathematics is mathematical aptitude—an inherent or acquired ability to understand and solve mathematical problems. Mathematical aptitude, as described by Mangal (2019), involves cognitive skills such as logical reasoning, numerical ability, and abstract thinking. However, in Mizoram, there is a lack of research focusing specifically on the mathematical aptitude of secondary school students and how it influences their academic achievement. Without a clear understanding of students' mathematical aptitude, educators and policymakers are ill-equipped to design effective teaching strategies and curricula that address the diverse needs of learners. Additionally, socioeconomic status (SES) plays a significant role in shaping students' educational experiences and outcomes. SES encompasses factors such as family income, parental education, and occupational status, all of which impact access to educational resources, quality of instruction, and learning environments (Pandey, 2017). Students from higher SES backgrounds often enjoy advantages such as private tutoring, advanced learning materials, and supportive home environments. Conversely, students from lower SES backgrounds face barriers including inadequate resources, limited parental involvement, and financial constraints, all of which negatively affect their academic performance (Dhoundiyal & Rawat, 2021).

The interplay between mathematical aptitude, academic achievement, and SES underscores the need for a comprehensive study that examines these relationships in the context of secondary school students in Mizoram. Such research is particularly important for addressing systemic inequities and improving educational outcomes. By identifying the levels of mathematical aptitude among students and understanding how SES influences achievement, this study aims to provide actionable insights for educators, policymakers, and curriculum designers. Furthermore, the study seeks to address critical gaps in the literature. While previous

studies have explored the relationship between mathematical aptitude and achievement in other regions (Narula, 2007; Bala, 2014; Kaur, 2016), there is limited research focusing on Mizoram. This gap is significant given the unique sociocultural and economic context of the state. Mizoram's educational landscape is characterized by challenges such as limited access to advanced learning tools, disparities between rural and urban schools, late start of formal education, and varying levels of parental involvement. A focused investigation into these issues can help illuminate the specific factors contributing to low achievement in mathematics and inform targeted interventions.

Another rationale for the study lies in its potential to contribute to policy development. Findings from this research can inform the design of inclusive and equitable educational policies that address the needs of diverse student populations. For instance, understanding the role of SES in shaping academic achievement can guide resource allocation to underprivileged schools, ensuring that all students have access to quality education. Similarly, insights into mathematical aptitude can help educators adopt differentiated instruction methods that cater to varying levels of ability. The study also aims to empower teachers by equipping them with a deeper understanding of the factors influencing students' mathematical performance. Effective teaching requires more than subject knowledge; it demands an awareness of students' abilities, learning styles, and socioeconomic backgrounds. By highlighting the interplay between these factors, the research can help teachers adopt evidence-based practices that enhance learning outcomes.

From a broader perspective, the study aligns with global educational goals, particularly those emphasizing equity and inclusivity. The United Nations' Sustainable Development Goal 4 advocates for inclusive and equitable quality education, with a focus on eliminating disparities in educational outcomes. This study contributes to these objectives by addressing the root causes of underachievement in mathematics and proposing solutions to bridge gaps in access and achievement.

Finally, the study is timely given the increasing emphasis on STEM education in India. As the country aspires to become a global leader in science and technology, it is imperative to strengthen the mathematical foundation of students. Enhancing achievement in mathematics at the secondary school level is a critical step toward this goal, as it prepares students for advanced studies and careers in STEM fields. By investigating the factors that influence mathematical performance in Mizoram, this study aims to contribute to the broader effort of building a scientifically literate and capable workforce. Hence, the rationale for this study is rooted in its potential to address pressing educational challenges in Mizoram and contribute to the broader discourse on mathematics education. By examining the relationships among academic achievement, mathematical aptitude, and SES, the research aims to provide a nuanced understanding of the factors influencing students' performance. The findings are expected to have significant implications for teaching practices, curriculum design, and policy development, ultimately contributing to the goal of equitable and quality education for all students in Mizoram.

1.11 RESEARCH QUESTIONS

The study is guided by the following research questions, which aim to investigate the interplay between academic achievement, mathematical aptitude, and socioeconomic status among secondary school students in Mizoram:

1. What are the levels of academic achievement in Mathematics among secondary school students in Mizoram?
2. What are the levels of mathematical aptitude of secondary school students in Mizoram?
3. What are the levels of socioeconomic status of secondary school students of Mizoram?
4. Is there any relationship between academic achievement in mathematics and mathematical aptitude among secondary school students of Mizoram?
5. Is there any relationship between academic achievement in mathematics and socioeconomic status among secondary school students of Mizoram?

6. Is there any relationship between mathematical aptitude and socioeconomic status among secondary school students of Mizoram?
7. Is there any relationship between academic achievement in mathematics and dimensions of socioeconomic status among secondary school students of Mizoram?
8. Is there any relationship between mathematical aptitude and dimensions of socioeconomic status among secondary school students of Mizoram?
9. Is there any significant difference in the academic achievement in mathematics among secondary school students with respect to gender, locale and type of management of the school?
10. Is there any significant difference in the academic achievement in mathematics between male and female secondary school students of Mizoram based on locale and type of management of school?
11. Is there any significant difference in the mathematical aptitude of secondary school students with respect to their gender, locale, and type of management of the school?
12. Is there any significant difference in the mathematical aptitude between male and female secondary school students of Mizoram based on locale and type of management of school?
13. Is there any significant difference in the socioeconomic status of secondary school students with respect to their locale and type of management of the school?

These research questions aim to provide a comprehensive understanding of the factors influencing mathematical performance and to identify actionable solutions to address disparities in achievement.

1.12 STATEMENT OF THE PROBLEM

Mathematics is widely regarded as one of the most critical subjects in the school curriculum due to its role in fostering logical reasoning, problem-solving, and analytical skills. However, despite its importance, many secondary school students in Mizoram face challenges in achieving proficiency in mathematics. This

underachievement is compounded by a lack of research on the factors influencing mathematical performance in the region, particularly in relation to mathematical aptitude and socioeconomic status (SES).

The problem of low achievement in mathematics has far-reaching implications for students, educators, and policymakers. Poor performance in mathematics not only limits students' academic and career opportunities but also undermines their confidence and motivation. In a state like Mizoram, where educational resources are often unevenly distributed, understanding the root causes of these challenges is critical for devising effective interventions. The present study seeks to address this gap by investigating the relationship between academic achievement in mathematics, mathematical aptitude, and SES among secondary school students in Mizoram. By examining these interrelated factors, the study aims to provide a nuanced understanding of the barriers to mathematical achievement and to identify strategies for overcoming them. The research also seeks to inform policy and practice by highlighting the role of SES in shaping educational outcomes and by proposing targeted interventions to support students from diverse backgrounds.

Thus, the problem of the present study has been stated as “**Academic Achievement in Mathematics among Secondary School Students of Mizoram in Relation to their Mathematical Aptitude and Socioeconomic Status**”.

1.13 OBJECTIVES OF THE STUDY

The objectives of this study are designed to address critical gaps in the understanding of how mathematical aptitude, academic achievement, and socioeconomic status interact within the context of secondary school students in Mizoram. These objectives provide a roadmap for systematically exploring these relationships and generating actionable insights. The following are the objectives for the present research:

1. To construct and standardize Mathematical Aptitude Test (MAT) for secondary school level of education.
2. To find out the academic achievement in mathematics among secondary school students of Mizoram.

3. To find out the mathematical aptitude of secondary school students of Mizoram.
4. To find out the socioeconomic status of secondary school students of Mizoram.
5. To compare the academic achievement in mathematics among secondary school students of Mizoram based on:
 - i) Gender
 - ii) Locality
 - iii) Type of school management
6. To conduct gender-based comparison on academic achievement in mathematics among secondary school students of Mizoram based on
 - i) Locality
 - ii) Type of school management.
7. To compare the mathematical aptitude among secondary school students of Mizoram based on:
 - i) Gender
 - ii) Locality
 - iii) Type of school management
8. To conduct gender-based comparison on mathematical aptitude among secondary school students of Mizoram based on:
 - i) Locality
 - ii) Type of school management.
9. To compare the socioeconomic status among secondary school students of Mizoram based on
 - i) Locality
 - ii) Type of school management
10. To find out the relationship between academic achievement in mathematics and mathematical aptitude among secondary school students of Mizoram.
11. To find out the relationship between academic achievement in mathematics and socioeconomic status among secondary school students of Mizoram.
12. To find out the relationship between mathematical aptitude and socioeconomic status among secondary school students of Mizoram.

13. To find out the relationship between academic achievement in mathematics and dimensions of socioeconomic status among secondary school students of Mizoram.
14. To find out the relationship between mathematical aptitude and dimensions of socioeconomic status among secondary school students of Mizoram.
15. To compare academic achievement in mathematics between high and low socioeconomic status dimensions.

1.14 HYPOTHESES OF THE STUDY

The hypotheses of this study have been formulated to test specific relationships and differences among the variables under investigation. These hypotheses provide a structured approach to examining the interplay between mathematical aptitude, academic achievement, and socioeconomic status:

1. There is a significant difference in academic achievement in mathematics between male and female secondary school students of Mizoram.
2. There is a significant difference in academic achievement in mathematics between urban and rural secondary school students of Mizoram.
3. There is a significant difference in academic achievement in mathematics between government and private secondary school students of Mizoram.
4. There is a significant difference in academic achievement in mathematics between male and female of urban secondary school students of Mizoram.
5. There is a significant difference in academic achievement in mathematics between male and female of rural secondary school students of Mizoram.
6. There is a significant difference in academic achievement in mathematics between male and female of government secondary school students of Mizoram.
7. There is a significant difference in academic achievement in mathematics between male and female of private secondary school students of Mizoram.
8. There is a significant difference in mathematical aptitude between male and female secondary school students of Mizoram.
9. There is a significant difference in mathematical aptitude between urban and rural secondary school students of Mizoram.

10. There is a significant difference in mathematical aptitude between government and private secondary school students of Mizoram.
11. There is a significant difference in mathematical aptitude between male and female of urban secondary school students of Mizoram.
12. There is a significant difference in mathematical aptitude between male and female rural secondary school students of Mizoram.
13. There is a significant difference in mathematical aptitude between male and female government secondary school students of Mizoram.
14. There is a significant difference in mathematical aptitude between male and female private secondary school students of Mizoram.
15. There is a significant difference in socioeconomic status between urban and rural secondary school students of Mizoram.
16. There is a significant difference in socioeconomic status between government and private secondary school students of Mizoram.
17. There is a significant relationship between academic achievement in mathematics and mathematical aptitude among secondary school students of Mizoram.
18. There is a significant relationship between academic achievement in mathematics and socioeconomic status among secondary school students of Mizoram.
19. There is a significant relationship between mathematical aptitude and socioeconomic status among secondary school students of Mizoram.
20. There is a significant relationship between parental education and academic achievement in mathematics among secondary school students of Mizoram.
21. There is a significant relationship between parental occupation and academic achievement in mathematics among secondary school students of Mizoram.
22. There is a significant relationship between family income and academic achievement in mathematics of secondary school students in Mizoram.
23. There is a significant relationship between family assets and academic achievement in mathematics of secondary school students in Mizoram.

24. There is a significant relationship between parental socio-religious position and academic achievement in mathematics of secondary school students in Mizoram.
25. There is a significant relationship between parental education and mathematical aptitude of secondary school students in Mizoram.
26. There is a significant relationship between parental occupation and mathematical aptitude of secondary school students in Mizoram.
27. There is a significant relationship between family income and mathematical aptitude of secondary school students in Mizoram.
28. There is a significant relationship between family assets and mathematical aptitude of secondary school students in Mizoram.
29. There is a significant relationship between parental socio-religious position and mathematical aptitude of secondary school students in Mizoram.
30. There is a significant difference in academic achievement in mathematics between high and low parental education levels among secondary school students of Mizoram.
31. There is a significant difference in academic achievement in mathematics between high and low parental occupation levels among secondary school students of Mizoram.
32. There is a significant difference in academic achievement in mathematics between high and low family income among secondary school students of Mizoram.
33. There is a significant difference in academic achievement in mathematics between high and low family assets among secondary school students of Mizoram.
34. There is a significant difference in academic achievement in mathematics between high and low parental socio-religious position among secondary school students of Mizoram.

1.15 OPERATIONAL DEFINITION OF THE TERM USED

In any research, the clarity and consistency of terminology are paramount for ensuring validity and reliability. The operational definitions provided here delineate the specific meanings of key terms as they are used within the context of this study. These definitions establish the framework for data collection, analysis, and interpretation, thereby enhancing the precision and replicability of the research findings. For the present study, the operational definitions of the terms used are as follows:

Academic Achievement in Mathematics: Academic achievement in mathematics is operationally defined as the measurable success or proficiency a student demonstrates in mathematics-related tasks and assessments. For this study, it is specifically quantified by the marks scored in mathematics in the Class 9 annual examination. These scores serve as a measure of a student's mathematics competency and academic achievement in mathematics at the secondary school level.

Mathematical Aptitude: In the context of this study, mathematical aptitude refers to a student's inherent or developed ability to understand and apply mathematical concepts to solve problems. This includes competencies such as numerical ability, ability to use symbol and formula, logical reasoning, pattern recognition, and spatial visualization. Mathematical aptitude is assessed using a standardized test designed to measure these skills comprehensively. It reflects not only a natural propensity for mathematical thinking but also the extent of prior learning and cognitive development in mathematical contexts.

Socioeconomic Status (SES): Socioeconomic status is a multi-dimensional construct that reflects the economic and social standing of a family. It is determined by three primary factors: parental education levels, family income, and occupational status. In this study, SES is categorized into three levels: low, middle, and high, based on a validated SES scale. This classification provides insights into how economic resources, educational background, and occupational roles influence students' access to educational opportunities and outcomes.

Secondary School Students: Secondary school students, for the purposes of this study, refer to individuals enrolled in Class 10 within secondary schools in Mizoram. These students represent a critical stage in their academic journey, having successfully completed Class 9 and preparing for the HSLC examination. This cohort is chosen because their academic performance and aptitude at this level are pivotal for determining future educational and career trajectories.

These operational definitions establish a clear framework for the terms used in this study, ensuring precision and consistency in data collection, analysis, and interpretation.

1.16 DELIMITATIONS OF THE STUDY

This study is delimited to specific parameters to ensure clarity, feasibility, and relevance within the research context. It is focused exclusively on secondary school students enrolled in Class 10 in Mizoram, who are preparing for the High School Leaving Certificate (HSLC) examination. This specific cohort is chosen due to the critical nature of this academic stage, which often determines future educational and career pathways.

The primary variables under investigation are mathematical aptitude, academic achievement in mathematics, and socioeconomic status. Other factors that may influence academic performance, such as curriculum, attitude toward mathematics, parental involvement, teaching methodologies, peer dynamics, or psychological factors, are beyond the scope of this study. While these factors are recognized as significant, the study prioritizes a concentrated examination of the chosen variables to provide focused insights.

Geographically, the study is limited to the state of Mizoram. It encompasses both urban and rural secondary schools to ensure a comprehensive understanding of the educational landscape and its disparities. However, the study does not include private coaching centers, alternative education systems, or institutions outside the formal school framework. The data collection methods involve the use of standardized tests to measure mathematical aptitude and validated socioeconomic status scales. Academic achievement is evaluated based on class IX annual

examination scores. These assessment methods may lack reliability and consistency, as the varying question papers across different schools introduce disparities in evaluation. Additionally, the findings may not be generalizable to other regions or educational contexts due to Mizoram's unique sociocultural and economic characteristics.

Furthermore, the study's temporal scope is limited to one academic year. This timeframe allows for a detailed examination of current trends and relationships among the variables but does not account for longitudinal changes or long-term impacts. By delineating the scope in this manner, the study aims to provide actionable and context-specific insights while acknowledging its inherent limitations.

CHAPTER II

REVIEW OF RELATED LITERATURE

The review of related literature is a fundamental component of academic research, providing a comprehensive understanding of existing knowledge, theories, and findings related to the study. It serves as both a road map and a foundation upon which new research is built, helping to identify gaps, establish context, providing ideas, theories and explanations. By critically analysing previous studies, researchers can refine their research questions, avoid duplication, and bridge connecting the current research with existing scholarly works.

This review synthesizes empirical studies and theoretical perspectives to explore how mathematical aptitude and socioeconomic status interact to shape students' achievement in mathematics. By analysing previous research, this chapter aims to identify gaps in the literature and establish a theoretical framework for understanding the complex dynamics that influence academic achievement in mathematics among secondary school students. The findings will provide a foundation for the current study and contribute to the broader discourse on improving research work by means of providing much needed information.

2.1 INTRODUCTION

Review of related studies is divided into six categories: i) studies on construction and standardization of mathematical aptitude test ii) studies on academic achievement in mathematics iii) studies on mathematical aptitude iv) studies on academic achievement in mathematics in relation to mathematical aptitude v) studies on academic achievement in mathematics in relation to socioeconomic status vi) studies on theories, trend and practices in mathematics education. The researcher reviewed a total of 86 literature related to different objectives, comprising 34 conducted outside India, 45 from various regions across India, and the remaining 7 conducted specifically in Mizoram. The selected literature encompasses a 78-years period, extending from 1947 to 2025. The following table provides a systematic

overview of the studies reviewed, delineating their chronological span (1947–2025) and their distribution across international and Indian contexts -

Table 2.1

Details of related literature reviewed

Sl. No.	Studies with reference to location	Span of Years	Total
1	Studies on construction and standardization of Mathematical Aptitude Test (MAT) conducted outside India	1947-2021	4
2	Studies on academic achievement in mathematics conducted outside India	2010-2024	5
3	Studies on mathematical aptitude conducted outside India	2005-2011	3
4	Studies on academic achievement in mathematics in relation to mathematical aptitude conducted outside India	1958-2021	3
5	Studies on academic achievement in mathematics in relation to socioeconomic status conducted outside India	1991-2024	17
6	Studies on theories, trend and practices in mathematics education conducted outside India	2014	2
7	Studies on construction and standardization of Mathematical Aptitude Test (MAT) conducted in India	2007-2014	4
8	Studies on academic achievement in mathematics conducted in India	1998-2025	13
9	Studies on mathematical aptitude conducted in India	1988-2023	9

10	Studies on academic achievement in mathematics in relation to mathematical aptitude conducted in India	1996-2018	7
11	Studies on academic achievement in mathematics in relation to socioeconomic status conducted in India	2014-2024	8
12	Studies on theories, trend and practices in mathematics education conducted in India	1988-2020	4
13	Studies on academic achievement in mathematics conducted in Mizoram	2011-2021	3
14	Studies on academic achievement in mathematics in relation to socioeconomic status conducted in Mizoram	2014-2024	2
15	Studies on theories, trend and practices in mathematics education conducted in Mizoram	1988-2020	2
Total			86

2.2 STUDIES CONDUCTED OUTSIDE INDIA

Studies conducted outside India were divided into six distinct groups.

1. Studies on construction and standardization of Mathematical Aptitude Test (MAT) outside India.
2. Studies on academic achievement in mathematics conducted outside India.
3. Studies on mathematical aptitude conducted outside India.
4. Studies on academic achievement in mathematics in relation to mathematical aptitude conducted outside India.
5. Studies on academic achievement in mathematics in relation to socioeconomic status conducted outside India.

6. Studies on theories, trend and practices in mathematics education conducted outside India.

2.2.1 Studies on construction and standardization of Mathematical Aptitude Test (MAT) outside India

Bennett et al. (1947) designed Differential Ability Test (DAT) to measure a variety of aptitude including aptitude related to mathematical ability in students. The test was used to aid educational and vocational guidance for students of Grade 8 to 12. The DAT consist of seven dimensions of mathematics such as: verbal reasoning which contain 50 items, numerical ability which contain 40 items, abstract reasoning – 50 items, space relation – 60 items, mechanical reasoning – 70 items, clerical speed and accuracy – 100 items, and 160 items for language usage (spelling and sentences). Split half method was used for reliability test. For this, the reliability coefficients were corrected by Spearman Brown formula. The reliability coefficient was found to be 0.87 to 0.94 for boys and 0.80 to 0.94 for girls. For clerical speed and accuracy test, the reliability coefficient was calculated and it was found to be 0.79 to 0.89 for boys and 0.90 to 0.93 for girls. For test of validity, the test was measured on the basis of coefficient between DAT and grades. The test should also be applicable to use in counselling, placement and selection procedures. For establishing norms, the test was administered to 47000 students from 100 schools in various states of USA. The scores were converted to percentile to avoid falsify accuracy. Separate norms were established for boys and girls. Separate norms were also established based on the grades.

Brown et al. (2012) developed Test of Mathematical Abilities (TOMA). The test items consisted of four dimensions of mathematics and one supplement subset: (i) mathematical symbols and concepts (ii) computation (iii) mathematics in everyday life (iv) word problems (v) attitude toward mathematics (supplement). The test was administered to 1456 students from 21 states in United States of America. Reliability test is conducted in three ways: i) Cronbach's alpha test method (ii) test-retest method (iii) scorer differences method. Using Cronbach's alpha test method, the coefficient test reliability is found to be 0.96, which was nearly perfect reliability. For

test-retest method, test items was administered to 51 students from Texas state. The test was administered again after 14 days. The reliability coefficient was calculated and it was found to exceed 0.80. Using scorer differences method, 23 male students and 27 female students who complete the test were selected randomly. The scoring of the two groups were correlated and was found to exceed 0.90. For validity test, the mean of the standard score and standard deviation of Test of Mathematical Abilities (TOMA) and mathematical ability measured were calculated. The mean differences of the two tests were analysed using t-test and it was found that there was no significant differences. These findings provided strong evidence supporting the validity of the test.

Aliyu and Akinoso (2016) developed a Mathematical Aptitude Test (MAT) using Rasch model and 2-PL model of Item Response Theory (IRT). The test originally contained 150 items and it is divided into three components which includes: Verbal Aptitude test, Abstract Aptitude Test and Numerical/Quantitative Aptitude Test. The 150 test items in the MAT covered the six levels of cognitive domain of Bloom's taxonomy such as knowledge, comprehension, application, analysis, synthesis and evaluation. The sample of the study consists of 600 secondary school students studying class 10. After the experimental try-out, 120 test items were drawn using the Classical Test Theory (CTT) method. Test items were analysed by finding difficulty index and discrimination index. Coefficient of reliability was established by using Kuder-Richardson formular 20 (KR-20) and it was found to be 0.86.

Chinyere et al. (2021) constructed and standardized mathematics achievement test for senior secondary school students. The test consists of seven content areas such as Set, Geometry, Statistics, Indices & Logarithm, Fraction, Decimal & Percentage, Numbers and Quadratic equations. Each of the content areas were based on six cognitive domains namely Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation. The total number of test items were 80. Each of the test items were developed in Multiple Choice Question (MCQ) with five options ranging from A to E. For trial testing, the test items were administered to 300 students selected from three secondary schools in Anambra state. Analysis of test

items was carried out by computing difficulty index and discriminative power. Items with discriminative power above 0.20 and difficulty index between 0.3 to 0.7 were selected. After items analysis, 40 items were deleted and the remaining other 40 items were subjected to reliability test. For reliability test, split half method was adopted. The test items were administered to 32 students. Reliability of coefficient was calculated by using product moment correlation and it was found to be 0.76, whereas by using Spearman-Brown prophecy formula, it was found to be 0.86. For validity test, the test items were checked and examined by subject specialists. For determination of test norms, the newly constructed test items were administered to 1000 students. The test scores were analysed to establish the required norms.

2.2.2 Studies on academic achievement in mathematics conducted outside India

Lindberg et al. (2010) conducted a meta-analysis of data on mathematics performance of students from 242 studies published between 1990 and 2007 which represent the testing of 1,286,350 students. Second, data were analysed from large data sets based on probability sampling of U.S. adolescents over the past 20 years. The study highlighted about gender stereotype in mathematics that prevail in the society. Stereotype which emphasised that male students are superior than female students in mathematics related subjects. Contrary to this belief, the study found that male and female perform similarly in mathematics. It was also found that gender differences have significantly decreased in recent decades, likely due to increased female participation in STEM and educational reforms.

Nazeri and Entezar (2017) examined gender differences in mathematics achievement. The sample of the study comprised of 400 Iranian secondary school students in Tehran. Samples are selected from 232 boys and 168 girls based on stratified random sampling. The data have been collected with the assist from Ministry of Education. The researcher used the mathematics marks scored in final examination for evaluating final examination. Demographic information of the participants such as age, gender was also collected. From the analysis of respondents, 70.5 percent of them were under 17 years old. The findings of the study indicated that girls outperformed boys in achievement in mathematics.

Jiang (2021) investigated gender differences in mathematics academic performance of high school students in western China. The sample of the study consisted of 2800 secondary school students which were randomly selected from score data. Mathematics performance of students was evaluated from the result of China's high school mathematics academic proficiency test. The test was organised and conducted by the provincial education administration in western China. The test comprehensively evaluated the mathematical knowledge and mathematical abilities of senior secondary school students. The test papers consisted of 30 questions including 20 multiple-choice questions, 6 fill in the blank questions, and 4 long answer questions. The findings of the study show that female students have significantly better academic performance in mathematics than that of male students. On the other hand, it was also found that there is no significant difference between male students and female students in three mathematical abilities dimensions which are abstraction, logical reasoning and intuitive imagination.

Shehzadi et al. (2022) conducted a comparative study on academic achievement in mathematics, engagement and self-regulated in mathematics between private and public school. Proportionate sampling technique was employed and 80 schools, both private and public schools, were selected for the study. The study was designed to improve the achievement in mathematics. The total sample comprised of 1000 students studying Grade 9 in Lahore districts, Pakistan. The study found that:

- 1) Private school have higher academic achievement in mathematics than public school.
- 2) Private school has shown more engagement toward learning mathematics compare to public school.
- 3) Private school were more self-regulated learner in mathematical classroom compare to public school.

Mohammadpour and Yon (2024) offered a comprehensive examination of the disparities in mathematics achievement between rural and urban secondary schools in Malaysia. Utilizing data from the Trends in International Mathematics and Science Study (TIMSS) spanning from 1999 to 2015, the researchers employed multilevel

modelling to dissect the influences of various student-level and school-level factors on mathematics performance. The study found that:

- 1) For student-level factors, individual attributes such as self-concept, attitudes toward mathematics, educational aspirations, and parental education were found to significantly impact mathematics achievement in both rural and urban schools.
- 2) For school-level factors, elements like school size, class size, teacher experience, and resource availability had a more pronounced effect on student achievement in urban schools compared to rural ones.
- 3) Urban schools pronounced a stronger relationship between self-concept and mathematics achievement compared to rural schools.
- 4) There is a significantly correlation between attitudes towards mathematics and mathematics achievement in various years where urban schools show slightly stronger correlation than rural schools.
- 5) Urban schools and rural schools have similar correlation between utility value and mathematics achievement for different years.
- 6) In urban areas, students' socioeconomic status showed a stronger correlation with mathematics performance, highlighting the influence of compositional factors in these settings.
- 7) The study suggests investing in early childhood education programs, particularly in rural areas and promoting positive self-concept and attitudes toward mathematics through collaborative efforts involving educators, parents, and communities.

2.2.3 Studies on mathematical aptitude conducted outside India

Hyde (2005) challenged the notion that gender gaps in mathematics performance stem primarily from innate biological differences. Instead, meta-analyses of her study suggest that observed differences are small, context-dependent, and heavily influenced by sociocultural factors. The study review 46 meta-analyses and it was found that:

- 1) There is no consistent biological mechanism explains variation in brain structure between male and female that linked to mathematical abilities.
- 2) Male and female are almost similar in most of the psychological variables that are connected to mental abilities, but not all of them.
- 3) Testosterone exposure in male has been weakly correlated with spatial skills, but not general mathematics ability.
- 4) Twin studies show mathematics ability is heritable, but no "mathematics gene" is gender-linked.
- 5) Female students now match or outperform male students in mathematics grades and standardized tests in many countries.
- 6) In gender-equal countries (e.g., Sweden, Iceland), mathematics achievement gaps disappear or reverse whereas in nations with strong gender stereotypes (e.g., Turkey, India), gaps are larger, implying socialization plays a key role

Spelkes (2005) examined the cognitive sex differences description of male and female in high-level careers in mathematics and science. The study found that there is no difference in the cognitive abilities at the foundations of mathematical and scientific thinking between male and female infants. They have similar abilities to understand and learn about numbers, mathematical objects, language, and space.

Olatoye and Aderogba (2011) explored the performance of senior secondary school students in aptitude test. The test measured the verbal, numerical abilities and general aptitude of the students. The study found that:

- 1) Numerical abilities and verbal abilities are predictor of general aptitude.
- 2) There is a positive correlation between numerical abilities, verbal abilities and general aptitude.
- 3) Male and female students do not differ in numerical ability, verbal ability and general aptitude.
- 4) The study recommended the school should develop curricula that enables to improve the skills of student in numerical and verbal ability.

2.2.4 Studies on academic achievement in mathematics in relation to mathematical aptitude conducted outside India

Wrigley (1958) conducted a study on the factorial ability in elementary mathematics. The study investigated the structure of mathematical ability by factorial analysis. The study found that:

- 1) There is a close relationship between mathematical ability and general ability, and it is a significant factor for academic achievement in mathematics.
- 2) Performance in geometry is correlated with spatial ability as measured by spatial factor.
- 3) Performance in arithmetic and algebra is correlated with numerical ability as measured by number factor.
- 4) Performance of verbal ability has weak correlation with mathematical ability.

Rosemary and Ibibo (2019) examined the relationship between academic achievement in mathematics and quantitative reasoning ability. Mathematics Cognitive Achievement Test (MCAT) and Quantitative Reasoning Ability Test (QRAT) were used for collecting data by administering test to students. A sample of 61 students were selected from junior secondary school students in Nigeria. The study found that

- 1) There is a positive significant relationship between students' achievement in mathematics and their quantitative reasoning ability.
- 2) There is a positive significant relationship between female students' achievement in mathematics and their quantitative reasoning ability.
- 3) There is a positive significant relationship between male students' achievement in mathematics and their quantitative reasoning ability.

Sugano and Mamolo (2021) assessed and analysed students' aptitude and academic performance among Grade 10 students. National Career Assessment Examination (NCAE) results and academic performance of Grade 10 students were

analysed. Technical-Vocational (T.V.) and Academic Track (AT) were determined for this study. The study found that:

- 1) Majority of the students performed on the average to high aptitude level in General Scholastic Aptitude (GSA), Technical-Vocational Aptitude (TVA), and Academic Track (AT).
- 2) 46% of the students performed above average level in Technical-Vocational Aptitude (TVA) which shows that they have poor aptitude performance in TVA domain.
- 3) There is a positive relationship between mathematical ability and students' academic performance in mathematics.
- 4) Students performed better in Academic Track (AT) than in the Technical-Vocational Aptitude (TVA).

2.2.5 Studies on academic achievement in mathematics in relation to socioeconomic status conducted outside India

Brown (1991) investigated how gender and socioeconomic status (SES) influence reading skills and mathematics achievement. The study first examined gender differences, finding that while girls tend to perform slightly better in reading, the gender gap in mathematics achievement is negligible when controlling for other factors. This challenges common stereotypes about innate gender-based math abilities and suggests that observed differences may stem from social or cultural influences rather than biological determinism. The study found that while gender differences in mathematics performance were minimal, SES significantly impacts achievement levels, with higher-SES students outperforming their lower-SES peers. The research highlights the persistent role of economic disparities in shaping educational outcomes, suggesting that SES-related resource inequalities contribute more substantially to achievement gaps than gender. Brown's findings emphasize the need for targeted interventions to address socioeconomic barriers in education.

Zhan (2006) investigated the effects of parental assets with their expectations on students' performance in mathematics. Data were collected through the analysis of the mother-child data set of the National Longitudinal Survey of Youth (NLSY79).

The study founded that there is a positive and significant relationship between parental assets and students' achievement in mathematics. It was also found that parental assets were positively correlated with parental expectation and involvement of school activities.

Shanks (2007) examined the impact of household wealth on child development, emphasizing how economic resources shape cognitive, emotional, and physical outcomes. The study highlights that wealthier households provide better access to educational materials, nutrition, and stable environments, fostering positive development. Conversely, children from low-wealth families face higher risks of developmental delays due to limited resources and increased stress. The review also notes that wealth effects persist even after controlling for income, suggesting that assets and long-term stability play a critical role. The researcher calls for policies addressing wealth inequality to mitigate disparities in child development. The overall findings revealed that family wealth is a significant predictor for the achievement in mathematics.

Chudgar and Luschei (2010) in their study "Does Inequality Influence the Impact of Schools on Student Mathematics Achievement? A Comparison of Nine High-, Medium-, and Low-Inequality Countries" found that:

- 1) Schools in high-inequality countries demonstrated greater effectiveness in reducing socioeconomic disparities when classrooms were socioeconomically diverse.
- 2) Broader societal inequalities were found to significantly impact the overall effectiveness of schools in improving mathematics outcomes, underscoring the limitations of educational interventions alone.
- 3) Equitable access to quality education was emphasized as a critical measure for addressing socioeconomic gaps in student performance.
- 4) Recommendations included addressing societal inequalities outside the school system to complement educational reforms and create a more equitable learning environment.

Kodippili (2011) study the effects of parents' education level in students' mathematics achievement. The data for the study was drawn from the database of 232 schools from 48 countries that participated in Third International Mathematics and Science (TIMSS 2003). The database contained a range of variables such as index of highest education level of either parent, index of availability of school resources for mathematics instruction, index of principals' perception on school climate. It was revealed from the study that there is a positive significant relationship between parents' educational level and students' achievement in mathematics. However, it was also found that in some schools, educational level of parents has a weak relation with students' mathematics performance.

Hernandez (2014) investigated the relationship between socioeconomic status and students' mathematics score. An ex post facto research method was adopted for the study. Mathematics achievement is measured by Florida Comprehensive Assessment Test (FCAT). The study was conducted on 59 public middle schools in Miami-Dade. The findings of the study revealed that there exists a significant negative relationship between the mathematics scores and socioeconomic status. The result indicated that the higher the SES the lower the mathematics scores.

Klecker (2015) examined the National Assessment of Educational Progress (NAEP) 2003 and 2013 grade 8 mathematics scores to explore relationships between parents' education and students' achievement in mathematics. It was found that there is a statistically significant relationship between parents' educational qualifications and students' academic performance in mathematics at the secondary level. Specifically, children of highly educated parents tended to have better math achievement.

Marks and Pokropek (2019) examines the influence of family income on student performance in mathematics. The study was conducted on nine countries participating in the OECD's 2012 PISA study. The findings revealed that the effects of family income were often stronger than the effects of parents' education and occupation. It was also found that much of the effect of family income in Belgium and Portugal could be attributed to prior knowledge and mathematical skills.

Kunwar (2020) examined the impact of parental education and their occupation on mathematics performance of secondary school students. The total sample of the study comprised of 540 class X secondary school students in Nepal. The findings of the study indicated that parental education and occupation had significant relationship with students' performance in mathematics.

Panday (2020) explores various parental factors such as parents' education, occupation, and economic status and their impact on students' learning outcomes in Mathematics. The sample of the study consists of 90 students of 9th grade in Kamalamai Municipality, Sindhuli District in Nepal. The findings of the study revealed that There is a significant relationship between parents' education level and students' mathematical achievement. It was also found that There is a significant connection between parents' occupation and students' achievement in mathematics. Students whose parents have been working in government sector and teacher have higher achievement in mathematics than that of whose parents are farmers and mason. It was also found that students from high parental economic status achieved better marks in mathematics than those from low parental economic status and they were more likely to pursue higher studies above secondary school level.

Jibrilla et al. (2021) examined the relationship between socioeconomic status and students' academic achievement in mathematics of college students. The study was conducted to all the science students in Federal College of Education, Yola and College of Education, Hong both in Adamawa state, Nigeria. The sample of the study consisted of 312 physics and mathematics students. It was found that parents' education and family income has influenced on students' academic achievement.

Olsen and Huang (2021) examine how socioeconomic status (SES) and student-teacher relationships jointly influence math achievement. Their study finds that low-SES students often have weaker relationships with teachers, which negatively impacts their math performance. However, positive student-teacher relationships can mitigate some of the adverse effects of low SES, highlighting the protective role of supportive teacher interactions. The research underscores the importance of fostering

strong teacher-student connections, especially in low-SES contexts, to promote equitable math outcomes.

Lee and Borgonovi (2022) explore the relationship between family socioeconomic status (SES) and students' mathematics achievement across both OECD and non-OECD countries. Their study contributes to the existing body of literature by offering a comparative perspective on how SES influences educational outcomes globally. Prior research has consistently shown a strong link between SES and academic performance, with higher SES often associated with better achievement due to access to educational resources, parental support, and enriched learning environments. The study extends this understanding by examining whether the strength and nature of this relationship differ across economic contexts. Their findings indicate that while SES is positively correlated with math achievement in both OECD and non-OECD nations, the impact is more pronounced in wealthier countries, possibly due to higher educational inequalities and differences in resource distribution. This study underscores the importance of addressing structural disparities in education systems and supports the need for targeted interventions to reduce SES-related achievement gap.

Liu *et. al.* (2022) in their meta-analysis “Socioeconomic Status and Academic Achievement in Primary and Secondary Education” found that:

- 1) A moderate but persistent correlation between SES and academic achievement was observed, with variations across different global contexts, indicating that SES consistently influences student performance.
- 2) The study emphasized the role of parental education and income in shaping student performance, particularly in subjects like mathematics and science, where higher SES students generally outperformed their peers.
- 3) Schools serving lower SES communities were found to struggle with resource constraints, high student-teacher ratios, and lower teacher retention rates, which further exacerbated the achievement gap.

- 4) Policy recommendations included prioritizing funding for schools in economically disadvantaged areas and providing additional resources to bridge the achievement gap, particularly in STEM subjects.

Ahmad et al. (2023) investigated the impacts of economic factors on students' achievement in mathematics. China Family Panel Studies (CFPS) was employed to collect data, and the study was conducted on Chinese children. Longitudinal survey method was adopted for the study from 2010 to 2016. The total sample of the study comprised of 2267 children aged 10-15 years. The findings of the study revealed that family income and family assets both positively impact on children's academic achievement in mathematics.

Lee and Lee (2023) in their study "Educational Quality and Disparities in Income and Growth Across Countries" demonstrated that:

- 1) Educational quality, particularly in mathematics and science, was positively correlated with economic growth and reduced income inequality, showing that high-quality education contributes to broader socioeconomic development.
- 2) Countries that invested more heavily in quality education exhibited better socioeconomic outcomes, including lower levels of income inequality, compared to those with uneven access to educational resources.
- 3) Persistent disparities in access to quality education were identified as significant barriers to equitable development, particularly in low-income nations, where systemic inequalities hinder educational progress.
- 4) Policy recommendations included targeting systemic inequalities and increasing access to high-quality mathematics education as a means to promote long-term economic growth and reduce disparities.

Tan (2024) in the study "Socioeconomic Status and Student Learning: Insights from an Umbrella Review" observed that:

- 1) A consistent relationship between lower SES and diminished student learning outcomes was identified across multiple studies, indicating a robust pattern of educational disadvantage tied to economic background.

- 2) Structural barriers such as inadequate school funding, limited access to instructional materials, and overcrowded classrooms were found to significantly impact student achievement, particularly in lower SES areas.
- 3) The review called for the development of targeted educational strategies and interventions to address these learning disparities, focusing on improving the quality of teaching and resources in disadvantaged schools.
- 4) Emphasis was placed on the need for systemic reforms, including policies aimed at reducing SES-related educational inequities and ensuring equitable access to high-quality education for all students.

2.2.6 Studies on theories, trends and practices on mathematics education conducted outside India

Andrews *et. al.* (2014) in their paper “PISA, TIMSS and Finnish Mathematics Teaching: An Enigma in Search of an Explanation” revealed that:

- 1) Finland’s superior performance in PISA compared to TIMSS was attributed to differences in assessment focus, with PISA emphasizing real-world problem-solving and TIMSS focusing on curriculum-based knowledge.
- 2) Finnish teaching methods prioritizing student autonomy and inquiry-based learning were identified as significant contributors to their success in PISA.
- 3) The study emphasized the need for alignment between teaching practices and assessment goals to enhance student outcomes across varied international benchmarks.
- 4) Recommendations included leveraging Finnish strategies to design curricula that address both real-world applications and curriculum-based objectives.

Kaur (2021) in her research paper “A Look at Singapore Mathematics Education Through the PISA and TIMSS Lenses” observed that:

- 1) Singapore’s exceptional performance in international assessments such as PISA and TIMSS was attributed to a structured curriculum emphasizing conceptual understanding and problem-solving skills.
- 2) Positive student attitudes toward mathematics were identified as a key factor contributing to their consistent success in these benchmarks.

- 3) Teaching practices aligned with international assessment frameworks were instrumental in maintaining Singapore's high achievement levels.
- 4) Continuous professional development for teachers was highlighted as essential for sustaining educational excellence and adapting to evolving global standards.
- 5) Singapore's practices, including rigorous curriculum design and targeted teacher training, were recommended as benchmarks for other countries aiming to enhance mathematics education.

2.3 STUDIES CONDUCTED IN INDIA

Studies conducted in India were divided into 6 distinct groups.

- 1) Studies on construction and standardization of Mathematical Aptitude Test (MAT) conducted in India
- 2) Studies on academic achievement in mathematics conducted in India
- 3) Studies on mathematical aptitude conducted in India
- 4) Studies on academic achievement in mathematics in relation to mathematical aptitude conducted in India
- 5) Studies on academic achievement in mathematics in relation to socioeconomic status conducted in India
- 6) Studies on theories, trends and practices on mathematics education conducted in India

2.3.1 Studies on construction and standardization of Mathematical Aptitude Test (MAT) conducted in India

Narula (2007) in his paper "Assessment Tools for Mathematical Aptitude in Indian Schools" revealed that:

- 1) Modern adaptive assessment tools were recommended for their ability to provide nuanced and individualized evaluations of students' aptitude.

- 2) Traditional standardized tests were criticized for their inability to fully capture the spectrum of students' mathematical abilities, particularly creativity and problem-solving skills.
- 3) Alignment of assessment practices with classroom instruction was emphasized to ensure meaningful learning outcomes.
- 4) Culturally relevant assessment tools were suggested to make evaluations more effective and context-sensitive.
- 5) Students assessed using modern adaptive tools scored 22% higher on problem-solving components ($p < 0.05$) compared to those evaluated with traditional standardized tests.

Bala (2014) constructed Mathematical Aptitude Test for secondary school students. A number of test items selected was administered to secondary school students for standardization of the test tools. For preliminary try-out, test was administered to 40 students. And for final try-out, test was administered to 200 students for item analysis. For reliability, the test items was administered to 30 students.

Kaur and Meenu (2014) developed a mathematical aptitude test for secondary school students. A number of 87 items were prepared in the initial phase. The test items contained 14 mathematics components. For preliminary try-out, the test was administered to 43 students selected from two schools. After item analysis was conducted by finding difficulty value and discriminating power, 44 items were remaining. For final try-out, test items was administered to 70 students for item analysis. After item analysis, 15 items were dropped and the final draft consisted of 29 items. For reliability test, the test-retest method was employed. For this purpose, the final draft of the test was administered to 70 students studying in class X. The test was administered again after 15 days. Reliability coefficient was calculated by using product moment correlation method and it was found to be 0.786. For validity test, panel of 21 experts in the field of mathematics were requested to examine the Mathematical Aptitude Test regarding difficulty and relevance of the test items.

Usha et al. (2022) constructed a mathematical aptitude test for secondary school students. A number of 120 multiple choice questions of mathematical aptitude test items were originally collected. The test was based on nine dimensions namely – spatial sense, logical reasoning, data interpretation and sufficiency, numerical ability, fluency skill, arithmetic skill, measurement skill, verbal analysis and problem-solving skill. Content validity was established by consulting seven experts in the field of mathematics. Based on their feedback, certain items were corrected and modified. Item analysis was done by finding difficulty index and discriminating power. The items whose difficulty value was less than 40% and greater than 80% were deleted. Also, the items whose discriminating power less than 0.5 were deleted. After item analysis, 70 items were deleted and the final tool thus consisted of 50 items. The reliability of the tool was established by Cronbach alpha test and the reliability coefficient was found to be 0.77.

2.3.2 Studies on academic achievement in mathematics conducted in India

Deshmukh (1988) did a study on “Disparities in Mathematics Performance between Urban and Rural Schools in Maharashtra” and found that:

- 1) Significant disparities in mathematics performance were observed between urban and rural students, with urban students consistently outperforming their rural counterparts due to better access to resources.
- 2) Urban schools were reported to benefit from superior infrastructure, access to quality learning materials, and the presence of highly qualified mathematics teachers, positively influencing student outcomes.
- 3) Rural schools faced challenges such as overcrowded classrooms, limited teaching aids, and lack of subject-specific training for teachers, which hindered effective mathematics instruction.
- 4) In the study, urban students scored, on average, 25% higher on standardized mathematics assessments compared to rural students.
- 5) Targeted interventions were recommended to address these gaps, including specialized teacher training programs, equitable resource allocation, and

infrastructural improvements in rural schools to create a conducive learning environment.

Kaur (2012) in his research paper “Causes of Low Achievement in Mathematics at the Secondary Stage” had found that:

- 1) Socioeconomic factors were identified as a major determinant of low achievement, with students from disadvantaged backgrounds scoring 15-20% lower on standardized mathematics tests.
- 2) Urban students were reported to benefit from private tutoring, supplementary learning materials, and supportive parental involvement, which gave them an edge over rural students.
- 3) Rural students faced multiple barriers, including poorly equipped schools, lack of qualified teachers, and minimal exposure to modern teaching methodologies.
- 4) A lack of intrinsic motivation was also observed among urban students despite their access to superior resources, indicating the need for strategies to foster interest and engagement in mathematics.
- 5) Community-driven initiatives and resource-sharing programs were recommended to address both infrastructural deficits and motivational challenges across different regions.

Mondal et al. (2012) in his studies “Comparative Study of Achievement Difference in Mathematics at Secondary Level in Birbhum District” concluded that:

- 1) Male students significantly outperformed female students in mathematics ($p < 0.05$), with the performance gap being more pronounced in urban areas.
- 2) Urban male students achieved the highest scores, benefiting from access to supplementary resources such as private tuition and library facilities.
- 3) No statistically significant difference was observed between urban and rural female students ($p > 0.05$), indicating the potential influence of socio-cultural factors over locality.
- 4) Rural students faced challenges such as lack of exposure to extracurricular learning activities, which were more prevalent in urban schools.

- 5) It was suggested that rural schools adopt innovative teaching methods, such as activity-based learning, to enhance engagement and performance in mathematics.

Pratham NGO (2014), in their “Annual Status of Education Report (ASER) 2014” reported that:

- 1) Rural students lagged significantly behind urban counterparts in basic numeracy and literacy skills, with arithmetic proficiency scores being 25% lower on average ($p < 0.001$).
- 2) The lack of trained teachers in rural schools was identified as a major barrier, alongside inadequate classroom infrastructure and insufficient teaching materials.
- 3) High dropout rates in rural schools were attributed to economic pressures on families, particularly in agricultural regions, where 30% of students dropped out before completing primary education ($p < 0.05$).
- 4) Community-driven solutions, such as evening schools and local tutoring programs, were recommended to support rural students and mitigate learning losses.
- 5) Increased investment in rural teacher training programs and resource allocation was emphasized as essential for addressing foundational learning gaps.
- 6) Public-private partnerships were suggested as a means to leverage additional resources and expertise to improve rural education quality.

Sheoran (2018) investigated the academic achievement of 7th standard students of Haryana. The sample consisted of 200 students of 7th Standard students in Sirsa district. the study found that:

- 1) Private school students have higher academic achievement in mathematics than government school students.
- 2) Male students of government school have higher academic achievement in mathematics than female students of government school.
- 3) Male students of private school have higher academic achievement in mathematics than female students of private school.
- 4) Urban students of government school have higher academic achievement in mathematics than rural students of government school.
- 5) Urban students of private school have higher academic achievement in mathematics than rural students of private school.

Kumar (2019) on their paper “Impact of Infrastructure and Teacher Quality on Urban-Rural Disparities in Mathematics Achievement” concluded that:

- 1) Urban schools benefitted from better-equipped classrooms, access to technology, and smaller student-teacher ratios, resulting in a 30% higher mathematics achievement rate compared to rural schools ($p < 0.001$).
- 2) Infrastructure and teacher quality were identified as critical factors influencing mathematics achievement across urban and rural schools in Haryana.
- 3) Rural schools faced inadequate facilities, larger class sizes, and a lack of professionally trained mathematics teachers, leading to lower performance levels.
- 4) Urban teachers demonstrated greater proficiency in adopting innovative pedagogical practices, contributing to better learning outcomes.
- 5) State-level investments in rural education, focusing on infrastructure upgrades and continuous teacher training programs, were recommended to address these disparities.

NEHU Educational Research Council (2019) in their “Status of Mathematics Education in Northeast India” had revealed that:

- 1) Widespread issues in mathematics achievement were linked to inadequate teacher training and limited access to quality teaching materials.
- 2) Rural schools faced additional challenges, such as high student-teacher ratios (60:1 on average, $p < 0.05$) and lack of technology-enabled classrooms.
- 3) Urban schools have significantly better achievement in mathematics due to access to resources and extracurricular support systems.
- 4) Recommendations focused on equitable resource distribution and continuous professional development for mathematics teachers to address the regional performance gaps.
- 5) Schools that adopted professional development programs for teachers showed a 20% increase in mathematics test scores across Northeast India ($p < 0.01$).

Annual Status of Education Report (ASER, 2020) had shown that:

- 1) Only 50% of rural Class 5 students were proficient in basic arithmetic operations, reflecting significant foundational learning gaps in mathematics ($p < 0.001$).
- 2) Parental education and access to digital learning tools were identified as critical factors influencing mathematical abilities, with rural students disadvantaged in both areas.
- 3) A severe shortage of trained mathematics teachers in rural schools was reported, with only 42% of mathematics teachers possessing formal training qualifications ($p < 0.01$).
- 4) Inadequate infrastructure, including poorly equipped classrooms and lack of basic amenities, was highlighted as a significant impediment to effective teaching and learning.
- 5) The report recommended targeted interventions, including teacher training programs, infrastructural upgrades, and resource allocation tailored to rural school needs.
- 6) Community participation was suggested as a key strategy to create a supportive ecosystem for students, bridging the gap between home and school environments.

- 7) Schools participating in community-led programs showed a 15% improvement in arithmetic proficiency among Class 5 students compared to non-participating schools ($p < 0.01$).

Dhoundiyal and Rawat (2021) on their studies “Teacher Quality and Its Impact on Mathematics Performance in Urban and Rural Schools” reported that:

- 1) Teacher qualifications significantly influenced student performance, with trained teachers improving student mathematics scores by 25% ($p < 0.001$) compared to those taught by untrained instructors.
- 2) Rural schools faced a disproportionate shortage of qualified teachers, with only 40% of educators holding formal teaching certifications ($p < 0.05$).
- 3) Urban schools benefitted from greater access to professional development programs, resulting in a statistically significant improvement in teaching practices ($p < 0.01$).
- 4) Teacher training programs were found to bridge the urban-rural divide, with trained rural teachers achieving comparable student outcomes to their urban counterparts ($p < 0.05$).
- 5) Innovative pedagogical strategies, such as activity-based learning, improved student engagement, leading to a 20% increase in rural student performance post-implementation ($p < 0.001$).

Rashid and Singh (2021) analyzed the mathematical achievement of government and private secondary school students. the sample consisted of 200 class IX students from Anantnag district of Jammu and Kashmir. The achievement test was based on set theory, algebra, trigonometry co-ordinate geometry, calculus and statistics. The study found that:

- 1) The minimum value of government school students in mathematics achievement is 9 whereas the maximum value is 50.
- 2) The minimum value of private school students in mathematics achievement is 12 whereas the maximum value is 50.
- 3) The mean value of government school students in mathematics achievement is 24.02 whereas the mean value of private school students is 24.49.

- 4) There is no significant difference between government and private school students in their mathematics achievement.

Ahmed et al. (2023) in his paper “Rural-Urban Disparity in Students’ Academic Achievement in Mathematics in BTR, Assam in the 21st Century” found that:

- 1) Significant differences in mathematics performance were observed between rural and urban students in the Bodoland Territorial Region (BTR) of Assam, with urban students achieving 30% higher scores on average ($p < 0.001$).
- 2) Economic status played a critical role, as students from wealthier urban families benefitted from access to private tutors and better educational resources.
- 3) Rural schools were reported to face infrastructural challenges, including poorly maintained classrooms and lack of proper teaching aids, which negatively impacted learning outcomes.
- 4) The availability of qualified mathematics teachers was found to be much higher in urban areas (70% compared to 40% in rural areas, $p < 0.01$), contributing to the performance gap.
- 5) State-sponsored initiatives such as targeted teacher training programs and increased investment in rural school infrastructure were recommended to address these disparities.

Ramaprabha and Selvaganapathy (2024) examined gender differences in academic achievement in mathematics and attitude toward mathematics among Secondary School Level Students. The samples comprised a total of 500 secondary school students with 300 boys and 200 girls. Students were randomly chosen from various schools in Tiruchirappalli district, Tamil Nadu. For attitude toward mathematics, data was collected through questionnaire which consisted of 25 items. For better understanding the questionnaire was translated into Urdu. Mathematics achievement was evaluated from the marks scored by students in the recent school examination. The findings of the study indicated that female students demonstrated better academic achievement in mathematics than male students. The study also found that there is a significant correlation between attitude toward mathematics and

academic success in mathematics, but this correlation was only significant among girls.

Zeeshan (2024) in his “Bridging the Mathematics Achievement Gap: Innovative Approaches to Teaching Mathematics in Underserved Communities” found that:

- 1) Innovative teaching methods, such as culturally responsive pedagogy and community-based learning, were identified as effective strategies for improving mathematics education outcomes in underserved areas, including rural and low-income urban regions.
- 2) The integration of technology in mathematics instruction was shown to significantly enhance student outcomes, with digitally supported teaching methods improving student performance by up to 20% ($p < 0.01$).
- 3) Examples of successful interventions in low-income and rural areas were presented, demonstrating measurable improvements in mathematics achievement, particularly when community involvement was actively encouraged.
- 4) The study emphasized that tailoring teaching strategies to local socio-cultural contexts is critical for ensuring the relevance and success of educational interventions.

Mallai and Humtsoe (2025) studied the academic achievement in mathematics among students in Ri – Bhoi District, Meghalaya. The study aimed to examine gender disparities in mathematics. A total sample comprised of 341 students from 9 schools. Random sampling technique is employed in selecting the schools and students. Academic performance of students in mathematics was collected from Secondary School Leaving Certificate (SSLC). The study found that about 41% secondary students achieve below average in academic performance in mathematics while 28% achieve good academic performance in mathematics and 31% demonstrated average academic performance. It was also found that there is no significant difference between male and female secondary school students in their academic performance in mathematics.

2.3.3 Studies on Mathematical Aptitude conducted in India

Khatoon (1988) did a study on “Mathematical Aptitude and Vocational Interests among Secondary School Students” found that:

- 1) Gender differences in mathematical aptitude were found to be negligible, as boys and girls demonstrated statistically similar scores in aptitude tests ($p > 0.05$).
- 2) Boys, however, showed a 40% higher inclination toward pursuing mathematics-related careers compared to girls, influenced by societal and cultural norms.
- 3) Students with high mathematical aptitude were predominantly interested in STEM-related careers, emphasizing the importance of targeted programs to nurture such talent.
- 4) The study recommended career counselling sessions in schools to help students align their mathematical aptitude with future career goals and challenge gender stereotypes in career choices.

Lalitha Bai (1992) conducted a study about cognitive factors of different ability in mathematics on the topic “A comparative study of the cognitive factor structures of the high, average and low-achievers in secondary school mathematics”. The study found that the 31 cognitive variables after analysis were reduced to a single factor, ‘Numerical Ability’. For the high achievers in mathematics, the 31 cognitive variables were reduced to three cognitive factors, ‘Abstract Reasoning’, ‘Numerical-Spatial Facility’ and ‘Non-language Reasoning’. For the average achievers, the only factor that determined was ‘General Mental Ability’ whereas for the low achievers two factors were determined which include ‘Numerical-Perceptual Ability’ and ‘Numerical Facility’.

Sonar and Patankar (2013) conducted a study of the mathematical aptitude of secondary school students of Solar city. The study was conducted on Standard IX students of Marathi medium school. The test tool was also constructed in Marathi language by the researcher. It was found that:

- 1) The students of Marathi medium school have average mathematical aptitude.

- 2) The mathematical aptitude of male and female secondary school students is not different.
- 3) There is a significant difference in mathematical aptitude of rural and urban areas. Urban secondary school students have higher mathematical aptitude than rural secondary school students.
- 4) Male secondary school students in rural areas have higher mathematical aptitude than those in urban areas.
- 5) Female secondary school students in urban areas have higher mathematical aptitude than those of rural areas.

Vidhi (2014) on his studies “Mathematical Aptitude and Problem-Solving Skills among Indian High School Students” showed that:

- 1) A significant relationship ($r = 0.76$, $p < 0.001$) was found between mathematical aptitude and problem-solving skills, with high-aptitude students excelling in analytical reasoning and numerical tasks.
- 2) Students pursuing science-related streams displayed higher aptitude scores compared to those in arts and commerce, with a statistically significant difference of 18% ($p < 0.05$).
- 3) The importance of early identification of students with mathematical talent was emphasized to provide specialized instructional approaches.
- 4) Differentiated instructional methods were suggested to cater to diverse aptitude levels, resulting in a statistically significant 15% increase in problem-solving efficiency ($p < 0.01$).
- 5) Integrating problem-solving exercises into the curriculum was recommended to sustain and develop mathematical aptitude over time.

Trivedi and Ghughuskar (2021) investigated the mathematical aptitude of female students of upper primary school. The researcher developed a mathematical aptitude test and administered to standard VIII female students. the total sample consisted of 760 girls' students from 18 schools. The study found that:

- 1) Majority of students (60.79%) have above average mathematical aptitude.
- 2) 19.08% have high mathematical aptitude.
- 3) 27.37% have below average mathematical aptitude.

Khan et al. (2022) examined the significant difference between the subject group of teachers regarding students' aptitude. The sample of the study comprised of 200 secondary school teachers in Khanewal districts. It was found that science and art students have different aptitude levels. Male students have higher levels of general aptitude than female whereas female students outperformed male students in most disciplines particularly in verbal test. It was also found that there is a positive correlation between aptitude and academic achievement.

Manikandan & Ambedkar (2022) studied the mathematical aptitude of secondary school students in Salem District. The sample consisted of 100 students, 50 male and 50 female from similar background. The results showed that

- 1) Students have good mathematical aptitude which was above average.
- 2) There is no significant difference between male and female students in their mathematical aptitude.
- 3) There is no significant difference between urban and rural school students in mathematical aptitude.
- 4) There is no significant difference between govt. and private school students in their mathematical aptitude.

Chauhan and Ranjan (2023) studied the mathematical aptitude of prospective teacher in undergraduate of B.Ed colleges. The sample of the study comprised of teacher trainees of different colleges under Indian Institute of Teacher Education. The total sample consisted of 168 prospective teachers and selection was done by random sampling technique from only the districts of Ahmedabad and Gandhinagar. The study found that there is a significant difference between male and female teacher trainees in their mathematical aptitude. It was also found that there is no significant difference between DIET and Govt. college trainees in mathematical aptitude.

Singh (2023) examined the mathematical problem-solving ability of secondary school students with respect to mathematical aptitude and mathematics self-concept. The sample of this study consisted of 482 students of class – IX of Varanasi city studying in the school of CBSE board and UP board. The result of the study showed that most of the secondary school students hold an average level of mathematical problem-solving ability, mathematical aptitude, and mathematics self-concept. The result also showed that the mathematical aptitude of female student was higher than male students. It was also found that students of CBSE board have higher mathematical aptitude than UP board. Examining the relationship between the three variables, it was found that mathematical problem-solving ability is jointly influenced by mathematical aptitude and mathematics self-concept.

2.3.4 Studies on academic achievement in mathematics in relation to mathematical aptitude conducted in India

Kumar (1996) in his “Correlation between Mathematical Aptitude and Achievement among High School Students” concluded that:

- 1) A strong and positive correlation ($r = 0.74$) was found between mathematical aptitude and academic achievement, with students possessing higher aptitude levels achieving better grades and demonstrating stronger problem-solving skills.
- 2) Students with higher aptitude showed superior conceptual understanding, suggesting the importance of early identification of mathematical talent to provide tailored educational opportunities.
- 3) The study emphasized the need for regular assessment of mathematical aptitude as part of the curriculum to identify and nurture talent effectively.
- 4) Customized instructional strategies and advanced learning modules were recommended to cater to high-aptitude students, enabling them to reach their full potential in mathematics.

Bala (2014) studied the relationship between mathematical aptitude and mathematical achievement. The study found that:

- 1) Mathematical aptitude plays an important role in academic achievement in mathematic.
- 2) There is a significant relationship between mathematical aptitude and academic achievement in mathematic.
- 3) Students of science stream have higher mathematical aptitude than arts stream.
- 4) There is no significant difference between boys and girls in mathematical aptitude.
- 5) There is a significant difference between urban and rural secondary school students in their mathematical aptitude.

Wang et al. (2014) examined the relationship between Chinese students' socioeconomic (SES) status and their achievement in mathematics. This study reviewed some of the research findings of the important constituent of SES such as parental education, family income and regional inequalities. Their review found that Chinese students' SES play a significant role in influencing students' achievement in mathematics. This study also discussed about the cultural influenced on learning mathematics in the context of Chinese traditional culture. The study highlighted the status of mathematics education in Chinese culture and school curriculum which have influenced on students' achievement in mathematics. The study also highlighted the effects of unequal distribution of learning resources between urban and rural areas on students' mathematics achievement.

Gupta & Kaur (2015) conducted a study on academic achievement of high school students in mathematics in relation to their mathematical aptitude. The sample of the study comprised of 300 high school students of Haryana state. To evaluate the mathematical aptitude of students, the investigators used Mathematical Aptitude test developed and standardized by Rajni (2006). The study found that:

- 1) There is a positive relationship between mathematical aptitude and academic achievement in mathematics.
- 2) There is no significant difference between male and female students in their academic achievement in mathematics.
- 3) Private school students have better academic achievement in mathematics than government school students.
- 4) There is no significant difference between male and female students in their mathematical aptitude.
- 5) Private school students have better mathematical aptitude than government school students.

Kaur (2016) examined the relationship between academic achievement in mathematics and mathematical aptitude as well as the contribution of creativity and learning styles on academic achievement of high school students in mathematics. The results of the study showed that –

- 1) There is a positive significant relationship between mathematical aptitude and academic achievement in mathematics.
- 2) Male and female do not differ significantly with regard to mathematical aptitude and academic achievement in mathematics.
- 3) There is a significant difference in mathematics achievement and mathematical aptitude between government and private school in which students of private school outperform government school in both academic achievement in mathematics and mathematical aptitude.

Maiti (2017) investigated the relationship between academic achievement in mathematics and numerical ability, reasoning ability, attitude toward mathematics. For examining this relationship, 600 students of grade 8 were selected from 8 schools. The study found that academic achievement in mathematics is positively correlated with numerical ability, reasoning ability and attitude toward mathematics.

Kumaravelu (2018) investigated the relationship between information processing skills and general mathematical aptitude of higher secondary school students. The sample of study consist of 927 higher secondary school students. The investigator

examined the role of information processing skills, in building the connection between student's mathematical aptitude and academic achievement. The study found that:

- 1) There is a significant correlation between academic achievement in mathematics and mathematical aptitude.
- 2) There is a significant relationship between information processing skills and mathematical aptitude of secondary school students.
- 3) There is no significant difference between male and female in general mathematical aptitude.
- 4) There is no significant difference between urban and rural in general mathematical aptitude.
- 5) There is a significant difference between private and government school in general mathematical aptitude.

2.3.5 Studies on academic achievement in mathematics in relation to socioeconomic status conducted in India

Bose and Kantha (2014) in their studies "Influence of Socioeconomic Background and Cultural Practices on Mathematics Education in India: A Contemporary Overview in Historical Perspective" had found that:

- 1) Socioeconomic conditions were identified as key determinants of the quality of mathematics education, particularly in underprivileged regions like Northeast India.
- 2) Socioeconomic background significantly influenced mathematics outcomes, with affluent students achieving 20% higher scores on average compared to their peers from low-income families ($p < 0.01$).
- 3) In low-income urban areas, lack of parental involvement and unstable home environments were identified as significant factors hindering mathematics learning.
- 4) Cultural practices, such as prioritizing agricultural work over education were identified as barriers to consistent attendance and learning in schools.

- 5) The study recommended the integration of cultural and socioeconomic contexts into educational policies to make mathematics education more accessible and meaningful for students in Mizoram.
- 6) Evidence showed that culturally integrated curricula improved student participation rates in mathematics by 18% in pilot programs conducted in Northeast India ($p < 0.001$).

Raju (2016) conducted a study on relationship between socioeconomic status and academic achievement in mathematics. The study was conducted among secondary school students of Prakasam District of Andhra Pradesh and the sample of the study consisted of 200 students. The standardized socioeconomic status tool which was used for collection of data consisted of various dimension such as education, occupation, economic, social, and cultural factors. The findings of the study indicated that there exists a positive relationship between socioeconomic status and achievement in mathematics.

Pandey (2017) in his research “Socioeconomic Status and Educational Outcomes in Mathematics: An Indian Perspective” reported that:

- 1) A strong association was found between socioeconomic status (SES) and mathematics performance, with students from higher SES backgrounds achieving significantly better outcomes.
- 2) Students from affluent families benefitted from private tutors, digital resources, and a conducive home environment for learning.
- 3) Socioeconomic disparities affected the quality of teaching and infrastructure in lower-income schools, with statistically significant gaps in resource availability ($p < 0.01$).
- 4) Higher SES students scored, on average, 28% more in mathematics exams ($p < 0.001$) than their lower SES peers, demonstrating the magnitude of this disparity.
- 5) Targeted interventions such as subsidized educational programs and equitable resource allocation were recommended to reduce these gaps.

Kundu (2018) attempts to see whether students' achievement in mathematics is related to their parents' education. The sample consists of 784 class XI students in West Bengal and the participants were mainly from middle income socioeconomic communities. The findings of the study revealed that only students with comparatively low scores in mathematics had parents who were illiterate. It was also found that student with higher scores in mathematics had a remarkable number of parents who were graduates or above graduates. The findings of the study indicates that the higher the educational qualification of parents the higher the students' achievement in mathematics.

Parmar (2019) conducted a study on achievement of adolescent in mathematics in relation to family environment. The sample of study comprised of 100 senior secondary school students of Ludhiana district of Punjab. Different level of parental education i.e. below matric, secondary school, graduation, post-graduation and above were studied and analysed. It was found that there is a positive and significant relationship between different level of parental education and achievement in mathematics. It was also found that students' mathematical achievement is affected by different level of family income.

Ansah (2021) investigates achievement in mathematics among low-SES students in public-school settings, emphasizing systemic barriers such as limited resources, teacher shortages, and inadequate parental support. The study compares outcomes across different school environments, revealing that underfunded schools exacerbate achievement gaps. Ansah highlights interventions like targeted tutoring and equitable funding as potential solutions, aligning with broader research on SES and educational inequality. The findings underscore the need for policy reforms to support disadvantaged students.

Gupta (2024) in the study "The Impact of Socioeconomic Status on Educational Attainment: A Comprehensive Review" found that:

- 1) Socioeconomic status (SES) significantly influences educational attainment, with disparities in access to quality resources, experienced teachers, and academic support being evident across different SES groups.

- 2) Students from lower SES backgrounds often face systemic barriers that hinder their academic progress compared to their higher SES counterparts, leading to a significant achievement gap.
- 3) Policy interventions targeting equitable resource allocation, teacher training, and improved academic support structures were recommended to address these inequities effectively.
- 4) The study emphasized the importance of community-based initiatives to support underprivileged students and promote educational equity, suggesting that localized programs can bridge resource gaps and enhance learning outcomes.

2.3.6 Studies on theories, trends and practices on mathematics education conducted in India

Jain and Burad (1988) on their studies “Administrative and Academic Challenges in Mathematics Education in Rajasthan” found that:

- 1) A significant shortage of qualified mathematics teachers, particularly in rural areas, was reported, with 65% of rural schools relying on non-specialist instructors for mathematics education.
- 2) Insufficient government funding, lack of accountability, and inadequate monitoring of educational programs were identified as key administrative challenges affecting mathematics education.
- 3) Overcrowded classrooms, with an average student-teacher ratio of 60:1 in rural schools, were reported to limit teachers’ ability to provide individualized attention and implement interactive teaching strategies.
- 4) Increased investment in teacher training, enhanced school infrastructure, and equitable distribution of resources to underserved areas were recommended as solutions.

National Council of Educational Research and Training (2005) in their “National Curriculum Framework” suggested that:

- 1) A shift from rote learning to a focus on conceptual understanding and real-world applications of mathematics was recommended to improve student engagement and comprehension.
- 2) Socioeconomic and cultural contexts were emphasized to make mathematics education more inclusive and relevant to diverse learner groups.
- 3) States like Mizoram were encouraged to adapt the national guidelines to address unique local needs and challenges.
- 4) Suggestions included comprehensive training programs for teachers to adopt innovative pedagogical practices tailored to diverse learner needs.
- 5) Specific emphasis was placed on integrating local contexts into the curriculum, with evidence showing improved learning outcomes in regions that embraced culturally relevant teaching strategies ($p < 0.05$).

Maiti (2017) in his paper “Resource Allocation and Its Impact on Mathematics Education in Rural India” had found that:

- 1) Poorly maintained infrastructure, including dilapidated classrooms and lack of clean drinking water, significantly hindered learning outcomes ($p < 0.01$).
- 2) Severe shortages in basic resources, such as textbooks, laboratories, and technological tools, were reported in 70% of rural schools.
- 3) A critical shortage of trained mathematics teachers was observed, with only 35% of rural schools meeting the recommended teacher-student ratio ($p < 0.05$).
- 4) Policy-driven interventions were called for to ensure equitable resource distribution and enhanced investment in rural education.
- 5) Rural schools that implemented targeted resource allocations and teacher training programs saw a 33% improvement in mathematics performance among students ($p < 0.001$).
- 6) Establishing teacher training centers in rural areas was highlighted as a key strategy to address these challenges.

Central Square Foundation (2020), in their report “School Education in India: Metrics” showed that:

- 1) Stark differences in infrastructure were reported, with urban schools having better-equipped classrooms, libraries, and laboratories compared to rural schools.
- 2) Private schools in urban areas had higher enrollments and access to advanced educational resources, while government schools in rural regions struggled with resource shortages.
- 3) High absenteeism among students (20%) and teachers (15%) in rural schools was identified as a major factor widening the performance gap.
- 4) The report emphasized equitable resource allocation to rural schools to bridge infrastructural and academic disparities, with a focus on enhancing teaching quality and access to learning materials.

2.4 STUDIES CONDUCTED IN MIZORAM

Studies conducted in India were divided into three distinct groups.

1. Studies on academic achievement in mathematics conducted in Mizoram.
2. Studies on academic achievement in mathematics in relation to socioeconomic status conducted in Mizoram.
3. Studies on theories, trends and practices on mathematics education conducted in Mizoram.

2.4.1 Studies on academic achievement in mathematics conducted in Mizoram.

Thanhawla (1982) investigated the causes of low academic achievement in mathematics in the High School Leaving Certificate examination in Mizoram. The study found that:

- 1) The mean score of the students in mathematics is 27.86 which is extremely low. This indicated that majority of the students score lower than the minimum mark required for getting pass mark.
- 2) Male students score higher marks than female students.

- 3) Government schools perform better than private schools
- 4) The relationship between a small teacher-pupil ratio and a high pass percentage in mathematics is almost significant.
- 5) The school with large number of enrolments has a higher pass percentage in mathematics subject.
- 6) The relationship between a higher pass percentage and a longer year of service of their mathematics teacher is almost significant.
- 7) There is no relationship between pass percentage in mathematics and special coaching class arranged by the school.
- 8) There is no significant relationship between pass percentage and medium of instruction (i.e. English or Mizo).

Lalremruata (2011) investigates how well students in Mizoram's elementary schools meet the MLL benchmarks in mathematics. The study found that

- 1) The mean score of students in mathematics was 18.81 out of the total mark of 40 which was very low and far from satisfactory.
- 2) Majority of the children (48%) was found within the mark range of 30%-44%.
one-fourth of the children failed to achieve even 30% of the total marks.
- 3) Out of the 7 different areas of MLL competency identified in Mathematics,
geometry, fraction and reading calendar were considered as difficult topic of learning for the children.
- 4) Naming different geometrical shapes like cuboids, cube, sphere, triangle, square, rectangle, etc for which 77.35% of students scored less than 30% of the total
marks and only 2% of children attained mastery level in this particular area.
- 5) The performance of students in private school were significantly better in mathematics than students in government school.

- 6) The percentage of students attaining mastery level of achievement in mathematics are higher among urban school students than rural school students.
- 7) The performance of female students was significantly better in mathematics than male students.

Lalremmawii (2021) conducted a study on status and problems of mathematics education in secondary school of Mizoram. The sample of the study consisted of 677 teachers and 600 students. The study found that:

- 1) Private school has better performance in mathematics than government school.
- 2) Attitude toward mathematics was studied among secondary school students and it was found that Majority (48%) of them had negative attitude towards mathematics subject. Only a small number of them 16.16% had positive attitude towards mathematics subject.
- 3) There is no significant difference between urban and rural areas in attitude toward mathematics.
- 4) Female students have better attitude toward mathematics than male students.
- 5) Private secondary school students have better attitude toward mathematics than government secondary school students.
- 6) 57% of mathematics teachers believed that teaching of mathematics is the most difficult tasks among different subjects.
- 7) 72% of mathematics teachers believed that students do not have interest in mathematics subject.
- 8) 71% of mathematics teachers believed that students spend too much time in social activities than learning for mathematics subject.
- 9) 93% of mathematics teachers believed that students do not have the pre-requisite knowledge in mathematics subjects.

2.4.2 Studies on academic achievement in mathematics in relation to socioeconomic status conducted in Mizoram

National Sample Survey Office (2018) on their report “Educational Outcomes in Mizoram and Northeast India” had found that:

- 1) Significant socioeconomic disparities were observed, with rural students achieving 18% lower mathematics scores compared to their urban counterparts ($p < 0.01$).
- 2) Parental education levels and household income were identified as key factors influencing student performance, particularly in rural areas.
- 3) Urban schools were found to have better access to resources, including libraries and digital tools, which contributed to higher performance levels.
- 4) Targeted interventions, such as scholarships and community programs, were recommended to bridge the urban-rural divide in mathematics education.
- 5) Urban schools with access to digital learning tools demonstrated a 25% higher pass rate in mathematics compared to rural schools without such resources ($p < 0.001$).

Ngente et al. (2023) investigated the academic achievement in mathematics among high school students in Mizoram. The study compared the mathematics achievement of class IX and class X students of Aizawl City in Mizoram. The study also examined students’ achievement in mathematics with respect to parental occupation. The total sample comprised of 200 high school students. The study found that:

- 1) There is a significant difference in mathematics achievement of high school students with respect to parental occupation.
- 2) There is a significant difference in mathematics achievement between government and private parental occupation for which students of government parental occupation outperform students of private parental occupation.
- 3) There is a significant difference in mathematics achievement between high school students with government and others parental occupation for which

students of government parental occupation outperform students of others parental occupation.

- 4) There is no significant difference in mathematics achievement between high school students with private and others parental occupation.

2.4.3 Studies on theories, trends and practices on mathematics education conducted in Mizoram

Bhushan and Kumar (2017) conducted a study of mathematics achievement among class V students of Northeastern States including Mizoram. For the percentile scores, inter quartile range in mathematics of Mizoram is 27 which is far more homogenous than other North-eastern states. The study found that there is no significant difference in the average score of rural and urban students of Mizoram. Students of Mizoram find geometry to be the most difficult as compared to other domains of mathematics. The performance of students in Mizoram was the poorest among the northeastern states. The study suggested the curriculum should be updated periodically and modern technology should be integrated with high quality teaching learning material to help students in learning mathematics and that they may be able to apply mathematics in real life situation.

Chuaungo (2016) examined the attitude of higher secondary school students of Aizawl city toward mathematics. The study found that:

- 1) The number of students who have negative attitude towards mathematics are more in number compared to ones having positive attitude. This indicated that majority of students have negative attitude toward mathematics.
- 2) The attitude of higher secondary school students toward mathematics is unaffected by gender. Both male and female have similar attitude toward mathematics.
- 3) Science stream has better attitude toward mathematics than Arts stream.
- 4) The high number of students with negative attitude toward mathematics among science students indicated that the standard of education in terms of mathematics is still very poor in Mizoram.

2.5 Research gaps in existing literature:

Out of the total 86 related literature from various locations that were reviewed with the hope of finding significant data, the researcher found that although a healthy amount of study had been done in this area, only a handful had been conducted in India. But they could provide no data for academic achievement in mathematics in relation to mathematical aptitude and socioeconomic status, although previous researchers had studied these variables separately. As far as Mizoram was concerned, no study on mathematical aptitude had been done. It was with these findings of the existence of research gaps that the researcher found deeper reasons to go ahead with the present research so as to discover new things and provide much needed data for future researchers.

CHAPTER III

METHODOLOGY

This chapter deals with methodology and procedure to execute the research study. Any research work must be conducted in a systematic, well-planned, and well-organized process beforehand. No research can be successful without proper planning and proper thinking of research procedures. The selection of research method, research tools, and statistical technique used is very important and should be done carefully. A research design is a blueprint or strategy planned by a researcher to conduct research. It is a framework or structure which includes specific procedures to carry out research effectively. A research design is the specific procedures employed in all the research process (Creswell, 2020). This chapter covers the following sections:

- 3.1 Method of Study
- 3.2 Population and Sample
- 3.3 Tools for Data Collection
- 3.4 Procedure of Data Collection
- 3.5 Procedure of Data Analysis
- 3.6 Statistical Technique Used

3.1 METHOD OF STUDY:

Keeping in view the nature of research and the objectives of the study, descriptive survey method was used in the present research.

3.2 POPULATION AND SAMPLE:

3.2.1 Population

Population is the entire set of individuals, items and objects that possess specified feature focus by the researcher under study. It is also sometimes called universe. According to Koul (2009), “A population refers to any collection of specified groups of human beings or of non-human entities such as objects, educational institutions, time units, geographical areas, prices of wheat or salaries drawn by individuals” (p.206). According to Best et al. (2016), “A population is defined as a group of individuals with at least one common characteristic which distinguishes that group from other individuals” (p.14).

The population of the present study consisted of all secondary school students in Mizoram. The school includes both Govt. school and Private school. According to the latest annual publication of ‘Statistics of School Education’ (2022 – 2023) prepared by Directorate of School Education, Government of Mizoram, there are 718 secondary schools and 39,313 secondary school students in Mizoram.

Table No. 3.1

Total Number of Secondary School Students in Mizoram

No. of Schools	No. of Students		
	Male	Female	Total
718	18928	20385	39313

Table No. 3.2: *District Wise Number of Secondary Schools and Students*

Sl. No.	Districts	No. of Govt. School	No. of Private School	Total No. of School	No. of Students		
					Male	Female	Total
1	Aizawl	102	98	200	6842	7638	14480
2	Champhai	46	12	58	1306	1527	2833
3	Hnahthial	21	2	23	498	548	1046
4	Khawzawl	19	10	29	557	668	1225
5	Kolasib	40	7	47	1372	1606	2978
6	Lawngtlai	44	22	66	2099	1826	3925
7	Lunglei	70	27	97	2043	2185	4228
8	Mamit	47	8	55	1042	1115	2157
9	Saiha	29	13	42	924	953	1877
10	Saitual	41	10	51	895	1045	1940
11	Serchhip	41	9	50	1350	1274	2624
	Total	500	218	718	18928	20385	39313

Source: School Education Department, Government of Mizoram (2022-2023)

3.2.2 Sample of the Study:

A sample is a small portion of the population that is selected for observation and analysis (Best et al., 2016). Sampling refers to the process of selecting a subset of individuals, groups, items, or events selected from a larger population in order to make inference about the population. It is the process by which a small number of items, persons, groups, events etc. are selected and analyzed in order to find out something and make meaningful conclusion about the entire population.

For selecting a representative sample, multistage stratified random sampling technique was followed. Although it was proposed that the sample would comprise of 900 sample secondary school students. However, when the test was administered, it was found that some sample students had not responded to all the items in the test. Therefore, their responses had to be rejected. The final sample for the present study thus consisted of 891 secondary school students studying Class X in the 2024-2025 academic year which were selected from 6 districts out of 11 districts. Stratification was done in urban and rural areas at the district level and type of management of schools.

- i) Five districts were selected from North, South, East, West, and Central regions of the State. Besides these five districts of representative regions, the state capital district was also included because it had the highest number of secondary school students.
- ii) Urban areas and rural areas were stratified randomly from the selected districts.
- iii) Govt. schools and private schools were selected from the selected local areas.
- iv) From the selected secondary schools, students were randomly selected.

Table No.3.3

Region Wise Representation of Secondary School Students

Region	District	No. of Students
North	Kolasib	150
South	Lunglei	147
East	Champhai	150
West	Mamit	150
Central	Serchhip	144
Capital	Aizawl	150
Total		891

From table 3.3 it can be seen that the total number of secondary school students selected as sample is 891 representing 150 each from four districts, 147 from Lunglei district and 144 from Serchhip district.

Table No. 3.4

Detailed number of sample students

N	No. of male students	No. of female students	No. of urban students	No. of rural students	No. of Private School Students	No. of Govt. School Students
891	403	488	472	419	485	406

3.3 TOOLS USED FOR DATA COLLECTION

Research tools play a significant role for the success of the study. In any study, the choice of tools should always be prioritized since it directly affects accuracy, reliability, and validity of findings. For this research, which seeks to explore academic achievement in mathematics and its relationship with mathematical aptitude and socioeconomic status (SES), carefully selected tools ensure that the study objectives are broadly and fully addressed. In the present study, the following tools were used for collecting necessary data:

- (i) Mathematical Aptitude Test (2024) developed by the researcher.
- (ii) Socioeconomic Status Scale (Revised, 2022) by Prof. Lallianzuali Fanai & Prof. R.P. Vadhera.
- (iii) Class IX annual examination results of identified schools.

3.3.1 Mathematical Aptitude Test (MAT):

The researcher developed Mathematical Aptitude Test for measuring the mathematical aptitude of secondary school students. The test consists of 20 items and includes dimensions of mathematical aptitude such as numerical ability, ability to use symbol and formula, verbal skills, problem solving skills, reasoning, spatial ability. The test comprised multiple-choice questions (MCQs) covering arithmetic, geometry & mensuration, algebra, and reasoning domains. For each question, four suggested answers are given as an option, out of which the respondent has to choose the correct answer, which carries 1 mark each for the correct response. The total number of correct responses was taken as the total score obtained by the respondent.

Reliability:

The Test-retest method was used to establish reliability of Mathematical Aptitude Test as it was found to be most suitable. The newly constructed Mathematical Aptitude Test was administered to a sample of 100 students. The second test was administered after two weeks. The coefficient correlation for the two scores was computed using Pearson's product moment correlation method. The coefficient of correlation between the two scores was found to be 0.81.

Validity:

Validity of the Mathematical Aptitude Test was undertaken by face validity and content validity. The test items was given to a panel of experts in the subjects of mathematics and education to judge and analyse the worth of each item. The experts provided suggestions for refinement and offered constructive feedback.

3.3.2 Socioeconomic Status Scale

The socioeconomic status scale developed by Lallianzuali Fanai & R.P.Vadhera (Revised, 2022) measures a person's social and economic position relative to others in society. The scale consists of various areas namely – education of parents, occupation of parents, income of family per month, opinion of other people on students' family status, possession of vehicles, household commodities, housing, important post held by parents in the society and in the church, newspaper subscription. These different areas of socioeconomic status (SES) can be grouped into distinct dimensions by clustering related variables, allowing for a more structured analysis. The key dimensions include: i) Parental Education

ii) Parental Occupation iii) Family Income iv) Family Assets v) Parental Socio-religious Position. vi) Subscription of Newspaper. The scale which has been developed for this purpose is a point scale where the points range between 0 to 8 depending upon the items or variables under assessment. The key dimensions are defined as follows:

Parental Education:

The highest level of education completed by parents (mother and father) of students. It is an ordinal scale, with education levels scored on a scale from 1 to 6, where higher values correspond to higher educational attainment.

Parental Occupation:

The job or profession of a parent (mother and father). It is a 5 - point ordinal scale representing a hierarchy of occupations from low-skilled to highly skilled profession.

Family Income:

The total monetary or financial resources a family earn per month. It is an 8 – point ordinal scale where family income is measured from lowest to highest, without specifying exact income amount.

Family Assets:

Family assets comprise of the total value of resources owned by a family such as land, house, vehicles, durable goods etc. In this SES scale, family assets refer to the combination of vehicles, household commodities and house owned by a family.

Parental Socio-religious Position:

In this study, socio-religious position is the combination of important post held by parents in the society and in the religious activities of the church. It is an ordinal scale where these posts are ranked in order of importance or hierarchy.

Subscription of Newspaper:

It refers to whether and how regularly a family subscribes to newspapers.

The nature of the SES scale is comprehensive and multi-dimensional as it encompasses various aspects of a person's social and economic position. The scale is specially constructed in context of the Mizo society. It does not discriminate between urban and rural, male and female, government school and private school. A copy of socioeconomic status scale has been given in Appendix II.

3.4 PROCEDURE OF DATA COLLECTION:

The researcher personally visited schools across the entire Mizoram state in the east, west, south, north and central regions to collect necessary data. Before administration of the test, due permissions were taken from each of the school headmasters. The test was administered only when both the researcher and the students were ready.

Before administering the test, the researcher first established a close and harmonious relationship with the students and explained the purpose and importance

of the research. Students were assured that the information would be kept in secret and confidential and it will be used only for research purpose. The researcher also requested the respondents to respond the test sincerely and no one should copy from their friends. After the researcher has given instruction on how to respond the test, the students were asked to answer first the socioeconomic status scale and then the mathematical aptitude test may follow it. The entire time taken to complete the test was about one hour.

For academic achievement in mathematics, marks in mathematics subject scored by the students in their class - IX Promotion Examination 2024, were collected by the researcher from school records.

3.5 PROCEDURE OF DATA ANALYSIS

After collecting the responses on mathematical aptitude test and socioeconomic status scale, the data obtained from 891 secondary school students were scored with the help of respective scoring key provided for each test. Normality test was conducted by employing skewness and kurtosis. The skewness and kurtosis of the data in the present study was computed using Microsoft Excel and the resulting values supported the normality of the data distribution. The collected data was plotted for graphical test which showed bell curve shape. The scores of each test were tabulated using SPSS tabulation sheet and were treated with statistical technique for analysis to conduct correlational analysis and differential analysis.

3.6 STATISTICAL TECHNIQUE USED

For analysis of data various types of statistical techniques were used. Descriptive statistical measures such as central tendency, standard deviation, percentage, percentiles, kurtosis and skewness were used for finding out the nature of score distribution and classification of scores in different categories. For finding the significant difference between the mean scores of students, t-test was used. Pearson's product moment correlation and Spearman's rank correlation was used to find out the relationship between different variables such as academic achievement in mathematics, mathematical aptitude and socioeconomic status and dimensions of socioeconomic status.

CHAPTER – IV

ANALYSIS AND INTERPRETATION OF DATA

This chapter focuses on analysis and interpretation of the data collected from academic achievement in mathematics, mathematical aptitude test and socioeconomic status of secondary school students of Mizoram and also the correlation that exist between these variables. Data were collected from a representative sample of secondary school students using standardized tools, and were analysed using appropriate statistical techniques to draw meaningful conclusions.

For better clarity and systematic presentation, the research data is divided into five sections for analysis.

Section – I : Research Tool Construction

Section – II : Nature of Score Distribution

Section – III : Comparative Analysis of Variables

Section – IV : Correlational Analysis of Variables

Section – V : Differential Analysis of Academic Achievement in Mathematics
Based on High and Low Socioeconomic Status

SECTION – I: RESEARCH TOOL CONSTRUCTION

4.1 CONSTRUCTION AND STANDARDIZATION OF MATHEMATICAL APTITUDE TEST (MAT)

Even though there were already a number of mathematical aptitude tests available, the researcher decided to create a new one especially for secondary school students of Mizoram. The primary purpose of constructing a mathematical aptitude test specifically for secondary school students in Mizoram is to develop a culturally and contextually relevant assessment instrument that accurately reflects the learning environment, cognitive development, and curriculum exposure of students in the

region. While mathematical aptitude is a universal cognitive domain, the ways in which students acquire and demonstrate such aptitude are often influenced by linguistic, socio-cultural, and educational systems unique to their setting.

Considering the need for a reliable, valid, and curriculum-aligned assessment tool, the researcher constructed mathematical aptitude test which consists of 20 items of multiple-choice questions. The construction and standardization procedure employed for this test are as follows:

4.1.1 Selection of Items

The investigator critically reviewed literature related to various mathematical aptitude tests which were already standardized and applied by different investigators. A detailed test blueprint was developed to guide item selection, ensuring a balanced representation of the major dimensions of mathematical aptitude. The blueprint categorized items based on content areas and cognitive levels. After analysing the contents and dimensions of different aptitude tests, a preliminary draft of 60 items for mathematical aptitude test was constructed. The test was based on six dimensions namely numerical ability, ability to use symbol and formula, verbal skills, spatial sense, problem solving skills, logical and abstract reasoning. It consisted of arithmetic, algebra, geometry and reasoning.

Table 4.1

Dimension of first draft of mathematical aptitude test

Sl. No.	Dimension	No. of items
1	Numerical Ability	13
2	Ability to use symbol & Formula	10
3	Verbal Skills	9
4	Problem Solving Skills	8
5	Reasoning	12
6	Spatial Sense	8
TOTAL		60

4.1.2 Screening and Pre-Try Out:

A number of 60 items on mathematical aptitude test which was originally prepared were shown to mathematics experts who comprised of professors, assistant professors and senior high school mathematics teachers. The experts were consulted to assess the relevance and quality of the test items. On the basis of their assessment 19 items were rejected and the remaining 41 items were selected for preliminary test. These 41 items were administered to 40 students. It was found out that some items were not relevant to secondary school students, while some items had some defects. It was also found out that 41 items were too many in numbers which caused some problems in administering the test since students found it extremely boring and tedious. On the basis of the test result and on the consultation of experts, 9 items which were not relevant to secondary school students were rejected and ultimately 32 items were selected for actual try-out.

4.1.3 Actual Try Out:

The final draft of mathematical aptitude test containing 32 items was administered to 100 students from 2 government schools and from 2 private schools. The test items had a multiple-choice question (MCQ) consisting of simple arithmetic, geometry & mensuration, algebra, and reasoning which were based on dimensions such as: numerical ability, ability to use symbols & formulae, numerical reasoning and abstract reasoning, spatial ability. The method of scoring was determined by counting the number of right responses and wrong responses. Each right response was given '1' mark whereas '0' was given for each wrong response.

4.1.4 Item Analysis:

The next step after administering test was item analysis. Item analysis is a process which tries to analyse the quality of items on the basis of finding the most appropriate difficulty level and discriminating power. Item analysis helps in identifying the strengths and shortcomings of test items. The main objectives of item analysis are:

- 1) To select the appropriate items for the final draft and reject the poor items which do not contribute in the functioning of the test (Lal, 2007)
- 2) Item analysis indicates which items are difficult, easy, moderately difficult or moderately easy.
- 3) It provides indices of the ability of the items to discriminate between inferior and superior (Singh, 2013).
- 4) Item analysis helps in arranging items in order of difficulty which is one of the objectives of test construction (Prakash, 2008).

Difficulty Value:

For calculating difficulty value, the number of students who gave right responses (R) was counted and it was divided by the total number of students who were given the aptitude test.

$$D.V = \frac{R}{N}$$

The items which had difficulty value within the range of 0.25 to 0.75 were accepted. The larger the value of the index is, the easier the item is (Ebel & Frisbie, 1991).

The item with greater value of difficulty value indicated that the item was easier and smaller value of difficulty value indicated that the item was more difficult.

Table 4.1.2

Total number of right responses of each item and the difficulty values

Item No.	No. of Student who gave right response (R)	Difficulty Value D.V = R/N		Item No.	No. of Student who gave right response (R)	Difficulty Value D.V = R/N
1	58	0.58		17	38	0.38
2	45	0.45		18	56	0.56
3	54	0.54		19	21	0.21
4	47	0.47		20	11	0.11
5	53	0.53		21	45	0.45
6	45	0.45		22	36	0.36
7	46	0.46		23	51	0.51
8	31	0.31		24	72	0.72
9	23	0.23		25	43	0.43
10	71	0.71		26	43	0.43
11	54	0.54		27	37	0.37
12	39	0.39		28	43	0.43
13	43	0.43		29	4	0.43
14	49	0.49		30	15	0.15
15	43	0.43		31	44	0.44
16	64	0.64		32	22	0.22

Based on the above result, test items no. 20, 30 and 32 having difficulty value < 0.25 which were found too difficult, were rejected.

Discriminative Power:

For calculating discriminative power, Kelley's method (Kelly, 1939) as cited by Dhyani (2014) was used. According to this method, score sheet of 100 students was arranged in descending order from the highest to the lowest. From these score sheets, 27% upper group and 27% lower group were selected for comparison. The total number of students who gave right answer in upper group (R_U) and the number of students who gave right answer in lower group (R_L) were counted. The discriminative power was calculated by subtracting R_L from R_U and dividing by the number of students in either group (n).

$$D.P = \frac{R_U - R_L}{n}$$

The higher each item discrimination index, the better (Ebel & Frisbie, 1991)

For selection of items in term of discriminating index, the following rule of thumb has been provided by Ebel and Frisbie (1991).

Table 4.1.3

Ebel and Frisbie's Index of Discrimination

Index of Discrimination	Item Evaluation	Recommendation
0.40 and up	Very Good items	Retain
0.30 to 0.39	Reasonably Good	Possibly subject to improvement
0.20 to 0.29	Marginal, Averages	Usually needing and being subjected to improvement
Below 0.19	Poor items	Poor items, to be rejected or improved by revision

From the above table, discriminative power 0.20 – 0.29 were in marginal and not very poor items. But those items having discriminative power (D.P) less than 0.25 were rejected in this mathematical aptitude test.

Table 4.1.4

Discriminative power, difficulty value and right responses from both upper group and lower group

item No.	R_U	R_L	D.P	D.V	Accepted (A)/ Rejected (R)
1	19	14	0.18	0.58	R
2	18	8	0.37	0.45	A
3	16	8	0.3	0.54	A
4	24	7	0.6	0.47	A
5	24	5	0.7	0.53	A
6	22	4	0.6	0.45	A
7	23	4	0.7	0.46	A
8	9	4	0.18	0.31	R
9	11	2	0.33	0.23	R
10	27	12	0.56	0.71	A
11	19	4	0.56	0.54	A
12	14	10	0.14	0.39	R
13	12	12	0	0.43	R
14	25	3	0.81	0.49	A
15	20	3	0.6	0.43	A
16	24	11	0.48	0.64	A
17	20	6	0.52	0.38	A
18	23	11	0.44	0.56	A
19	9	2	0.26	0.21	R
20	4	2	0.07	0.11	R
21	14	6	0.3	0.45	A
22	15	7	0.3	0.36	A
23	24	6	0.67	0.51	A
24	25	12	0.48	0.72	A
25	15	5	0.37	0.43	A
26	19	7	0.44	0.43	A
27	12	6	0.22	0.37	R
28	17	4	0.48	0.43	A
29	0	3	-0.11	0.43	R
30	7	3	0.15	0.15	R
31	10	6	0.15	0.44	R
32	15	9	0.4	0.22	R

Based on the above result, items no. 1, 8, 12, 13, 20, 27, 29, 30, 31 having discriminating Power < 0.25 were rejected. Therefore, after finding the difficulty

value and discriminating power of each test items, 12 items were deleted and 20 items were retained. The final draft thus consisted of 20 items.

4.1.5 Reliability of the tool:

A test score is reliable if it provides consistency of result on repeated test. According to Garrett (2021), “A test score is called reliable when we have reasons for believing the score to be stable and trustworthy” (p.337). The reliability of the test tool was measured by test-retest method. Aptitude test was administered to 100 students studying class X from two schools. The test was administered again after two weeks. Reliability coefficient was calculated by computing coefficient of correlation between the first and second test scores by Pearson’s product moment method. The reliability coefficient was found to be 0.81.

4.1.6 Validity of the tool:

Validity refers to the accuracy of a test when it measures the purpose of the test. According to Ebel and Frisbie (1991), validity refers to the level to which the test really measures what it claims to measure. For example, when a test is constructed to measure mathematical aptitude, it should measure that particular mathematical aptitude and nothing else. The investigator established content validity of the test by taking the opinion and suggestions of experts. Three professors and five assistant professors in the fields of mathematics and education were consulted.

Table 4.1.5

Dimension of final draft of Mathematical Aptitude Test.

Sl. No.	Dimension	No. of items
1	Numerical Ability	4
2	Ability to use symbol & Formula	4
3	Verbal Skills	3
4	Problem Solving Skills	3
5	Reasoning	4
6	Spatial Sense	2
	TOTAL	20

4.1.7 Norms and Interpretation of Mathematical Aptitude:

Norms are the basis or reference points used to interpret test scores and compare an individual's performance of a defined group. They help determine how well a test-taker has performed relative to others in a specific population or sample. To establish norms for the Mathematical Aptitude Test, the researcher administered the newly constructed aptitude test to 891 secondary school students of Mizoram. The norm was then developed by the researcher by z-scores to interpret the level of mathematical aptitude of secondary school students.

z-score norms: The raw scores of all 891 secondary school students obtained from mathematical aptitude test administered by the researcher were converted into z-score. Given in the following table, levels of mathematical aptitude were classified into 5 levels. The scores between -1 and +1 constituted average mathematical aptitude, the scores between +1 and +2 constituted high aptitude, the scores above +2 constituted very high aptitude, the scores between -2 and -1 constituted low aptitude and the scores below -2 constituted very low aptitude.

Table 4.1.6

Norms for Interpretation of the Levels of Mathematical Aptitude Test based on z-scores

Sl. No.	Score Range	Range of z-score	Level of Mathematical Aptitude
1	18 to 20	+2 and above	Very High
2	14 to 17	+1 to +2	High
3	6 to 13	-1 to +1	Average
4	1 to 5	-2 to -1	Low
5	0	-2 and below	Very Low

SECTION – II: NATURE OF SCORE DISTRIBUTION

4.2 DETERMINATION OF ACADEMIC ACHIEVEMENT IN MATHEMATICS

To determine the academic achievement in mathematics among secondary school students of Mizoram, the marks obtained by secondary school students in mathematics subjects in the Class 9 annual examination was analyzed using descriptive statistics.

4.2.1 Level of academic achievement in mathematics among secondary school students of Mizoram

The Mizoram Board of School Education (MBSE) classifies level of scored marks into five categories: Distinction, First Division, Second Division, Third Division and Fail.

Table 4.2.1

Level of Academic Achievement in Mathematics among Secondary School Students

Level of Academic Achievement in Mathematics	Score Range	N = 891	Percentage
		No. of Students	
Distinction	75 to 100	128	14.4
I Division	60 to 74	108	12.1
II Division	50 to 59	124	13.9
III Division	33 to 49	343	38.5
Fail	Below 33	188	21.1

Figure 4.2.1

Level of Academic Achievement in Mathematics among Secondary School Students

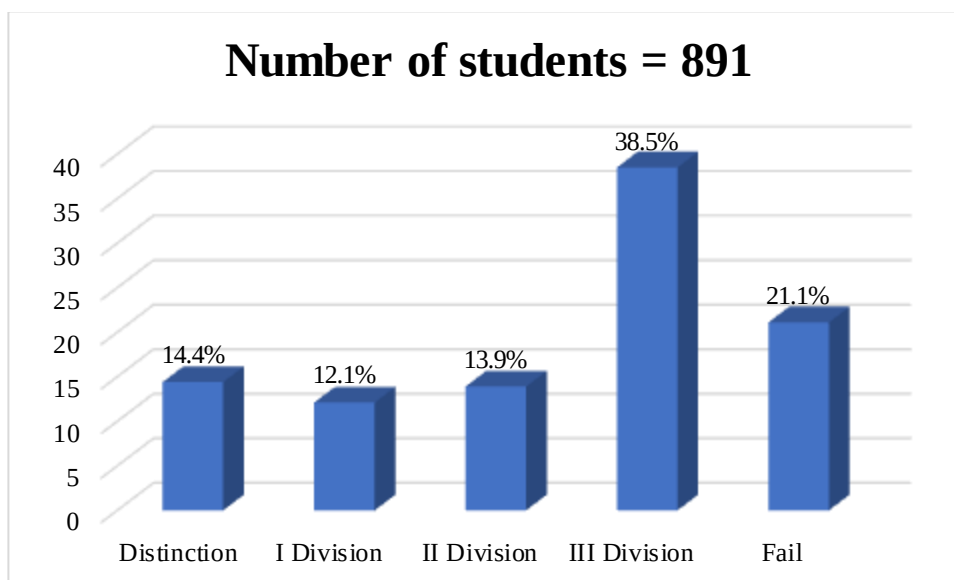


Table 4.2.1 shows that majority of the student, comprising 38.5% is in the third division. This indicates that a significant portion of the students have a basic understanding of mathematics but are struggling with more complex concepts. Approximately 21.1% of the students failed to achieve the minimum passing score. This is a concerning figure, suggesting that a substantial number of students do not meet the basic academic standards in mathematics. On the other hand, 12.1% of the students achieved first division and only 14.4% achieved distinction in mathematics, indicating a high level of proficiency. These students have demonstrated high standard of understanding and performance in the subject. It is also observed that 13.9% of the students achieved second division.

4.2.2 Frequency Distribution of Academic Achievement in Mathematics among Secondary School Students of Mizoram

The score obtained by secondary school students in academic achievement in mathematics is classified and grouped into frequency distribution gender wise, locality wise and type of school management.

Table 4.2.2:

Frequency Distribution of Academic Achievement in Mathematics of Secondary School Students

Marks C.I	Boys	Girls	Urban	Rural	Govt. School	Private School
0 – 9	3	3	2	4	5	1
10 – 19	15	11	14	12	19	7
20 – 29	59	64	64	59	91	32
30 – 39	94	83	92	85	117	60
40 – 49	94	105	83	116	125	73
50 – 59	47	77	57	67	68	55
60 – 69	39	44	41	42	33	50
70 – 79	19	30	38	11	9	40
80 – 89	20	48	49	19	12	56
90 – 99	13	23	32	4	6	30
TOTAL	403	488	472	419	485	406

The distribution of marks in Table 4.2.2 shows that the two highest frequencies fall in the intervals 30–39 (177 students) and 40–49 (199 students). Fewer students achieved very high scores in the range 80–99 or very low scores in the range 0–19, indicating a bell-shaped distribution typical of academic performance.

4.2.3: Statistical Measures of Academic Achievement in Mathematics of Secondary School Students

To determine the statistical measure of academic achievement in mathematics among secondary school students of Mizoram, a table was prepared showing the minimum and maximum score, mean and median score, skewness, kurtosis, and standard deviation.

Table 4.2.3

Statistical Measures of Academic Achievement in Mathematics of Secondary School Students

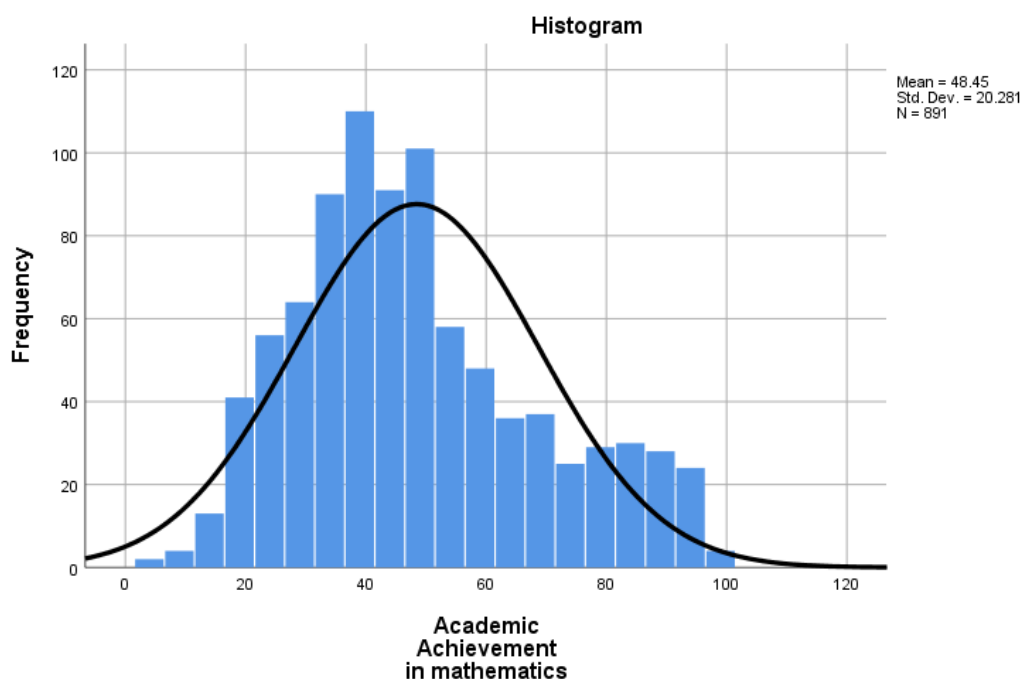
N	Minimum Score	Maximum Score	Mean	Median	Skewness	Kurtosis	S.D
891	4	99	48.44	45	0.549	-0.395	20.28

From Table 4.2.3 it can be seen that academic achievement in mathematics of secondary school students with the lowest score is 4 whereas the highest score is 99. The above table shows that the mean and median on the academic achievement in mathematics of secondary school students were 48.44 and 45 respectively which are quite proximate to each other. The mean score of 48.44 indicates that the academic achievement in mathematics of secondary school students is in third division marks or below average level.

The positive value of skewness (0.549) which is slightly greater than zero indicates that the data is moderately skewed to the right and the distribution is approximately symmetric. The negative value of kurtosis (-0.395) which is slightly less than zero indicates that the distribution is slightly platykurtic, which means it is a little bit flatter than normal, but very close to normal. Thus, it can be concluded that the academic achievement in mathematics of secondary school students is normally distributed, with fewer students scoring extremely high or extremely low. The following figure shows the normal distribution of student score in academic achievement in mathematics:

Fig 4.2.2

Bell curve showing normal distribution of students score for academic achievement in mathematics



4.3 DETERMINATION OF MATHEMATICAL APTITUDE

To determine the mathematical aptitude of secondary school students of Mizoram, Mathematical Aptitude Test (MAT) developed by the researcher was employed.

4.3.1 Level of Mathematical Aptitude of Secondary School Students

To find out the level of mathematical aptitude of secondary school students of Mizoram, the test scored of the respondents were categorized into various levels of mathematical aptitude which was based on their z-scores. The following table provide the various levels of mathematical aptitude of secondary school students:

Table 4.3.1

Level of Mathematical Aptitude of Secondary School Students

Range of z-score	Level of Mathematical Aptitude	Score Range	N = 891 No. of Students	Percentage
+2 and above	Very High	18 to 20	30	3.36
+1 to +2	High	14 to 17	142	15.94
-1 to +1	Average	6 to 13	550	61.73
-2 to -1	Low	1 to 5	168	18.86
-2 and below	Very Low	0	1	0.11

Figure 4.3.1

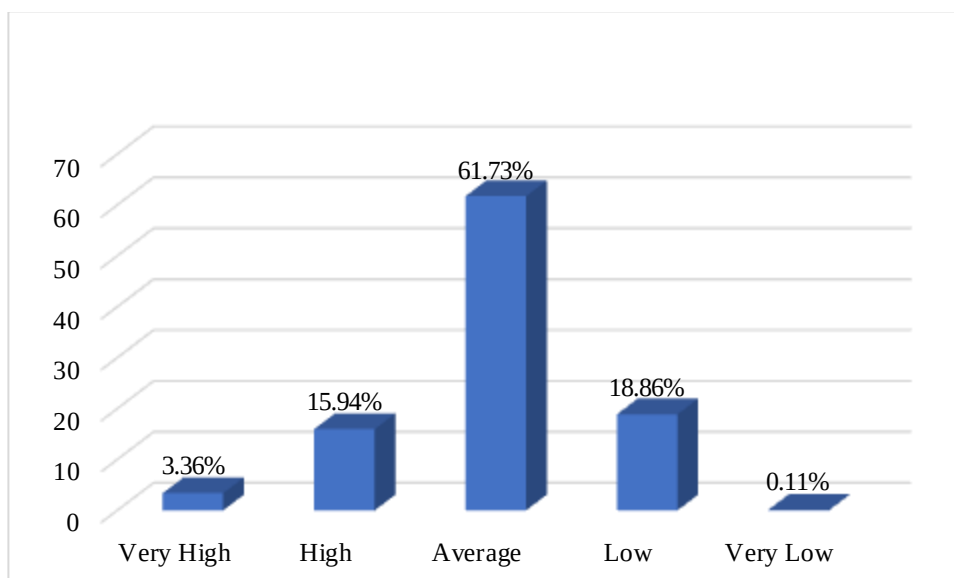
Level of Mathematical Aptitude among Secondary School Students

Table 4.3.1 shows that the majority of students (61.73%) fall within the average range in mathematical aptitude test. About 15.94% of students have high mathematical aptitude, scoring above average but not in the top tier. These students

are strong performers. A small proportion of students (3.36%) demonstrate very high mathematical aptitude. These students are likely exceptional performers. A significant proportion of students (18.86%) have low mathematical aptitude, scoring below average whereas only one student (0.11%) falls into the very low aptitude category, scoring at the extreme lower end of the distribution.

4.3.2: Statistical measures of mathematical aptitude among secondary school students of Mizoram

To determine the statistical measure of mathematical aptitude among secondary school students of Mizoram, a table was prepared showing the minimum and maximum score, mean and median score, skewness, kurtosis, and standard deviation. These were further analyzed and interpreted accordingly.

Table 4.3.2

Statistical Measures of Mathematical Aptitude of Secondary School Students

N	Minimum Score	Maximum Score	Mean	Median	S.D	Skewness	Kurtosis
891	0	20	9.33	9	4.23	0.355	-0.489

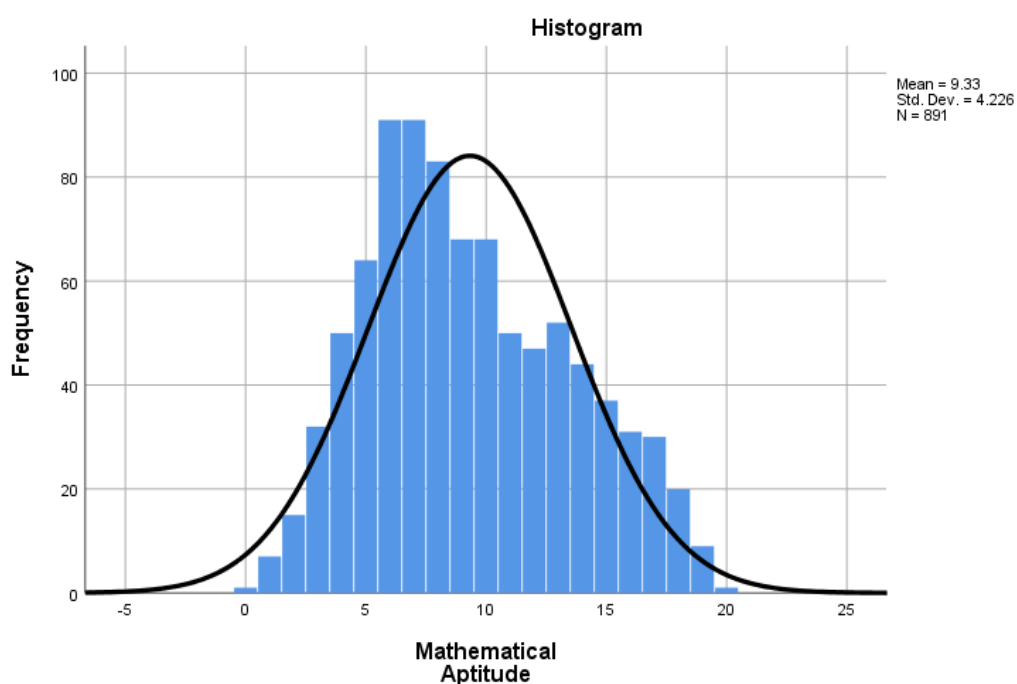
As shown in Table 4.3.2, it can be seen that mathematical aptitude of secondary school students with the lowest score is 0 whereas the highest score is 20. The above table shows that the mean and median on the mathematical aptitude of secondary school students were 9.33 and 9 respectively which are proximate to each other. The mean score of 9.33 indicates that the mathematical aptitude of secondary school student is in average level.

The positive value of skewness (0.355) which is slightly greater than zero indicates that the data is moderately skewed to the right and the distribution is approximately symmetric. The negative value of kurtosis (-0.489) which is slightly less than zero indicates that the distribution is slightly platykurtic, which means it is a little bit flatter than normal, but close to normal. Thus, it can be concluded that the

mathematical aptitude of secondary school students is normally distributed, with fewer students scoring extremely high or extremely low.

Fig 4.3.2

Bell curve showing normal distribution of students score in mathematical aptitude test



4.4 DETERMINATION OF SOCIOECONOMIC STATUS OF SECONDARY SCHOOL STUDENTS

To determine the socioeconomic status among secondary school students of Mizoram, Socioeconomic Status Scale (Revised, 2022) developed by Prof. Lallianzuali Fanai & Prof. R.P. Vadhera was employed.

4.4.1 Level of socioeconomic status among secondary school students of Mizoram

To find out the level of socioeconomic status among secondary school students of Mizoram, the test scores of the respondents were categorized into various levels of socioeconomic status which was based on their z-scores. The following table provides the various levels of socioeconomic status of secondary school students:

Table 4.4.1

Level of Socioeconomic Status of Students

N	Range of z-score	Level of SES	Score Range	No. of Student as per level	Percentage
891	+2 and above	Very High	55 and above	26	2.9
	+1 to +2	High	46 to 54	121	13.6
	-1 to +1	Average	27 to 45	581	65.2
	-2 to -1	Low	16 to 26	158	17.7
	-2 and below	Very Low	15 and below	5	0.6

Figure 4.4.1

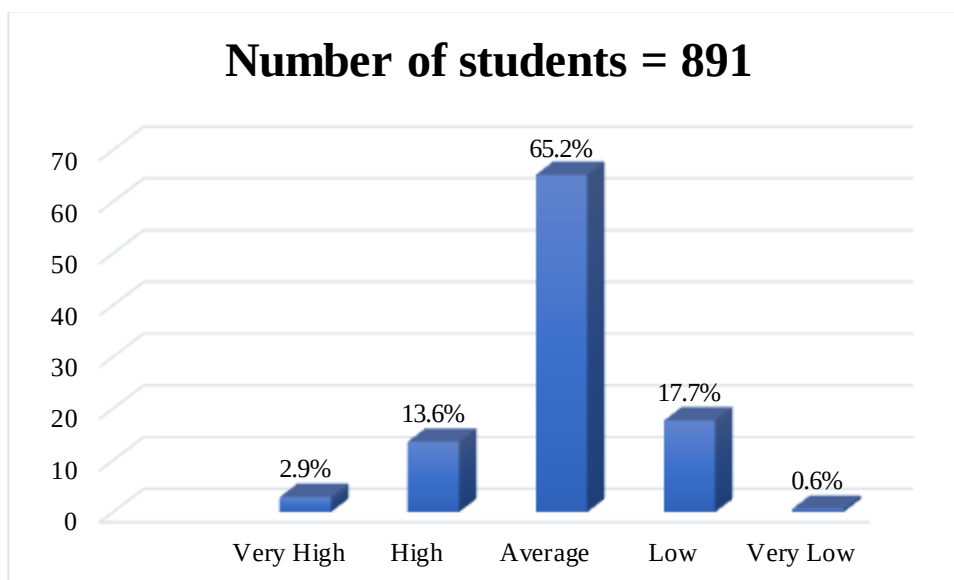
Level of Socioeconomic Status of Secondary School Students

Table 4.4.1 shows that majority of students (65.2%) fall in the "Average" SES category indicating that most students have SES levels close to the mean. A significant portion (17.7%) falls in the "Low" SES group, indicating that a substantial number of students come from economically disadvantaged backgrounds whereas about 13.6% of students are in the "High" SES group, which is a moderate proportion. These students have above-average SES but not as high as the "Very High" group. Only 2.9% of students have a "Very High" SES, while only 0.6% have a "Very Low" SES indicating fewer students in the extreme high and low categories.

4.4.2: Statistical measures of socioeconomic status of secondary school students

To determine the statistical measure of socioeconomic status among secondary school students of Mizoram, a table was prepared showing the minimum and maximum score, mean and median score, skewness, kurtosis, and standard deviation.

Table 4.4.2

Statistical Measures of Socioeconomic Status of Secondary School Students

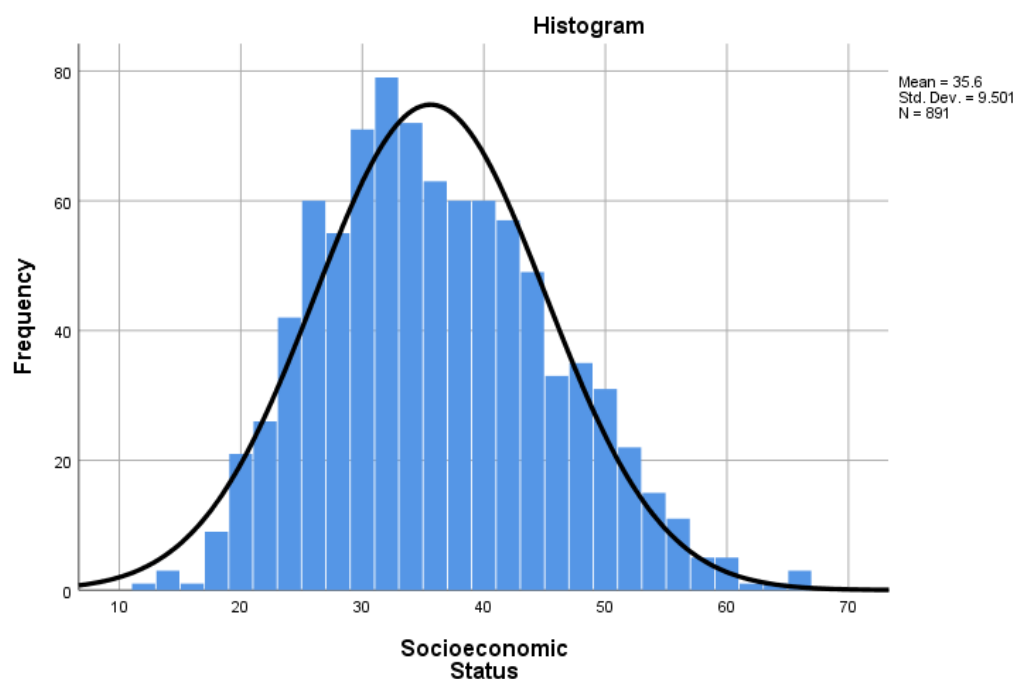
N	Minimum Score	Maximum Score	Mean	Median	S.D	Skewness	Kurtosis
891	12	66	35.60	35	9.50	0.33	-0.302

As shown in Table 4.4.2 it can be seen that socioeconomic status of secondary school students with the lowest score is 12 whereas the highest score is 66. The mean score of 35.60 indicates that the socioeconomic status of secondary school students is in average level.

The positive value of skewness (0.33) which is slightly greater than zero indicates that the data is skewed to the right and the distribution is approximately symmetric. The negative value of kurtosis (-0.302) which is slightly less than zero indicates that the distribution is slightly platykurtic, which means it is a little bit flatter than normal, but very close to normal. Thus, it can be concluded that the socioeconomic status of secondary school students is normally distributed, with fewer students scoring extremely high or extremely low.

Fig 4.4.2

Bell curve showing normal distribution of students score in mathematical aptitude test



SECTION – III: COMPARATIVE ANALYSIS OF VARIABLES

This section systematically compares different groups across selected variables to identify key differences. It deals with identifying and evaluating differences of Academic Achievement in Mathematics, Mathematical Aptitude and Socioeconomic Status with respect to male and female students, urban and rural students, government and private secondary school students.

4.5 Analysis of data related to difference in academic achievement in mathematics

4.5.1 Comparison of academic achievement in mathematics between male and female by test of significance

Hypothesis No.1 states: 'There is a significant difference in academic achievement in mathematics between male and female secondary school students of Mizoram.' This hypothesis was converted into a null hypothesis which states that, 'There is no significant difference in academic achievement in mathematics between male and female secondary school students of Mizoram.' The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.5.1

Comparison of academic achievement in mathematics between male and female secondary school students by test of significance

Groups	N	Mean	SD	SE _p	Df	t-value	Sig. Level
Male	403	46.06	19.21	1.347	889	-3.227	0.01
Female	488	50.41	20.94				

As presented in Table 4.5.1, the t-value for the difference in academic achievement in mathematics between male and female students is -3.227. Since the calculated t-value is greater than the critical value at 0.01 level of significance, the null hypothesis that there is no significant difference in the academic achievement in mathematics between male and female is rejected. It indicates that the academic achievement in mathematics of male and female students differ significantly. Comparison of mean scores revealed that the mean score of female students is higher than the mean score of male students which shows that female students have significantly higher academic achievement in mathematics than male students.

4.5.2 Comparison of male and female secondary school students based on level of academic achievement in mathematics

The following table presents the comparison of academic achievement in mathematics between male and female secondary school students:

Table 4.5.2

Comparison of the level of academic achievement in mathematics between male and female secondary school students

Levels of Academic Achievements in Mathematics	Score Range	Male		Female	
		N	%	N	%
Distinction	75 to 100	42	10.42	86	17.62
I Division	60 to 74	49	12.16	59	12.09
II Division	50 to 59	47	11.66	77	15.78
III Division	33 to 49	175	43.42	168	34.43
Fail	Below 33	90	22.34	98	20.08
Total		403	100	488	100

As shown in Table 4.5.2, female students have higher percentage of Distinction (17.62%) and II Division (15.78%) marks compared to male students, who achieve lower percentage in these categories (10.42% for Distinction and 11.66% for II Division). In contrast, male students have higher percentage of III Division (43.42%) and Fail (22.34%) than female students, who report 34.43 % for III Division and 20.08% for Fail categories. Male and female students show similar percentage (approx.) in the I Division category, with male students at 12.16% and female students at 12.09%.

4.5.3 Comparison of academic achievement in mathematics between urban and rural students by test of significance

Hypothesis No.2 states: ‘There is a significant difference in academic achievement in mathematics between urban and rural secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in academic achievement in mathematics between urban and rural secondary school students of Mizoram.’ The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.5.3

Comparison of academic achievement in mathematics between urban and rural secondary school students by test of significance

Groups	N	Mean	SD	SE _D	Df	t-value	Sig. Level
Urban	472	51.48	22.41	1.323	889	4.885	0.01
Rural	419	45.02	16.96				

As presented in Table 4.5.3, the t-value for the difference in academic achievement in mathematics between urban and rural students is 4.885. Since the calculated t-value is greater than the critical value at 0.01 level of significance, the null hypothesis that there is no significant difference in the academic achievement in mathematics between urban and rural students is rejected. It indicates that the academic achievement in mathematics of urban and rural students differs significantly. Comparison of mean scores revealed that the mean score of urban students is higher than the mean score of rural students which shows that urban secondary school students have significantly higher academic achievement in mathematics than rural secondary school students.

4.5.4 Comparison of urban and rural secondary school students based on level of academic achievement in mathematics

The following table presents the comparison of academic achievement in mathematics between urban and rural secondary school students:

Table 4.5.4

Comparison of the level of academic achievement in mathematics between urban and rural secondary school students

Levels of Academic Achievements in Mathematics	Score Range	Urban		Rural	
		N	%	N	%
Distinction	75 to 100	99	20.97	29	6.92
I Division	60 to 74	61	12.92	47	11.21
II Division	50 to 59	57	12.08	67	16
III Division	33 to 49	154	32.63	189	45.10
Fail	Below 33	101	21.40	87	20.77
Total		472	100	419	100

As shown in Table 4.5.4, urban students have higher percentage of Distinction (20.97%) and I Division (12.92%) marks compared to rural students, who achieve lower percentage in these categories (6.92% for Distinction and 11.21% for I Division). In contrast, rural students have higher percentage of II Division (16%) and III Division (45.10%) than urban students, who report 12.08% for II Division and 32.63% for III Division categories. Urban and rural students show almost similar percentage in the Fail category, with urban students at 21.40% and rural students at 20.77%.

4.5.5 Comparison of academic achievement in mathematics between government and private secondary school students by test of significance

Hypothesis No.3 states: ‘There is a significant difference in academic achievement in mathematics between government and private secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in academic achievement in mathematics between government and private secondary school students of Mizoram.’ The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.5.5

Comparison of academic achievement in mathematics between government and private secondary school students by test of significance

Groups	N	Mean	SD	SE _D	Df	t-value	Sig. Level
Govt.	485	41.66	16.29	1.308	889	-11.642	0.01
Private	406	56.77	21.75				

As shown in Table 4.5.5, the t-value for the difference in academic achievement in mathematics between government and private school students is -11.642. Since the calculated absolute t-value is greater than the critical value at 0.01 level of significance, the null hypothesis that there is no significant difference in the academic achievement in mathematics between government and private school student is rejected. It indicates that the academic achievement in mathematics of government and private school students differs significantly. Comparison of mean scores revealed that the mean score of private school students is higher than the mean score of government school student which shows that private students have significantly higher academic achievement in mathematics than government school students.

4.5.6 Comparison of government and private secondary school students based on level of academic achievement in mathematics

The following table presents the comparison of academic achievement in mathematics between government and private secondary school students:

Table 4.5.6

Comparison of the level of academic achievement in mathematics between government and private secondary school students

Levels of Academic Achievements in Mathematics	Score Range	Govt. School		Private School	
		N	%	N	%
Distinction	75 to 100	22	4.54	108	26.60
I Division	60 to 74	38	7.83	70	17.24
II Division	50 to 59	68	14.02	55	13.55
III Division	33 to 49	226	46.60	116	28.57
Fail	Below 33	131	27.01	57	14.04
Total		485	100	406	100

As shown in Table 4.5.6, private school students have higher percentage of Distinction (26.60%) and I Division (17.24%) marks compared to government school students, who achieve lower percentage in these categories (4.54% for Distinction and 7.83% for I Division). In contrast, government school students have higher percentage of III Division (46.60%) and Fail (27.01%) than urban students, who report 28.57% for III Division and 14.04% for Fail categories. Government and private school students show almost similar percentage in the II Division category, with government school students at 14.02% and private school students at 13.55%.

4.5.7 Comparison of academic achievement in mathematics between male and female urban secondary school students by test of significance

Hypothesis No.4 states: ‘There is a significant difference in academic achievement in mathematics between male and female urban secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in academic achievement in mathematics between male and female of urban secondary school students of Mizoram.’ The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.5.7

Comparison of academic achievement in mathematics between male and female urban secondary school students by test of significance

Groups	N	Mean	SD	SE _D	Df	t-value	Sig. Level
Urban Male	206	49.02	22.43	2.072	470	-2.265	0.05
Urban Female	266	53.71	22.25				

As shown in Table 4.5.7, the t-value for the difference in academic achievement in mathematics between urban male and urban female students is - 2.265. Since the calculated t-value is greater than the Critical Value at 0.05 level of significance, the null hypothesis that there is no significant difference in the academic achievement in mathematics between urban male and urban female is rejected. It indicates that the academic achievement in mathematics of urban male and urban female students differs significantly. Comparison of mean scores revealed that the mean score of urban female students is higher than that of urban male student which shows that urban female secondary school students have significantly higher academic achievement in mathematics than urban male secondary school students.

4.5.8 Comparison of male and female urban students based on level of academic achievement in mathematics

The following table depicts the comparison of academic achievement in mathematics between urban secondary school students of male and female:

Table 4.5.8

Comparison of the level of academic achievement in mathematics between male and female students in urban secondary schools

Levels of Academic Achievements in Mathematics	Score Range	Urban Male		Urban Female	
		N	%	N	%
Distinction	75 to 100	37	17.96	63	17.62
I Division	60 to 74	26	12.62	35	12.09
II Division	50 to 59	19	9.22	39	15.78
III Division	33 to 49	74	35.92	79	34.43
Fail	Below 33	50	24.27	50	20.08
Total		206	100	266	100

As shown in Table 4.5.8, urban female students have significantly higher percentage of II Division (15.78%) marks compared to urban male students, who achieve lower percentage of 9.22%. In contrast, urban male students have slightly higher percentage of Fail category (24.27%) than urban female students, who report 20.08% for Fail categories. Urban male and female students show nearly similar percentage in the Distinction category (17.96% for males and 17.62% for females), I Division (12.62% for males and 12.09% for females), and III Division (35.92% for males and 34.43% for females).

4.5.9 Comparison of academic achievement in mathematics between male and female rural secondary school students by test of significance

Hypothesis No.5 states: ‘There is a significant difference in academic achievement in mathematics between male and female of rural secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in academic achievement in mathematics between male and female of rural secondary school students of Mizoram.’ The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.5.9

Comparison of academic achievement in mathematics between male and female rural secondary school students by test of significance

Groups	N	Mean	SD	SE _D	Df	t-value	Sig. Level
Rural Male	198	43.28	14.95	1.635	417	-2.016	0.05
Rural Female	221	46.58	18.48				

As found in Table 4.5.9 that the t-value for the difference in academic achievement in mathematics between rural male and rural female students is -2.016. Since the calculated t-value is greater than the critical value at 0.05 level of significance, the null hypothesis that there is no significant difference in the academic achievement in mathematics between rural male and rural female is rejected. It indicates that the academic achievement in mathematics of rural male and rural female students differs significantly. Comparison of mean scores revealed that the mean score of rural female students is higher than the mean score of rural male student which shows that rural female secondary school students have significantly higher academic achievement in mathematics than rural male secondary school students.

4.5.10 Comparison of male and female rural secondary school students based on level of academic achievement in mathematics

The following table depicts the comparison of academic achievement in mathematics between rural secondary school students of male and female:

Table 4.5.10

Comparison of the level of academic achievement in mathematics between male and female students in rural secondary schools

Levels of Academic Achievements in Mathematics	Score Range	Rural Male		Rural Female	
		N	%	N	%
Distinction	75 to 100	6	3.03	23	10.41
I Division	60 to 74	23	11.61	24	10.86
II Division	50 to 59	29	14.65	38	17.19
III Division	33 to 49	100	50.50	89	40.27
Fail	Below 33	40	20.20	47	21.27
Total		198	100	221	100

As shown in Table 4.5.10, rural female students have significantly higher percentage of Distinction (10.41%) and II Division (17.19%) marks compared to rural male students, who achieve lower percentage in these categories (3.03% for Distinction and 14.65% for II Division). In contrast, rural male students have higher percentage of III Division (50.50%) than rural female students, who scored 40.27% for this category. Rural male and female students show almost similar percentage in the I Division and Fail categories, with rural male students at 11.61% and rural female students at 10.86% in the I Division and rural male students at 20.20% and rural female students at 21.27% in the Fail category.

4.5.11 Comparison of academic achievement in mathematics between male and female government secondary school students by test of significance

Hypothesis No.6 states: ‘There is a significant difference in academic achievement in mathematics between male and female government secondary school students of Mizoram’. This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in academic achievement in mathematics between male and female of government secondary school students of Mizoram’. The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.5.11

Comparison of academic achievement in mathematics between male and female government secondary school students by test of significance

Groups	N	Mean	SD	SE _D	Df	t-value	Sig. Level
Govt. Male	219	40.12	14.33	1.452	483	-1.928	NS**
Govt. Female	266	42.92	17.67				

** NS not significant at 0.05 level of significance.

As shown in Table 4.5.11, the t-value for the difference in academic achievement in mathematics between male and female students of government school is -1.928. Since the calculated t-value is less than the Critical Value at 0.05 level of significance, the null hypothesis that there is no significant difference in the academic achievement in mathematics between male and female students in government school is accepted. It indicates that the academic achievement in mathematics of male and female students in government school do not differs significantly.

4.5.12 Comparison of male and female government secondary school students based on level of academic achievement in mathematics

The following table depicts the comparison of academic achievement in mathematics between government secondary school students of male and female:

Table 4.5.12

Comparison of the level of academic achievement in mathematics between male and female students in government secondary schools

Levels of Academic Achievements in Mathematics	Score Range	Male Govt. School		Female Govt. School	
		N	%	N	%
Distinction	75 to 100	5	2.28	17	6.39
I Division	60 to 74	17	7.76	21	7.89
II Division	50 to 59	25	11.42	43	16.17
III Division	33 to 49	115	52.51	111	41.73
Fail	Below 33	57	26.03	74	27.82
Total		219	100	266	100

As shown in Table 4.5.12, female students of government school have higher percentage of Distinction (6.39%) and II Division (16.17%) compared to male students of government school, who achieve lower percentage in these categories (2.28% for Distinction and 11.42% for II Division). Contrary to this results, male students of government school have higher percentage of III Division (52.51%) than female students of government school, who scored 41.73% for this category. Male and female students of government school show almost similar percentage in the I Division and Fail categories, with male students of government school at 7.76% whereas female students at 7.89% in the I Division, and male students of government

school at 26.03% and female students of government school at 27.82% in the Fail category.

4.5.13 Comparison of academic achievement in mathematics between male and female private secondary school students by test of significance

Hypothesis No.7 states: ‘There is a significant difference in academic achievement in mathematics between male and female of private secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which stated that, ‘There is no significant difference in academic achievement in mathematics between male and female of private secondary school students of Mizoram’. The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.5.13

Comparison of academic achievement in mathematics between male and female private secondary school students by test of significance

Groups	N	Mean	SD	SE_p	Df	t-value	Sig. Level
Private Male	177	53.06	22.11				
				2.15	404	3.051	0.01
Private Female	229	59.63	21.08				

As shown in Table 4.5.13, the t-value for the difference in academic achievement in mathematics between male and female students of private secondary school is 3.051. Since the calculated t-value is less than the Critical Value at 0.01 level of significance, the null hypothesis that there is no significant difference in the academic achievement in mathematics between male and female students in private secondary school is rejected. It indicates that the academic achievement in mathematics among male and female students in private schools differs significantly. Comparison of mean scores revealed that the mean score of female students is higher than that of male students in private schools which shows that female students have

significantly higher academic achievement in mathematics than male students among private schools of Mizoram.

4.5.14 Comparison of male and female private secondary school students based on level of academic achievement in mathematics

The following table depicts the comparison of academic achievement in mathematics between private secondary school students of male and female:

Table 4.5.14

Comparison of the level of academic achievement in mathematics between male and female students in private secondary schools

Levels of Academic Achievements in Mathematics	Score Range	Male Private School		Female Private School	
		N	%	N	%
Distinction	75 to 100	37	20.91	71	31.1
I Division	60 to 74	30	16.95	40	17.47
II Division	50 to 59	20	11.30	35	15.28
III Division	33 to 49	57	32.20	59	25.76
Fail	Below 33	33	18.64	24	10.48
Total		177	100	229	100

As shown in Table 4.5.14, female students of private secondary school have higher percentage of Distinction (31.1%) and II Division (15.28%) compared to male students of private secondary school, who achieve lower percentage in these categories (20.91% for Distinction and 11.30% for II Division). Contrary to this findings, male students of private secondary school have higher percentage of III Division (32.20%) and Fail category (18.64%) than female students of private secondary school, who report 25.76% in the III Division and 10.48% in the Fail

category. Male and female students of private secondary school show almost similar percentage in the I Division category, with male students of private secondary school at 16.95% whereas female students of private secondary school at 17.47%.

4.6 Analysis of data related to difference in mathematical aptitude

4.6.1 Comparison of mathematical aptitude between male and female secondary school students by test of significance

Hypothesis No.8 states: ‘There is a significant difference in mathematical aptitude between male and female secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in mathematical aptitude between male and female secondary school students of Mizoram.’ The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.6.1

Comparison of mathematical aptitude between male and female secondary school students by test of significance

Groups	N	Mean	SD	SE _D	Df	t-value	Sig. Level
Male	403	9.51	4.29	0.284	889	1.185	NS**
Female	488	9.17	4.17				

** NS not significant at 0.05 level of significance.

As presented in Table 4.6.1, the t-value for the difference in mathematical aptitude between male and female students is 1.185. Since the calculated t-value is less than the critical value at 0.05 and 0.01 level of significance, the null hypothesis that there is no significant difference in the mathematical aptitude between male and female is accepted. It indicates that the mathematical aptitude of male and female students does not differ significantly.

4.6.2 Comparison of male and female secondary school students based on level of mathematical aptitude

The following table provides the comparison of mathematical aptitude between male and female secondary school students:

Table 4.6.2

Comparison of the level of mathematical aptitude between male and female secondary school students

Mathematical Aptitude	Range of z-score	Male		Female	
		N	%	N	%
Very High	+2 and above	18	4.47	12	2.46
High	+1 to +2	65	16.13	77	15.78
Average	-1 to +1	245	60.79	305	62.5
Low	-2 to -1	74	18.36	94	19.26
Very Low	-2 and below	1	0.25	0	0
Total		485	100	406	100

As shown in Table 4.6.2, male students have slightly higher percentage of Very High mathematical aptitude (4.47%) compared to female students, who report lower percentage (2.46%) in the Very High mathematical aptitude category. In contrast, female have slightly higher percentage of Average mathematical aptitude (62.5%) than male students who report 60.79% in the Average category. Both male and female students exhibit closely aligned percentages in the remaining aptitude categories. In the High aptitude range, male students account for 16.13%, while female students are slightly lower at 15.78%. Similarly, in the Low aptitude category, 18.36% of males and 19.26% of females fall within this range, showing only a

marginal difference. In the Very Low aptitude category, a negligible 0.25% of male students are represented, whereas no female students were recorded in this group.

The overall distribution of mathematical aptitude is largely balanced between male and female students, with only minor differences across the aptitude levels.

4.6.3 Comparison of mathematical aptitude between urban and rural secondary school students by test of significance

Hypothesis No.9 states: ‘There is a significant difference in mathematical aptitude between urban and rural secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which stated that, ‘There is no significant difference in mathematical aptitude between urban and rural secondary school students of Mizoram.’ The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.6.3

Comparison of mathematical aptitude between urban and rural secondary school students by test of significance

Groups	N	Mean	SD	SE_D	Df	t-value	Sig. Level
Urban	472	10.47	4.47	0.268	889	9.092	0.01
Rural	419	8.03	3.51				

As presented in Table 4.6.2, the t-value for the difference in mathematical aptitude between urban and rural students is 9.092. Since the calculated t-value is greater than the Critical Value at 0.01 level of significance, the null hypothesis that there is no significant difference in the mathematical aptitude between urban and rural is rejected. It indicates that the mathematical aptitude of urban and rural students differs significantly. Comparison of mean scores revealed that the mean score of urban students is higher than that of rural students which shows that urban students have significantly higher mathematical aptitude than rural students.

4.6.4 Comparison of urban and rural secondary school students based on level of mathematical aptitude

The following table provides the comparison of mathematical aptitude between urban and rural secondary school students:

Table 4.6.4

Comparison of the level of mathematical aptitude between urban and rural secondary school students

Level of Mathematical Aptitude	Range of z-score	Urban		Rural	
		N	%	N	%
Very High	+2 and above	27	5.72	3	0.72
High	+1 to +2	108	22.88	34	8.11
Average	-1 to +1	268	56.78	282	67.30
Low	-2 to -1	69	14.62	99	23.63
Very Low	-2 and below	0	0	1	0.24
Total		472	100	419	100

As shown in Table 4.6.4, urban students have higher percentage of Very High mathematical aptitude (5.72%) compared to rural students (0.72%). Similarly, urban students have higher percentage of High mathematical aptitude (22.88%) compared to rural students (8.11%). In the Average mathematical aptitude category, rural students have higher percentage (67.30%) compared to urban students (56.78%). The percentage of students with Low mathematical aptitude is higher among rural students (23.63%) compared to urban students (14.62%).

4.6.5 Comparison of mathematical aptitude between government and private secondary school students by test of significance

Hypothesis No.10 states: 'There is a significant difference in mathematical aptitude between government and private secondary school students of Mizoram.' This hypothesis was converted into a null hypothesis which states that, 'There is no significant difference in mathematical aptitude between government and private secondary school students of Mizoram.' The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.6.5

Comparison of mathematical aptitude between government and private secondary school students by test of significance

Groups	N	Mean	SD	SE _D	Df	t-value	Sig. Level
Govt.	485	7.841	3.67				
				0.265	889	-12.352	0.01
Private	406	11.12	4.16				

As shown in Table 4.6.5, the t-value for the difference in mathematical aptitude of govt. and private school students is -12.352. Since the calculated absolute t-value is greater than the Critical Value at 0.01 level of significance, the null hypothesis that there is no significant difference in the mathematical aptitude between govt. and private school students is rejected. It indicates that the mathematical aptitude of govt. and private school students differs significantly. Comparison of mean scores revealed that the mean score of private school students is higher than the mean score of govt. school students which shows that private school students have significantly higher mathematical aptitude than govt. secondary school students.

4.6.6 Comparison of government and private secondary school students based on level of mathematical aptitude

The following table provides the comparison of mathematical aptitude between government and private secondary school students:

Table 4.6.6

Comparison of the level of mathematical aptitude between government and private secondary school students

Level of Mathematical Aptitude	Range of z-score	Govt. School		Private School	
		N	%	N	%
Very High	+2 and above	2	0.41	28	6.90
High	+1 to +2	43	8.86	99	24.38
Average	-1 to +1	305	62.89	245	60.34
Low	-2 to -1	134	27.63	34	8.37
Very Low	-2 and below	1	0.21	0	0
Total		485	100	406	100

Table 4.6.6 shows that in the Very High mathematical aptitude category, private secondary school students outnumber government secondary school students with 6.90% to 0.41%. Similarly, in the High mathematical aptitude category, private secondary school students have higher percentage (24.38%) than government secondary school students (8.86%). Government secondary school students (27.63%) have higher percentage of Low mathematical aptitude category than private secondary school students (8.37%). Government secondary school students show almost similar percentage in the Average mathematical aptitude category, with government secondary students at 62.89% and private secondary school students at 60.34%.

4.6.7 Comparison of mathematical aptitude between male and female urban secondary school students by test of significance

Hypothesis No.11 states: ‘There is a significant difference in mathematical aptitude between male and female urban secondary school students of Mizoram’. This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in mathematical aptitude between male and female urban secondary school students of Mizoram’. The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.6.7

Comparison of mathematical aptitude between male and female urban secondary school students by test of significance

Groups	N	Mean	SD	SE _D	Df	t-value	Sig. Level
Urban Male	206	10.95	4.57				
Urban Female	266	10.20	4.35	0.413	470	1.801	NS**

NS** not significant

As presented in Table 4.6.7, the t-value for the difference in mathematical aptitude between urban male and urban female students is 1.801. Since the calculated t-value is less than the Critical Value at 0.05 level of significance, the null hypothesis that there is no significant difference in mathematical aptitude between urban male and urban female is accepted. It indicates that the mathematical aptitude of urban male and urban female students do not differ significantly.

4.6.8 Comparison of male and female urban students based on level of mathematical aptitude

The following table provides the comparison of mathematical aptitude between urban secondary school students of male and female:

Table 4.6.8

Comparison of the level of mathematical aptitude between male and female students in urban secondary schools

Level of Mathematical Aptitude	Range of z-score	Urban Male		Urban Female	
		N	%	N	%
Very High	+2 and above	16	7.77	11	4.14
High	+1 to +2	52	25.24	58	21.80
Average	-1 to +1	110	53.39	158	59.39
Low	-2 to -1	28	13.60	39	14.66
Very Low	-2 and below	0	0	0	0
Total		206	100	266	100

As shown in Table 4.6.8, male students of urban secondary school have slightly higher percentage of Very High mathematical aptitude (7.77%) and High mathematical aptitude (25.24%) compared to female students of urban secondary school, who achieve lower percentage in these categories (4.14% for Very High and 21.80% for High mathematical aptitude). Contrary to this results, female students of urban secondary school have higher percentage of Average category (59.39%) than male students of urban secondary school, who scored 53.39% for this category. Male and female students of urban secondary school show almost similar percentage in the Low mathematical aptitude category, with male students at 13.60% whereas

female students at 14.66%. Neither male nor female students in urban secondary schools fell into the 'Very Low' mathematical aptitude category.

4.6.9 Comparison of mathematical aptitude between male and female rural secondary school students by test of significance

Hypothesis No.12 states: 'There is a significant difference in mathematical aptitude between male and female of rural secondary school students of Mizoram.' This hypothesis was converted into a null hypothesis which states that, 'There is no significant difference in mathematical aptitude between male and female rural secondary school students of Mizoram.' The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.6.9

Comparison of mathematical aptitude between male and female rural secondary school students by test of significance

Groups	N	Mean	SD	SE_D	Df	t-value	Sig. Level
Rural Male	198	8.11	3.45				
				0.344	417	0.415	NS**
Rural Female	221	7.97	3.58				

** NS not significant.

As shown in Table 4.6.9, the t-value for the difference in mathematical aptitude between urban male and urban female students is 0.415. Since the calculated t-value is less than the Critical Value at 0.05 level of significance, the null hypothesis that there is no significant difference in the mathematical aptitude between rural male and rural female secondary students is accepted. It indicates that the mathematical aptitude of rural male and rural female secondary school students do not differ significantly.

4.6.10 Comparison of male and female rural students based on level of mathematical aptitude

The following table provides the comparison of mathematical aptitude between rural secondary school students of male and female:

Table 4.6.10

Comparison of the level of mathematical aptitude between male and female students in rural secondary schools

Level of Mathematical Aptitude	Range of z-score	Rural Male		Rural Female	
		N	%	N	%
Very High	+2 and above	2	1.01	1	0.45
High	+1 to +2	15	7.57	19	8.60
Average	-1 to +1	135	68.18	147	66.52
Low	-2 to -1	45	22.73	54	24.43
Very Low	-2 and below	1	0.51	0	0
Total		198	100	221	100

As shown in Table 4.6.10, male and female students of rural secondary school show almost similar percentage in every level of mathematical aptitude category. Female students have slightly higher percentage in the High (8.60%) and Low (24.43%) categories than male students who shows High (7.57%) and Low (22.23%) categories, whereas male students have slightly higher percentage in the Average category (68.18%) than female students who reports 66.52%.

4.6.11 Comparison of mathematical aptitude between male and female government secondary school students by test of significance

Hypothesis No.13 states: ‘There is a significant difference in mathematical aptitude between male and female government secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in mathematical aptitude between male and female Government secondary school students of Mizoram.’ The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.6.11

Comparison of mathematical aptitude between male and female government secondary school students by test of significance

Groups	N	Mean	SD	SE _D	Df	t-value	Sig. Level
Govt. School Male	219	8.13	3.62	0.33	483	1.564	NS**
Govt. School Female	266	7.60	3.69				

** NS not significant at 0.01 and 0.05.

As shown in Table 4.6.11, the t-value for the difference in mathematical aptitude between male and female students of government secondary school is 1.564. Since the calculated t-value is less than the critical value at 0.05 level of significance, the null hypothesis that there is no significant difference in mathematical aptitude between male and female students in government school is accepted. It indicates that the mathematical aptitude of male and female students in government school do not differ significantly.

4.6.12 Comparison of male and female government secondary school students based on level of mathematical aptitude

The following table depicts the comparison of mathematical aptitude between government secondary school students of male and female:

Table 4.6.12

Comparison of the level of mathematical aptitude between male and female students in government secondary schools

Level of Mathematical Aptitude	Range of z-score	Male Govt. School		Female Govt. School	
		N	%	N	%
Very High	+2 and above	1	0.46	1	0.45
High	+1 to +2	20	9.13	19	8.60
Average	-1 to +1	142	64.84	147	66.52
Low	-2 to -1	55	25.11	54	24.43
Very Low	-2 and below	1	0.46	0	0
Total		219	100	266	100

As shown in Table 4.6.12, male and female students of government secondary school show almost similar percentage in every level of mathematical aptitude category. The majority in both groups fall into the Average category, with females (66.52%) slightly ahead of males (64.84%). Very high scores are rare for both genders in the Very High category with only 1 student each which is a negligible difference of 0.01 percentage points, indicating no meaningful gender gap at the highest aptitude level. High scorers are also low in percentage, with males at 9.13% and females at 8.60%.

4.6.13 Comparison of mathematical aptitude between male and female private secondary school students by test of significance

Hypothesis No.14 states: ‘There is a significant difference in mathematical aptitude between male and female private secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in mathematical aptitude between male and female private secondary school students of Mizoram.’ The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.6.13

Comparison of mathematical aptitude between male and female private secondary school students by test of significance

Groups	N	Mean	SD	SE _D	Df	t-value	Sig. Level
Private School Male	177	11.33	4.44				
				0.42	404	0.915	NS**
Private School Female	229	10.95	3.93				

** NS not significant at 0.01 and 0.05.

As shown in Table 4.6.13, the t-value for the difference in mathematical aptitude between male and female students of private secondary school is 0.915. Since the calculated t-value is less than the Critical Value at 0.05 level of significance, the null hypothesis that there is no significant difference in mathematical aptitude between male and female students in private school is accepted. It indicates that the mathematical aptitude of male and female students in private secondary schools do not differ significantly.

4.6.14 Comparison of male and female private secondary students based on level of mathematical aptitude

The following table depicts the comparison of mathematical aptitude between private secondary school students of male and female:

Table 4.6.14

Comparison of the level of mathematical aptitude between male and female students in private secondary schools

Level of Mathematical Aptitude	Range of z-score	Male Private School		Female Private School	
		N	%	N	%
Very High	+2 and above	17	9.60	11	4.80
High	+1 to +2	46	25.99	53	23.14
Average	-1 to +1	96	54.24	149	65.07
Low	-2 to -1	18	10.17	16	6.99
Very Low	-2 and below	0	0	0	0
Total		177	100	229	100

As shown in Table 4.6.14, male students (9.60%) outnumbered female students (4.80%) in the Very High category. Similarly, male students (25.99%) also have slightly higher mathematical aptitude than female students (23.14%) in the High category. Female students dominate Average category with female at 65.07% and male at 54.24%. A larger percentage of males (10.17%) scored in the low range compared to females (6.99%). No students from either gender scored zero.

4.7 Analysis of data related to difference in socioeconomic status

4.7.1 Comparison of socioeconomic status between urban and rural secondary school students by test of significance

Hypothesis No.15 states: ‘There is a significant difference in socioeconomic status between urban and rural secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in socioeconomic status between urban and rural secondary school students of Mizoram.’ The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.7.1

Comparison of socioeconomic status between urban and rural secondary school students by test of significance

Groups	N	Mean	SD	SE _D	Df	t-value	Sig. Level
Urban	472	38.39	9.60				
				0.60	889	9.886	0.01
Rural	419	32.45	8.33				

As shown in Table 4.7.1, the t-value for the difference in socioeconomic status between urban and rural students is 9.886. Since the calculated t-value is greater than the Critical Value at 0.01 level of significance, the null hypothesis that there is no significant difference in the socioeconomic status between urban and rural is rejected. It indicates that the socioeconomic status of urban and rural students differs significantly. Comparison of mean scores revealed that the mean score of urban students is higher than that of rural students which shows that urban students have significantly higher socioeconomic status than rural students.

4.7.2 Comparison of urban and rural secondary school students based on level of socioeconomic status

The following table presents the comparison of socioeconomic status between urban and rural secondary school students:

Table 4.7.2

Comparison of the level of socioeconomic status between urban and rural secondary school students

Level of Socioeconomic Status	Range of z-score	Urban		Rural	
		N	%	N	%
Very High	+2 and above	22	4.66	4	0.95
High	+1 to +2	92	19.49	29	6.92
Average	-1 to +1	302	63.98	279	66.59
Low	-2 to -1	54	11.44	104	24.82
Very Low	-2 and below	2	0.42	3	0.72
Total		472	100	419	100

As shown in Table 4.7.2, urban students (4.66%) outnumbered rural students (0.95%) in the Very High SES category. Similarly, urban students (19.49%) also have significantly higher SES than rural students (6.92%) in the High category. Rural students represent 66.59% of Average category, surpassing urban students (63.98%). A larger percentage of rural (24.82%) reported in the low range compared to urban (11.44%). Urban and rural students show almost similar percentage in the Very Low category, with 0.42% for urban students and 0.72% for rural students.

4.7.3 Comparison of socioeconomic status between government and private secondary school students by test of significance

Hypothesis No.16 states: 'There is a significant difference in socioeconomic status between government and private secondary school students of Mizoram.' This hypothesis was converted into a null hypothesis which states that, 'There is no significant difference in socioeconomic status between government and private secondary school students of Mizoram.' The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.7.3

Comparison of socioeconomic status between government and private secondary school students by test of significance

Groups	N	Mean	SD	SE _D	Df	t-value	Sig. Level
Govt.	485	32.24	8.30				
				0.593	889	-12.48	0.01
Private	406	39.65	9.24				

As shown in Table 4.7.3, it can be seen that the t-value for the difference in socioeconomic status between government and private school students is -12.48. Since the calculated absolute t-value is greater than the Critical Value at 0.01 level of significance, the null hypothesis that there is no significant difference in the socioeconomic status between govt. and private school students is rejected. It indicates that the socioeconomic status of govt. and private school students differs significantly. Comparison of mean scores revealed that the mean score of government school students is higher than that of private school students which shows that private school students have significantly higher socioeconomic status than government school students.

4.7.4 Comparison of government and private secondary school students based on level of socioeconomic status

The following table presents the comparison of socioeconomic status between government and private secondary school students:

Table 4.7.4

Comparison of the level of socioeconomic status between government and private secondary school students

Level of Socioeconomic Status	Range of z-score	Govt. School		Private School	
		N	%	N	%
Very High	+2 and above	5	1.03	21	5.17
High	+1 to +2	31	6.39	90	22.17
Average	-1 to +1	320	65.98	262	64.53
Low	-2 to -1	124	25.57	33	8.13
Very Low	-2 and below	5	1.03	0	0
Total		485	100	406	100

As shown in Table 4.7.2, private school students (5.17%) outnumbered government school students (1.03%) in the Very High SES category. Similarly, private school students (22.17%) also have significantly higher SES than government school students (6.92%) in the High category. A larger percentage of government school students (25.57%) reported in the low range compared to urban (8.13%). Only 1.03% of government school students are represented in the Very Low SES group whereas no students from private school students are in this group. Government and private school students show almost similar percentage in the Average category, with 65.98% for government school students and 64.53% for private school students.

SECTION – IV: CORRELATIONAL ANALYSIS OF VARIABLES

This section examines the relationship between Academic Achievement in Mathematics, Mathematical Aptitude and Socioeconomic Status among Secondary School Students. It also examines the relationship between dimensions of socioeconomic status and Academic Achievement in Mathematics and Mathematical Aptitude among Secondary School Students. A correlational analysis was established using SPSS to determine the strength of the relationship between the variables. Pearson's product moment correlation method was used to determine the relationship between academic achievement in mathematics and mathematical aptitude of secondary school students. In contrast, Spearman's rank correlation was used to determine the relationship between: (a) academic achievement in mathematics and socioeconomic status of students, (b) mathematical aptitude and socioeconomic status. Spearman's rank correlation was also employed to examine the relationships between: (i) academic achievement in mathematics and each socioeconomic status dimension, and (ii) mathematical aptitude and each socioeconomic status dimension.

The relationship between academic achievement in mathematics and each dimension of socioeconomic status, between mathematical aptitude and each dimension of socioeconomic status was also established using Spearman's rank correlation.

4.8 The relationship between academic achievement in mathematics and mathematical aptitude of secondary school students

Exploring the correlation between academic achievement in mathematics and mathematical aptitude provides insights into patterns that can guide targeted educational interventions and support strategies. Hypothesis No.17 states: 'There is a significant relationship between academic achievement in mathematics and mathematical aptitude.' This hypothesis was converted into a null hypothesis which states that, 'There is no significant relationship between academic achievement in

mathematics and mathematical aptitude'. Table No.4.8 provides the correlation between academic achievement in mathematics and mathematical aptitude among secondary school students of Mizoram.

Table 4.8

Correlation between Academic Achievement in Mathematics and Mathematical Aptitude of Secondary School Students

N	Categories	Academic Achievement in Mathematics	Mathematical Aptitude
891	Academic Achievement in Mathematics	1	0.507*
	Mathematical Aptitude	0.507*	1

* significant at 0.01 level

P = 0.000

df = 889

Table No. 4.8 shows the correlation between academic achievement in mathematics and mathematical aptitude among secondary school students. The calculated value of correlation is 0.507 and the p-value ($p = 0.000$) is smaller than 0.01 level of confidence. Thus, the null hypothesis which stated that there is no significant relationship between academic achievement in mathematics and mathematical aptitude was rejected. Hence, there exists a positive and significant relationship between academic achievement in mathematics and mathematical aptitude among secondary school students in Mizoram. A positive correlation implies that the higher the mathematical aptitude, the higher the academic achievement in mathematics and vice versa.

4.9 The relationship between academic achievement in mathematics and socioeconomic status of secondary school students

Exploring the relationship between academic achievement in mathematics and socioeconomic status provides insights into the complex factors that influence student performance. Hypothesis No.18 states: ‘There is a significant relationship between academic achievement in mathematics and socioeconomic status.’ This hypothesis is converted into a null hypothesis which stated that, ‘There is no significant relationship between academic achievement in mathematics and socioeconomic status.’ Table No. 4.9 provides the correlation between academic achievement in mathematics and socioeconomic status among secondary school students of Mizoram.

Table 4.9

Correlation between Academic Achievement in Mathematics and Socioeconomic Status of Secondary School Students

N	Categories	Academic Achievement in Mathematics	Socioeconomic Status
891	Academic Achievement in Mathematics	1	0.235*
	Socioeconomic Status	0.235*	1

* significant at 0.01 level

P = 0.000

df = 889

Table 4.9 shows the correlation between academic achievement in mathematics and socioeconomic status among secondary school students. The calculated value of correlation is 0.235 and the p-value is smaller than 0.01 level of confidence. Thus, the null hypothesis that there is no significant relationship between academic achievement in mathematics and socioeconomic status was rejected. Hence, there exists a positive and significant relationship between academic

achievement in mathematics and socioeconomic status among secondary school students in Mizoram. A positive correlation implies that the higher the socioeconomic status, the higher the academic achievement in mathematics.

The relationship between dimensions of socioeconomic status and academic achievement in mathematics was also examined. The following are the analysis and interpretation of the relationship between dimensions of socioeconomic status and academic achievement in mathematics among secondary school students:

4.10 The relationship between mathematical aptitude and socioeconomic status of secondary school students

Exploring the relationship between mathematical aptitude and socioeconomic status provides insights into the complex factors that influence student performance. Hypothesis No.19 states: ‘There is a significant relationship between mathematical aptitude and socioeconomic status.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant relationship between mathematical aptitude and socioeconomic status.’ Table No. 4.10 provides the correlation between mathematical aptitude and socioeconomic status among secondary school students of Mizoram.

Table 4.10

Correlation between Mathematical Aptitude and Socioeconomic Status of Secondary School Students

N	Categories	Mathematical Aptitude	Socioeconomic Status
891	Mathematical Aptitude	1	0.355*
	Socioeconomic Status	0.355*	1

* significant at 0.01 level

P = 0.000

df = 889

Table 4.10 shows the correlation between mathematical aptitude and socioeconomic status among secondary school students. The calculated value of correlation is 0.355 and the p-value ($p = 0.000$) is smaller than 0.01 level of confidence. Thus, the null hypothesis that there is no significant relationship between mathematical aptitude and socioeconomic status was rejected. Hence, there exists a positive and significant relationship between mathematical aptitude and socioeconomic status among secondary school students in Mizoram. A positive correlation implies that the higher the socioeconomic status the higher the mathematical aptitude, and vice versa.

4.11 The Relationship between dimensions of socioeconomic status and academic achievement in mathematics of secondary school students

Exploring the relationship between academic achievement in mathematics and various dimensions socioeconomic status provides insights into the complex factors that influence student performance. Table No. 4.11.1 to Table No. 4.11.5 provides the correlation between various dimensions of socioeconomic status and academic achievement in mathematics among secondary school students of Mizoram. The Spearman's rank correlation method was used to determine the relationship between these variables.

Hypothesis No.20 states: 'There is a significant relationship between academic achievement in mathematics and parental education.' This hypothesis was converted into a null hypothesis which stated that, 'There is no significant relationship between academic achievement in mathematics and parental education.'

Table 4.11.1

Correlation between Academic Achievement in Mathematics and Parental Education of Secondary School Student

N	Categories	Academic Achievement in Mathematics	Parental Education
891	Academic Achievement in Mathematics	1	0.199*
	Parental Education	0.199*	1

* significant at 0.01 level

P = 0.000

df = 889

Table 4.11.1 shows the correlation between academic achievement in mathematics and parents' education among secondary school students. The calculated value of correlation is 0.199 and the p-value ($p = 0.000$) is smaller than 0.01 level of confidence. Thus, the null hypothesis that there is no significant relationship between academic achievement in mathematics and parental education was rejected. Hence, there existed a positive and significant relationship between academic achievement in mathematics and parental education among secondary school students in Mizoram. A positive correlation implies that the higher the parental education, the higher the academic achievement in mathematics.

Hypothesis No.21 states: 'There is a significant relationship between academic achievement in mathematics and parental occupation.' This hypothesis was converted into a null hypothesis which stated that, 'There is no significant relationship between academic achievement in mathematics and parental occupation.'

Table 4.11.2

*Correlation between Academic Achievement in Mathematics and Parental
Occupation of Secondary School Student*

N	Categories	Academic Achievement in Mathematics	Parental Occupation
891	Academic Achievement in Mathematics	1	0.234*
	Parental Occupation	0.234*	1

* significant at 0.01 level

P = 0.000

df = 889

Table 4.11.2 shows the correlation between academic achievement in mathematics and parental education among secondary school students. The calculated value of correlation is 0.234 and the p-value ($p = 0.000$) is smaller than 0.01 level of confidence. Thus, the null hypothesis that there is no significant relationship between academic achievement in mathematics and parental occupation was rejected. Hence, there existed a positive and significant relationship between academic achievement in mathematics and parental occupation among secondary school students in Mizoram. A positive correlation implies that the higher the parental occupation, the higher the academic achievement in mathematics.

Hypothesis No.22 states: 'There is a significant relationship between academic achievement in mathematics and family income.' This hypothesis was converted into a null hypothesis which stated that, 'There is no significant relationship between academic achievement in mathematics and family income.'

Table 4.11.3

Correlation between Academic Achievement in Mathematics and Family Income of Secondary School Students

N	Categories	Academic Achievement in Mathematics	Family Income
891	Academic Achievement in Mathematics	1	0.221*
	Family Income	0.221*	1

* significant at 0.01 level

P = 0.000

df = 889

Table 4.11.3 shows the correlation between academic achievement in mathematics and family income among secondary school students. The calculated value of correlation is 0.221 and the p-value ($p = 0.000$) is smaller than 0.01 level of confidence. Thus, the null hypothesis that there is no significant relationship between academic achievement in mathematics and family income was rejected. Hence, there existed a positive and significant relationship between academic achievement in mathematics and family income among secondary school students in Mizoram. A positive correlation implies that the higher the family income, the higher the academic achievement in mathematics.

Hypothesis No.23 states: 'There is a significant relationship between academic achievement in mathematics and family assets.' This hypothesis was converted into a null hypothesis which stated that, 'There is no significant relationship between academic achievement in mathematics and family assets.'

Table 4.11.4

Correlation between Academic Achievement in Mathematics and Family Assets of Secondary School Students

N	Categories	Academic Achievement in Mathematics	Family Assets
891	Academic Achievement in Mathematics	1	0.202*
	Family Assets	0.202*	1

* significant at 0.01 level

P = 0.000

df = 889

Table 4.11.4 shows the correlation between academic achievement in mathematics and family assets among secondary school students. The calculated value of correlation is 0.202 and the p-value ($p = 0.000$) is smaller than 0.01 level of confidence. Thus, the null hypothesis that there is no significant relationship between academic achievement in mathematics and family assets was rejected. Hence, there existed a positive and significant relationship between academic achievement in mathematics and family assets among secondary school students in Mizoram. A positive correlation implies that the higher the family assets, the higher the academic achievement in mathematics.

Hypothesis No.24 states: 'There is a significant relationship between academic achievement in mathematics and parental socio-religious position.' This hypothesis was converted into a null hypothesis which stated that, 'There is no significant relationship between academic achievement in mathematics and parental socio-religious position.'

Table 4.11.5

Correlation between Academic Achievement in Mathematics and Parental Socio-religious Position of Secondary School Students

N	Categories	Academic Achievement in Mathematics	Parental Socio-religious Position
891	Academic Achievement in Mathematics	1	0.040
	Parental Socio-Religious Position	0.040	1

P = 0.231

df = 889

Table 4.11.5 shows the correlation between academic achievement in mathematics and parental socio-religious position among secondary school students. The calculated value of correlation is 0.040 and the p-value ($p = 0.231$) is greater than 0.01 and 0.05. Thus, the null hypothesis that there is no significant relationship between academic achievement in mathematics and parental socio-religious position was accepted. Hence, there is no significant relationship between academic achievement in mathematics and parental socio-religious position among secondary school students in Mizoram.

4.12 The relationship between dimensions of socioeconomic status and mathematical aptitude of secondary school students

Exploring the relationship between various dimensions of socioeconomic status and mathematical aptitude provides insights into the complex factors that influence student performance. Table No. 4.12.1 to Table No. 4.12.5 provides the correlation between dimensions of socioeconomic status and mathematical aptitude among secondary school students of Mizoram. The Spearman's rank correlation method was used to determine the relationship between these variables.

Hypothesis No.25 states: ‘There is a significant relationship between mathematical aptitude and parental education.’ This hypothesis was converted into a null hypothesis which stated that, ‘There is no significant relationship between mathematical aptitude and parental education.’

Table 4.12.1

Correlation between Parental Education and Mathematical Aptitude of Secondary School Students

N	Variables	Parental Education	Mathematical Aptitude
891	Parental Education	1	0.305*
	Mathematical Aptitude	0.305*	1

* significant at 0.01 level

P = 0.000

df = 889

Table 4.12.1 shows the correlation between parental education and mathematical aptitude among secondary school students. The calculated value of correlation is 0.305 and the p-value ($p = 0.000$) is smaller than 0.01 level of confidence. Thus, the null hypothesis that there is no significant relationship between parental education and mathematical aptitude is rejected. Hence, there exists a positive and significant relationship between parental education and mathematical aptitude among secondary school students in Mizoram. A positive correlation implies that the higher the parental education, the higher the mathematical aptitude.

Hypothesis No.26 states: ‘There is a significant relationship between mathematical aptitude and parental occupation.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant relationship between mathematical aptitude and parental occupation.’

Table 4.12.2

Correlation between Parental Occupation and Mathematical Aptitude of Secondary School Students

N	Categories	Parental Occupation	Mathematical Aptitude
891	Parental Occupation	1	0.366*
	Mathematical Aptitude	0.366*	1

* significant at 0.01 level

P = 0.000

df = 889

Table 4.12.2 shows the correlation between parental occupation and mathematical aptitude of secondary school students. The calculated value of correlation is 0.366 and the p-value ($p = 0.000$) is smaller than 0.01 level of confidence. Thus, the null hypothesis that there is no significant relationship between parental occupation and mathematical aptitude is rejected. Hence, there exists a positive and significant relationship between parental occupation and mathematical aptitude among secondary school students in Mizoram. A positive correlation implies that the higher the parental occupation, the higher the mathematical aptitude.

Hypothesis No.27 states: 'There is a significant relationship between mathematical aptitude and family income.' This hypothesis was converted into a null hypothesis which states that, 'There is no significant relationship between mathematical aptitude and family income'.

Table 4.12.3

Correlation between Family Income and Mathematical Aptitude of Secondary School Students

N	Categories	Family Income	Mathematical Aptitude
891	Family Income	1	0.354*
	Mathematical Aptitude	0.354*	1

* significant at 0.01 level

P = 0.000

df = 889

Table 4.12.3 shows the correlation between family income and mathematical aptitude of secondary school students. The calculated value of correlation is 0.354 and the p-value (0.000) is smaller than 0.01. Thus, the null hypothesis that there is no significant relationship between family income and mathematical aptitude was rejected. Hence, there exists a positive and significant relationship between family income and mathematical aptitude of secondary school students in Mizoram. A positive correlation implies that the higher the family income, the higher the mathematical aptitude.

Hypothesis No.28 states: 'There is a significant relationship between mathematical aptitude and family assets.' This hypothesis was converted into a null hypothesis which states that, 'There is no significant relationship between mathematical aptitude and family assets.'

Table 4.12.4

Correlation between Family Assets and Mathematical Aptitude of Secondary School Student

N	Categories	Family Assets	Mathematical Aptitude
891	Family Assets	1	0.317*
	Mathematical Aptitude	0.317*	1

* significant at 0.01 level

P = 0.000

df = 889

Table 4.12.4 shows the correlation between family assets and mathematical aptitude among secondary school students. The calculated value of correlation is 0.317 and the p-value (0.000) is smaller than 0.01. Thus, the null hypothesis that there is no significant relationship between family assets and mathematical aptitude was rejected. Hence, there exists a positive and significant relationship between family assets and mathematical aptitude among secondary school students in Mizoram. A positive correlation implies that the higher the family assets, the higher the mathematical aptitude.

Hypothesis No.29 states: ‘There is a significant relationship between mathematical aptitude and parental socio-religious position.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant relationship between mathematical aptitude and parental socio-religious position.’

Table 4.12.5

Correlation between Parental Socioreligious Position and Mathematical Aptitude of Secondary School Students

N	Categories	Parental Socio-religious Position	Mathematical Aptitude
891	Parental Socio-religious Position	1	-0.042*
	Mathematical Aptitude	-0.042*	1

* not significant at 0.01 and 0.05 level

P = 0.208

df = 889

Table 4.12.5 shows the correlation between parents' socio-religious position and mathematical aptitude among secondary school students. The calculated value of correlation is -0.042 and the p-value ($p = 0.208$) is greater than 0.01 and 0.05. Thus, the null hypothesis that there is no significant relationship between parental socio-religious position and mathematical aptitude was accepted. Hence, there is no significant relationship between parental socio-religious position and mathematical aptitude among secondary school students in Mizoram.

SECTION – IV: DIFFERENTIAL ANALYSIS OF ACADEMIC ACHIEVEMENT IN MATHEMATICS BASED ON HIGH AND LOW SOCIOECONOMIC STATUS

4.13 Comparison of Academic Achievement in Mathematics between High and Low Socioeconomic Status Dimensions among Secondary School Students:

Each dimension of SES was categorised into high ($>$ median) and low ($<$ median) groups based on their median values. An independent sample t-test was conducted to

determine if the difference in academic performance between the two groups was statistically significant.

4.13.1 Comparison of Academic Achievement in Mathematics among Secondary School Students based on High and Low Parental Education

Hypothesis No. 30 states: ‘There is a significant difference in academic achievement in mathematics between high and low parental education levels among secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in academic achievement in mathematics between high and low parental education levels among secondary school students of Mizoram.’ The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.13.1

Comparison of High and Low Parental Education of Secondary School Students in their Academic Achievement in Mathematics

Level of Education	N	Marks Scored in Mathematics		SE _D	Df	t-value	Sig. Level
		Mean	SD				
High	443	52.49	21.94	1.473	711	6.003	0.01
Low	270	43.65	17.11				

Table 4.13.1 compares the academic achievement in mathematics between high and low parental educational levels of secondary school students. The t-value is 6.003 which is greater than the critical value indicating a significant difference between the two groups at 0.01 level. High parental education levels with a larger value of mean shows higher academic achievement in mathematics as compared to low parental education levels of secondary school students.

Consequently, the null hypothesis, ‘There is no significant difference in academic achievement in mathematics between high and low parental education levels among secondary school students of Mizoram’ is rejected.

4.13.2 Comparison of Academic Achievement in Mathematics among Secondary School Students based on High and Low Parental Occupation

Hypothesis No. 31 states: ‘There is a significant difference in academic achievement in mathematics between high and low parental occupation levels among secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in academic achievement in mathematics between high and low parental occupation levels among secondary school students of Mizoram.’ The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.13.2

Comparison of High and Low Parental Occupation of Secondary School Students in their Academic Achievement in Mathematics

Level of Occupation	N	Marks Scored in Mathematics		SE_D	Df	t-value	Sig. Level
		Mean	SD				
High	336	53.92	21.77	1.495	695	7.052	0.01
Low	361	43.38	17.26				

. Table 4.13.2 compares the academic achievement in mathematics between high and low levels of parental occupation of secondary school students. The t-value is 7.052 which is greater than the critical value indicating a significant difference between the two groups at 0.01 level. High parental occupation levels with a larger

value of mean shows higher academic achievement in mathematics as compared to low parental occupation levels of secondary school students.

Consequently, the null hypothesis, 'There is no significant difference in academic achievement in mathematics between high and low parental occupation levels among secondary school students of Mizoram' is rejected.

4.13.3 Comparison of Academic Achievement in Mathematics among Secondary School Students based on High and Low Family Income

Hypothesis No. 32 states: 'There is a significant difference in academic achievement in mathematics between high and low family income among secondary school students of Mizoram.' This hypothesis was converted into a null hypothesis which states that, 'There is no significant difference in academic achievement in mathematics between high and low family income among secondary school students of Mizoram.' The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.13.3

Comparison of High and Low Family Income of Secondary School Students in their Academic Achievement in Mathematics

Family Income	N	Marks Scored in Mathematics		SE_D	Df	t-value	Sig. Level
		Mean	SD				
High	319	55.53	22.12	1.731	695	6.117	0.01
Low	215	44.94	17.73				

Table 4.13.3 compares the academic achievement in mathematics between high and low family income of secondary school students. The t-value is 6.117 which is greater than the critical value indicating a significant difference between the two groups at 0.01 level. High family income with a larger value of

mean shows higher academic achievement in mathematics as compared to low family income of secondary school students.

Consequently, the null hypothesis, 'There is no significant difference in academic achievement in mathematics between high and low family income among secondary school students of Mizoram' is rejected.

4.13.4 Comparison of Academic Achievement in Mathematics among Secondary School Students based on High and Low Family Assets

Hypothesis No.33 states: 'There is a significant difference in academic achievement in mathematics between high and low family assets among secondary school students of Mizoram.' This hypothesis was converted into a null hypothesis which states that, 'There is no significant difference in academic achievement in mathematics between high and low family assets among secondary school students of Mizoram.' The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.13.4

Comparison of High and Low Family Assets of Secondary School Students in their Academic Achievement in Mathematics

Family Assets	N	Marks Scored in Mathematics		SE _D	Df	t-value	Sig. Level
		Mean	SD				
High	406	52.63	21.86	1.382	840	5.627	0.01
Low	436	44.85	17.89				

Table 7 compares the academic achievement in mathematics between high and low family assets of secondary school students. The t-value is 5.627 which is greater than the critical value indicating a significant difference between the two groups at 0.01 level. High family assets with a larger value of mean show higher

academic achievement in mathematics as compared to low family assets of secondary school students.

Consequently, the null hypothesis, ‘There is no significant difference in academic achievement in mathematics between high and low family assets among secondary school students of Mizoram’ is rejected.

4.13.5 Comparison of Academic Achievement in Mathematics among Secondary School Students based on High and Low Parental Socio-religious Position

Hypothesis No. 34 states: ‘There is a significant difference in academic achievement in mathematics between high and low parental socio-religious position among secondary school students of Mizoram.’ This hypothesis was converted into a null hypothesis which states that, ‘There is no significant difference in academic achievement in mathematics between high and low parental socio-religious position among secondary school students of Mizoram.’ The significant difference of the mean scores between the two groups were tested using t-test. The detail is given in the following.

Table 4.13.5

Comparison of High and Low Parental Socio-religious Position of Secondary School Students in their Academic Achievement in Mathematics

Parental Socio-religious Position	N	Marks Scored in Mathematics		SE_D	Df	t-value	Sig. Level
		Mean	SD				
High	392	49.21	20.46	1.508	734	1.029	NS**
Low	344	47.65	20.38				

NS** no significant.

Table 4.13.5 compares the academic achievement in mathematics between high and low parental socio-religious position of secondary school students. The t-value is 1.029 which is less than the critical value indicating no significant difference

between the two groups at both 0.01 and 0.05 level. High parental socio-religious position with a larger value of mean shows higher academic achievement in mathematics as compared to low parental socio-religious position of secondary school students.

Consequently, the null hypothesis, 'There is no significant difference in academic achievement in mathematics between high and low parental socio-religious position among secondary school students of Mizoram' is rejected.

CHAPTER – V

FINDINGS, DISCUSSIONS, EDUCATIONAL IMPLICATIONS, CONCLUSIONS, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

This chapter presents the findings, discussion of the results, educational implications, recommendations and suggestions based on the findings of the present study.

5.1 MAJOR FINDINGS

The following are the major findings of the study: -

5.1.1 Construction and Standardization of Mathematical Aptitude Test (MAT)

A multiple-choice questions (MCQs) type Mathematical Aptitude Test (MAT) consisting of 20 items had been constructed and standardized. The reliability of the test was established by test-retest method in which reliability coefficient was found to be 0.81. The test was validated through rigorous examination by a panel of subject-matter experts to ensure content validity.

5.1.2 Findings based on descriptive statistics of Academic Achievement in Mathematics

1. Out of the 891 secondary school students in Mizoram, the findings revealed that-
 - Only 14.4% of the students achieved distinction in mathematics
 - 12.1% achieved first division
 - 13.9% achieved second division
 - 38.5% achieved third division
 - 21.1% of the students failed to achieve the minimum passing score
 - The overall findings indicate that majority of the students were low achievers in mathematics as nearly 60% either failed or scored only marginally above the passing mark.

2. In the frequency distribution of academic achievement in mathematics among secondary school students, the highest concentration of students was in the 40–49 marks range, making it the most common achievement level. Very few students scored extremely low (0–9 marks) or extremely high (90–99 marks).
3. It was found that the academic achievement in mathematics among secondary school students varied significantly, with the lowest score recorded at 4 and the highest at 99. The mean and median score was found to be 48.44 and 45 respectively which were quite proximate to each other. The positive value of skewness (0.549) which was slightly greater than zero indicated that the data was skewed to the right and the distribution was approximately symmetric. The negative value of kurtosis (-0.395) which was slightly less than zero indicated that the distribution was slightly platykurtic. The observation leads to the conclusion that the academic achievement in mathematics of secondary school students was normally distributed.

5.1.3 Findings based on descriptive statistics of Mathematical Aptitude

1. Out of the 891 secondary school students in Mizoram, the findings revealed that-
 - Only 3.36 % of the students demonstrated a very high mathematical aptitude
 - Only 15.94% of students had high mathematical aptitude
 - Majority of the students (61.73%) fell within the average range
 - 18.86% of the students had low mathematical aptitude
 - Only one student (0.11%) had very low mathematical aptitude
 - The overall finding indicated that secondary school students of Mizoram had an average mathematical aptitude.
2. It was found that the mathematical aptitude among secondary school students varied significantly, with the lowest score recorded at 0 and the highest at 20. The mean and median score was found to be 9.33 and 9 respectively which were very proximate to each other. The positive value

of skewness (0.355) which was slightly greater than zero indicated that the data was skewed to the right and the distribution was approximately symmetric. The negative value of kurtosis (-0.489) which was slightly less than zero indicated that the distribution was slightly platykurtic. The observation leads to the conclusion that the mathematical aptitude of secondary school students was normally distributed.

5.1.4 Findings based on descriptive statistics of Socioeconomic Status

1. Out of 891 secondary school students, the findings revealed that-
 - Only 2.9 % of the students had a very high SES
 - % of students have high SES
 - Majority of students (65.2%) fell in the "Average" category
 - 17.7% of the students fell in the "Low" category
 - Only 0.6% had a "Very Low" SES
 - The overall findings indicate that secondary school students of Mizoram had an average SES.
2. The socioeconomic status of secondary school students with the lowest score was 12 whereas the highest score was 66. The mean and median on socioeconomic status of secondary school students were 35.60 and 35 respectively which were very close to each other. The positive value of skewness (0.33) which was slightly greater than zero indicates that the data was skewed to the right and the distribution was approximately symmetric. The negative value of kurtosis (-0.302) which was slightly less than zero indicates that the distribution was slightly platykurtic. The observation leads to the conclusion that the socioeconomic status of secondary school students was normally distributed.

5.1.5 Findings based on comparison of Academic Achievement in Mathematics

5.1.5.1 Comparison of academic achievement in mathematics between male and female secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in academic achievement in mathematics between male and female secondary school students of Mizoram, with female students exhibited higher academic achievement in mathematics than male students. (Significant at 0.01).

2. Comparison based on level of academic achievement in mathematics

- A greater proportion of female students (17.62%) achieved Distinction compared to male students (10.42%), indicating a significantly higher performance at the top level among females.
- Female students also outperformed males in the II Division category, with 15.78% of females scoring in this range compared to 11.66% of males.
- In the I Division category, both male and female students showed nearly equal achievement levels, with 12.16% of males and 12.09% of females.
- A larger percentage of male students (43.42%) fell into the III Division, compared to 34.43% of female students.
- The Fail rate was also higher among males (22.34%) than females (20.08%).

5.1.5.2 Comparison of academic achievement in mathematics between urban and rural secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in academic achievement in mathematics between urban and rural secondary school students. It was found that urban secondary school students exhibited higher academic achievement in mathematics than rural secondary school students. (Significant at 0.01).

2. Comparison based on level of academic achievement in mathematics

- A notably higher percentage of urban students (20.97%) achieved Distinction, compared to only 6.92% of rural students.
- Urban students also slightly outperformed rural students in the I Division category, with 12.92% compared to 11.21% among rural students.
- A greater proportion of rural students (16%) fell in the II Division compared to urban students (12.08%), indicating a moderate level of achievement was more prevalent in rural areas.
- Rural students (45.10%) showed a considerably higher percentage in the III Division than urban students (32.63%), pointing to lower academic performance in rural settings.
- The percentage of students who failed was almost the same in both groups, with urban students at 21.40% and rural students at 20.77%, indicating no substantial difference in the lowest achievement level.

5.1.5.3 Comparison of academic achievement in mathematics between government and private secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in academic achievement in mathematics between government and private secondary school students of Mizoram, with private secondary school students had significantly higher academic achievement in mathematics than government secondary school students. (Significant at 0.01).

2. Comparison based on level of academic achievement in mathematics

- A significantly higher percentage of private school students (26.60%) achieved Distinction, compared to only 4.54% of government school students.
- In the I Division category, private school students (17.24%) outperformed government school students (7.83%), indicating stronger overall academic performance.

- Both school types showed similar achievement in the II Division range, with government school students at 14.02% and private school students at 13.55%, suggesting minimal difference at this level.
- A large proportion of government school students (46.60%) fell into the III Division, compared to 28.57% of private school students.
- The Fail rate was also much higher among government school students (27.01%), nearly double that of private school students (14.04%), highlighting a concerning trend of low academic performance in government schools.

5.1.5.4 Comparison of academic achievement in mathematics between male and female students of urban secondary school of Mizoram

1. Comparison by test of significance

There was a significant difference in academic achievement in mathematics between urban male and urban female secondary school students of Mizoram. It was found that urban female secondary school students had significantly higher academic achievement in mathematics than urban male secondary school students. (Significant at 0.05).

2. Comparison based on level of academic achievement in mathematics

- A slightly higher percentage of urban male students (17.96%) achieved Distinction compared to urban female students (17.62%), though the difference is minimal.
- The percentage of students in the first Division was nearly the same for both genders: urban males (12.62%) and urban females (12.09%).
- A noticeably higher proportion of urban female students (15.78%) achieved second Division compared to urban male students (9.22%).
- A significant portion of both groups fell under III Division category: 35.92% of urban males and 34.43% of urban females.
- Urban male students had a higher failure rate (24.27%) than urban female students (20.08%), suggesting slightly better performance among females in terms of passing rates.

5.1.5.5 Comparison of academic achievement in mathematics between male and female students of rural secondary schools of Mizoram

1. Comparison by test of significance

There was a significant difference in academic achievement in mathematics between rural male and female secondary school students of Mizoram, with rural female secondary school students exhibiting significantly higher academic achievement in mathematics than rural male secondary school students. (Significant at 0.01).

2. Comparison based on level of academic achievement in mathematics

- A greater proportion of rural female students (10.41%) achieved Distinction, compared to only 3.03% of rural male students, indicating stronger top-level performance among females.
- In the II Division category, rural females (17.19%) outperformed rural males (14.65%), reflecting better moderate performance.
- Rural male students (50.50%) showed a notably higher percentage in the III Division compared to rural female students (40.27%), indicating a greater concentration of low achievement among males.
- In the I Division category, both groups showed similar achievement levels, with rural males at 11.61% and rural females at 10.86%.
- The Fail rates were also nearly equal, with rural males at 20.20% and rural females at 21.27%, indicating minimal gender difference at the lowest level of academic performance.

5.1.5.6 Comparison of academic achievement in mathematics between male and female students of government secondary school of Mizoram

1. Comparison by test of significance

There was no significant difference in academic achievement in mathematics between male and female students of government secondary school students.

2. Comparison based on level of academic achievement in mathematics

- A greater proportion of female students (6.39%) achieved Distinction compared to male students (2.28%) in government schools.
- Similarly, in the II Division category, female students (16.17%) outperformed male students (11.42%), indicating relatively stronger academic performance among females in these categories.
- A significantly higher percentage of male students (52.51%) fell into the III Division, as compared to female students (41.73%), suggesting that male students in government schools were more concentrated in the lower achievement range.
- In the I Division, both groups showed nearly equal performance, with males at 7.76% and females at 7.89%.
- Similarly, Fail rate was also close, with male students at 26.03% and female students at 27.82%, indicating minimal gender difference in the lowest performance category.

5.1.5.7 Comparison of academic achievement in mathematics between male and female students of private secondary school of Mizoram

1. Comparison by test of significance

There was a significant difference in academic achievement in mathematics between male and female students of private secondary school students. It was found that female students of private secondary school had higher academic achievement in mathematics than male students of private secondary school. (Significant at 0.01).

2. Comparison based on level of academic achievement in mathematics

- A significantly higher percentage of female students (31.1%) achieved Distinction, compared to male students (20.91%).
- Both male and female students showed similar performance in the I Division, with males at 16.95% and females at 17.47%.
- In the II Division as well, female students (15.28%) outperformed male students (11.30%), indicating stronger academic performance by females in both top and moderate achievement levels.

- A greater proportion of male students (32.20%) fell into the III Division, compared to female students (25.76%).
- Additionally, the Fail rate was higher among males (18.64%) than females (10.48%), suggesting that male students were more concentrated in the lower performance categories.

5.1.6 Findings based on comparison of Mathematical Aptitude

5.1.6.1 Comparison of mathematical aptitude between male and female secondary school students of Mizoram

1. Comparison by test of significance

There was no significant difference in mathematical aptitude between male and female secondary school students of Mizoram.

2. Comparison based on level of mathematical aptitude

- A slightly greater proportion of male students (4.47%) exhibited Very High mathematical aptitude category compared to female students (2.46%), indicating a marginal male advantage at the top aptitude level.
- Female students (62.5%) had a slightly higher representation in the Average mathematical aptitude category compared to male students (60.79%), indicating a stable performance among females.
- Both male and female students exhibited comparable percentages across the remaining categories: in the High Aptitude category, males accounted for 16.13% while females represented 15.78%; in the Low Aptitude category, males comprised 18.36% and females 19.26%; and in the Very Low Aptitude category, males constituted 0.25%, with no representation among females.
- The overall distribution of mathematical aptitude was almost similar between male and female students, with only minor differences.

5.1.6.2 Comparison of mathematical aptitude between urban and rural secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in mathematical aptitude between urban and rural secondary school students of Mizoram with urban secondary school students exhibiting higher mathematical aptitude than rural secondary school students. (Significant at 0.01).

2. Comparison based on level of mathematical aptitude

- A greater proportion of urban students (5.72%) demonstrated Very High mathematical aptitude, in contrast to only 0.72% of rural students.
- Urban students (22.88%) showed a higher percentage in the High aptitude category compared to rural students (8.11%), indicating that urban students generally performed better in mathematical aptitude.
- A higher percentage of rural students (67.30%) fell into the Average aptitude category than urban students (56.78%), suggesting that the majority of rural students performed within a moderate range.
- The Low aptitude category included 23.63% of rural students, significantly more than urban students (14.62%), indicating a greater concentration of lower aptitude levels in rural areas.
- The Very Low aptitude category showed negligible representation, with 0% among urban students and only 0.24% among rural students, indicating a very small proportion of students at the lowest level in both groups.

5.1.6.3 Comparison of mathematical aptitude between government and private secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in mathematical aptitude between government and private secondary school students of Mizoram. It was found that private secondary school students had higher mathematical aptitude than government secondary school students. (Significant at 0.01).

2. Comparison based on level of mathematical aptitude

- A greater proportion of private secondary school students (6.90%) fell under the Very High mathematical aptitude category, compared to only 0.41% of government school students.
- In the High aptitude category, private school students (24.38%) significantly outperformed government school students (8.86%), indicating stronger overall aptitude among private school learners.
- A much higher percentage of government school students (27.63%) fell into the Low mathematical aptitude category, in contrast to 8.37% of private school students, pointing to a greater concentration of lower aptitude levels in government schools
- Both school types showed nearly equal representation in the Average aptitude range, with government school students at 62.89% and private school students at 60.34%.

5.1.6.4 Comparison of mathematical aptitude between male and female students of urban secondary school of Mizoram

1. Comparison by test of significance

There was no significant difference in mathematical aptitude between male and female of urban secondary school students.

2. Comparison based on level of mathematical aptitude

- Urban males had slightly higher percentage (7.77%) of mathematical aptitude than urban females (4.14%) in the Very High category.
- Both genders showed strong performance in the High mathematical aptitude category, with males at 25.24% and females slightly lower at 21.80%.
- The majority of students fell in the Average category, with females (59.39%) having a higher proportion than males (53.39%).
- Both genders had almost similar percentages in the Low category with males at 13.60% and females at 14.66%.
- No students scored in the Very Low mathematical aptitude category.

- The overall distribution of mathematical aptitude was nearly identical between male and female students, with only negligible differences.

5.1.6.5 Comparison of mathematical aptitude between male and female students of rural secondary school of Mizoram

1. Comparison by test of significance

There was no significant difference in mathematical aptitude between male and female of rural secondary school students.

2. Comparison based on level of mathematical aptitude

- Both genders had minimal representation in the Very High mathematical aptitude category, with males at 1.01% and females at 0.45%.
- Females (8.60%) had a marginally higher percentage than males (7.57%) in the High category.
- The majority of rural students fell in the Average category, with males at 68.18% and females at 66.52%.
- 24.43% male students and 22.73% female students of rural school had Low mathematical aptitude.
- Only one male student (0.51%) scored in the Very Low mathematical aptitude category, while no female students fell in this category.

5.1.6.6 Comparison of mathematical aptitude between male and female students of government secondary school of Mizoram

1. Comparison by test of significance

There was no significant difference between male and female students of government secondary school.

2. Comparison based on level of mathematical aptitude

- Both male and female students of government secondary school showed nearly identical results of minimal representation in the Very

High mathematical aptitude category with male students at 0.46% and female students at 0.45%.

- Male students (9.13%) slightly outperformed female students (8.60%) in the High mathematical aptitude category.
- The majority of students fell within the Average category with male at 64.84% and female at 66.52%.
- 25.11% male students and 24.43% female students had Low mathematical aptitude showing almost similar representation.
- Only one male student (0.46%) scored in Very Low category, while no female students fell in this category.

5.1.6.7 Comparison of mathematical aptitude between male and female students of private secondary school of Mizoram

1. Comparison by test of significance

There was no significant difference between male and female students of private secondary school.

2. Comparison based on level of mathematical aptitude

- A larger percentage of male students (9.60%) attained Very High mathematical aptitude category compared to female students (4.80%), indicating a higher proportion of top performers among males of private secondary school.
- Male students (25.99%) slightly outperformed female students (23.14%) in this category, indicating more males in the High mathematical aptitude category.
- A significantly higher percentage of female students (65.07%) were in the average category compared to males (54.24%), indicating a stronger central concentration among females.
- A greater proportion of male students (10.17%) fell in the lower aptitude category than female students (6.99%).
- No students from either gender scored zero, indicating no representation in the Very Low aptitude category.

5.1.7 Findings based on comparison of Socioeconomic Status

5.1.7.1 Comparison of socioeconomic status between urban and rural secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in socioeconomic status between urban and rural secondary school students where urban secondary school students were found to have higher socioeconomic status than rural secondary school students. (Significant at 0.01).

2. Comparison based on level of mathematical aptitude

- A significantly higher percentage of urban students (4.66%) fell in the Very High SES category compared to rural students (0.95%), indicating better economic condition in urban areas.
- Urban students (19.49%) outnumbered rural students (6.92%) in the high SES category.
- Rural students (66.59%) slightly exceed urban students (63.98%) in the Average category, suggesting a broad central distribution in both areas.
- A significantly higher percentage of rural students (24.82%) fell in the low SES category compared to urban students (11.44%), indicating economic disadvantage was more prevalent in rural areas.
- Both urban (0.42%) and rural (0.72%) groups had minimal representation in the very low SES category.

5.1.7.2 Comparison of socioeconomic status between government and private secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in socioeconomic status between Government and Private secondary school students where private secondary school students were found to have higher socioeconomic status than Government secondary school students. (Significant at 0.01).

2. Comparison based on level of socioeconomic status

- A significantly greater proportion of private school students belonged to the Very High (5.17%) compared to government school (1.03%).
- Private school students (22.17%) outnumbered rural students (6.39%) in the High SES category.
- Government school students (65.98%) and private school students (64.53%) showed almost equal distribution in the Average category.
- A significantly higher percentage of government school students (25.57%) fell in the Low SES category compared to private school students (8.13%)
- 1.03% of government school students fell in the Very Low SES category, whereas none of the private school students belonged to this category.

5.1.8 Findings based on correlation between Academic Achievement in Mathematics, Mathematical Aptitude and Socioeconomic Status

1. The calculated value of correlation between academic achievement in mathematics and mathematical aptitude among secondary school students was 0.507. It was found that there existed a positive and significant relationship between academic achievement in mathematics and mathematical aptitude among secondary school students in Mizoram. The correlation was significant at 0.01 level.
2. The calculated value of correlation between academic achievement in mathematics and socioeconomic status among secondary school students was 0.235. It was found that there existed a positive and significant relationship between academic achievement in mathematics and socioeconomic status of secondary school students in Mizoram. The correlation was significant at 0.01 level.
3. The calculated value of correlation between mathematical aptitude and socioeconomic status among secondary school students was 0.355. It was found that there existed a positive and significant relationship between

mathematical aptitude and socioeconomic status among secondary school students in Mizoram. The correlation was significant at 0.01 level.

5.1.9 Findings based on correlation between Dimensions of Socioeconomic Status and Academic Achievement in Mathematics

1. The calculated value of correlation between parental education and academic achievement in mathematics of secondary school students was 0.199. A positive and significant relationship was found between parental education and academic achievement in mathematics of secondary school students in Mizoram. The correlation was significant at 0.01 level.
2. The calculated value of correlation between parental occupation and academic achievement in mathematics of secondary school students was 0.234. The study revealed a positive and significant relationship between parental occupation and academic achievement in mathematics among secondary school students in Mizoram. The correlation was significant at 0.01 level.
3. The calculated value of correlation between family income and academic achievement in mathematics of secondary school students was 0.221. The finding revealed that there existed a positive and significant relationship between family income and academic achievement in mathematics among secondary school students in Mizoram. The correlation was significant at 0.01 level.
4. The calculated value of correlation between family assets and academic achievement in mathematics of secondary school students was 0.202. It was found that there existed a positive and significant relationship between family assets and academic achievement in mathematics among secondary school students in Mizoram. The correlation was significant at 0.01 level.
5. The calculated value of correlation between parental socio-religious position and academic achievement in mathematics of secondary school students was 0.040. It was found that there was no significant relationship between parental socio-religious position and academic achievement in mathematics of secondary school students in Mizoram.

5.1.10 Findings based on correlation between dimensions of Socioeconomic Status and Mathematical Aptitude.

1. The calculated value of correlation between parental education and mathematical aptitude of secondary school students was 0.305. A positive and significant relationship was found between parental education and mathematical aptitude of secondary school students in Mizoram. The correlation was significant at 0.01 level.
2. The calculated value of correlation between parental occupation and mathematical aptitude of secondary school students was 0.366. A positive and significant relationship was found between parental occupation and mathematical aptitude among secondary school students in Mizoram. The correlation was significant at 0.01 level.
3. The calculated value of correlation between family income and mathematical aptitude of secondary school students was 0.354. A positive and significant relationship was found between family income and mathematical aptitude among secondary school students in Mizoram. The correlation was significant at 0.01 level.
4. The calculated value of correlation between family assets and mathematical aptitude of secondary school students was 0.317. A positive and significant relationship was found between family assets and mathematical aptitude of secondary school students in Mizoram. The correlation was significant at 0.01 level.
5. The calculated value of correlation between parental socio-religious position and mathematical aptitude of secondary school students was -0.042 . It was found that there was no significant relationship between parental socio-religious position and mathematical aptitude of secondary school students in Mizoram.

5.1.11 Findings based on comparison of academic achievement in mathematics between high and low dimensions of socioeconomic status

1. There was a significant difference in academic achievement in mathematics between high and low parental education among secondary school students of Mizoram where students with high parental education were found to have

higher academic achievement in mathematics than low parental education as evidence by higher mean scores. (Significant at 0.01)

2. There was a significant difference in academic achievement in mathematics between high and low parental occupation among secondary school students of Mizoram where students with high parental education scored significantly higher in mathematics than those with low parental education. (Significant at 0.01)
3. There was a significant difference in academic achievement in mathematics between high and low family income among secondary school students of Mizoram where students from high family income demonstrated higher academic achievement in mathematics as compared to their counterparts from low family income as indicated by higher mean scores. (Significant at 0.01)
4. There was a significant difference in academic achievement in mathematics between secondary school students of Mizoram from high-family-assets and low-family-assets background. It was found that students of high-family-assets background demonstrated higher academic achievement in mathematics than students of low-family-assets background where the mean scores were significantly higher. (Significant at 0.01)
5. There was no significant difference in academic achievement in mathematics between high and low parental socio-religious position among secondary school students of Mizoram. (Not significant at 0.01 and 0.05)

5.2 DISCUSSIONS ON THE FINDINGS

The present study aims to discuss the findings on academic achievement in mathematics, mathematical aptitude and socioeconomic status among secondary school students. The study also intent to discuss the result and probable causes on the relationship of the three variables as well as their differences between male and female, urban and rural, government and private school.

5.2.1 Discussion on findings related to the academic achievement in mathematics among secondary school students.

i) *The finding showed that majority of secondary school students in Mizoram were low achievers in mathematics*

Discussion: The finding is in line with Lalremmawii (2015), who similarly observed that the secondary school students in Mizoram exhibited low proficiency in mathematics with the majority attaining a poor level of achievement. This finding also aligns with Kumari and Garg (2022), Day and Kapoor (2025) who found that majority of secondary school students in Kanpur had achieved below average in mathematics, and in many other regions where mathematics is often perceived as a challenging subject, leading to widespread underperformance among students. The prevalence of low achievement in mathematics among secondary school students in Mizoram raises important concerns about the quality of mathematics education and the factors contributing to this trend. There may be several factors that can contribute to low performance in mathematics including environmental factors, socioeconomic status, incompetency of teachers, poor study habits, lack of prior knowledge, mathematical anxiety, attitude toward mathematics.

One possible explanation about this trend is lack of foundational knowledge in mathematical concept in the elementary education level and lack of prior knowledge in basic mathematics. Lalremruata (2011) conducted a study to find the competency of elementary school students of Mizoram in mathematics, and he found that the Mizo students had a very poor level of competency in mathematics in relation to the Minimum Levels of Learning (MLL). This study show that elementary school students of Mizoram had not yet attained the pre-requisite knowledge and skills required to achieve excellence in mathematics at the secondary school level. Lalremmawii (2021) conducted a study on the opinion of mathematics teacher in Mizoram, and the study found that 93% of the mathematics teachers believed that student did not have previous knowledge in mathematics at the secondary level in Mizoram.

The findings of the present study underscore the need for a comprehensive and multi-faceted approach to address the issue of low achievement in mathematics among secondary school students in Mizoram. It is crucial to address the issue of the present study with targeted approach to identifies the root causes of low academic achievement in mathematics. By addressing various issues and challenges in mathematics education and by creating a healthy learning environment, it might be possible to improve students' achievement and attitudes toward mathematics. Joint efforts involving policymakers, educationist, teachers, parents, and community will be crucial in bringing about meaningful change. It is also essential to ensure that students are equipped with the necessary mathematical skills and knowledge right from the elementary school level for their future academic and professional success.

ii) The findings showed that female secondary school students have significantly higher academic achievement in mathematics than male secondary school students.

Discussion: Similar findings have been found in the studies done by Nazeri and Entezar (2017), Jiang (2021), Ramaprabha and Selvaganapathy (2024) who found that there was a significant difference between male and female secondary school students where female students outperformed male students. Contrary to this finding, Lindberg et al. (2010), Gupta and Kaur (2015), Kumaravelu (2017), Mallai and Humtsoe (2025), along with most related studies, showed that there was no significant difference between male and female in their academic achievement in mathematics.

The reason that female students of Mizoram outperformed their male peers in mathematics maybe attributed to various factors. One possible factor about this trend is female students in Mizoram seems to be more diligent, hardworking and sincere in their academic activities than male students. It is expected that male students are more likely engage in games and sport, outdoor activities, and hanging out with friends. The teaching and learning environment in Mizoram School may also play a significant role in building the academic performance of female student. The secondary school in Mizoram provide equal opportunities for male and female and there are no gender disparities in any school.

This result is in contrary to the traditional gender stereotypes that often portray males as naturally more likely to achieve in mathematics and related fields. One possible explanation for this finding lies in the sociocultural environment of Mizoram where gender equality in education is highly emphasized. The Mizo society traditionally values the well-being for both male and female in various aspect of life including education, and there is a strong emphasis on scholastic achievement and educational success for all. This egalitarian society may have created an environment where female students are equally encouraged and motivated to succeed in subjects like science and mathematics.

iii) *The findings showed that urban secondary school students had significantly higher academic achievement in mathematics than rural secondary school students.*

Discussion: A common perception is that urban students often have better academic performance, resulting in more job opportunities and higher social-economic status (Mohammadpour & Yon, 2024). Most of the research findings reveals that urban students performs better than rural students in mathematics. The finding of the present study is in align with the findings of Ali et al. (2024), Yadav (2024), Ahmed et al. (2020), and Pandey (2017), whose findings also showed that urban secondary school students outperformed their counterpart rural students. The reason that urban students had higher academic achievement in mathematics than rural students may be attributed to different factors. One of the primary reasons is the difference in infrastructural facilities and educational resources. Urban schools tend to have better laboratory, smart classroom, access to qualified teacher, and tutoring program than rural schools. On the other hand, rural schools are lack of these resources, especially it has difficulties in attracting and retaining efficient and qualified teacher. Additionally, parents in urban areas tend to be more involved in their children's education due to greater awareness in academic career and educational pathway. Urban students also have more competitive learning environment that constantly motivated them to excel in their studies. By addressing these educational disparities, the Government, educationist and policy maker should take necessary measures to bridge the achievement gap by implementing targeted interventions.

iv) *The findings showed that private secondary school students have significantly higher academic achievement in mathematics than government secondary school students.*

Private schools in Mizoram have emerged as a cornerstone of the state's education system, offering quality education, modern infrastructure, and a competitive learning environment. Over the past few decades, they have gained immense popularity, especially among middle-class and affluent families, due to their emphasis on academic excellence, English-medium instruction, and holistic development. Many research studies show that private school students perform better than government school students. The finding of the present study concurred with the finding of Sheoran (2018) and Shehzadi et al. (2022) who found that private school students outperformed government school students, whereas Singh and Imam (2013) found that students of private school achieved higher in mathematics than State Govt. school but lower than Central Govt. school. The reason may be due to the fact that State Government school teachers are less efficient, and often have less supervision, regular absenteeism, and weaker accountability (Muralidharan et al., 2017). Under these circumstances, students are less likely to be motivated and there was little possibility of a competitive environment. On the other hand, the existence of competitive environment in private schools is a significant factor contributing to their higher academic performance, especially in subjects like mathematics and science. Additionally, private school parents are often more educated and financially stable, providing additional academic support (Desai et al., 2010).

5.2.2 Discussion on findings related to mathematical aptitude among secondary school students

i) *The finding showed that majority of secondary school students in Mizoram have an average mathematical aptitude.*

Discussion: The result of the present study concurred with the finding of Sonar and Patankar (2013) and Sugano and Mamolo (2021) who found that most of the secondary school students of Solapur district in Maharashtra had average level of mathematical aptitude.

The finding of the present study indicates that most secondary school students in Mizoram seems to possess only basic understanding of mathematical concept but may lack logical thinking, problem-solving skills and ability to use mathematical knowledge in real life situation. The average mathematical aptitude may reflect the present status of mathematics education in Mizoram. The curriculum of secondary school mathematics may cover the basic mathematical knowledge but it may not sufficiently provide the necessary knowledge to develop critical thinking, higher order thinking skills and advanced learning of mathematics. Mathematical aptitude is a combination of both inborn ability and learned skills. Like other aptitude, mathematical aptitude needs to be developed and enhanced through practice, effort and learning from teacher. If teaching-learning relies highly on rote learning and procedural knowledge rather than conceptual knowledge and understanding, students may find difficulties in developing their ability to think logically and critically. Therefore teachers, schools and parents play a significant role in developing mathematical aptitude of a student.

ii) *The findings showed that male and female secondary school students did not differ in their mathematical aptitude*

Similar findings have been found in the studies done by Manikandan and Ambedkar (2022), Sonar and Patankar (2013), Olatoye and Aderogba (2011), Bala (2014), and Gupta and Kaur (2015) who found that male and female did not differ in mathematical aptitude. Contrary to this finding, Kumar and Kumari (2021), Chauhan and Ranjan (2024) found that male had higher mathematical aptitude than female whereas Gupta and Gehlawat (2013) found that female students had higher mathematical aptitude than male.

The finding of this study challenges the longstanding stereotype in Mizo society that females were inferior to males in terms of logical thinking and reasoning, and that male naturally possess greater inborn mathematical abilities than female. It underscores that the cognitive abilities in mathematics are not innate gender explicit. It also supports the research findings of Hyde (2005) and Spelkes (2005) who revealed that mathematical abilities are develops from biological based cognitive

capacities. The present study highlights that male and female students had similar mathematical aptitude indicating that when both genders are provided with the same opportunities and support, they have equal capacities to excel in mathematics. The finding is not just about test scores—it's about reshaping how society views gender and mental abilities. It encourages young women to have an interest in mathematics and related subjects and to confidently pursue careers in technology, engineering and other STEM related fields.

iii) *Urban secondary school students have higher mathematical aptitude than rural secondary school students.*

The finding of the present study is in line with the finding of Gupta & Gehlawat (2013), Sonar and Patankar (2013) and Manikandan and Ambedkar (2022) whose findings also showed that the mathematical aptitude of urban secondary school students were higher than their rural counterparts. Cognitive science studies have shown that aptitude is innate and can be shaped and nurtured by environmental factors. Studies also shown that differences in mathematical abilities among people in different regions are not due to biological but environmental (Dehaene, 2011). The findings of the present study indicated that mathematical aptitude is not genetically linked to geographic location. Instead, differences in performance arise primarily due to environmental factors such as societal attitude toward mathematics, access to quality education and learning styles adopted. One possible explanation why the present study found rural students had lower mathematical aptitude could be because innate mathematical abilities of rural students were not developed and nurtured. Boaler (2016) highlights that students who engage deeply with mathematical concepts develop cognitive skills. The present study suggests that students in urban areas are more sincerely engaged in mathematical related activities and problem-solving tasks which develops their mathematical aptitude. However, rural students may lack to access all those educational resources and activities that urban student has enjoyed. The study also highlights the importance of nurturing innate mathematical abilities. Even if student possess high mathematical aptitude it needs to be developed and nurtured through various mathematical activities under the

guidance of significant persons like educated parents, teachers, and brilliant classmate.

5.2.3 Discussion on findings related to the correlation between Academic Achievement in Mathematics, Mathematical Aptitude and Socioeconomic Status

i) *The findings showed that there existed a positive and significant relationship between academic achievement in mathematics and mathematical aptitude among secondary school students in Mizoram*

Discussion: The finding of the study shows that students who possess higher mathematical aptitude are more likely to score higher marks in mathematics than those possess lower mathematical aptitude. This is because people with high mathematical aptitude possess high intellectual ability, logical reasoning, problem solving ability and numerical ability, all of which are essential for academic achievement in mathematics (Dhyani, 2014; Maiti, 2017). The finding of the present study concurred with the findings of Bala (2014), Gupta and Kaur (2015), Kumaravelu (2018) and Khan et al. (2022) who's finding also showed that there was a relationship between mathematical aptitude and academic performance in mathematics.

Students with higher mathematical aptitude demonstrated higher capability in mental abilities, understanding abstract concepts and spatial sense, and ability to solve complex problems. Students with strong mathematical aptitude tends to have more conceptual understanding of mathematics, and are more likely to be success in mathematics. Therefore, mathematical aptitude can be used as an important predictor of academic success in mathematics (Bala, 2014). The finding of the present study suggest that teachers, educationists and parents should incorporate diagnostic assessments to identify students' mathematical aptitude at an early stage so that instructions and guidance can be given according to their needs.

ii) *The finding showed that there exists a positive and significant relationship between academic achievement in mathematics and socioeconomic status of secondary school students in Mizoram.*

Discussion: It is well known that socioeconomic status (SES) plays a crucial role in students' academic success in general. The finding of the present study also holds considerable significant for mathematics education in Mizoram as it revealed mathematics as one of the important factors affecting academic achievement in mathematics. The findings of the study are similar with the findings of Hernandez (2014), Wang et al. (2014), Raju (2016), Pandey (2017), Ansah (2021) and Olsen and Huang (2021) who all had found a positive relationship between academic achievement in mathematics and SES. The findings of Brown (1991) and Lee and Borgonovi (2022) which showed no correlation between academic achievement in mathematics and SES was contradictory with the present finding.

In Mizoram where unequal educational opportunities exist between urban and rural areas (Lalrinmawii et al., 2021), SES play a significant role in shaping academic outcomes. Students from higher SES families often have better access to private tutoring, enrichment program, digital mathematical tools and schools equipped with advanced learning facilities which enhance their mathematical skills. Addressing these disparities through targeted interventions can promote equitable academic success for all students in Mizoram, regardless of their economic background. But the correlation between SES and academic achievement in mathematics was found to be 0.291, which is a weak correlation, factors other than SES may play more significant role in students' success in mathematics.

5.2.4 Discussion on findings related to the correlation between Academic Achievement in Mathematics and dimensions of Socioeconomic Status.

The present study found correlation between academic achievement in mathematics and various SES dimensions – parents' education, parents' occupation, family income, and family assets but no correlation with parental socio-religious position. The finding of correlation between parents' education and academic achievement in mathematics is in tune with Ngente et al. (2023), Kodippili (2011), Akinsanya et al. (2014), Klecker (2015), Kundu (2018), Kunwar (2020), and Pandaya (2020) has consistently found that parents' education has significant influence on mathematical achievement in mathematics. Highly educated parents are

more likely to engage in mathematics related discussion and problem-solving activities; they are more likely involved in guiding or monitoring homework. The finding of Akinsanya et al. (2014) and Kunwar (2020), Ngente et al. (2023) which showed a correlation between parents' occupation and academic achievement in mathematics is similar with the present finding. The finding of Marks and Pokropek (2019), Parmar (2019) and Jibrilla et al. (2021) which showed a correlation between family income and academic achievement in mathematics is also similar with the present finding. The reason may be higher income families can afford private mathematics tutor, well-funded schools with advanced learning facilities, mathematics enrichment program. The present finding is in line with Zhan (2006), Shanks (2007) and Ahmad et al. (2023) who found that family assets positively correlate with mathematics achievement. Since the correlation between all these different dimensions of SES and mathematics performance is weak, others factors like school curriculum, teaching methods, students' mathematical abilities and attitude may play more significant role in students' success in mathematics. But it was also found that parental socio-religious position has no correlation with academic achievement in mathematics. The reason may be that, unlike other SES dimensions, socio-religious identity in Mizoram does not directly affects access to mathematics learning resources.

5.3 EDUCATIONAL IMPLICATION:

In the light of the above findings, mathematics education in Mizoram needs various drastic improvement. Some of the areas in which the present findings have practical application for the improvement of mathematics education in Mizoram are highlighted.

Since students have an average mathematical aptitude but low academic achievement, there is a gap between natural potential and academic performance. In order to bridge the gap, there is a need to enrich curriculum and to improve teaching methods. The finding may also imply that secondary school students in Mizoram are not diligent and hardworking in spite of possessing average mathematical aptitude.

The findings of the study reveal that there is a positive and significant relationship between mathematical aptitude and academic achievement in mathematics. This implies that the higher the mathematical aptitude of a student the higher the academic achievement in mathematics which suggests the importance of nurturing mathematical aptitude. Nurturing one's mathematical aptitude would help in improving their academic performance in mathematics. Additionally, identifying mathematical aptitude of a student can help in choosing their future educational career.

The findings of the study also reveal that there is a positive and significant relationship between socioeconomic status and academic achievement in mathematics. This implies that the higher the socioeconomic status of a student the higher the academic achievement in mathematics. Students with higher socioeconomic status are more likely to succeed in mathematics since parents' education, parents' occupation, family income or material resources has significant influence on academic achievement in mathematics. On the other hand, since the correlation is weak, it indicates that some factors other than parents' education, parents' occupation, family income or material resources play more significant role in students' mathematical achievement. The findings of the study suggests that mathematical performance of students may depend more on cognitive abilities, teaching methods, school mathematics curriculum and quality of teachers rather than socioeconomic status. This finding is significant and encouraging because with the right approaches, every student from all backgrounds may have an opportunity to excel in mathematics.

The fact that private school students outperformed government school students may be one of the major issues in the mathematics education of Mizoram. The Mizoram government spent large amount of money for students in government school. The government school received more fund and learning facilities than private schools from the Government, and teachers are more qualified than the private school teachers. Therefore, the underperformance of government schools compared to private schools needs to be addressed and considered. Encouraging stronger partnership between parents and school, and to educate parents about the

importance of parental support in mathematics education may create more effective mathematics learning. Parental attitude towards government and private school also need to be addressed. Parents often perceived private schools provides better quality education, extracurricular activities, and accountable teachers which is not always true. Therefore, private schools attract more high-quality students whereas the leftover are admitted by the government school. This may be one of the reasons why government school underperform compared to private school.

Since male and female have similar mathematical aptitude but female outperform male in academic achievement in mathematics, it suggests that the differences in performance are not due to inborn ability but rather environmental factor, study habits and life style. Mathematics needs hardworking, sincerity, and good study habits. In fact, male secondary school students in Mizo society are engage more in outdoor activities and games and are less likely to engage in studies whereas female spent more time at home and are more likely to engage in learning mathematics. Moreover, females are more sincere and diligent in their studies than male. This may be some of the reasons why male underperform in mathematics compared to female. Since both genders possess similar mathematical abilities yet achieve varying levels of success, this finding underscores the importance of hard work and diligence in academic achievement in mathematics. And since male underperform female, teachers, parents and community must take necessary measures to improve performance of male students through targeted strategies. Additionally, the findings of the study implies that both male and female students are genetically equal in mathematics, indicating there exists a progressive change in the long gender stereotype that male are better than female in mathematics. This finding suggests that teachers, parents and society must be educated to aware that male and female are equally competent in mathematics, or female can even outperform male, when both genders are provided the same educational opportunities. This finding would help female students to be more confidence in learning mathematics and choosing mathematics related subjects in their future academic career.

5.4 RECOMMENDATIONS:

A. Recommendations based on findings of the study:

1. *Development of standardized tool:* The present study developed a standardized tool to find out the mathematical aptitude of secondary school students. This tool may be used by teachers and administrators to find out the aptitude of their students and take necessary measures as indicated by the test results. Future studies may also focus on the development of a standardised tool to look into the problem of mathematics education and come up with more systematic research tools to tackle the problem of mathematics education.
2. *Academic achievement in mathematics:* It was found that the mathematics achievement among secondary school students was below average. In view of the importance accorded to mathematics in present day technology driven society, it is highly recommended that stakeholders themselves do research to enhance the achievement of students in mathematics. If educationists, policymakers and teachers do research on the root causes of low academic performance in mathematics, other causes besides poor socioeconomic status as well as low aptitude could also be contributing to the low performance of students. Accordingly, remedial measures may be taken.
3. *Mathematical aptitude:* Since the mathematical aptitude among secondary school students was average, it is recommended that mathematics textbook and curriculum be designed in such a way that it develops students' critical thinking and problem-solving skills. The NEP 2020 has introduced Foundation Literacy and Numeracy (FLN) to emphasize essential literacy and basic arithmetic, numbers, shapes, measurements during early years of education. It is recommended that schools may encourage closer collaboration with parents. Parents could be sensitized to encourage children to count objects and sort it out by shape and size, to use play-based learning like puzzles, building blocks right from their early childhood to develop logical thinking and reasoning. It is also recommended that teachers should

employ teaching methods that emphasize conceptual learning rather than rote learning.

4. *Gender based comparison on mathematical aptitude and academic achievement in mathematics:* It was found that the mathematical aptitude of male and female students did not differ significantly whereas female students outperformed male students in academic achievement in mathematics. This finding has further reiterated the breaking of the longstanding stereotype in Mizo society that females are inferior to males in terms of logical thinking and reasoning, and that males naturally possess greater mathematical abilities than female. It is recommended that administrators and teachers strive to dismantle the images of gender stereotype, ensuring an environment where gender equality in mathematics education shines brightly for all. Parents and society at large should also be educated to be aware that male and female students are equal in mental abilities and have the same capacities to achieve in mathematical studies. Additionally, since female students outperformed male students in academic achievement in mathematics, it is also recommended that joint efforts involving parents, teachers, NGO like Young Mizo Association (YMA), Mizo Students' Union, and even the Church must take proactive steps to uplift the backwardness of the condition of males in the Mizo society.
5. *Locality based comparison on academic achievement in mathematics:* Since there is a significant disparity in mathematics performance, with rural school students underperforming relative to urban school students, it is recommended that the Government should strengthen and upgrade infrastructural and instructional resources of rural schools. It is also recommended that more teacher training and workshop be organized for rural school teachers for their professional development. To attract and retain efficient and more qualified teachers in rural schools, the government may offer incentives through salary hike and allowances, housing support by constructing quarters for teachers.
6. *School management-based comparison on academic achievement in mathematics:* It was found that students in government schools

underperformed in mathematics compared to students in private schools. It is recommended that the Government must organize surprise inspection to government schools more often. It is recommended that the authority should take strong measures against inefficient and unaccountable teachers while trying to create more fertile soil for the students. Parent-teacher meetings should be conducted more frequently in government schools so that that parents and teachers work together toward the child's holistic growth and success. Parents must be encouraged to actively participate in their children's academic development in mathematics. It is also recommended that schools should organize more co-curricular activities like essay writing, mathematics quiz, mathematics competition to motivate students and to make schools learning environment more enjoyable and more competitive.

7. *Relationship between academic achievement in mathematics and mathematical aptitude of students:* It was found that there is a significant relationship between academic achievement in mathematics and mathematical aptitude of students. In the teaching-learning process, it is highly recommended that students must be taught and guided based on their mathematical aptitude. Since mathematical aptitude is a predictor of future success in mathematics, it is recommended that students' future career on mathematics and related subjects must be guided based on their mathematical aptitude. There are some students who have high mathematical aptitude but low academic achievement due to various problems. It is recommended that parents and teachers should encourage students that they have the ability to learn mathematics even if their academic marks were low.
8. *Relationship between academic achievement in mathematics and socioeconomic status of students:* It was found that there is a significant relationship between academic achievement in mathematics and socioeconomic status of students. It is recommended that teachers should maintain confidential records of each student's family background, including parental education, occupation, family structure (single-parent, divorced parents, guardianship), home environment, and any socioeconomic challenges. Teachers can use this data to teach and support students with

different strategies accordingly. It is recommended that schools implement free mathematics tutoring programs, provide free learning materials, and scholarship opportunities to uplift the economically disadvantaged students.

B. General recommendations:

Improving mathematics education requires a multi-faceted approach that addresses various levels. Here are some key general recommendations:

1. Curriculum and Pedagogical Approaches:

The mathematics curricula currently adopted in most of the schools may not be relevant to meet the needs of the students. There is a need to enrich curriculum beyond textbook and to adopt innovative teaching methods equipped with modern technology and teaching aid. Conceptual understanding should be emphasized and strengthen, not just employing procedural knowledge. Curriculum should be enriched in such a way that it strengthens the foundational concept and enhance critical thinking and basic understanding of mathematics, and therefore shift away from rote learning. Students should be taught and motivated so that they could experience the joy of learning mathematics. Teachers should make learning mathematics interesting and enjoyable by connecting it to everyday life and encouraging activity-based learning including mathematics games, puzzles, and hands-on experiment.

2. State Government Level:

- i) The government should organise continuous professional development program to enhance the quality and efficiency of mathematics teachers.
- ii) The government should take necessary measures to improve government school by organising random school inspection program to identify areas of improvement needed by assessing the performance of teachers and status of schools.
- iii) Since many students in private school find difficulties in mathematics, some private school also need to be checked and monitored. The government should forbid all the private school to recruit untrained teachers.

- iv) The government should often organise mathematics exhibition, seminar and awareness programme for the promotion of mathematics education among students in Mizoram.
- v) Research on mathematics education must be conducted frequently to know the exact status and problems in Mizoram and the government should take necessary measures based on the research findings.

3. School Level:

- i) Right from the very beginning of the school year, teacher must assess the mathematical aptitude of students so as to develop their mathematical aptitude and to guide each and every student according to their abilities.
- ii) Care must be taken to develop mathematical skills at early age among students right from elementary school stage so that children may have necessary foundational mathematical skills or prior knowledge for learning mathematics at secondary school or at higher education.
- iii) Establishment of mathematics club should be encouraged in the school.
- iv) Mathematics learning resources like digital technology, library, teaching aid, qualified and enthusiastic teachers should be available and accessible.
- v) The school may organised mathematics competition and incentive must be given to those who achieve high marks in order to motivate them and improve their mathematics learning outcomes.
- vi) Finding of the study may recommend that care must be taken to encounter and deal with students' learning problems according to their family background.

4. Family Level:

- i) Parents should involve more in their child's mathematics learning by encouraging, motivating, supporting and providing learning environment.
- ii) Gender stereotypes like males are better than females should be eliminated within families. Parents should not undermine the mathematical abilities of female.
- iii) Parents should cultivate positive attitude toward mathematics so that it may significantly influence their children's mathematics learning and engagement with the subject.

- iv) While household chores have significant role in developing a child, parents should allow their children to dedicate more time for learning mathematics.

5.5 SUGGESTIONS FOR FURTHER RESEARCH:

The following have been suggested for further research:

1. The present study was carried out on secondary school students, studying in class X of Mizoram state. Similar study can be carried upon the students of different school stages, different age groups, different educational streams.
2. The present study is limited to the state of Mizoram only. In order to have broader perspective, studies can be conducted on comparative study of Mizoram state and other states.
3. The study can also be conducted on mathematics teacher of elementary and secondary school teachers to know their level of mathematical aptitude.
4. Longitudinal studies can be conducted on how mathematical aptitude and socioeconomic status impacts academic achievement in mathematics from elementary education to higher education.
5. Similar study can be conducted to examine the impact of gender stereotypes on mathematics education.
6. Study can be conducted on whether parental involvement have impact on academic achievement in mathematics.
7. Study can be conducted to examine the effects of parental education, income and occupation on students' mathematical development.
8. Study can be conducted on whether targeted intervention can mitigate educational disparities in mathematics performance.
9. Study can be conducted to compare how classroom resources, teacher quality and teaching methods in rural and urban areas affect students' learning outcomes in mathematics.
10. A study on the effects of early childhood mathematics education reduces SES related disparities in mathematics performance.

5.6 CONCLUSION:

Mathematics education has always been a major concern at the elementary and secondary school stages in Mizoram. The findings of this study revealed that secondary school students of Mizoram exhibited low academic achievement in mathematics but an average level of mathematical aptitude. The study also revealed that there was no significant difference in mathematical aptitude between male and female students; however, female students demonstrated higher academic achievement in mathematics compared to their male counterpart. This research finding disproves the longstanding stereotype in Mizo society that males are genetically better in mathematics than females. Additionally, urban students performed better in mathematics compared to their rural counterparts, and private school also outperformed government school. Academic achievement in mathematics was found to be correlated with mathematical aptitude and socioeconomic status (SES), suggesting that higher mathematical aptitude and SES may contribute to better performance in mathematics. These findings highlighted the need for targeted interventions and systematic approaches to enhance mathematical learning outcomes among students in Mizoram and bridge the gap in educational inequalities.

SUMMARY

INTRODUCTION

Mathematics occupies an important position in curriculum and holds a central and foundational position in modern education systems worldwide due to its universal applicability, cognitive benefits, and role in scientific and technological advancement. It is a compulsory subject from Class - I to Class - X in Indian education system and it forms part of the core curriculum under all major educational boards (CBSE, ICSE, State Boards). Education is universally acknowledged as the cornerstone of societal advancement, fostering intellectual growth, social equity, and economic development. It serves as a catalyst for innovation, personal empowerment, and the promotion of a just and equitable society. Beyond individual enrichment, education drives collective progress, shaping communities and nations. Among various educational disciplines, mathematics holds a unique and indispensable position due to its universality and broad applicability. Mathematics forms the backbone of critical thinking, scientific discovery, and technological progress, cementing its role as an integral component of modern education systems worldwide (NCERT, 2005).

One of the aims of education is to mould and develop a person so as to become a useful and productive human by inculcating creativity, problem solving skills, logical thinking, etc. Mathematics education is one of the most important tools for developing a child's thinking. According to NCF 2005, "The main goal of Mathematics education in schools is the 'mathematisation' of a child's thinking" (NCERT, 2005). Developing mathematics skills in child in an early stage helps in intellectual development which is necessary for the growth and development of a child in various aspect of life. The term education is derived from the Latin word 'Educere' which means "to bring up" or "to nourish". The ultimate aim of education is to bring up an individual for the betterment of the world, societies and for himself. By understanding mathematical patterns, conjectures, measurement, counting, shapes and size, averages etc helps a child in cognitive development, building up confidence, personality and social development. Learning mathematics helps a child

to develop values such as rigor and integrity in communication and formulation of argument which is the aims of mathematics education according to NCF 2023.

During the past few decades, the status of mathematics education in Mizoram was generally poor. Academic achievement in mathematics was considerably low among students in Mizoram. Students were underperforming all kinds of assessment in mathematics subject in the school. Thanhawla (1983) found that the general standard of achievement in mathematics was 27.86 % which was extremely low. From the study of Thomas (1991) it was revealed that the level of achievement in mathematics subjects was between 33 and 50 percent only. There are only few people who have science and mathematics background, and most of the student opted for arts and humanities in the higher studies rather than science and mathematics. The reason for insufficient number of people who have science and mathematics background in Mizoram is due to the weak foundations of mathematics and science in the school system (Wangu, 1995). It has all started right from the school level where most of the students were not interested in mathematics which result in lack of mathematics graduate among the educated who could able to teach mathematics in the school. The number of school teachers with science and mathematics background is insufficient compared to the needs of the area. Thus, the state Government was forced to import and employ numerous science and mathematics teachers from outside the state.

The growth and progress of mathematics education can be seen since from the last few years. The number of science and mathematics graduate is gradually increasing driven by the growing demand in various Government jobs and private sector. Academic performance in mathematics continues to progress, and at the same time it also grows increasingly challenging due to various issues and problems. With the passage of time, students are starting to learn mathematics with greater interest in the subjects and are beginning to find the study enjoyable. Academic marks and performance in mathematics continue to improve. But the percentage of failure in mathematics is still persistently high. The following are the academic performance of secondary school students in HSLC examination during the last 5 years:

Students' performance in mathematics in HSLC examination between 2020–2024.

Division	No. of Students	Percentage
Distinction	6237	6.94
First	12694	14.13
Second	16,899	18.82
Third	36,080	40.19
Fail	17,870	19.90
Total	88,913	100

Source: MBSE, Government of Mizoram

From the above table it can be seen that there is a progression in the mathematics result, however, the result is still unsatisfactory since majority of the students were those who have failed and those who secured third division marks. This indicates that secondary school students of Mizoram have low academic achievement in Mathematics.

The interplay among academic achievement in mathematics, mathematical aptitude, and socioeconomic status (SES) is complex, reflecting a dynamic relationship between intrinsic abilities and extrinsic influences. Mathematical aptitude, defined as an individual's natural or developed capacity for understanding and applying mathematical concepts, serves as both a predictor and a determinant of academic achievement. However, the extent to which aptitude translates into measurable success often depends on SES, which moderates access to resources, opportunities, and support systems (Bloom, 1956). Students with high mathematical aptitude generally excel in tasks requiring abstract reasoning, logical problem-solving, and quantitative analysis. However, SES plays a pivotal role in shaping the environments where these aptitudes can be nurtured. High-SES students typically benefit from enriched learning environments, including access to advanced learning materials, private tutoring, and extracurricular activities that amplify their potential. In contrast, low-SES students may struggle to realize their capabilities due to systemic barriers such as underfunded schools, inadequate infrastructure, and limited academic support (Maiti, 2017).

Understanding the interrelationship among achievement, aptitude, and SES requires a holistic approach that considers cognitive, emotional, and environmental factors. By addressing systemic inequities and fostering inclusive practices, educators can create environments where all students, regardless of their socioeconomic background, have the opportunity to achieve their full potential in mathematics.

RATIONALE OF THE STUDY

One of the key factors influencing academic achievement in mathematics is mathematical aptitude—an inherent or acquired ability to understand and solve mathematical problems. Mathematical aptitude, as described by Mangal (2019), involves cognitive skills such as logical reasoning, numerical ability, and abstract thinking. However, in Mizoram, there is a lack of research focusing specifically on the mathematical aptitude of secondary school students and how it influences their academic achievement. Without a clear understanding of students' mathematical aptitude, educators and policymakers are ill-equipped to design effective teaching strategies and curricula that address the diverse needs of learners. Additionally, socioeconomic status (SES) plays a significant role in shaping students' educational experiences and outcomes. SES encompasses factors such as family income, parental education, and occupational status, all of which impact access to educational resources, quality of instruction, and learning environments (Pandey, 2017). Students from higher SES backgrounds often enjoy advantages such as private tutoring, advanced learning materials, and supportive home environments. Conversely, students from lower SES backgrounds face barriers including inadequate resources, limited parental involvement, and financial constraints, all of which negatively affect their academic performance (Dhoundiyal & Rawat, 2021).

The interplay between mathematical aptitude, academic achievement, and SES underscores the need for a comprehensive study that examines these relationships in the context of secondary school students in Mizoram. Such research is particularly important for addressing systemic inequities and improving educational outcomes. By identifying the levels of mathematical aptitude among

students and understanding how SES influences achievement, this study aims to provide actionable insights for educators, policymakers, and curriculum designers. Furthermore, the study seeks to address critical gaps in the literature. While previous studies have explored the relationship between mathematical aptitude and achievement in other regions (Narula, 2007; Bala, 2014), there is limited research focusing on Mizoram. This gap is significant given the unique sociocultural and economic context of the state. Mizoram's educational landscape is characterized by challenges such as limited access to advanced learning tools, disparities between rural and urban schools, late start of formal education, and varying levels of parental involvement. A focused investigation into these issues can help illuminate the specific factors contributing to low achievement in mathematics and inform targeted interventions.

Another rationale for the study lies in its potential to contribute to policy development. Findings from this research can inform the design of inclusive and equitable educational policies that address the needs of diverse student populations. For instance, understanding the role of SES in shaping academic achievement can guide resource allocation to underprivileged schools, ensuring that all students have access to quality education. Similarly, insights into mathematical aptitude can help educators adopt differentiated instruction methods that cater to varying levels of ability. The study also aims to empower teachers by equipping them with a deeper understanding of the factors influencing students' mathematical performance. Effective teaching requires more than subject knowledge; it demands an awareness of students' abilities, learning styles, and socio-economic backgrounds. By highlighting the interplay between these factors, the research can help teachers adopt evidence-based practices that enhance learning outcomes.

From a broader perspective, the study aligns with global educational goals, particularly those emphasizing equity and inclusivity. The United Nations' Sustainable Development Goal 4 advocates for inclusive and equitable quality education, with a focus on eliminating disparities in educational outcomes. This study contributes to these objectives by addressing the root causes of

underachievement in mathematics and proposing solutions to bridge gaps in access and achievement.

Finally, the study is timely given the increasing emphasis on STEM education in India. As the country aspires to become a global leader in science and technology, it is imperative to strengthen the mathematical foundation of students. Enhancing achievement in mathematics at the secondary school level is a critical step toward this goal, as it prepares students for advanced studies and careers in STEM fields. By investigating the factors that influence mathematical performance in Mizoram, this study aims to contribute to the broader effort of building a scientifically literate and capable workforce. Hence, the rationale for this study is rooted in its potential to address pressing educational challenges in Mizoram and contribute to the broader discourse on mathematics education. By examining the relationships among academic achievement, mathematical aptitude, and SES, the research aims to provide a nuanced understanding of the factors influencing students' performance. The findings are expected to have significant implications for teaching practices, curriculum design, and policy development, ultimately contributing to the goal of equitable and quality education for all students in Mizoram.

RESEARCH QUESTIONS

1. What are the levels of academic achievement in Mathematics among secondary school students in Mizoram?
2. What are the levels of mathematical aptitude of secondary school students in Mizoram?
3. What are the levels of socioeconomic status of secondary school students of Mizoram?
4. Is there any relationship between academic achievement in mathematics and mathematical aptitude among secondary school students of Mizoram?
5. Is there any relationship between academic achievement in mathematics and socioeconomic status among secondary school students of Mizoram?
6. Is there any relationship between mathematical aptitude and socioeconomic status among secondary school students of Mizoram?

7. Is there any relationship between academic achievement in mathematics and various dimensions of socioeconomic status among secondary school students of Mizoram?
8. Is there any relationship between mathematical aptitude and various dimensions of socioeconomic status among secondary school students of Mizoram?
9. Is there any significant difference in the academic achievement in mathematics among secondary school students with respect to gender, locale and type of management of the school?
10. Is there any significant difference in the academic achievement in mathematics between male and female secondary school students of Mizoram based on locale and type of management of school?
11. Is there any significant difference in the mathematical aptitude of secondary school students with respect to their gender, locale, and type of management of the school?
12. Is there any significant difference in the mathematical aptitude between male and female secondary school students of Mizoram based on locale and type of management of school?
13. Is there any significant difference in the socioeconomic status of secondary school students with respect to their locale and type of management of the school?

STATEMENT OF THE PROBLEM

The problem of the present study has been stated as “Academic Achievement in Mathematics among Secondary School Students of Mizoram in Relation to their Mathematical Aptitude and Socioeconomic Status”.

OBJECTIVES OF THE STUDY

The following are the objectives for the present research:

1. To construct and standardize Mathematical Aptitude Test (MAT) for secondary school level of education.
2. To find out the academic achievement in mathematics among secondary school students of Mizoram.

3. To find out the mathematical aptitude of secondary school students of Mizoram.
4. To find out the socioeconomic status of secondary school students of Mizoram.
5. To compare the academic achievement in mathematics among secondary school students of Mizoram based on:
 - iv) Gender
 - v) Locality
 - vi) Type of school management
6. To conduct gender-based comparison on academic achievement in mathematics among secondary school students of Mizoram based on
 - iii) Locality
 - iv) Type of school management.
7. To compare the mathematical aptitude among secondary school students of Mizoram based on:
 - iv) Gender
 - v) Locality
 - vi) Type of school management
8. To conduct gender-based comparison on mathematical aptitude among secondary school students of Mizoram based on:
 - iii) Locality
 - iv) Type of school management.
9. To compare the socioeconomic status among secondary school students of Mizoram based on
 - iii) Locality
 - iv) Type of school management
10. To find out the relationship between academic achievement in mathematics and mathematical aptitude among secondary school students of Mizoram.
11. To find out the relationship between academic achievement in mathematics and socioeconomic status among secondary school students of Mizoram.
12. To find out the relationship between mathematical aptitude and socioeconomic status among secondary school students of Mizoram.

13. To find out the relationship between academic achievement in mathematics and dimensions of socioeconomic status among secondary school students of Mizoram.
14. To find out the relationship between mathematical aptitude and dimensions of socioeconomic status among secondary school students of Mizoram.
15. To compare academic achievement in mathematics between high and low socioeconomic status dimensions.

HYPOTHESES OF THE STUDY

1. There is a significant difference in academic achievement in mathematics between male and female secondary school students of Mizoram.
2. There is a significant difference in academic achievement in mathematics between urban and rural secondary school students of Mizoram.
3. There is a significant difference in academic achievement in mathematics between government and private secondary school students of Mizoram.
4. There is a significant difference in academic achievement in mathematics between male and female of urban secondary school students of Mizoram.
5. There is a significant difference in academic achievement in mathematics between male and female of rural secondary school students of Mizoram.
6. There is a significant difference in academic achievement in mathematics between male and female of government secondary school students of Mizoram.
7. There is a significant difference in academic achievement in mathematics between male and female of private secondary school students of Mizoram.
8. There is a significant difference in mathematical aptitude between male and female secondary school students of Mizoram.
9. There is a significant difference in mathematical aptitude between urban and rural secondary school students of Mizoram.
10. There is a significant difference in mathematical aptitude between government and private secondary school students of Mizoram.
11. There is a significant difference in mathematical aptitude between male and female of urban secondary school students of Mizoram.
12. There is a significant difference in mathematical aptitude between male and female rural secondary school students of Mizoram.

13. There is a significant difference in mathematical aptitude between male and female government secondary school students of Mizoram.
14. There is a significant difference in mathematical aptitude between male and female private secondary school students of Mizoram.
15. There is a significant difference in socioeconomic status between urban and rural secondary school students of Mizoram.
16. There is a significant difference in socioeconomic status between government and private secondary school students of Mizoram.
17. There is a significant relationship between academic achievement in mathematics and mathematical aptitude among secondary school students of Mizoram.
18. There is a significant relationship between academic achievement in mathematics and socioeconomic status among secondary school students of Mizoram.
19. There is a significant relationship between mathematical aptitude and socioeconomic status among secondary school students of Mizoram.
20. There is a significant relationship between parental education and academic achievement in mathematics among secondary school students of Mizoram.
21. There is significant relationship between parental occupation and academic achievement in mathematics among secondary school students of Mizoram.
22. There is a significant relationship between family income and academic achievement in mathematics of secondary school students in Mizoram.
23. There is a significant relationship between family assets and academic achievement in mathematics of secondary school students in Mizoram.
24. There is a significant relationship between parental socio-religious position and academic achievement in mathematics of secondary school students in Mizoram.
25. There is a significant relationship between parental education and mathematical aptitude of secondary school students in Mizoram.
26. There is a significant relationship between parental occupation and mathematical aptitude of secondary school students in Mizoram.
27. There is a significant relationship between family income and mathematical aptitude of secondary school students in Mizoram.

28. There is a significant relationship between family assets and mathematical aptitude of secondary school students in Mizoram.
29. There is a significant relationship between parental socio-religious position and mathematical aptitude of secondary school students in Mizoram.
30. There is a significant difference in academic achievement in mathematics between high and low parental education levels among secondary school students of Mizoram.
31. There is a significant difference in academic achievement in mathematics between high and low parental occupation levels among secondary school students of Mizoram.
32. There is a significant difference in academic achievement in mathematics between high and low family income among secondary school students of Mizoram.
33. There is a significant difference in academic achievement in mathematics between high and low family assets among secondary school students of Mizoram.
34. There is a significant difference in academic achievement in mathematics between high and low parental socio-religious position among secondary school students of Mizoram.

REVIEW OF RELATED LITERATURE

A review of literature on how mathematical aptitude and socioeconomic status interact to shape students' achievement in mathematics was done by the scholar in order to know more about the status of research done and also to understand the findings of other researchers on the topic. The researcher reviewed a total of 86 literature related to different objectives, comprising 34 conducted outside India, 45 from various regions across India, and the remaining 7 conducted specifically in Mizoram. The selected literature encompasses a 78-years period, extending from 1947 to 2025. The most researched area was academic achievement in mathematics, the others reviewed literature were studies on mathematical aptitude, studies on construction and standardization of mathematical aptitude test, studies on academic achievement in mathematics in relation to mathematical aptitude, studies

on academic achievement in mathematics in relation to socioeconomic status, and a few studies on theories, trends and practices in mathematics education.

METHOD OF THE STUDY

Keeping in view the nature of research and the objectives of the study, descriptive survey method was used in the present research.

Population

The population of the present study consisted of all secondary school students in Mizoram. The school includes both government and private secondary school. According to the latest annual publication of 'Statistics of School Education' (2022 – 2023) prepared by Directorate of School Education, Government of Mizoram, there are 718 secondary schools and 39,313 secondary school students in Mizoram.

Sample

For selecting a representative sample, multistage stratified random sampling technique was followed. Although it was proposed that the sample would comprise of 900 sample secondary school students. However, when the test was administered, it was found that some sample students had not responded to all the items in the test. Therefore, their responses had to be rejected. The final sample for the present study thus consisted of 891 secondary school students studying Class X in the 2024-2025 academic year which were selected from 6 districts out of 11 districts. Stratification was done in urban and rural areas at the district level and management of schools.

- i. Five districts were selected from North, South, East, West, and Central regions of the State. Besides these five districts of representative regions, the state capital district was also included because it had the highest number of secondary school students. Given that the majority of the students is concentrated in the state capital Aizawl, its inclusion was deemed significant to ensure a representative sample.
- ii. Urban areas and rural areas were stratified randomly from the selected districts.

- iii. Government schools and private schools were selected from the selected local areas.
- iv. From the selected secondary schools, students were randomly selected.

Region Wise Representation of Secondary School Students

Region	District	No. of Students
North	Kolasib	150
South	Lunglei	147
East	Champhai	150
West	Mamit	150
Central	Serchhip	144
Capital	Aizawl	150
	Total	891

From the above table it can be seen that the total number of secondary school students selected as sample is 891 representing 150 each from four districts, 147 from Lunglei district and 144 from Serchhip district.

Detailed number of sample students

N	No. of male students	No. of female students	No. of urban students	No. of rural students	No. of Private School Students	No. of Govt. School Students
891	403	488	472	419	485	406

TOOLS FOR DATA COLLECTION

In the present study, the following tools were used for collecting necessary data:

- i. Mathematical Aptitude Test developed by the researcher.
- ii. Socioeconomic Status Scale (Revised, 2022) by Prof. Lallianzuali Fanai & Prof. R.P. Vadhera.
- iii. Class IX annual examination results of identified schools.

i) Mathematical Aptitude Test (MAT):

The researcher developed Mathematical Aptitude Test for measuring the mathematical aptitude of secondary school students. The test consists of 20 items and includes dimensions of mathematical aptitude such as numerical ability, ability to use symbol and formula, verbal skills, problem solving skills, reasoning, spatial ability. The test comprised multiple-choice questions (MCQs) covering arithmetic, geometry & mensuration, algebra, and reasoning domains. For each question, four suggested answers are given as an option, out of which the respondent has to choose the correct answer, which carries 1 mark each for the correct response. The total number of correct responses was taken as the total score obtained by the respondent.

Reliability:

The Test-retest method was used to establish reliability of Mathematical Aptitude Test as it was found to be most suitable. The newly constructed Mathematical Aptitude Test was administered to a sample of 100 students. The second test was administered after two weeks. The coefficient correlation for the two scores was computed using Pearson's product moment correlation method. The coefficient of correlation between the two scores was found to be 0.81.

Validity:

Validity of the Mathematical Aptitude Test was undertaken by face validity and content validity. The test items was given to a panel of experts in the subjects of

mathematics and education to judge and analyse the worth of each item. The experts provided suggestions for refinement and offered constructive feedback.

Dimension of final draft of Mathematical Aptitude Test.

Sl. No.	Dimension	No. of items
1	Numerical Ability	4
2	Ability to use symbol & Formula	4
3	Verbal Skills	3
4	Problem Solving Skills	3
5	Reasoning	4
6	Spatial Sense	2
TOTAL		20

Socioeconomic Status Scale

The socioeconomic status scale developed by Lallianzuali Fanai & R.P.Vadhera (Revised, 2022) measures a person's social and economic position relative to others in society. The scale consists of various areas namely – education of parents, occupation of parents, income of family per month, opinion of other people on students' family status, possession of vehicles, household commodities, housing, important post held by parents in the society and in the church, newspaper subscription. These different areas of socioeconomic status (SES) can be grouped into distinct dimensions by clustering related variables, allowing for a more structured analysis. The key dimensions include: i) Parental Education ii) Parental Occupation iii) Family Income iv) Family Assets v) Parental Socio-religious Position. vi) Subscription of Newspaper. The scale which has been developed for this purpose is a point scale where the points range between 0 to 8 depending upon the items or variables under assessment. The key dimensions are defined as follows:

i) Parental Education:

The highest level of education completed by parents (mother and father) of students. It is an ordinal scale, with education levels scored on a scale from 1 to 6, where higher values correspond to higher educational attainment.

ii) Parental Occupation:

The job or profession of a parent (mother and father). It is a 5 - point ordinal scale representing a hierarchy of occupations from low-skilled to highly skilled profession.

iii) Family Income:

The total monetary or financial resources a family earn per month. It is an 8 – point ordinal scale where family income is measured from lowest to highest, without specifying exact income amount.

iv) Family Assets:

Family assets is the total value of resources owned by a family such as land, house, vehicles, durable goods etc. In this SES scale, family assets refer to the combination of vehicles, household commodities and house owned by a family.

v) Parental Socio-religious Position:

In this study, socio-religious position is the combination of important post held by parents in the society and in the religious activities of the church. It is an ordinal scale where these posts are ranked in order of importance or hierarchy.

vi) Subscription of Newspaper:

It refers to whether and how regularly a family subscribes to newspapers.

The nature of the SES scale is comprehensive and multi-dimensional as it encompasses various aspects of a person's social and economic position. The scale is specially constructed in context of the Mizo society. It does not discriminate between urban and rural, male and female, government school and private school.

PROCEDURE OF DATA COLLECTION

The researcher personally visited schools across the entire Mizoram state in the east, west, south, north and central regions to collect necessary data. Before administration of the test, due permissions were taken from each of the school headmasters. The test was administered only when both the researcher and the students were ready.

Before administering the test, the researcher first established a close and harmonious relationship with the students and explained the purpose and importance of the research. Students were assured that the information would be kept in secret and confidential and it will be used only for research purpose. The researcher also requested the respondents to respond to the test sincerely and no one should copy from their friends. After the researcher has given instruction on how to respond to the test, the students were asked to answer first the socioeconomic status scale and then the mathematical aptitude test may follow it. The entire time taken to complete the test was about one hour.

For academic achievement in mathematics, marks in mathematics subject scored by the students in their class - IX Promotion Examination 2024, were collected by the researcher from school records.

DATA ANALYSIS

In the data analysis phase, the researcher employed quantitative methods to analyze the collected data.

Quantitative analysis involves the use of descriptive and inferential statistics to examine numerical data quantitatively such as percentage, means, standard deviation, normality tests, t-tests and Pearson's product moment correlation and Spearman's rank correlation. Normality test was conducted by employing skewness and kurtosis. The skewness and kurtosis of the data in the present study was computed using Microsoft Excel and the resulting values supported the normality of the data distribution. The collected data was plotted for graphical test which showed bell curve shape. The scores of each test were tabulated using SPSS tabulation sheet

and were treated with statistical techniques for analysis to conduct correlational analysis and differential analysis.

MAJOR FINDINGS

The major findings of the present study based on the research objectives were as follows:

1. Construction and Standardization of Mathematical Aptitude Test (MAT)

A multiple-choice questions (MCQs) type Mathematical Aptitude Test (MAT) consisting of 20 items had been constructed and standardized. The reliability of the test was established by test-retest method in which reliability coefficient was found to be 0.81. The test was validated through rigorous examination by a panel of subject-matter experts to ensure content validity.

2. Findings based on descriptive statistics of Academic Achievement in Mathematics

- i) The study revealed that –
 - Only 14.4% of the students achieved distinction in mathematics
 - 12.1% achieved first division
 - 13.9% achieved second division
 - 38.5% achieved third division
 - 21.1% of the students failed to achieve the minimum passing score
 - The overall findings indicated that majority of the students were low achievers in mathematics as nearly 60% either failed or scored only marginally above the passing mark.
- ii) In the frequency distribution of academic achievement in mathematics among secondary school students, the highest concentration of students was in the 40–49 marks range, making it the most common

achievement level. Very few students scored extremely low (0–9 marks) or extremely high (90–99 marks).

- iii) The lowest score recorded was 4 and the highest was 99. The positive value of skewness (0.549) which was slightly greater than zero indicated that the data was moderately skewed to the right and the distribution was approximately symmetric. The negative value of kurtosis (-0.395) which was slightly less than zero indicated that the distribution was mildly platykurtic. The observation leads to the conclusion that the academic achievement in mathematics of secondary school students was normally distributed.

3. Findings based on descriptive statistics of Mathematical Aptitude

- i) The study revealed that:
- 3.36 % of the students demonstrated a very high mathematical aptitude
 - 15.94% of students had high mathematical aptitude
 - Majority of the students (61.73%) fell within the average range
 - 18.86% of the students had low mathematical aptitude
 - Only one student (0.11%) had very low mathematical aptitude
 - The overall finding indicated that secondary school students of Mizoram had an average level of mathematical aptitude.
- ii) The lowest score recorded was 0 and the highest was 20. The positive value of skewness (0.355) which was slightly greater than zero indicated that the data was moderately skewed to the right and the distribution was approximately symmetric. The negative value of kurtosis (-0.489) which was slightly less than zero indicated that the distribution was mildly platykurtic. The observation leads to the conclusion that the mathematical aptitude of secondary school students was normally distributed.

4. Findings based on descriptive statistics of socioeconomic status

- i) The study revealed that:
 - 2.9 % of the students had a very high SES
 - 13.6 % of students had high SES
 - Majority of students (65.2%) fell in the "Average" category
 - 17.7% of the students fell in the "Low" category
 - Only 0.6% had a "Very Low" SES
 - The overall finding indicated that secondary school students of Mizoram had an average SES.
- ii) The lowest score recorded was 12 and the highest was 66. The positive value of skewness (0.33) which was slightly greater than zero indicated that the data was moderately skewed to the right and the distribution was approximately symmetric. The negative value of kurtosis (-0.302) which was slightly less than zero indicated that the distribution was mildly platykurtic. The observation leads to the conclusion that the socioeconomic status of secondary school students was normally distributed.

5. Findings based on comparison of Academic Achievement in Mathematics

1. Comparison of academic achievement in mathematics between male and female secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in academic achievement in mathematics between male and female secondary school students of Mizoram, with female students exhibited higher academic achievement in mathematics than male students. (Significant at 0.01).

2. Comparison based on level of academic achievement in mathematics

- A greater proportion of female students (17.62%) achieved Distinction compared to male students (10.42%), indicating a significantly higher performance at the top level among females.

- Female students also outperformed males in the II Division category, with 15.78% of females scoring in this range compared to 11.66% of males.
- In the I Division category, both male and female students showed nearly equal achievement levels, with 12.16% of males and 12.09% of females.
- A larger percentage of male students (43.42%) fell into the III Division, compared to 34.43% of female students.
- The Fail rate was also higher among males (22.34%) than females (20.08%).

2. Comparison of academic achievement in mathematics between urban and rural secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in academic achievement in mathematics between urban and rural secondary school students. It was found that urban secondary school students exhibited higher academic achievement in mathematics than rural secondary school students. (Significant at 0.01).

2. Comparison based on level of academic achievement in mathematics

- A notably higher percentage of urban students (20.97%) achieved Distinction, compared to only 6.92% of rural students.
- Urban students also slightly outperformed rural students in the I Division category, with 12.92% compared to 11.21% among rural students.
- A greater proportion of rural students (16%) fell in the II Division compared to urban students (12.08%), indicating a moderate level of achievement was more prevalent in rural areas.
- Rural students (45.10%) showed a considerably higher percentage in the III Division than urban students (32.63%), pointing to lower academic performance in rural settings.

- The percentage of students who failed was almost the same in both groups, with urban students at 21.40% and rural students at 20.77%, indicating no substantial difference in the lowest achievement level.

3. Comparison of academic achievement in mathematics between government and private secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in academic achievement in mathematics between government and private secondary school students of Mizoram, with private secondary school students have significantly higher academic achievement in mathematics than government secondary school students. (Significant at 0.01).

2. Comparison based on level of academic achievement in mathematics

- A significantly higher percentage of private school students (26.60%) achieved Distinction, compared to only 4.54% of government school students.
- In the I Division category, private school students (17.24%) outperformed government school students (7.83%), indicating stronger overall academic performance.
- Both school types showed similar achievement in the II Division range, with government students at 14.02% and private students at 13.55%, suggesting minimal difference at this level.
- A large proportion of government school students (46.60%) fell into the III Division, compared to 28.57% of private school students.
- The Fail rate was also much higher among government school students (27.01%), nearly double that of private school students (14.04%), highlighting a concerning trend of low academic performance in government schools.

4. Comparison of academic achievement in mathematics between male and female students of urban secondary school of Mizoram

1. Comparison by test of significance

There was a significant difference in academic achievement in mathematics between urban male and urban female secondary school students of Mizoram. It was found that urban female secondary school students had significantly higher academic achievement in mathematics than urban male secondary school students. (Significant at 0.05).

2. Comparison based on level of academic achievement in mathematics

- A slightly higher percentage of urban male students (17.96%) achieved Distinction compared to urban female students (17.62%), though the difference is minimal.
- The percentage of students in the first Division was nearly the same for both genders: urban males (12.62%) and urban females (12.09%).
- A noticeably higher proportion of urban female students (15.78%) achieved second Division compared to urban male students (9.22%).
- A significant portion of both groups fell under III Division category: 35.92% of urban males and 34.43% of urban females.
- Urban male students had a higher failure rate (24.27%) than urban female students (20.08%), suggesting slightly better performance among females in terms of passing rates.

5. Comparison of academic achievement in mathematics between male and female students of rural secondary school of Mizoram

1. Comparison by test of significance

There was a significant difference in academic achievement in mathematics between rural male and female secondary school students of Mizoram, with rural female secondary school students exhibiting significantly higher academic achievement in mathematics than rural male secondary school students. (Significant at 0.05).

2. Comparison based on level of academic achievement in mathematics

- A greater proportion of rural female students (10.41%) achieved Distinction, compared to only 3.03% of rural male students, indicating stronger top-level performance among females.
- In the I Division category, both groups showed similar achievement levels, with rural males at 11.61% and rural females at 10.86%.
- In the II Division category, rural females (17.19%) outperformed rural males (14.65%), reflecting better moderate performance.
- Rural male students (50.50%) showed a notably higher percentage in the III Division compared to rural female students (40.27%), indicating a greater concentration of low achievement among males.
- The Fail rates were also nearly equal, with rural males at 20.20% and rural females at 21.27%, indicating minimal gender difference at the lowest level of academic performance.

6. Comparison of academic achievement in mathematics between male and female students of government secondary school of Mizoram

1. Comparison by test of significance

There was no significant difference in academic achievement in mathematics between male and female students of government secondary school students.

2. Comparison based on level of academic achievement in mathematics

- A greater proportion of female students (6.39%) achieved Distinction compared to male students (2.28%) in government schools.
- Similarly, in the II Division category, female students (16.17%) outperformed male students (11.42%), indicating relatively stronger academic performance among females in these categories.
- A significantly higher percentage of male students (52.51%) fell into the III Division, as compared to female students (41.73%), suggesting that male students in government schools were more concentrated in the lower achievement range.

- In the I Division, both groups showed nearly equal performance, with males at 7.76% and females at 7.89%.
- Similarly, Fail rates were also close, with male students at 26.03% and female students at 27.82%, indicating minimal gender difference in the lowest performance category.

7. Comparison of academic achievement in mathematics between male and female students of private secondary school of Mizoram

1. Comparison by test of significance

There was a significant difference in academic achievement in mathematics between male and female students of private secondary school students. It was found that female students of private secondary school had higher academic achievement in mathematics than male students of private secondary school. (Significant at 0.01).

2. Comparison based on level of academic achievement in mathematics

- A significantly higher percentage of female students (31.1%) achieved Distinction, compared to male students (20.91%).
- Both male and female students showed similar performance in the I Division, with males at 16.95% and females at 17.47%.
- In the II Division as well, female students (15.28%) outperformed male students (11.30%), indicating stronger academic performance by females in both top and moderate achievement levels.
- A greater proportion of male students (32.20%) fell into the III Division, compared to female students (25.76%).
- Additionally, the Fail rate was higher among males (18.64%) than females (10.48%), suggesting that male students were more concentrated in the lower performance categories.

6. Findings based on comparison of Mathematical Aptitude

i) Comparison of mathematical aptitude between male and female secondary school students of Mizoram

1. Comparison by test of significance

There was no significant difference in mathematical aptitude between male and female secondary school students of Mizoram.

ii) Comparison based on level of mathematical aptitude

- A slightly greater proportion of male students (4.47%) exhibited Very High mathematical aptitude category compared to female students (2.46%), indicating a marginal male advantage at the top aptitude level.
- Female students (62.5%) had a slightly higher representation in the Average mathematical aptitude category compared to male students (60.79%), indicating a stable performance among females.
- Both male and female students exhibited comparable percentages across the remaining categories: in the High Aptitude category, males account for 16.13% while females represented 15.78%; in the Low Aptitude category, males comprised 18.36% and females 19.26%; and in the Very Low Aptitude category, males constituted 0.25%, with no representation among females.
- The overall distribution of mathematical aptitude was almost similar between male and female students, with only minor differences.

iii) Comparison of mathematical aptitude between urban and rural secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in mathematical aptitude between urban and rural secondary school students of Mizoram with urban secondary school students exhibiting higher mathematical aptitude than rural secondary school students (Significant at 0.01).

7) Comparison based on level of mathematical aptitude

- A greater proportion of urban students (5.72%) demonstrated Very High mathematical aptitude, in contrast to only 0.72% of rural students.
- Urban students (22.88%) showed a higher percentage in the High aptitude category compared to rural students (8.11%), indicating that urban students generally performed better in mathematical aptitude.
- A higher percentage of rural students (67.30%) fell into the Average aptitude category than urban students (56.78%), suggesting that the majority of rural students performed within a moderate range.
- The Low aptitude category included 23.63% of rural students, significantly more than urban students (14.62%), indicating a greater concentration of lower aptitude levels in rural areas.
- The Very Low aptitude category showed negligible representation, with 0% among urban students and only 0.24% among rural students, indicating a very small proportion of students at the lowest level in both groups.

iv) Comparison of mathematical aptitude between government and private secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in mathematical aptitude between government and private secondary school students of Mizoram. It was found that private secondary school students have higher mathematical aptitude than government secondary school students (Significant at 0.01).

2. Comparison based on level of mathematical aptitude

- A greater proportion of private secondary school students (6.90%) fell under the Very High mathematical aptitude category, compared to only 0.41% of government school students.

- In the High aptitude category, private school students (24.38%) significantly outperformed government school students (8.86%), indicating stronger overall aptitude among private school learners.
- A much higher percentage of government school students (27.63%) fell into the Low mathematical aptitude category, in contrast to 8.37% of private school students, pointing to a greater concentration of lower aptitude levels in government schools
- Both school types showed nearly equal representation in the Average aptitude range, with government school students at 62.89% and private school students at 60.34%.

v) Comparison of mathematical aptitude between male and female students of urban secondary school of Mizoram

1. Comparison by test of significance

There was no significant difference in mathematical aptitude between male and female of urban secondary school students.

2. Comparison based on level of mathematical aptitude

- Urban males had slightly higher percentage (7.77%) of mathematical aptitude than urban females (4.14%) in the Very High category.
- Both genders showed strong performance in the High mathematical aptitude category, with males at 25.24% and females slightly lower at 21.80%.
- The majority of students fell in the Average category, with females (59.39%) having a higher proportion than males (53.39%).
- Both genders had almost similar percentages in the Low category with males at 13.60% and females at 14.66%.
- No students scored in the Very Low mathematical aptitude category.
- The overall distribution of mathematical aptitude was nearly identical between male and female students, with only negligible differences.

vi) Comparison of mathematical aptitude between male and female students of rural secondary school of Mizoram

1. Comparison by test of significance

There was no significant difference in mathematical aptitude between male and female of rural secondary school students.

2. Comparison based on level of mathematical aptitude

- Both genders had minimal representation in the Very High mathematical aptitude category, with males at 1.01% and females at 0.45%.
- Females (8.60%) had a marginally higher percentage than males (7.57%) in the High category.
- The majority of rural students fell in the Average category, with males at 68.18% and females at 66.52%.
- 24.43% male students and 22.73% female students of rural school have Low mathematical aptitude.
- Only **one male student (0.51%)** scored in the Very Low mathematical aptitude category, while no female students fell in this category.

vii) Comparison of mathematical aptitude between male and female students of government secondary school of Mizoram

1. Comparison by test of significance

There was no significant difference between male and female students of government secondary school.

2. Comparison based on level of mathematical aptitude

- Both male and female students of government secondary school showed nearly identical results of minimal representation in the Very High mathematical aptitude category with male students at 0.46% and female students at 0.45%.

- Male students (9.13%) slightly outperformed female students (8.60%) in the High mathematical aptitude category.
- The majority of students fell within the Average category with male at 64.84% and female at 66.52%.
- 25.11% male students and 24.43% female students had Low mathematical aptitude showing almost similar representation.
- Only one male student (0.46%) scored in Very Low category, while no female students fell in this category.

viii) Comparison of mathematical aptitude between male and female students of private secondary school of Mizoram

1. Comparison by test of significance

There was no significant difference between male and female students of private secondary school.

2. Comparison based on level of mathematical aptitude

- A larger percentage of male students (9.60%) attained Very High mathematical aptitude category compared to female students (4.80%), indicating a higher proportion of top performers among males of private secondary school.
- Male students (25.99%) slightly outperformed female students (23.14%) in this category, indicating more males in the High mathematical aptitude category.
- A significantly higher percentage of female students (65.07%) were in the average category compared to males (54.24%), indicating a stronger central concentration among females.
- A greater proportion of male students (10.17%) fell in the lower aptitude category than female students (6.99%).
- No students from either gender scored zero, indicating no representation in the very low aptitude category.

7. Findings based on comparison of Socioeconomic Status

i) Comparison of socioeconomic status between urban and rural secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in socioeconomic status between urban and rural secondary school students where urban secondary school students were found to have higher socioeconomic status than rural secondary school students. (Significant at 0.01).

2. Comparison based on level of mathematical aptitude

- A significantly higher percentage of urban students (4.66%) fell in the Very High SES category compared to rural students (0.95%), indicating better economic condition in urban areas.
- Urban students (19.49%) outnumbered rural students (6.92%) in the high SES category.
- Rural students (66.59%) slightly exceed urban students (63.98%) in the Average category, suggesting a broad central distribution in both areas.
- A significantly higher percentage of rural students (24.82%) fell in the low SES category compared to urban students (11.44%), indicating economic disadvantage was more prevalent in rural areas.
- Both urban (0.42%) and rural (0.72%) groups had minimal representation in the very low SES category.

ii) Comparison of socioeconomic status between government and private secondary school students of Mizoram

1. Comparison by test of significance

There was a significant difference in socioeconomic status between Government and Private secondary school students where private secondary

school students were found to have higher socioeconomic status than Government secondary school students. (Significant at 0.01).

2. Comparison based on level of socioeconomic status

- A significantly greater proportion of private school students belong to the Very High (5.17%) compared to government school (1.03%).
- Private school students (22.17%) outnumbered rural students (6.39%) in the High SES category.
- Government school students (65.98%) and private school students (64.53%) showed almost equal distribution in the Average category.
- A significantly higher percentage of government school students (25.57%) fell in the Low SES category compared to private school students (8.13%)
- 1.03% of government school students fell in the Very Low SES category, whereas none of the private school students belong to this category.

8. Findings based on correlation between Academic Achievement in Mathematics, Mathematical Aptitude and Socioeconomic Status

1. The calculated value of correlation between academic achievement in mathematics and mathematical aptitude among secondary school students was 0.507. It was found that there existed a positive and significant relationship between academic achievement in mathematics and mathematical aptitude among secondary school students in Mizoram. The correlation was significant at 0.01 level.
2. The calculated value of correlation between academic achievement in mathematics and socioeconomic status among secondary school students was 0.235. It was found that there existed a positive and significant relationship between academic achievement in mathematics and socioeconomic status of secondary school students in Mizoram. The correlation was significant at 0.01 level.

3. The calculated value of correlation between mathematical aptitude and socioeconomic status among secondary school students was 0.355. It was found that there existed a positive and significant relationship between mathematical aptitude and socio-economic status among secondary school students in Mizoram. The correlation was significant at 0.01 level.

9. Findings based on correlation between various Dimensions of Socio-economic Status and Academic Achievement in Mathematics and Mathematical Aptitude.

- i) The calculated value of correlation between parental education and academic achievement in mathematics of secondary school students was 0.199. It was found that there existed a positive and significant relationship between parental education and academic achievement in mathematics of secondary school students in Mizoram. The correlation was significant at 0.01 level.
- ii) The calculated value of correlation between parental occupation and academic achievement in mathematics of secondary school students is 0.234. It was revealed that there existed a positive and significant relationship between parents' occupation and academic achievement in mathematics among secondary school students in Mizoram. The correlation was significant at 0.01 level.
- iii) The calculated value of correlation between family income and academic achievement in mathematics of secondary school students was 0.221. The finding revealed that there existed a positive and significant relationship between family income and academic achievement in mathematics among secondary school students in Mizoram. The correlation was significant at 0.01 level.
- iv) The calculated value of correlation between family assets and academic achievement in mathematics of secondary school students was 0.202. It was found that there existed a positive and significant relationship between family assets and academic achievement in mathematics of

secondary school students in Mizoram. The correlation was significant at 0.01 level.

- v) The calculated value of correlation between parental socio-religious position and academic achievement in mathematics of secondary school students was 0.040. It was found that there is no significant relationship between parental socio-religious position and academic achievement in mathematics of secondary school students in Mizoram.

10. Findings based on correlation between various Dimensions of Socio-economic Status and Mathematical Aptitude.

1. The calculated value of correlation between parental education and mathematical aptitude of secondary school students was 0.305. It was found that there existed a positive and significant relationship between parental education and mathematical aptitude of secondary school students in Mizoram. The correlation was significant at 0.01 level.
2. The calculated value of correlation between parental occupation and mathematical aptitude of secondary school students was 0.366. It was found that there existed a positive and significant relationship between parental occupation and mathematical aptitude among secondary school students in Mizoram. The correlation was significant at 0.01 level.
3. The calculated value of correlation between family income and mathematical aptitude of secondary school students was 0.354. It was found that there existed a positive and significant relationship between family income and mathematical aptitude among secondary school students in Mizoram. The correlation was significant at 0.01 level.
4. The calculated value of correlation between family assets and mathematical aptitude of secondary school students was 0.317. It was found that there existed a positive and significant relationship between family assets and mathematical aptitude of secondary school students in Mizoram. The correlation was significant at 0.01 level.
5. The calculated value of correlation between parental socio-religious position and mathematical aptitude of secondary school students is – 0.042. It was

found that there was no significant relationship between parental socio-religious position and mathematical aptitude of secondary school students in Mizoram.

11. Findings based on comparison of academic achievement in mathematics between high and low dimensions of socioeconomic status

1. There was a significant difference in academic achievement in mathematics between high and low parental education among secondary school students of Mizoram where students with high parental education were found to have higher academic achievement in mathematics than low parental education as evidence by higher mean scores. (Significant at 0.01)
2. There was a significant difference in academic achievement in mathematics between high and low parental occupation among secondary school students of Mizoram where students with high parental education scored significantly higher in mathematics than those with low parental education. (Significant at 0.01)
3. There was a significant difference in academic achievement in mathematics between high and low family income among secondary school students of Mizoram where students from high family income demonstrated higher academic achievement in mathematics as compared to their counterparts from low family income as indicated by higher mean scores. (Significant at 0.01)
4. There was a significant difference in academic achievement in mathematics between secondary school students of Mizoram from high-family-assets and low-family-assets background. It was found that students of high-family-assets background demonstrated higher academic achievement in mathematics than students of low-family-assets background where the mean scores were significantly higher. (Significant at 0.01)
5. There was no significant difference in academic achievement in mathematics between high and low parental socio-religious position among secondary school students of Mizoram. (Not significant at 0.01 and 0.05).

SUMMARY OF FINDINGS

1. Majority of the secondary school students of Mizoram were low achievers in mathematics.
2. Majority of the secondary school students of Mizoram had an average level of mathematical aptitude.
3. Majority of the secondary school students of Mizoram had an average socioeconomic status.
4. Female students exhibited higher academic achievement in mathematics than male students.
5. Urban secondary school students exhibited higher academic achievement in mathematics than rural secondary school students.
6. Private secondary school students had significantly higher academic achievement in mathematics than government secondary school students.
7. Male and female secondary school students of Mizoram had similar mathematical aptitude.
8. Urban secondary school students of Mizoram exhibited higher mathematical aptitude than rural secondary school students.
9. Private secondary school students have higher mathematical aptitude than government secondary school students.
10. Urban secondary school students have higher socioeconomic status than rural secondary school students.
11. Private secondary school students have higher socioeconomic status than Government secondary school students.
12. A positive and significant relationship was found between academic achievement in mathematics and mathematical aptitude among secondary school students in Mizoram.

13. A positive and significant relationship was found between academic achievement in mathematics and socioeconomic status of secondary school students in Mizoram.
14. A positive and significant relationship was found between mathematical aptitude and socioeconomic status among secondary school students in Mizoram.
15. A positive and significant relationship was found between academic achievement in mathematics and each dimension of socioeconomic status -parental education, parental occupation, family income, and family assets among secondary school students in Mizoram, except for parental socio-religious position.
16. There existed a positive and significant relationship between mathematical aptitude and each dimension of socioeconomic status - parental education, parental occupation, family income, and family assets among secondary school students in Mizoram, except for parental socio-religious position.
17. Students of parents with higher education were found to have higher academic achievement in mathematics than students of parents with lower education.
18. Students of parents with higher occupation were found to have higher academic achievement in mathematics than students of parents with lower occupation.
19. Students from higher-income families were found to have higher academic achievement in mathematics than those from lower-income families.
20. Students with higher family assets were found to have higher academic achievement in mathematics than those with lower family assets.
21. There was no significant difference in academic achievement in mathematics between high and low parental socio-religious position among secondary school students of Mizoram.

APPENDIX – I

MATHEMATICAL APTITUDE TEST (MAT)

Fill in the information given below:

Name: _____

School: _____

Roll No: _____

Age: _____

Gender: male ☐ female ☐

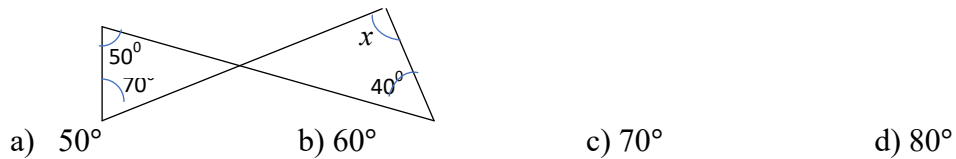
INSTRUCTIONS

1. The test contains 20 questions in all.
2. Each questions have four alternative answers out of which only one is correct. Put a tick mark (✓) against the correct option.
3. The test is not being conducted for any kind of evaluation or to grade individual's performance. It is solely for research purpose.
4. Your answers and mark scores will be kept in confidential.

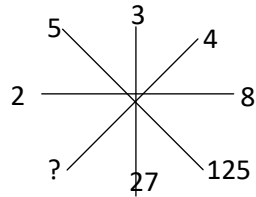
MATHEMATICAL APTITUDE TEST (MAT)

1. $\frac{4}{9} \times \frac{35}{56} \div \frac{5}{36} =$ _____
a) 5 b) 2 c) $\frac{7}{5}$ d) $\frac{5}{9}$
2. $\sqrt{324} \times \frac{2}{3} =$ _____
a) 12 b) 14 c) 15 d) 18
3. If $3^x = 243$, then $x =$ _____
a) 4 b) 5 c) 6 d) 7
4. 2.25 can be written as –
a) $\frac{2}{5}$ b) $\frac{4}{25}$ c) $\frac{9}{4}$ d) $\frac{5}{2}$
5. If $\frac{x-2}{3} = \frac{2x+1}{9}$, then $x =$ _____
a) 7 b) 10 c) 12 d) 5
6. $(4 - \sqrt{7})(4 + \sqrt{7}) =$ _____
a) 3 b) 11 c) $4\sqrt{7}$ d) 9
7. Which sign complete the equation?
 $72 \div 4 = 15 ? 3$
a) $\times$ b) $-$ c) $+$ d) $\div$
8. If the cost of 7 oranges is Rs.40, how many oranges can be bought for Rs.200?
a) 25 b) 35 c) 45 d) 50
9. $94 + 94 + 94$ can be written as –
a) $(90 + 4)(90 + 4)(90 + 4)$ c) $(90 + 4) \times 3$
b) $(90 \times 4) + (90 \times 4) + (90 \times 4)$ d) $(90 \times 4) + (90 \times 3)$
10. A boy read $\frac{3}{8}$ of a book on one day and $\frac{4}{5}$ of the remaining on another day. If the book contains a total of 480 pages, how many pages are left unread?
a) 40 b) 50 c) 60 d) 80
11. A field is in the shape of rectangle whose length is 7 m and breadth 5 m. A man walks around the field one time. How many distance does he covered?
a) 12 m b) 24 m c) 35 m d) 49 m

12. The value of x in the figure is _____

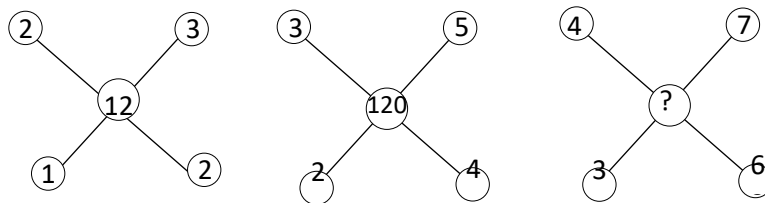


13. The missing number in the following figure is –



- a) 36 b) 48 c) 56 d) 64

14. The missing number in the following figure is



- a) 24 b) 240 c) 504 d) 1200

15. If $1+2=9$
 $2+3=25$
 $3+4=49$
 Then $4+5=?$

- a) 69 b) 75 c) 81 d) 85

16. The next term in the series -
 DSN, ERL, FQJ, GPH, ?

- a) HIR b) JON c) HOF d) SIR

17. Ruata, Muana, Dawnga and Sanga are four brothers. Ruata is 3 years older than Sanga, Muana is 1 year younger than Sanga, and Dawnga is 2 years older than Ruata. Who among them is the oldest?

- a) Ruata b) Sanga c) Dawnga d) Muana

18. If HADE is written as 2194 and EARTH is written as 41572, then HEARD will be written as
- a) 24175 b) 24157 c) 25194 d) 24159

19. Four positions of dice are given below. Which of the followings can be made from the given figure (X)?

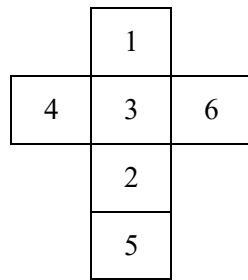
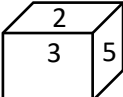
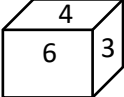
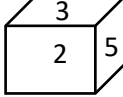
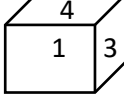


Figure (X)

- a)  b)  c)  d) 

20. Find out how will the key figures (X) looks after rotation?

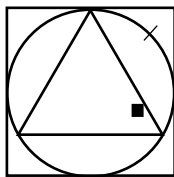
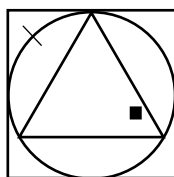
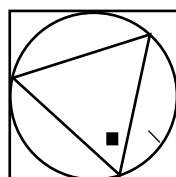


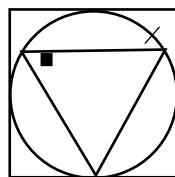
Figure (X)



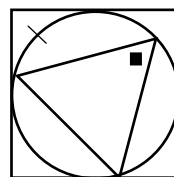
(a)



(b)



(c)



(d)

ANSWER KEY: MATHEMATICAL APTITUDE TEST

1. (b) 2
2. (a) 12
3. (b) 5
4. (c) $\frac{9}{4}$
5. (a) 7
6. (d) 9
7. (c) +
8. (b) 35
9. (c) $(90 + 4) \times 3$
10. (c) 60
11. (b) 24
12. (d) 80°
13. (d) 64
14. (c) 504
15. (c) 81
16. (c) HOF
17. (c) DAWNGA
18. (d) 24159
19. (d)
20. (d)

SOCIO-ECONOMIC STATUS SCALE
Prof Lallianzuali Fanai and Prof RP Vadhera (Revised, 2022)

APPENDIX - II

A. Personal Information:

1. Name _____ Age _____ Gender: Male/Female
 2. Name of School: _____ Roll No. _____ 3. Locale: Rural/Urban District

B. Instruction:

On the basis of this Scale, Socio-Economic Status of your family is being studied. You are requested to give information related to the question by putting tick (√) mark in the place holder provided against them. The information furnished by you would be used only for research purpose and your identity will be kept confidential. Therefore, feel free and answer all the questions without any reservation. Along with the questions probable answers are given. You have to tick one of answer which most suits to your family.

1) What is the education of your Parents?

Father Mother

a) University's high degree e.g Ph.D, D.Litt.,D.Sc., M.D. or similar professional degree.	()	()
b) Post graduate education M.A, M.Sc, M.Com., M.Ed., M.Th.)	()	()
c) Graduate level education (B.A,B.Sc,B.Com, B.Ed LL.B, etc) or any other equivalent training after intermediate.	()	()
d) Higher Secondary, Intermediate, and other Professional certificate, or any diploma after High School.	()	()
e) Middle School (Class V – VIII) or equivalent training certificate.	()	()
f) Primary Education.	()	()

2) What is the occupation of your parents?

Father Mother

a) High Administrative (Gazetted) Officer such as Secretaries, Professors, Director, Principal of College, Teachers in the University, Colleges and Professionals, Engineer, Doctor Lawyer, Bank Manager, Managing Director of Industrial or Business House, Owner of Factory, Political Leader like Municipal Counselor, MLA & M.P etc.	()	()
b) Middle class professional such as Higher Secondary School Teacher, High School Teacher, Section Officer Assistant, Research Assistant, Chemist, J.E., Wholesaler Accountants, Renowned Artist, Shop Keeper, Instructor etc.	()	()
c) Ordinary Professional, such as Clerk, Typist Stenographer, Technician, Laboratory Asst., Primary and Middle School Teacher, Salesman, Small Shopkeeper Electricians, Owner of Small Scale Industry etc.	()	()
d) Other Professions such as Peon, Driver, Lineman Plumber, Fitter, Masons, Painter, Mechanics, Carpenter	()	()
e) Labourer, Kuli, unskilled workers, farmer etc	()	()

3) What is the income of your family per month?

- a) Above Rs.300,000 ()
- b) Between Rs.250,001 to Rs.300,000 ()
- c) Between Rs.200,001 to Rs.250,000 ()
- d) Between Rs.150,001 to Rs.200,000 ()
- e) Between Rs.100,001 to Rs.150,000 ()
- f) Between Rs.50,001 to Rs.100,000 ()
- g) Between Rs.15001 to Rs.50,000 ()
- h) Below Rs.15000 ()

4) What is the opinion of your friend/other people about you and your family?

- a) Prosperous family ()
- b) Middle class family ()
- c) Low class family ()

5) Tick the following items which your family possesses

- a) Two wheeler (scooty, motorcycle) ()
- b) Four wheeler
 - i. Commercial heavy vehicle (Bus, Truck, JCB, Bull Dozer etc) ()
 - ii. Commercial light vehicle (Auto rickshaw, taxi, sumo etc) ()
 - iii. Family Vehicle (Private car, Bolero/Gypsy/Van etc) ()
- c) Household commodities –
 - i. Air Conditioner ()
 - ii. Laptop/Desktop Computer ()
 - iii. Washing machine ()
 - iv. Broadband Internet Connection ()
 - v. Television (Portable T.V & Big T.V) ()
 - vi. Refrigerator (fridge) ()
 - vii. LPG Connection (Cooking Gas) ()
 - viii. Mobile phone ()
 - ix. Water Connection ()
 - x. Radio ()

6) Does your family has its own house? Yes ()/ No ()

If Yes, what type of house it is?

- a) Cement Concrete Building ()
- b) Asbestos Tile wall with Dyna roof/GCI sheet roof (Assam Type) ()
- c) Bamboo wall with GCI sheet roof ()
- d) Bamboo wall with thatch roof ()

7. Does your parent hold any important post in the church?

Father

Mother

a) Elder (Upa) ()	Chairperson ()
b) Committee member (Tual Upa) ()	Committee member of the women wing ()
c) Deaconates e.g Preacher, Sunday School teacher, Evangelist etc ()	Deaconates e.g preacher, Sunday School teacher, Evangelist etc ()

8. Does your parents hold any important post in the society like YMA, MHIP etc.? Yes ()/No ()

9. Does your family subscribe daily Newspaper?

- a) Regularly ()
- b) Occasionally ()
- c) Never ()

Scoring Key for Socioeconomic Status (SES) Scale

1. Educational Status

Sl.	Father	Mother
A	6	6
B	5	5
C	4	4
D	3	3
E	2	2
F	1	1

2. Occupational Status

Sl.	Father	Mother
A	5	5
B	4	4
C	3	3
D	2	2
E	1	1

3. Income

a	8
b	7
c	6
d	5
e	4
f	3
g	2
h	1

4. Family Status as Perceived by Others

a	3
b	2
c	1

5. Material Possession

a)	1
b) i	2
ii	1
iii	3
c) i	3
ii	3
iii	3
iv	2
v	2
vi	2
vii	2
viii	1
ix	1
x	1

6. Type of House

I	1
II	
a)	4
b)	3
c)	2
d)	1

7. Position in the church

SL	Father	Mother
a)	3	3
b)	2	2
c)	1	1

8. Position in the society

Yes	2
No	1

9. Subscription of Newspaper

a)	3
b)	2
c)	1

APPENDIX – III

Detail of Selected Sample Schools

Sl. No.	Name of School	Type of Management	Locality
1	B.C. Academy	Private	Urban
2	Govt. Ruantlang High School	Government	Urban
3	Pine Hill Adventist Academy	Private	Rural
4	Govt. Kelkang High School	Government	Rural
5	Govt. Khuangleng High School	Government	Rural
6	Govt. Sazep High School	Government	Rural
7	Presbyterian English School (Mamit)	Private	Urban
8	Govt. KR High School	Government	Rural
9	Govt. Borai High School	Government	Rural
10	Adventist English School (West Phaileng)	Private	Rural
11	Govt. Lengte High School	Government	Rural
12	Govt. Ropuichhip High School	Government	Rural
13	Govt. Kawrtethawveng High School	Government	Rural
14	Baptist English School	Private	Rural
15	Govt. Kawrthah High School	Government	Rural
16	Govt. Mamit High School	Government	Urban
17	Govt. Hautlangpui High School	Government	Rural
18	Govt. Haulawng High School	Government	Rural
19	Adventist Englisg School (Lunglei)	Private	Urban
20	Govt. Lunglei High School	Government	Urban
21	Southern Flower School	Private	Urban
22	Govt. Electric High School	Government	Urban
23	Mount Olive School	Private	Rural
24	Govt. Kolasib High School	Government	Urban
25	Govt. Thingdawl High School	Government	Rural

26	Susanne Downs Boarding School	Private	Urban
27	Govt. Bilkhawthlir High School	Government	Rural
28	St. John Higher Secondary School	Private	Urban
29	Govt. PCR High School	Government	Urban
30	Govt. Bungtlang High School	Government	Rural
31	Marian High School	Private	Urban
32	Govt. Chhiahtlang High School	Government	Rural
33	St. Peter Higher Secondary School	Private	Rural
34	Govt. Baktawng High School	Government	Rural
35	Govt. Ch. Chhunga High School	Government	Urban
36	Mount Carmel School	Private	Urban
37	Govt. KVM High School	Government	Rural
38	Neuhof English Medium School	Private	Urban
39	Govt. Thingsulthliah High School	Government	Rural
40	Govt. Bethlehem High School	Government	Urban
41	Divine Intervention School	Private	Urban

APPENDIX – IV

List of 27 % High and 27% Low Scorer on Mathematical Aptitude Test (MAT)

27% High Scorer on MAT				27% Low Scorer on MAT		
Sl. No.	Name	Score		Sl. No.	Name	Score
1	Zoramchhana	27		1	Esther Lalrinmawii	4
2	Grace Rampari	26		2	Zoramsanga	5
3	Lalnunmawii	26		3	Zoengmawia	5
4	John Lalrindika	25		4	Lalchhuanmawia	5
5	Samuel Lalmuanpuia	24		5	Diana Lalsangliani	6
6	Lalremsanga	23		6	Chawngthanpari	6
7	Lalchhuanliana	22		7	Abraham Rinpuia	6
8	Lalnunzira	22		8	Vanlalmawizuali	7
9	Malsawmtluangi	21		9	David Lalzartzova	7
10	Cathy Lalrempuii	21		10	Laltanpuia	7
11	Rebecca Hlimpuui	21		11	Lalmuansanga	8
12	Lalremsiama	21		12	Vanlalhriatpuui	8
13	Lalnuntluanga	20		13	Cindy Lalrinsangi	8
14	Reuben LC	20		14	Vanlalmuani	8
15	Zonunsanga	20		15	Laldanmawia	9
16	Judy Lalramliani	20		16	Vanlalchhanhimi	9
17	Malsawmtluanga	20		17	Lalrindiki	9
18	Melody Lalnunsangi	19		18	Lucy Zairemmawii	9
19	Lalhmingangi	19		19	Lalchhuanmawia	9
20	Emelyn Lalremruati	19		20	Zothanpuia	9
21	Lalpianmawia	19		21	Lalhruaitluangi	10
22	Rodingliana	19		22	Zorinsangi	10
23	Jimmy Sangzuala	19		23	Lalnunremi	10
24	Donald Ropuia	19		24	Julie Lalhmunsangi	10
25	Jason Lalremsanga	19		25	Vanlalringa	10
26	Vanneihtluanga	18		26	David Lalrempuia	10
27	Lalrinpuui	18		27	Laldawngmawia	10

APPENDIX – V

Product Moment Correlation Method for determining the reliability of Mathematical Aptitude Test

Sl. No.	Score on 1 st Test	Score on 2 nd Test	Sl. No.	1 st Test	2 nd Test	Sl. No.	1 st Test	2 nd Test
1	6	4	35	6	10	69	11	10
2	3	4	36	10	9	70	6	5
3	7	8	37	6	4	71	4	8
4	7	9	38	9	8	72	12	5
5	8	8	39	14	11	73	5	6
6	6	5	40	6	10	74	9	7
7	10	10	41	13	15	75	7	10
8	12	15	42	11	11	76	19	20
9	8	10	43	10	14	77	17	16
10	4	5	44	14	12	78	8	9
11	9	13	45	6	7	79	10	11
12	6	4	46	4	4	80	5	6
13	6	6	47	10	14	81	9	11
14	13	9	48	11	12	82	8	8
15	7	5	49	4	5	83	8	7
16	2	4	50	9	11	84	16	17
17	9	10	51	14	12	85	6	7
18	15	12	52	8	8	86	8	9
19	7	4	53	10	5	87	7	6
20	12	12	54	7	6	88	13	14
21	2	6	55	9	9	89	9	11
22	8	7	56	9	5	90	10	13
23	6	6	57	11	6	91	11	12
24	8	9	58	8	2	92	16	19
25	17	19	59	9	8	93	7	3

26	18	20	60	12	14	94	8	7
27	17	18	61	13	9	95	8	5
28	11	15	62	12	11	96	5	7
29	5	8	63	11	8	97	7	9
30	15	14	64	14	18	98	3	5
31	12	12	65	6	7	99	3	5
32	16	18	66	10	13	100	6	6
33	12	11	67	8	9			
34	15	15	68	7	13			

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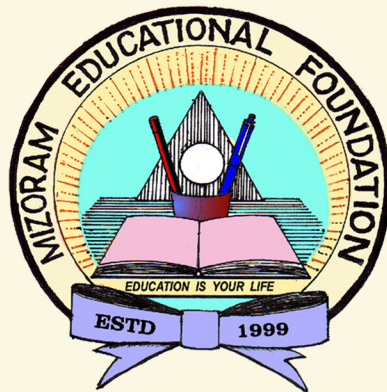
BRIEF BIO-DATA OF THE CANDIDATE

NAME	: L. Nunchanga
FATHER'S NAME	: Lalruata
D.O.B.	: 19.06.1983
ADDRESS	: VB-64/A, Vaivakawn, Aizawl
GENDER	: Male
RELIGION	: Christianity
MARITAL STATUS	: Single
EDUCATIONAL QUALIFICATION	: M.Sc., B. Ed., M.Ed., NET (Edu.)
PH.D. REGISTRATION NO & DATE	: MZU/Ph.D./1896 of 27.08.2021
DEPARTMENT	: Education Mizoram university
TITLE OF THE THESIS	: Academic Achievement in Mathematics among Secondary School Students of Mizoram in Relation to their Mathematical Aptitude and Socioeconomic Status

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Mathematical Aptitude of Secondary School Students of Mizoram

L. Nunchanga*
Lynda Zohmingliani**

Abstract

This research paper has aimed to study the mathematical aptitude of secondary school students of Mizoram. The sample taken for the study is 137 students reading 10th standard in different school in Aizawl and its outskirts. Mathematical aptitude test developed and standardized by the researcher was used as a research tool. The findings indicated that the mathematical aptitude of secondary school students of Mizoram is low. It was also found that there are some significant differences between mathematical aptitude based on type of management of school but no difference concerning gender.

Key words: *Aptitude, mathematical aptitude test, gender, management.*

Introduction

Mathematics education is always a matter of big concerns in Mizoram since many students has poor performance in mathematics. Mizoram has literacy rate of 91.3% (2011 census), the third highest in India. But in spite of high literacy rate, there are still many low achievers in mathematics among students in each school stages and mathematics subject is the most dreadful subject. But this may not mean that low achiever students are not capable of learning mathematics. It is believed that many students have ability and potential to learn mathematics in spite of their poor academic performance in mathematics. At the same time, students with good marks in mathematics may not have ability to pursue further studies in mathematics related courses. Therefore, it is necessary to find the mathematical aptitude of secondary school students to know their exact position for their ability to learn mathematics.

*Mr. L. Nunchanga, Research scholar, Department of Education, Mizoram University, Aizawl-796004, Email: hrangnuna@gmail.com

**Prof. Lynda Zohmingliani, Department of Education, Mizoram University, Aizawl-796004, Email: lynda.zohmingliani@gmail.com

Mathematics Education

NCF 2023 stated that, “Mathematics education involves learning creative and logical thinking through fundamental concepts such as numbers and operations, geometry, algebra, probability, and statistics. It also aims to nurture the fundamental mathematical capacities of finding patterns, making conjectures, providing explanations through logical reasoning, creativity, problem-solving, computational thinking, and logical communication”. Mathematics Education is not only about learning how to master computing and calculation of numbers, but it is also about learning how to use our mind by inculcating logical thinking and brain storming.

The word ‘Mathematics’ is derived from the Greek word ‘**mathema**’ which means ‘that which is learnt’. According to Cambridge dictionary, “Mathematics is the study of numbers, shapes and space using reason, and usually a special system of symbols and rules for organizing them”. Mathematics involves measurement, counting, calculation, imagination, thinking, analysis, structuring and arrangement of numbers, quantities and physical objects. It includes the study of relation, formulas, space, abstracts, structure and changes of quantities. Mathematics involves logical reasoning which includes inductive and deductive reasoning. It uses creative thinking to create new knowledge and ideas. Mathematics can be considered as an art which is the expression of human mind by making use of numbers, symbols and logical reasoning. According to Courant and Robbins (1941), “Mathematics as an expression of the human mind reflects the active will, the contemplative reason, and the desire for aesthetic perfection. Its basic elements are logic and intuition, analysis and construction, generality and individuality”.

Mathematics is an exact science. It is traditionally defined as the science of measurement, quantity, numbers and relations. Webster dictionary defined mathematics as, “the science of numbers and their operations, interrelations, combinations, generalizations, and abstractions and of space configurations and their structure, measurement, transformations, and generalizations”. Some of the famous philosopher and mathematician give the definition of mathematics as follows:

Aristotle defined mathematics as “The science of quantity”.

August Comte (1851) defined mathematics as “The science of indirect measurement”.

Carl Friedrich Gauss (1777 – 1855) referred to mathematics as “The Queen of Sciences”.

Benjamin Pierce (1809 – 1880) called mathematics “the science that draws necessary conclusions”

From the above definition mathematics can be considered as science which deals with quantity, relations and reasoning which helps us to understand the world around us and to draw conclusion of certain problems.

Importance of mathematics

Mathematics has always occupied an important position in any school curriculum. It is the most important subject in the school because of its utility values. Actually, modern life is not possible without basic knowledge of mathematics. Basic knowledge in mathematics like counting, measuring, weighing, simple calculation, reasoning and structuring is important in day to day life in various walks of life. Each and every person starts a day by using mathematics with knowing or without knowing it. Every person use mathematics in their various occupations no matter what kind of job it is. From cook to engineer, rich and poor, low class and high class, literate and illiterate, mathematics is used in day to day interaction and it serve as a very important tool in various activities.

According to the National Curriculum Framework (NCF 2005), the main aim of mathematics in school is ‘the mathematisation of a child’s thinking’. Mathematics helps a child to think logically, to reason mathematically, to perceive and visualize abstract structure and pattern. Developing mathematical thinking is the heart of mathematics education. Mathematics helps in the development of mental capacity and it sharpens the mind to think precisely, logically, analytically and creatively. Kothari Commission (1964–66) recommended that science and mathematics should be an integral part of general education and should be taught on a compulsory basis till the end of school stage. It is included in the school curriculum because of its importance in day-to-day life and in developing intellectual power. It also helps to study other subjects easier as it is related to various subjects. Mathematics is considered as an important tool for learning science and it is the basis for all science. It helps in the development of scientific thinking. Learning mathematics in the school helps student to think decisively and rationally, and it inculcate problem solving skills among students to apply in their daily life.

Mathematical Aptitude

The word ‘aptitude’ is described as a ‘natural ability’ and also ‘a capacity for learning’ in Merriam Webster Dictionary. Mangal (2019) described aptitude as a special ability or specific capacity distinct from general intellectual ability which helps a person to acquire the required degree of achievement or success in a specific area. Aptitude is the ease with which a person will obtain a new skills or capacities. An individual is said to have an aptitude for a particular skill if he or she learns that skill more rapidly and with more ease than other persons with the same previous knowledge (Hayes & Straton, 2012). Some believes that aptitude refers to one’s inherited ability where as other believe that it refers to present ability or ease of acquisition of some skill (Chaube & Chaube, 2011).

Aptitude is an innate ability that can be facilitate or enhance for the future success. A person may not have current abilities to perform certain task but may have inborn ability to

be successful in the future. For example, a person may not be able to play piano but may have an aptitude for playing piano or any musical instrument which makes him/her to be good musician in the future if he/she receives proper training and guidance. So, aptitude has future implication and tries to predict the possibility of an individual's success in the future in the specific areas. An individual may not have an ability to perform certain unfamiliar task but may have ability in performing others task which is related to previous task. This shows that there is a chance that he/she has an ability to perform that particular task. For example, Lalremnga, a participant in Olympic archery for India has never shoot an arrow before he received training. But he has a great skill in using slingshot to shoot birds from his childhood which is a traditional weapon of tribal people of northeast India. Even though he didn't know how to use bow and arrow but Sport Authority of India (SAI) have seen his ability and believed that he would have skill in archery. So, SAI decided to give training for archery for which they have seen his future ability.

So, mathematical aptitude maybe explained as a natural ability to solve mathematical problems. It may also mean a capacity to learn mathematics. To have high mathematical aptitude is not the same as scoring good marks in mathematics or high achievement in mathematics. Student scoring good marks in mathematics may not have high mathematical aptitude. High achievement in mathematics may depend on one's study habits, high computational skills, learning styles, completing all the required works, memorizing theorem etc. whereas mathematical aptitude depends on a person's inborn potential and ability toward mathematics. So, mathematical aptitude cannot be enclosed to only computational skills (Dhyani, 2014). Mathematical aptitude refers to a person's potential toward mathematics to perform different mathematical operations. It may be an ability to visualize shape and structure, ability of abstraction to understand certain relationship, capacity of quick numerical calculation, logical thinking and reasoning. Mathematical aptitude refers to the qualities of an individual being able to learn mathematics or solve mathematical problem. It may be a natural ability or acquired capacity. According to Warrier and Baron-Cohen (2016), mathematical aptitude refers to normative variance in mathematical ability which includes several different components such as numerical ability and number processing, shape processing, mathematical modeling and non-numerical processes.

Mathematical aptitude is a natural ability that indicates a person's competency and proficiency in handling abstract mathematical ideas and it is an indicator of success in mathematics and other related field (Chauhan & Ranjan, 2024). So, mathematical aptitude refers to the qualities of an individual being able to learn mathematics or solve mathematical problem. It may be a natural ability or acquired capacity. According to Warrier & Baron-Cohen (2016), mathematical aptitude refers to normative variance in mathematical ability which includes several different components such as numerical ability and number processing, shape processing, mathematical modeling and non-numerical processes. To have high

mathematical aptitude is not same as scoring good marks in mathematics. Student who scores good marks in mathematics can have low mathematical aptitude. So, mathematical aptitude cannot be enclosed to only computational skills (Dhyani, 2014).

When given a right treatment under the right condition, an individual with high mathematical aptitude can have success in the field of mathematics and its related subjects. Therefore, it is important to assess the mathematical aptitude of an individual from an early age.

Review of Related Literature

Sonar and Patankar (2013) examined the mathematical aptitude of secondary school students with the test tools developed and standardized by the researchers. It was observed that most of the tested students have middle level mathematical aptitude. The study found that the mathematical aptitude of boys and girls is not different. It was also found that secondary school students in urban area have more level of mathematical aptitude than those in rural area.

Dhyani (2014) conducted a study on mathematical aptitude in relation to intellectual and problem solving abilities of secondary level students. The result showed that the mathematical aptitude was positively and significantly related with intellectual and problem solving abilities. The results also revealed that public school shows a positive significant role in determining the three variables. The science stream is found to possess highest mathematical aptitude level, intellectual abilities and problem solving abilities which indicates that stream has a significant impact on the three variables.

Bala (2014) studied the relationship between mathematical aptitude and mathematical achievement. Mathematical aptitude test, developed and standardized by the investigator, was used for the investigation. The study found that mathematical aptitude plays an important role as a predictor of mathematical achievement. It was also found that students of science stream have more mathematical aptitude than arts stream. Boys and girls do not differ much in mathematical aptitude whereas urban students have more mathematical aptitude than rural students.

Kaur (2016) investigated the contribution of creativity, learning styles and mathematical aptitude on academic achievement of high school students in mathematics. The results of the study showed that there is a positive significant relationship between mathematical aptitude and academic achievement in mathematics. It was also found that male and female do not differ significantly with regard to academic achievement in mathematics, creativity, learning styles and mathematical aptitude. It was found that academic achievement, creativity, and mathematical aptitude of Government and Private school differ significantly in which student of Private School showed higher creativity, academic achievement in mathematics and mathematical aptitude as compared to students of Government School. On the other hand, learning styles of Government and Private School do not differ significantly.

Kumaravelu (2018) conducted a study on information processing skills and mathematical aptitude of higher secondary school students. He studied the role of mathematical aptitude when incorporated with information processing skills, in building the linkage between student's mathematical ability and achievement. The study found that there is a positive relationship between academic achievement in mathematics and general mathematical aptitude. It was also found that there is a positive relationship between information processing skills and general mathematical aptitude of secondary school students.

Manikandan & Ambedkar (2022) studied the mathematical aptitude of secondary school students in Salem District. The sample consisted of 100 students, 50 male and 50 female from similar background. The results showed that students have good mathematical aptitude which was above average. The results also showed that the mathematical aptitude of secondary school students was unaffected by gender, geographical location and type of management of school.

Chauhan & Ranjan (2023) tried to find the mathematical aptitude of future teacher. The study was conducted among teacher trainees of different colleges under Indian Institute of Teacher Education. The sample consisted of 168 prospective teachers. The study found that male and female teacher trainees do not have same Mathematical aptitude. It was also found that DIET and Govt. college trainees have same mathematical aptitude.

Objectives of the Study

1. To find out the mathematical aptitude of secondary school students in Aizawl district, India.
2. To compare the mathematical aptitude of secondary school students of Aizawl district with respect to
 - a. Gender
 - b. Type of management of the school

Hypotheses

1. There is no significant difference in mathematical aptitude among secondary school students of Aizawl district of male and female.
2. There is no significant difference in mathematical aptitude among secondary school students of Aizawl district of Private school and Government School.

Delimitation of the Study:

1. The study is delimited to 10th standard of secondary school students only.
2. The study is delimited in secondary schools of Aizawl District.

Method of Study

The study was conducted on secondary school students studying 10th Standard. There were 137 respondents who participated in this study. The respondents were students from secondary schools in Aizawl district, Mizoram. All the respondents were standard – X from private schools and government schools. The respondents were given mathematical aptitude test which was developed by the researcher. There were 20 test items which were multiple choice questions and it was based on six dimensions namely numerical ability, ability to use symbol and formula, verbal skills, spatial sense, problem solving skills, logical reasoning and abstract reasoning. It consisted of arithmetic, algebra, geometry and reasoning.

Analysis and Interpretation of Data

Table No. 1: Mathematical Aptitude of Secondary School

No. of Student	Minimum Score	Maximum Score	Mean	S.D
137	2	18	8.3	3.9

Observation: From Table No.1 it is observed that –

1. The minimum score of secondary school students in Mathematical Aptitude test is 2 whereas the maximum score is 18.
2. The mean score of secondary school students in mathematical aptitude test is 8.3 and SD is 3.9

Interpretation: From Table No.1 it can be seen that the mean score of students in mathematical aptitude is 8.3 which indicates that the mathematical aptitude of secondary school students in Mizoram is quite low.

Table No.2 : Level of Mathematical Aptitude of Students

Total No. of Students	Level	No. of Student as per level	Percentage
137	Low (1 to 7)	64	46.7
	Average (8 to 12)	51	37.2
	High (13 to 20)	22	16.1

Observation: It is observed from Table 2 that about 64 students have low level of Mathematical Aptitude which comprised of 46.7%. There were 51 students who have average level of Mathematical Aptitude which comprised of 37.2%. About 22 students, which is 16.1%, have high level of Mathematical Aptitude.

Hypothesis No.1: *There is no significant difference between male and female of secondary school students in their mathematical aptitude.*

Table No.3: Comparison of Male and Female secondary school students of Mizoram in their Mathematical Aptitude

Groups	Number	Mean	SD	Df	t-value	Level of Significance
Male	61	9.049	4.36	114	-1.925	0.05
Female	76	7.724	3.51			

Observation: It is observed from table No.3 that -

- 1) The mean value of Mathematical Aptitude of secondary school male students is 9.049 and SD is 4.36
- 2) The mean value of Mathematical Aptitude of secondary school female students is 7.724 and SD is 3.512
- 3) The calculated 't' value is found to be -1.925 which is less than the critical value 1.98 at 0.05 level of significance.
- 4) Therefore, the hypothesis No.1 is accepted at 0.05 significant level.

Interpretation: Thus, from the above observation it may be inferred that the mathematical aptitude of male and female secondary school students of Aizawl District is not different.

Hypothesis No.2: *There is no significant difference between male and female of secondary school students in their mathematical aptitude.*

Table No.4**Comparison of Government and Private secondary school students of Aizawl District in their Mathematical Aptitude**

Groups	Number	Mean	SD	df	t-value	Level of Significance
Govt. School	37	5.784	3.23	75	5.357	0.05
Private School	100	9.28	3.79			

Observation: It is observed from table No.4 that -

- 1) The mean value of Mathematical Aptitude of Govt. secondary school students is 5.784 and SD is 3.232
- 2) The mean value of Mathematical Aptitude of Private secondary school students is 9.28 and SD is 3.787
- 3) The calculated 't' value is found to be 5.357 which is less than the critical value 1.99 at 0.05 level of significance.
- 4) Therefore, the hypothesis No.2 is rejected at 0.05 significant level.

Interpretation: Thus, from the above observation it can be interpreted that there is a significant difference in mathematical aptitude of Govt. and Private secondary school students of Aizawl District.

Conclusion

The study concluded that mathematical aptitude play an important role in knowing capacity of students in mathematics and predicting future career. The study revealed that students have low level of mathematical aptitude. There is a significant difference between mathematical aptitude of Private school and Government school but no difference between male and female.

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A Study Of Relationship Between Academic Achievement In Mathematics And Mathematical Aptitude Of Secondary School Students Of Aizawl

L Nunchanga^{1*}, Lynda Zohmingliani², Lalrintluanga Sailo³

^{1*}Research Scholar, Department of Education, Mizoram University, Aizawl, Mizoram – 796001.

²Professor, Department of Education, Mizoram University, Aizawl, Mizoram – 796001.

³Assistant Professor, Department of Physics, Govt. Serchhip College, Serchhip Mizoram-796181

*Corresponding Author: L Nunchanga

*Email: hrangnuna@gmail.com

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ABSTRACT

This study explores the relationship between academic achievement in mathematics and mathematical aptitude among secondary school students in Aizawl, Mizoram. Using a sample of 220 students, the research investigates variations in mathematical performance based on gender and school type while examining the correlation between mathematical aptitude and academic success. The findings reveal no significant gender-based differences in academic achievement, but male students show higher mathematical aptitude. Private school students significantly outperform government school students in both academic achievement and mathematical aptitude. A strong positive correlation is identified between academic achievement in mathematics and mathematical aptitude, highlighting the predictive role of aptitude in academic performance. These insights emphasize the need for targeted interventions, gender equity, and improved support systems in mathematics education to enhance learning outcomes.

Keywords: Academic Achievement, Mathematical Aptitude, Gender Differences, Secondary Education

1. Introduction

India has a rich and illustrious history in mathematics, contributing immensely to its development in diverse fields such as algebra, geometry, and number theory. Scholars like Aryabhata, Bhaskara, and Srinivasa Ramanujan have made significant contributions to the global mathematical community, creating a legacy that continues to inspire modern education, as highlighted by Sandhu [1], Joseph [2], and Raju [3]. Mathematics remains a crucial aspect of India's education system, where emphasis on mental calculations, problem-solving, and analytical skills is instilled early, as noted by Singh [4]. This system has enabled Indian students to excel internationally, as demonstrated by their remarkable achievement of securing the fourth position globally at the 2024 International Mathematics Olympiad, according to the IMO [5].

However, the state of Mizoram, despite having the third-highest literacy rate in India, as reported by the Government of India [6], presents a paradoxical scenario where students consistently show poor performance in mathematics. This underachievement raises critical questions about the factors influencing mathematical performance in the region. Kumar and Sinha [7] argue that many students with low academic achievement in mathematics have the potential to improve their performance if provided with the right guidance, resources, and a supportive learning environment. Conversely, Sharma [8] points out that students who score high in mathematics exams may lack a deeper understanding or aptitude for the subject, relying instead on rote memorization or examination-focused strategies.

Bala [9] and Gupta [10] emphasize that understanding mathematical aptitude becomes a key area of focus in such a context. Mathematical aptitude, which refers to an individual's natural ability to understand and solve mathematical problems, is considered a strong predictor of mathematical achievement. Pathak and Srivastava [11] advocate for evaluating mathematical aptitude in secondary school students to identify their unique strengths and weaknesses. This understanding, they argue, helps educators design tailored

interventions to support students' learning processes, maximize their abilities, and foster a more engaging and inclusive approach to mathematics education.

Furthermore, Kaur [12] and Mishra [13] suggest that interventions in mathematics education should not solely aim at improving students' scores but also focus on making mathematics-related occupations and higher studies more appealing to secondary school students. Mukhopadhyay [14] adds that such interventions must address the psychological and social factors influencing students' attitudes toward mathematics, including their confidence, interest, and perceived utility of the subject.

The role of gender in mathematical performance is another area of ongoing debate and research. Heyder et al. [15] and Hyde et al. [16] challenge the common stereotype that males outperform females in mathematics, presenting empirical evidence that the differences in performance between genders are statistically negligible. Choudhary [17] argues that addressing these misconceptions is vital to promoting gender equity in mathematics education and encouraging all students to reach their full potential.

Singh and Verma [18] conclude that assessing the relationship between mathematical aptitude and academic achievement in mathematics is crucial for understanding the diverse factors that impact students' performance. By identifying the specific needs and potential of secondary school students, educators and policymakers can create effective strategies to improve mathematical learning outcomes in Mizoram and beyond.

2. Needs of the Study

Mathematics is universally regarded as a critical subject in shaping cognitive abilities, logical reasoning, and problem-solving skills among students. Despite Mizoram's commendable literacy rate, students in the state exhibit a persistent struggle in achieving satisfactory outcomes in mathematics. This paradox underscores the need to investigate the factors influencing students' mathematical performance, particularly the role of mathematical aptitude. Academic achievement in mathematics and mathematical aptitude are interconnected but distinct constructs, and understanding their relationship can provide valuable insights into students' strengths and weaknesses.

The necessity of this study arises from the observation that high academic achievement in mathematics does not always reflect true mathematical aptitude. Some students who perform well in mathematics exams might lack a deep understanding of the subject, while others who underperform may have latent potential that remains untapped due to a lack of appropriate support, teaching methods, or resources. Therefore, a focused analysis of mathematical aptitude is essential for identifying and addressing the individual needs of students to help them realize their full potential. Additionally, there is a pressing need to design interventions that not only enhance students' academic performance in mathematics but also nurture their interest in pursuing mathematics-related careers. This is especially relevant in a global context where STEM (Science, Technology, Engineering, and Mathematics) fields are increasingly pivotal in driving economic growth and innovation.

This study also seeks to address gender-related misconceptions in mathematical ability, providing evidence-based insights to dispel stereotypes and promote gender equity in mathematics education. By exploring the relationship between academic achievement and mathematical aptitude among secondary school students in Aizawl, this research aims to contribute to the development of a more inclusive and effective mathematics education framework that supports students in achieving both academic success and real-world application of mathematical skills.

3. Objectives of the Study:

1. To assess the academic achievement in mathematics among secondary school students in Aizawl.
2. To evaluate the mathematical aptitude of secondary school students in Aizawl.
3. To compare the academic achievement in mathematics of secondary school students of Aizawl based on:
 - a. Gender
 - b. Type of the school management (Government vs Private)
4. To compare the mathematical aptitude of secondary school students of Aizawl based on:
 - a. Gender
 - b. Type of the school management (Government vs Private)
5. To determine the relationship between academic achievement in mathematics and mathematical aptitude among secondary school students.

4. Hypotheses

1. There is no significant difference in the academic achievement in mathematics between male and female secondary school students.
2. There is no significant difference in the academic achievement in mathematics between secondary school students from private schools and government schools.
3. There is no significant difference in the mathematical aptitude of male and female secondary school students.

4. There is no significant difference in the mathematical aptitude of secondary school students from private schools and government schools.
5. There is no significant relationship between academic achievement in mathematics and mathematical aptitude among secondary school students.

5. Method of Study

5.1 Sample

The study was conducted on a sample of 220 secondary school students from Aizawl, Mizoram. The students were selected using a stratified random sampling technique to ensure representation across different schools, genders, and academic levels. This diverse sample was chosen to provide a comprehensive understanding of the relationship between mathematical aptitude and academic achievement in mathematics within the context of Aizawl's education system.

5.2 Tools Used

To assess the mathematical aptitude of the students, a *standardized Mathematical Aptitude Test* was constructed and validated by the researcher. The test was designed to measure various dimensions of mathematical aptitude, including logical reasoning, numerical ability, spatial visualization, and problem-solving skills. The test underwent rigorous validation procedures, including item analysis and reliability testing, to ensure its accuracy and effectiveness in capturing students' mathematical potential.

5.3 Statistical Techniques

The collected data were analyzed using a combination of descriptive and inferential statistical techniques:

Mean and Standard Deviation (SD): These measures were used to describe the central tendency and variability of students' mathematical aptitude and academic achievement scores.

Percentage and Percentile: These statistical tools were employed to categorize and compare students' performance levels in mathematics and aptitude scores.

t-Test: The t-test was used to determine whether significant differences existed in mathematical aptitude and academic achievement across subgroups, such as gender or school type.

Correlation Coefficient: To examine the relationship between mathematical aptitude and academic achievement, the Pearson correlation coefficient was calculated. This provided insights into the strength and direction of the association between the two variables.

By employing these methods, the study aims to uncover patterns and relationships that can inform targeted interventions to improve mathematical performance and foster a supportive educational environment for secondary school students in Aizawl.

6. Analysis and Interpretation of Data

6.1 Academic Achievement in Mathematics

Academic achievement in mathematics reflects the performance levels of students and serves as an essential metric for evaluating their understanding and application of mathematical concepts. Table 1 provides a summary of the academic achievement scores of secondary school students, including the minimum and maximum scores, mean, and standard deviation (SD). This data highlights the range and variability in students' performance, shedding light on the diverse proficiency levels within the sample.

Table No. 1

No. of Student	Minimum Score	Maximum Score	Mean	S.D
220	9	98	55.29	22.7

Observation:

- The minimum academic achievement score in mathematics is 9, while the maximum is 98.
- The mean score is 55.29, and the SD is 22.7.

Interpretation:

The average performance level (mean score of 55.29) indicates that most students have a moderate understanding of mathematics. The high SD of 22.7 suggests significant variability in performance, pointing to the need for targeted interventions to bridge the gap between low and high achievers.

6.2 Mathematical Aptitude of Students

Mathematical aptitude refers to the natural ability of students to understand and solve mathematical problems. It is a crucial determinant of their academic achievement and potential in mathematics-related fields. Table 2 summarizes the results of the Mathematical Aptitude Test administered to the students, highlighting the range of scores, mean, and SD.

Table No. 2

No. of Student	Minimum Score	Maximum Score	Mean	S.D
220	2	19	10.59	4.07

Observation:

- The minimum score in the Mathematical Aptitude Test is 2, and the maximum score is 19.
- The mean score is 10.59, with an SD of 4.07.

Interpretation:

The average score of 10.59 (out of 20) reflects moderate mathematical aptitude among students. The slight shortfall from the midpoint indicates room for improvement in fostering students' problem-solving and analytical skills. The SD of 4.07 highlights moderate variability in aptitude levels within the sample.

6.3 Levels of Mathematical Aptitude

To further analyze the aptitude levels, the students' scores were categorized into five levels: Very Low, Low, Average, High, and Very High. Table 3 presents the distribution of students across these levels, expressed in terms of numbers and percentages.

Table No.3

Level	No. of Student as per level	Percentage
Very Low (1 to 3)	8	3.64
Low (4 to 7)	51	23.18
Average (8 to 14)	121	55
High (15 to 17)	33	15
Very High (18 to 20)	7	3.18

Observation:

- Most students (55%) fall under the Average category of mathematical aptitude.
- A smaller proportion of students are in the Very Low (3.64%) and Very High (3.18%) categories.

Interpretation:

The predominance of students in the Average category suggests a need for consistent academic support to enhance their mathematical abilities. Special attention should be directed to students in the Low and Very Low categories, while students in the High and Very High categories can benefit from enrichment programs to challenge their potential further.

7. Results and Discussion

7.1 Hypothesis No.1: *There is no significant difference in the academic achievement in mathematics between male and female secondary school students.*

An analysis of academic achievement in mathematics among male and female secondary school students aims to determine the presence of any significant differences in performance.

Table No.4: Comparison of Male and Female secondary school students of Mizoram in their Academic Achievement in Mathematics.

Groups	N	Mean	SD	Df	t-value	Level of Significance
Male	84	57.7	23.37	169	1.249	0.05
Female	136	53.77	22.23			

Table 4 shows that the mean academic achievement in mathematics for male students is 57.7 with a standard deviation of 23.37, while female students have a mean of 53.77 with a standard deviation of 22.23. The calculated t-value of 1.249 is lower than the critical value of 1.97 at the 0.05 level of significance. As a result, the null hypothesis is accepted, indicating no statistically significant difference in academic achievement in mathematics between male and female secondary school students in Aizawl City. This suggests that gender does not play a decisive role in determining academic performance in mathematics among the students sampled.

7.2 Hypothesis No.2: *There is no significant difference in the academic achievement in mathematics between secondary school students from private schools and government schools.*

The study compares academic achievement in mathematics between government and private school students to evaluate how institutional factors may impact performance.

Table No.5: Comparison of Govt. School and Private School students of Mizoram in their Academic Achievement in Mathematics.

Groups	N	Mean	SD	Df	t-value	Level of Significance
Male	112	43.56	16.71	201	- 9.12	0.05
Female	108	67.45	21.72			

Table 5 reveals that the mean academic achievement in mathematics for government school students is 43.56 with a standard deviation of 16.71, whereas private school students achieve a substantially higher mean of 67.45 with a standard deviation of 21.72. The observed absolute t -value of 9.12 significantly exceeds the critical value of 1.97 at the 0.05 level of significance. Consequently, the null hypothesis is rejected, indicating a statistically significant difference in academic achievement between students from government and private schools. This result highlights the superior academic performance of private school students in mathematics, which could be attributed to differences in teaching methodologies, resources, or overall academic environments between the two types of institutions.

7.3 Hypothesis No.3: *There is no significant difference in the mathematical aptitude of male and female secondary school students.*

The focus is on identifying any significant differences in mathematical aptitude between male and female students, addressing potential gender-based disparities.

Table No.6: Comparison of Male and Female secondary school students of Mizoram in their Mathematical Aptitude

Groups	N	Mean	SD	Df	t-value	Level of Significance
Male	84	11.53	4.23	164	- 2.67	0.05
Female	136	10.01	3.87			

As presented in Table 6, the mean mathematical aptitude score for male students is 11.53 with a standard deviation of 4.23, while female students have a mean score of 10.01 with a standard deviation of 3.87. The absolute t -value of 2.67 surpasses the critical value of 1.98 at the 0.05 significance level. This leads to the rejection of the null hypothesis, confirming a statistically significant difference in mathematical aptitude between male and female students. The results indicate that male students exhibit higher mathematical aptitude than their female counterparts.

7.4 Hypothesis No.4: *There is no significant difference in the mathematical aptitude of secondary school students from private schools and government schools.*

This analysis investigates how the type of school, government or private, influences the mathematical aptitude of secondary school students.

Table No.7: Comparison of Government and Private secondary school students of Aizawl in their Mathematical Aptitude

Groups	N	Mean	SD	df	t-value	Level of Significance
Govt. School	112	8.72	3.66	218	7.85	0.05
Private School	108	12.54	3.53			

Government school students exhibit a mean mathematical aptitude score of 8.72 with a standard deviation of 3.66, whereas private school students achieve a higher mean score of 12.54 with a standard deviation of 3.53. The calculated t -value of 7.85 exceeds the critical value of 1.97 at the 0.05 significance level, leading to the rejection of the null hypothesis. This indicates a statistically significant difference in mathematical aptitude between the two groups, with private school students outperforming their government school peers.

7.5 Hypothesis No.5: *There is no significant relationship between academic achievement in mathematics and mathematical aptitude among secondary school students.*

Exploring the correlation between academic achievement in mathematics and mathematical aptitude provides insights into patterns that can guide targeted educational interventions and support strategies.

Table No. 8: Comparison of Academic Achievement in Mathematics and Mathematical Aptitude of Secondary School Student of Aizawl City

Group	N	Mean	S.D	Cor Coff (r)	Level
Academic Achievement in Mathematics	220	55.29	22.7	$r = 0.67$	
Mathematical Aptitude	220	10.59	4.07		

The correlation coefficient (r) of 0.67 indicates a significant positive relationship between academic achievement in mathematics and mathematical aptitude. This finding leads to the rejection of the null hypothesis, affirming that students with stronger mathematical aptitude are more likely to excel academically in mathematics. In essence, the data supports the conclusion that higher mathematical aptitude is associated with better performance in mathematics.

Conclusion

The research provides valuable insights into how academic performance in mathematics correlates with mathematical aptitude among secondary school students in Aizawl. It finds no notable differences in mathematics achievement between genders; however, male students demonstrate stronger mathematical aptitude. The analysis also highlights significant differences in both achievement and aptitude levels between students from government and private schools, with the latter performing better. Additionally, a robust positive relationship is evident between mathematical aptitude and academic achievement, emphasizing the critical role of aptitude in determining success. These results reveal the complex interplay of individual skills, institutional environments, and inherent abilities in shaping mathematical outcomes. To enhance mathematics education, it is vital to address these aspects comprehensively.

Educational Implications

- **Curriculum Development:** Emphasizing mathematical aptitude in the curriculum could help nurture problem-solving and logical reasoning skills in students, fostering a deeper understanding of mathematics beyond rote learning.
- **Teacher Training:** Teachers should be trained to identify and support students with varying levels of mathematical aptitude, enabling personalized interventions to enhance learning outcomes.
- **Targeted Interventions:** Special programs should be designed for government school students to bridge the gap in academic achievement and aptitude compared to private school students. These programs can include remedial classes, additional resources, and mentorship.
- **Gender Equity:** Efforts should be made to encourage female students to enhance their mathematical aptitude through mentorship, workshops, and exposure to female role models in STEM fields.
- **Parental Involvement:** Parents should be involved in fostering a positive attitude toward mathematics at home, ensuring that students receive consistent encouragement and support.
- **Aptitude Assessment:** Regular assessment of mathematical aptitude could help identify students' strengths and areas for improvement, guiding the design of customized learning strategies.
- **Focus on Government Schools:** Policymakers should allocate additional resources to government schools, ensuring equitable access to quality mathematics education for all students.

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Name & Institutional Address of the Supervisor	Prof. Lynda Zohmingliani, Department of Education, Mizoram University, Aizawl	
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DEGREE	: Doctor of Philosophy
DEPARTMENT	: Education
TITLE OF THESIS	: Academic achievement in
Mathematics among	Secondary School Students of
	Mizoram in Relation to their
	Mathematical Aptitude and
	Socioeconomic Status
DATE OF ADMISSION	: 27.08.2021
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1. DRC	: 31.03.2022
2. BOS	: 19.05.2022
3. SCHOOL BOARD	: 10.06.2022
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ABSTRACT

ACADEMIC ACHIEVEMENT IN MATHEMATICS AMONG SECONDARY SCHOOL STUDENTS OF MIZORAM IN RELATION TO THEIR MATHEMATICAL APTITUDE AND SOCIO-ECONOMIC STATUS

**AN ABSTRACT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF
PHILOSOPHY**

L. NUNCHANGA

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DEPARTMENT OF EDUCATION

SCHOOL OF EDUCATION

JULY, 2025

**ACADEMIC ACHIEVEMENT IN MATHEMATICS AMONG SECONDARY
SCHOOL STUDENTS OF MIZORAM IN RELATION TO THEIR
MATHEMATICAL APTITUDE AND SOCIO-ECONOMIC STATUS**

By

L. NUNCHANGA

Department of Education

Supervisor

Prof. LYNDIA ZOHMINGLIANI

Submitted

**In partial fulfillment of the requirement of the Degree of Doctor of Philosophy in
Education of Mizoram University, Aizawl.**

Introduction

Mathematics occupies an important position in curriculum and holds a central and foundational position in modern education systems worldwide due to its universal applicability, cognitive benefits, and role in scientific and technological advancement. It is a compulsory subject from Class - I to Class - X in Indian education system and it forms part of the core curriculum under all major educational boards (CBSE, ICSE, State Boards). Education is universally acknowledged as the cornerstone of societal advancement, fostering intellectual growth, social equity, and economic development. It serves as a catalyst for innovation, personal empowerment, and the promotion of a just and equitable society. Beyond individual enrichment, education drives collective progress, shaping communities and nations. Among various educational disciplines, mathematics holds a unique and indispensable position due to its universality and broad applicability. Mathematics forms the backbone of critical thinking, scientific discovery, and technological progress, cementing its role as an integral component of modern education systems worldwide (NCERT, 2005).

One of the aims of education is to mould and develop a person so as to become a useful and productive human by inculcating creativity, problem solving skills, logical thinking, etc. Mathematics education is one of the most important tools for developing a child's thinking. According to NCF 2005, "The main goal of Mathematics education in schools is the 'mathematisation' of a child's thinking" (NCERT, 2005). Developing mathematics skills in child in an early stage helps in intellectual development which is necessary for the growth and development of a child in various aspect of life. The term education is derived from the Latin word 'Educere' which means "to bring up" or "to nourish". The ultimate aim of education is to bring up an individual for the betterment of the world, societies and for himself. By understanding mathematical patterns, conjectures, measurement, counting, shapes and size, averages etc helps a child in cognitive development, building up confidence, personality and social development. Learning mathematics helps a child to develop values such as rigor and integrity in communication and formulation of argument which is the aims of mathematics education according to NCF 2023.

During the past few decades, the status of mathematics education in Mizoram was generally poor. Academic achievement in mathematics was considerably low among students in Mizoram. Students were underperforming all kinds of assessment in mathematics subject in the school. Thanhawla (1983) found that the general standard of achievement in mathematics was 27.86 % which was extremely low. From the study of Thomas (1991) it was revealed that the level of achievement in mathematics subjects was between 33 and 50 percent only. There are only few people who have science and mathematics background, and most of the student opted for arts and humanities in the higher studies rather than science and mathematics. The reason for insufficient number of people who have science and mathematics background in Mizoram is due to the weak foundations of mathematics and science in the school system (Wangu, 1995). It has all started right from the school level where most of the students were not interested in mathematics which result in lack of mathematics graduate among the educated who could able to teach mathematics in the school. The number of school teachers with science and mathematics background is insufficient compared to the needs of the area. Thus, the state Government was forced to import and employ numerous science and mathematics teachers from outside the state.

The growth and progress of mathematics education can be seen since from the last few years. The number of science and mathematics graduate is gradually increasing driven by the growing demand in various Government jobs and private sector. Academic performance in mathematics continues to progress, and at the same time it also grows increasingly challenging due to various issues and problems. With the passage of time, students are starting to learn mathematics with greater interest in the subjects and are beginning to find the study enjoyable. Academic marks and performance in mathematics continue to improve. But the percentage of failure in mathematics is still persistently high. The following are the academic performance of secondary school students in HSLC examination during the last 5 years:

Students' performance in mathematics in HSLC examination between 2020– 2024.

Division	No. of Students	Percentage
Distinction	6237	6.94
First	12694	14.13
Second	16,899	18.82
Third	36,080	40.19
Fail	17,870	19.90
Total	88,913	100

Source: MBSE, Government of Mizoram

From the above table it can be seen that there is a progression in the mathematics result, however, the result is still unsatisfactory since majority of the students were those who have failed and those who secured third division marks. This indicates that secondary school students of Mizoram have low academic achievement in Mathematics.

The interplay among academic achievement in mathematics, mathematical aptitude, and socioeconomic status (SES) is complex, reflecting a dynamic relationship between intrinsic abilities and extrinsic influences. Mathematical aptitude, defined as an individual's natural or developed capacity for understanding and applying mathematical concepts, serves as both a predictor and a determinant of academic achievement. However, the extent to which aptitude translates into measurable success often depends on SES, which moderates access to resources, opportunities, and support systems (Bloom, 1956). Students with high mathematical aptitude generally excel in tasks requiring abstract reasoning, logical problem-solving, and quantitative analysis. However, SES plays a pivotal role in shaping the environments where these aptitudes can be nurtured. High-SES students typically benefit from enriched learning environments, including access to advanced learning materials, private tutoring, and extracurricular activities that amplify their potential. In contrast, low-SES students may struggle to realize their capabilities due to systemic barriers such as underfunded schools, inadequate infrastructure, and limited academic support (Maiti, 2017).

Understanding the interrelationship among achievement, aptitude, and SES requires a holistic approach that considers cognitive, emotional, and environmental

factors. By addressing systemic inequities and fostering inclusive practices, educators can create environments where all students, regardless of their socioeconomic background, have the opportunity to achieve their full potential in mathematics.

Rationale of the Study

One of the key factors influencing academic achievement in mathematics is mathematical aptitude—an inherent or acquired ability to understand and solve mathematical problems. Mathematical aptitude, as described by Mangal (2019), involves cognitive skills such as logical reasoning, numerical ability, and abstract thinking. However, in Mizoram, there is a lack of research focusing specifically on the mathematical aptitude of secondary school students and how it influences their academic achievement. Without a clear understanding of students' mathematical aptitude, educators and policymakers are ill-equipped to design effective teaching strategies and curricula that address the diverse needs of learners. Additionally, socioeconomic status (SES) plays a significant role in shaping students' educational experiences and outcomes. SES encompasses factors such as family income, parental education, and occupational status, all of which impact access to educational resources, quality of instruction, and learning environments (Pandey, 2017). Students from higher SES backgrounds often enjoy advantages such as private tutoring, advanced learning materials, and supportive home environments. Conversely, students from lower SES backgrounds face barriers including inadequate resources, limited parental involvement, and financial constraints, all of which negatively affect their academic performance (Dhoundiyal & Rawat, 2021).

The interplay between mathematical aptitude, academic achievement, and SES underscores the need for a comprehensive study that examines these relationships in the context of secondary school students in Mizoram. Such research is particularly important for addressing systemic inequities and improving educational outcomes. By identifying the levels of mathematical aptitude among students and understanding how SES influences achievement, this study aims to provide actionable insights for educators, policymakers, and curriculum designers.

Furthermore, the study seeks to address critical gaps in the literature. While previous studies have explored the relationship between mathematical aptitude and achievement in other regions (Narula, 2007; Bala, 2014), there is limited research focusing on Mizoram. This gap is significant given the unique sociocultural and economic context of the state. Mizoram's educational landscape is characterized by challenges such as limited access to advanced learning tools, disparities between rural and urban schools, late start of formal education, and varying levels of parental involvement. A focused investigation into these issues can help illuminate the specific factors contributing to low achievement in mathematics and inform targeted interventions.

Another rationale for the study lies in its potential to contribute to policy development. Findings from this research can inform the design of inclusive and equitable educational policies that address the needs of diverse student populations. For instance, understanding the role of SES in shaping academic achievement can guide resource allocation to underprivileged schools, ensuring that all students have access to quality education. Similarly, insights into mathematical aptitude can help educators adopt differentiated instruction methods that cater to varying levels of ability. The study also aims to empower teachers by equipping them with a deeper understanding of the factors influencing students' mathematical performance. Effective teaching requires more than subject knowledge; it demands an awareness of students' abilities, learning styles, and socio-economic backgrounds. By highlighting the interplay between these factors, the research can help teachers adopt evidence-based practices that enhance learning outcomes.

From a broader perspective, the study aligns with global educational goals, particularly those emphasizing equity and inclusivity. The United Nations' Sustainable Development Goal 4 advocates for inclusive and equitable quality education, with a focus on eliminating disparities in educational outcomes. This study contributes to these objectives by addressing the root causes of underachievement in mathematics and proposing solutions to bridge gaps in access and achievement.

Finally, the study is timely given the increasing emphasis on STEM education in India. As the country aspires to become a global leader in science and technology, it is imperative to strengthen the mathematical foundation of students. Enhancing achievement in mathematics at the secondary school level is a critical step toward this goal, as it prepares students for advanced studies and careers in STEM fields. By investigating the factors that influence mathematical performance in Mizoram, this study aims to contribute to the broader effort of building a scientifically literate and capable workforce. Hence, the rationale for this study is rooted in its potential to address pressing educational challenges in Mizoram and contribute to the broader discourse on mathematics education. By examining the relationships among academic achievement, mathematical aptitude, and SES, the research aims to provide a nuanced understanding of the factors influencing students' performance. The findings are expected to have significant implications for teaching practices, curriculum design, and policy development, ultimately contributing to the goal of equitable and quality education for all students in Mizoram.

Research Questions

1. What are the levels of academic achievement in Mathematics among secondary school students in Mizoram?
2. What are the levels of mathematical aptitude of secondary school students in Mizoram?
3. What are the levels of socioeconomic status of secondary school students of Mizoram?
4. Is there any relationship between academic achievement in mathematics and mathematical aptitude among secondary school students of Mizoram?
5. Is there any relationship between academic achievement in mathematics and socioeconomic status among secondary school students of Mizoram?
6. Is there any relationship between mathematical aptitude and socioeconomic status among secondary school students of Mizoram?
7. Is there any relationship between academic achievement in mathematics and various dimensions of socioeconomic status among secondary school students of Mizoram?

8. Is there any relationship between mathematical aptitude and various dimensions of socioeconomic status among secondary school students of Mizoram?
9. Is there any significant difference in the academic achievement in mathematics among secondary school students with respect to gender, locale and type of management of the school?
10. Is there any significant difference in the academic achievement in mathematics between male and female secondary school students of Mizoram based on locale and type of management of school?
11. Is there any significant difference in the mathematical aptitude of secondary school students with respect to their gender, locale, and type of management of the school?
12. Is there any significant difference in the mathematical aptitude between male and female secondary school students of Mizoram based on locale and type of management of school?
13. Is there any significant difference in the socioeconomic status of secondary school students with respect to their locale and type of management of the school?

Statement of the Problem

The problem of the present study has been stated as “Academic Achievement in Mathematics among Secondary School Students of Mizoram in Relation to their Mathematical Aptitude and Socioeconomic Status”.

Objectives of the study

The following are the objectives for the present research:

1. To construct and standardize Mathematical Aptitude Test (MAT) for secondary school level of education.
2. To find out the academic achievement in mathematics among secondary school students of Mizoram.
3. To find out the mathematical aptitude of secondary school students of Mizoram.

4. To find out the socioeconomic status of secondary school students of Mizoram.
5. To compare the academic achievement in mathematics among secondary school students of Mizoram based on:
 - i) Gender
 - ii) Locality
 - iii) Type of school management
6. To conduct gender-based comparison on academic achievement in mathematics among secondary school students of Mizoram based on
 - i) Locality
 - ii) Type of school management.
7. To compare the mathematical aptitude among secondary school students of Mizoram based on:
 - i) Gender
 - ii) Locality
 - iii) Type of school management
8. To conduct gender-based comparison on mathematical aptitude among secondary school students of Mizoram based on:
 - i) Locality
 - ii) Type of school management.
9. To compare the socioeconomic status among secondary school students of Mizoram based on
 - i) Locality
 - ii) Type of school management
10. To find out the relationship between academic achievement in mathematics and mathematical aptitude among secondary school students of Mizoram.
11. To find out the relationship between academic achievement in mathematics and socioeconomic status among secondary school students of Mizoram.
12. To find out the relationship between mathematical aptitude and socioeconomic status among secondary school students of Mizoram.

13. To find out the relationship between academic achievement in mathematics and dimensions of socioeconomic status among secondary school students of Mizoram.
14. To find out the relationship between mathematical aptitude and dimensions of socioeconomic status among secondary school students of Mizoram.
15. To compare academic achievement in mathematics between high and low socioeconomic status dimensions.

Hypotheses of the study

1. There is a significant difference in academic achievement in mathematics between male and female secondary school students of Mizoram.
2. There is a significant difference in academic achievement in mathematics between urban and rural secondary school students of Mizoram.
3. There is a significant difference in academic achievement in mathematics between government and private secondary school students of Mizoram.
4. There is a significant difference in academic achievement in mathematics between male and female of urban secondary school students of Mizoram.
5. There is a significant difference in academic achievement in mathematics between male and female of rural secondary school students of Mizoram.
6. There is a significant difference in academic achievement in mathematics between male and female of government secondary school students of Mizoram.
7. There is a significant difference in academic achievement in mathematics between male and female of private secondary school students of Mizoram.
8. There is a significant difference in mathematical aptitude between male and female secondary school students of Mizoram.
9. There is a significant difference in mathematical aptitude between urban and rural secondary school students of Mizoram.
10. There is a significant difference in mathematical aptitude between government and private secondary school students of Mizoram.
11. There is a significant difference in mathematical aptitude between male and female of urban secondary school students of Mizoram.

12. There is a significant difference in mathematical aptitude between male and female rural secondary school students of Mizoram.
13. There is a significant difference in mathematical aptitude between male and female government secondary school students of Mizoram.
14. There is a significant difference in mathematical aptitude between male and female private secondary school students of Mizoram.
15. There is a significant difference in socioeconomic status between urban and rural secondary school students of Mizoram.
16. There is a significant difference in socioeconomic status between government and private secondary school students of Mizoram.
17. There is a significant relationship between academic achievement in mathematics and mathematical aptitude among secondary school students of Mizoram.
18. There is a significant relationship between academic achievement in mathematics and socioeconomic status among secondary school students of Mizoram.
19. There is a significant relationship between mathematical aptitude and socioeconomic status among secondary school students of Mizoram.
20. There is a significant relationship between parental education and academic achievement in mathematics among secondary school students of Mizoram.
21. There is significant relationship between parental occupation and academic achievement in mathematics among secondary school students of Mizoram.
22. There is a significant relationship between family income and academic achievement in mathematics of secondary school students in Mizoram.
23. There is a significant relationship between family assets and academic achievement in mathematics of secondary school students in Mizoram.
24. There is a significant relationship between parental socio-religious position and academic achievement in mathematics of secondary school students in Mizoram.
25. There is a significant relationship between parental education and mathematical aptitude of secondary school students in Mizoram.

26. There is a significant relationship between parental occupation and mathematical aptitude of secondary school students in Mizoram.
27. There is a significant relationship between family income and mathematical aptitude of secondary school students in Mizoram.
28. There is a significant relationship between family assets and mathematical aptitude of secondary school students in Mizoram.
29. There is a significant relationship between parental socio-religious position and mathematical aptitude of secondary school students in Mizoram.
30. There is a significant difference in academic achievement in mathematics between high and low parental education levels among secondary school students of Mizoram.
31. There is a significant difference in academic achievement in mathematics between high and low parental occupation levels among secondary school students of Mizoram.
32. There is a significant difference in academic achievement in mathematics between high and low family income among secondary school students of Mizoram
33. There is a significant difference in academic achievement in mathematics between high and low family assets among secondary school students of Mizoram
34. There is a significant difference in academic achievement in mathematics between high and low parental socio-religious position among secondary school students of Mizoram.

Review of Related Literature

A review of literature on how mathematical aptitude and socioeconomic status interact to shape students' achievement in mathematics was done by the scholar in order to know more about the status of research done and also to understand the findings of other researchers on the topic. The researcher reviewed a total of 86 literature related to different objectives, comprising 34 conducted outside India, 45 from various regions across India, and the remaining 7 conducted specifically in Mizoram. The selected literature encompasses a 78-years period,

extending from 1947 to 2025. The most researched area was academic achievement in mathematics, the others reviewed literature were studies on mathematical aptitude, studies on construction and standardization of mathematical aptitude test, studies on academic achievement in mathematics in relation to mathematical aptitude, studies on academic achievement in mathematics in relation to socioeconomic status, and a few studies on theories, trends and practices in mathematics education.

Method of the Study

Keeping in view the nature of research and the objectives of the study, descriptive survey method was used in the present research.

Population

The population of the present study consisted of all secondary school students in Mizoram. The school includes both government and private secondary school. According to the latest annual publication of ‘Statistics of School Education’ (2022 – 2023) prepared by Directorate of School Education, Government of Mizoram, there are 718 secondary schools and 39,313 secondary school students in Mizoram.

Sample

For selecting a representative sample, multistage stratified random sampling technique was followed. Although it was proposed that the sample would comprise of 900 sample secondary school students. However, when the test was administered, it was found that some sample students had not responded to all the items in the test. Therefore, their responses had to be rejected. The final sample for the present study thus consisted of 891 secondary school students studying Class X in the 2024-2025 academic year which were selected from 6 districts out of 11 districts. Stratification was done in urban and rural areas at the district level and management of schools.

- i) Five districts were selected from North, South, East, West, and Central regions of the State. Besides these five districts of representative regions, the state capital district was also included because it had the highest number of secondary school students. Given that the majority of the

students is concentrated in the state capital Aizawl, its inclusion was deemed significant to ensure a representative sample.

- ii) Urban areas and rural areas were stratified randomly from the selected districts.
- iii) Government schools and private schools were selected from the selected local areas.
- iv) From the selected secondary schools, students were randomly selected.

Tools for Data Collection

In the present study, the following tools were used for collecting necessary data:

- (i) Mathematical Aptitude Test developed by the researcher.
- (ii) Socioeconomic Status Scale (Revised, 2022) by Prof. Lallianzuali Fanai & Prof. R.P. Vadhera.
- (iii) Class IX annual examination results of identified schools.

Procedure of Data Collection

The researcher personally visited schools across the entire Mizoram state in the east, west, south, north and central regions to collect necessary data. Before administration of the test, due permissions were taken from each of the school headmasters. The test was administered only when both the researcher and the students were ready.

Before administering the test, the researcher first established a close and harmonious relationship with the students and explained the purpose and importance of the research. Students were assured that the information would be kept in secret and confidential and it will be used only for research purpose. The researcher also requested the respondents to respond to the test sincerely and no one should copy from their friends. After the researcher has given instruction on how to respond to the test, the students were asked to answer first the socioeconomic status scale and then the mathematical aptitude test may follow it. The entire time taken to complete the test was about one hour.

For academic achievement in mathematics, marks in mathematics subject scored by the students in their class - IX Promotion Examination 2024, were collected by the researcher from school records.

Data Analysis

In the data analysis phase, the researcher employed quantitative methods to analyze the collected data.

Quantitative analysis involves the use of descriptive and inferential statistics to examine numerical data quantitatively such as percentage, means, standard deviation, normality tests, t-tests and Pearson's product moment correlation and Spearman's rank correlation. Normality test was conducted by employing skewness and kurtosis. The skewness and kurtosis of the data in the present study was computed using Microsoft Excel and the resulting values supported the normality of the data distribution. The collected data was plotted for graphical test which showed bell curve shape. The scores of each test were tabulated using SPSS tabulation sheet and were treat with statistical technique for analysis to conduct correlational analysis and differential analysis.

Major Findings

The major findings of the present study based on the research objectives were as follows:

1. Construction and Standardization of Mathematical Aptitude Test (MAT)

A multiple-choice questions (MCQs) type Mathematical Aptitude Test (MAT) consisting of 20 items had been constructed and standardized. The reliability of the test was established by test-retest method in which reliability coefficient was found to be 0.81. The test was validated through rigorous examination by a panel of subject-matter experts to ensure content validity.

2. Findings based on descriptive statistics of Academic Achievement in Mathematics

- i) The study revealed that –
 - Only 14.4% of the students achieved distinction in mathematics
 - 12.1% achieved first division
 - 13.9% achieved second division
 - 38.5% achieved third division
 - 21.1% of the students failed to achieve the minimum passing score
 - The overall findings indicated that majority of the students were low achievers in mathematics as nearly 60% either failed or scored only marginally above the passing mark.

- ii) In the frequency distribution of academic achievement in mathematics among secondary school students, the highest concentration of students was in the 40–49 marks range, making it the most common achievement level. Very few students scored extremely low (0–9 marks) or extremely high (90–99 marks).

- iii) The lowest score recorded was 4 and the highest was 99. The positive value of skewness (0.549) which was slightly greater than zero indicated that the data was moderately skewed to the right and the distribution was approximately symmetric. The negative value of kurtosis (-0.395) which was slightly less than zero indicated that the distribution was mildly platykurtic. The observation leads to the conclusion that the academic achievement in mathematics of secondary school students was normally distributed.

3. Findings based on descriptive statistics of Mathematical Aptitude

- i) The study revealed that:
 - 3.36 % of the students demonstrated a very high mathematical aptitude
 - 15.94% of students had high mathematical aptitude
 - Majority of the students (61.73%) fell within the average range
 - 18.86% of the students had low mathematical aptitude
 - Only one student (0.11%) had very low mathematical aptitude
 - The overall finding indicated that secondary school students of Mizoram had an average level of mathematical aptitude.
- ii) The lowest score recorded was 0 and the highest was 20. The positive value of skewness (0.355) which was slightly greater than zero indicated that the data was moderately skewed to the right and the distribution was approximately symmetric. The negative value of kurtosis (-0.489) which was slightly less than zero indicated that the distribution was mildly platykurtic. The observation leads to the conclusion that the mathematical aptitude of secondary school students was normally distributed.

4. Findings based on descriptive statistics of socioeconomic status

- i) The study revealed that:
 - 2.9 % of the students had a very high SES
 - 13.6 % of students had high SES
 - Majority of students (65.2%) fell in the "Average" category
 - 17.7% of the students fell in the "Low" category
 - Only 0.6% had a "Very Low" SES
 - The overall finding indicated that secondary school students of Mizoram had an average SES.
- ii) The lowest score recorded was 12 and the highest was 66. The positive value of skewness (0.33) which was slightly greater than zero

indicated that the data was moderately skewed to the right and the distribution was approximately symmetric. The negative value of kurtosis (-0.302) which was slightly less than zero indicated that the distribution was mildly platykurtic. The observation leads to the conclusion that the socioeconomic status of secondary school students was normally distributed.

5. Findings based on comparison of Academic Achievement in Mathematics

i) Comparison of academic achievement in mathematics between male and female secondary school students of Mizoram

➤ *Comparison by test of significance*

There was a significant difference in academic achievement in mathematics between male and female secondary school students of Mizoram, with female students exhibited higher academic achievement in mathematics than male students. (Significant at 0.01).

➤ *Comparison based on level of academic achievement in mathematics*

- A greater proportion of female students (17.62%) achieved Distinction compared to male students (10.42%), indicating a significantly higher performance at the top level among females.
- Female students also outperformed males in the II Division category, with 15.78% of females scoring in this range compared to 11.66% of males.
- In the I Division category, both male and female students showed nearly equal achievement levels, with 12.16% of males and 12.09% of females.
- A larger percentage of male students (43.42%) fell into the III Division, compared to 34.43% of female students.
- The Fail rate was also higher among males (22.34%) than females (20.08%).

ii) Comparison of academic achievement in mathematics between urban and rural secondary school students of Mizoram

➤ ***Comparison by test of significance***

There was a significant difference in academic achievement in mathematics between urban and rural secondary school students. It was found that urban secondary school students exhibited higher academic achievement in mathematics than rural secondary school students. (Significant at 0.01).

➤ ***Comparison based on level of academic achievement in mathematics***

- A notably higher percentage of urban students (20.97%) achieved Distinction, compared to only 6.92% of rural students.
- Urban students also slightly outperformed rural students in the I Division category, with 12.92% compared to 11.21% among rural students.
- A greater proportion of rural students (16%) fell in the II Division compared to urban students (12.08%), indicating a moderate level of achievement was more prevalent in rural areas.
- Rural students (45.10%) showed a considerably higher percentage in the III Division than urban students (32.63%), pointing to lower academic performance in rural settings.
- The percentage of students who failed was almost the same in both groups, with urban students at 21.40% and rural students at 20.77%, indicating no substantial difference in the lowest achievement level.

iii) Comparison of academic achievement in mathematics between government and private secondary school students of Mizoram

➤ ***Comparison by test of significance***

There was a significant difference in academic achievement in mathematics between government and private secondary school students of Mizoram, with private secondary school students had significantly higher

academic achievement in mathematics than government secondary school students. (Significant at 0.01).

➤ ***Comparison based on level of academic achievement in mathematics***

- A significantly higher percentage of private school students (26.60%) achieved Distinction, compared to only 4.54% of government school students.
- In the I Division category, private school students (17.24%) outperformed government school students (7.83%), indicating stronger overall academic performance.
- Both school types showed similar achievement in the II Division range, with government students at 14.02% and private students at 13.55%, suggesting minimal difference at this level.
- A large proportion of government school students (46.60%) fell into the III Division, compared to 28.57% of private school students.
- The Fail rate was also much higher among government school students (27.01%), nearly double that of private school students (14.04%), highlighting a concerning trend of low academic performance in government schools.

iv) Comparison of academic achievement in mathematics between male and female students of urban secondary school of Mizoram

➤ ***Comparison by test of significance***

There was a significant difference in academic achievement in mathematics between urban male and urban female secondary school students of Mizoram. It was found that urban female secondary school students had significantly higher academic achievement in mathematics than urban male secondary school students. (Significant at 0.05).

➤ ***Comparison based on level of academic achievement in mathematics***

- A slightly higher percentage of urban male students (17.96%) achieved Distinction compared to urban female students (17.62%), though the difference is minimal.

- The percentage of students in the first Division was nearly the same for both genders: urban males (12.62%) and urban females (12.09%).
- A noticeably higher proportion of urban female students (15.78%) achieved second Division compared to urban male students (9.22%).
- A significant portion of both groups fell under III Division category: 35.92% of urban males and 34.43% of urban females.
- Urban male students had a higher failure rate (24.27%) than urban female students (20.08%), suggesting slightly better performance among females in terms of passing rates.

v) Comparison of academic achievement in mathematics between male and female students of rural secondary school of Mizoram

➤ ***Comparison by test of significance***

There was a significant difference in academic achievement in mathematics between rural male and female secondary school students of Mizoram, with rural female secondary school students exhibiting significantly higher academic achievement in mathematics than rural male secondary school students. (Significant at 0.05).

➤ ***Comparison based on level of academic achievement in mathematics***

- A greater proportion of rural female students (10.41%) achieved Distinction, compared to only 3.03% of rural male students, indicating stronger top-level performance among females.
- In the I Division category, both groups showed similar achievement levels, with rural males at 11.61% and rural females at 10.86%.
- In the II Division category, rural females (17.19%) outperformed rural males (14.65%), reflecting better moderate performance.
- Rural male students (50.50%) showed a notably higher percentage in the III Division compared to rural female students (40.27%), indicating a greater concentration of low achievement among males.

- The Fail rates were also nearly equal, with rural males at 20.20% and rural females at 21.27%, indicating minimal gender difference at the lowest level of academic performance.

vi) Comparison of academic achievement in mathematics between male and female students of government secondary school of Mizoram

➤ ***Comparison by test of significance***

There was no significant difference in academic achievement in mathematics between male and female students of government secondary school students.

➤ ***Comparison based on level of academic achievement in mathematics***

- A greater proportion of female students (6.39%) achieved Distinction compared to male students (2.28%) in government schools.
- Similarly, in the II Division category, female students (16.17%) outperformed male students (11.42%), indicating relatively stronger academic performance among females in these categories.
- A significantly higher percentage of male students (52.51%) fell into the III Division, as compared to female students (41.73%), suggesting that male students in government schools were more concentrated in the lower achievement range.
- In the I Division, both groups showed nearly equal performance, with males at 7.76% and females at 7.89%.
- Similarly, Fail rates were also close, with male students at 26.03% and female students at 27.82%, indicating minimal gender difference in the lowest performance category.

vii) Comparison of academic achievement in mathematics between male and female students of private secondary school of Mizoram

➤ ***Comparison by test of significance***

There was a significant difference in academic achievement in mathematics between male and female students of private secondary school

students. It was found that female students of private secondary school had higher academic achievement in mathematics than male students of private secondary school. (Significant at 0.01).

➤ ***Comparison based on level of academic achievement in mathematics***

- A significantly higher percentage of female students (31.1%) achieved Distinction, compared to male students (20.91%).
- Both male and female students showed similar performance in the I Division, with males at 16.95% and females at 17.47%.
- In the II Division as well, female students (15.28%) outperformed male students (11.30%), indicating stronger academic performance by females in both top and moderate achievement levels.
- A greater proportion of male students (32.20%) fell into the III Division, compared to female students (25.76%).
- Additionally, the Fail rate was higher among males (18.64%) than females (10.48%), suggesting that male students were more concentrated in the lower performance categories.

6. Findings based on comparison of Mathematical Aptitude

i) Comparison of mathematical aptitude between male and female secondary school students of Mizoram

➤ ***Comparison by test of significance***

There was no significant difference in mathematical aptitude between male and female secondary school students of Mizoram.

➤ ***Comparison based on level of mathematical aptitude***

- A slightly greater proportion of male students (4.47%) exhibited Very High mathematical aptitude category compared to female students (2.46%), indicating a marginal male advantage at the top aptitude level.
- Female students (62.5%) had a slightly higher representation in the Average mathematical aptitude category compared to male students (60.79%), indicating a stable performance among females.

- Both male and female students exhibited comparable percentages across the remaining categories: in the High Aptitude category, males account for 16.13% while females represented 15.78%; in the Low Aptitude category, males comprised 18.36% and females 19.26%; and in the Very Low Aptitude category, males constituted 0.25%, with no representation among females.
- The overall distribution of mathematical aptitude was almost similar between male and female students, with only minor differences.

ii) Comparison of mathematical aptitude between urban and rural secondary school students of Mizoram

➤ ***Comparison by test of significance***

There was a significant difference in mathematical aptitude between urban and rural secondary school students of Mizoram with urban secondary school students exhibiting higher mathematical aptitude than rural secondary school students (Significant at 0.01).

➤ ***Comparison based on level of mathematical aptitude***

- A greater proportion of urban students (5.72%) demonstrated Very High mathematical aptitude, in contrast to only 0.72% of rural students.
- Urban students (22.88%) showed a higher percentage in the High aptitude category compared to rural students (8.11%), indicating that urban students generally performed better in mathematical aptitude.
- A higher percentage of rural students (67.30%) fell into the Average aptitude category than urban students (56.78%), suggesting that the majority of rural students performed within a moderate range.
- The Low aptitude category included 23.63% of rural students, significantly more than urban students (14.62%), indicating a greater concentration of lower aptitude levels in rural areas.
- The Very Low aptitude category showed negligible representation, with 0% among urban students and only 0.24% among rural

students, indicating a very small proportion of students at the lowest level in both groups.

iii) Comparison of mathematical aptitude between government and private secondary school students of Mizoram

➤ ***Comparison by test of significance***

There was a significant difference in mathematical aptitude between government and private secondary school students of Mizoram. It was found that private secondary school students have higher mathematical aptitude than government secondary school students (Significant at 0.01).

➤ ***Comparison based on level of mathematical aptitude***

- A greater proportion of private secondary school students (6.90%) fell under the Very High mathematical aptitude category, compared to only 0.41% of government school students.
- In the High aptitude category, private school students (24.38%) significantly outperformed government school students (8.86%), indicating stronger overall aptitude among private school learners.
- A much higher percentage of government school students (27.63%) fell into the Low mathematical aptitude category, in contrast to 8.37% of private school students, pointing to a greater concentration of lower aptitude levels in government schools
- Both school types showed nearly equal representation in the Average aptitude range, with government school students at 62.89% and private school students at 60.34%.

iv) Comparison of mathematical aptitude between male and female students of urban secondary school of Mizoram

➤ ***Comparison by test of significance***

There was no significant difference in mathematical aptitude between male and female of urban secondary school students.

➤ ***Comparison based on level of mathematical aptitude***

- Urban males had slightly higher percentage (7.77%) of mathematical aptitude than urban females (4.14%) in the Very High category.
- Both genders showed strong performance in the High mathematical aptitude category, with males at 25.24% and females slightly lower at 21.80%.
- The majority of students fell in the Average category, with females (59.39%) having a higher proportion than males (53.39%).
- Both genders had almost similar percentages in the Low category with males at 13.60% and females at 14.66%.
- No students scored in the Very Low mathematical aptitude category.
- The overall distribution of mathematical aptitude was nearly identical between male and female students, with only negligible differences.

v) **Comparison of mathematical aptitude between male and female students of rural secondary school of Mizoram**

➤ ***Comparison by test of significance***

There was no significant difference in mathematical aptitude between male and female of rural secondary school students.

➤ ***Comparison based on level of mathematical aptitude***

- Both genders had minimal representation in the Very High mathematical aptitude category, with males at 1.01% and females at 0.45%.
- Females (8.60%) had a marginally higher percentage than males (7.57%) in the High category.
- The majority of rural students fell in the Average category, with males at 68.18% and females at 66.52%.
- 24.43% male students and 22.73% female students of rural school have Low mathematical aptitude.

- Only one male student (0.51%) scored in the Very Low mathematical aptitude category, while no female students fell in this category.

vi) Comparison of mathematical aptitude between male and female students of government secondary school of Mizoram

➤ ***Comparison by test of significance***

There was no significant difference between male and female students of government secondary school.

➤ ***Comparison based on level of mathematical aptitude***

- Both male and female students of government secondary school showed nearly identical results of minimal representation in the Very High mathematical aptitude category with male students at 0.46% and female students at 0.45%.
- Male students (9.13%) slightly outperformed female students (8.60%) in the High mathematical aptitude category.
- The majority of students fell within the Average category with male at 64.84% and female at 66.52%.
- 25.11% male students and 24.43% female students had Low mathematical aptitude showing almost similar representation.
- Only one male student (0.46%) scored in Very Low category, while no female students fell in this category.

vii) Comparison of mathematical aptitude between male and female students of private secondary school of Mizoram

➤ ***Comparison by test of significance***

There was no significant difference between male and female students of private secondary school.

➤ ***Comparison based on level of mathematical aptitude***

- A larger percentage of male students (9.60%) attained Very High mathematical aptitude category compared to female students (4.80%), indicating a higher proportion of top performers among males of private secondary school.
- Male students (25.99%) slightly outperformed female students (23.14%) in this category, indicating more males in the High mathematical aptitude category.
- A significantly higher percentage of female students (65.07%) were in the average category compared to males (54.24%), indicating a stronger central concentration among females.
- A greater proportion of male students (10.17%) fell in the lower aptitude category than female students (6.99%).
- No students from either gender scored zero, indicating no representation in the very low aptitude category.

7. Findings based on comparison of Socioeconomic Status

i) Comparison of socioeconomic status between urban and rural secondary school students of Mizoram

➤ ***Comparison by test of significance***

There was a significant difference in socioeconomic status between urban and rural secondary school students where urban secondary school students were found to have higher socioeconomic status than rural secondary school students. (Significant at 0.01).

➤ ***Comparison based on level of mathematical aptitude***

- A significantly higher percentage of urban students (4.66%) fell in the Very High SES category compared to rural students (0.95%), indicating better economic condition in urban areas.
- Urban students (19.49%) outnumbered rural students (6.92%) in the high SES category.

- Rural students (66.59%) slightly exceed urban students (63.98%) in the Average category, suggesting a broad central distribution in both areas.
- A significantly higher percentage of rural students (24.82%) fell in the low SES category compared to urban students (11.44%), indicating economic disadvantage was more prevalent in rural areas.
- Both urban (0.42%) and rural (0.72%) groups had minimal representation in the very low SES category.

ii) Comparison of socioeconomic status between government and private secondary school students of Mizoram

➤ ***Comparison by test of significance***

There was a significant difference in socioeconomic status between Government and Private secondary school students where private secondary school students were found to have higher socioeconomic status than Government secondary school students. (Significant at 0.01).

➤ **Comparison based on level of socioeconomic status**

- A significantly greater proportion of private school students belong to the Very High (5.17%) compared to government school (1.03%).
- Private school students (22.17%) outnumbered rural students (6.39%) in the High SES category.
- Government school students (65.98%) and private school students (64.53%) showed almost equal distribution in the Average category.
- A significantly higher percentage of government school students (25.57%) fell in the Low SES category compared to private school students (8.13%)
- 1.03% of government school students fell in the Very Low SES category, whereas none of the private school students belong to this category.

8. Findings based on correlation between Academic Achievement in Mathematics, Mathematical Aptitude and Socioeconomic Status

- i) The calculated value of correlation between academic achievement in mathematics and mathematical aptitude among secondary school students was 0.507. It was found that there existed a positive and significant relationship between academic achievement in mathematics and mathematical aptitude among secondary school students in Mizoram. The correlation was significant at 0.01 level.
- ii) The calculated value of correlation between academic achievement in mathematics and socioeconomic status among secondary school students was 0.235. It was found that there existed a positive and significant relationship between academic achievement in mathematics and socioeconomic status of secondary school students in Mizoram. The correlation was significant at 0.01 level.
- iii) The calculated value of correlation between mathematical aptitude and socioeconomic status among secondary school students was 0.355. It was found that there existed a positive and significant relationship between mathematical aptitude and socio-economic status among secondary school students in Mizoram. The correlation was significant at 0.01 level.

9. Findings based on correlation between various Dimensions of Socio-economic Status and Academic Achievement in Mathematics and Mathematical Aptitude.

- i) The calculated value of correlation between parental education and academic achievement in mathematics of secondary school students was 0.199. It was found that there existed a positive and significant relationship between parental education and academic achievement in mathematics of secondary school students in Mizoram. The correlation was significant at 0.01 level.
- ii) The calculated value of correlation between parental occupation and academic achievement in mathematics of secondary school students is 0.234. It was revealed that there existed a positive and significant

relationship between parents' occupation and academic achievement in mathematics among secondary school students in Mizoram. The correlation was significant at 0.01 level.

- iii) The calculated value of correlation between family income and academic achievement in mathematics of secondary school students was 0.221. The finding revealed that there existed a positive and significant relationship between family income and academic achievement in mathematics among secondary school students in Mizoram. The correlation was significant at 0.01 level.
- iv) The calculated value of correlation between family assets and academic achievement in mathematics of secondary school students was 0.202. It was found that there existed a positive and significant relationship between family assets and academic achievement in mathematics of secondary school students in Mizoram. The correlation was significant at 0.01 level.
- v) The calculated value of correlation between parental socio-religious position and academic achievement in mathematics of secondary school students was 0.040. It was found that there is no significant relationship between parental socio-religious position and academic achievement in mathematics of secondary school students in Mizoram.

10. Findings based on correlation between various Dimensions of Socio-economic Status and Mathematical Aptitude.

- i) The calculated value of correlation between parental education and mathematical aptitude of secondary school students was 0.305. It was found that there existed a positive and significant relationship between parental education and mathematical aptitude of secondary school students in Mizoram. The correlation was significant at 0.01 level.
- ii) The calculated value of correlation between parental occupation and mathematical aptitude of secondary school students was 0.366. It was found that there existed a positive and significant relationship between parental

occupation and mathematical aptitude among secondary school students in Mizoram. The correlation was significant at 0.01 level.

- iii) The calculated value of correlation between family income and mathematical aptitude of secondary school students was 0.354. It was found that there existed a positive and significant relationship between family income and mathematical aptitude among secondary school students in Mizoram. The correlation was significant at 0.01 level.
- iv) The calculated value of correlation between family assets and mathematical aptitude of secondary school students was 0.317. It was found that there existed a positive and significant relationship between family assets and mathematical aptitude of secondary school students in Mizoram. The correlation was significant at 0.01 level.
- v) The calculated value of correlation between parental socio-religious position and mathematical aptitude of secondary school students is -0.042 . It was found that there was no significant relationship between parental socio-religious position and mathematical aptitude of secondary school students in Mizoram.

11. Findings based on comparison of academic achievement in mathematics between high and low dimensions of socioeconomic status

1. There was a significant difference in academic achievement in mathematics between high and low parental education among secondary school students of Mizoram where students with high parental education were found to have higher academic achievement in mathematics than low parental education as evidenced by higher mean scores. (Significant at 0.01)
2. There was a significant difference in academic achievement in mathematics between high and low parental occupation among secondary school students of Mizoram where students with high parental education scored significantly higher in mathematics than those with low parental education. (Significant at 0.01)
3. There was a significant difference in academic achievement in mathematics between high and low family income among secondary school students of

Mizoram where students from high family income demonstrated higher academic achievement in mathematics as compared to their counterparts from low family income as indicated by higher mean scores. (Significant at 0.01)

4. There was a significant difference in academic achievement in mathematics between secondary school students of Mizoram from high-family-assets and low-family-assets background. It was found that students of high-family-assets background demonstrated higher academic achievement in mathematics than students of low-family-assets background where the mean scores were significantly higher. (Significant at 0.01)
5. There was no significant difference in academic achievement in mathematics between high and low parental socio-religious position among secondary school students of Mizoram. (Not significant at 0.01 and 0.05)

12. Recommendations

A. Recommendations based on findings of the study:

- i) *Development of standardized tool:* The present study developed a standardized tool to find out the mathematical aptitude of secondary school students. This tool may be used by teachers and administrators to find out the aptitude of their students and take necessary measures as indicated by the test results. Future studies may also focus on the development of a standardized tool to look into the problem of mathematics education and come up with more systematic research tools to tackle the problem of mathematics education.
- ii) *Academic achievement in mathematics:* It was found that the mathematics achievement among secondary school students was below average. In view of the importance accorded to mathematics in present day technology driven society, it is highly recommended that stakeholders themselves do research to enhance the achievement of students in mathematics. If educationists, policymakers and teachers do research on the root causes of low academic performance in mathematics, other causes besides poor socioeconomic status as well as low aptitude could also be contributing to the low performance of students. Accordingly, remedial measures may be taken.

- iii) *Mathematical aptitude*: Since the mathematical aptitude among secondary school students was average, it is recommended that mathematics textbook and curriculum be designed in such a way that it develops students' critical thinking and problem-solving skills. The NEP 2020 has introduced Foundation Literacy and Numeracy (FLN) to emphasize essential literacy and basic arithmetic, numbers, shapes, measurements during early years of education. It is recommended that schools may encourage closer collaboration with parents. Parents could be sensitized to encourage children to count objects and sort it out by shape and size, to use play-based learning like puzzles, building blocks right from their early childhood to develop logical thinking and reasoning. It is also recommended that teachers should employ teaching methods that emphasize conceptual learning rather than rote learning.
- iv) *Gender based comparison on mathematical aptitude and academic achievement in mathematics*: It was found that the mathematical aptitude of male and female students did not differ significantly whereas female students outperformed male students in academic achievement in mathematics. This finding has further reiterated the breaking of the longstanding stereotype in Mizo society that females are inferior to males in terms of logical thinking and reasoning, and that males naturally possess greater mathematical abilities than female. It is recommended that administrators and teachers strive to dismantle the images of gender stereotype, ensuring an environment where gender equality in mathematics education shines brightly for all. Parents and society at large should also be educated to be aware that male and female students are equal in mental abilities and have the same capacities to achieve in mathematical studies. Additionally, since female students outperformed male students in academic achievement in mathematics, it is also recommended that joint efforts involving parents, teachers, NGO like Young Mizo Association (YMA), Mizo Students' Union, and even the Church must take proactive steps to uplift the backwardness of the condition of males in the Mizo society.

- v) *Locality based comparison on academic achievement in mathematics:* Since there was a significant disparity in mathematics performance, with rural school students underperforming relative to urban school students, it is recommended that the Government should strengthen and upgrade infrastructural and instructional resources of rural schools. It is also recommended that more teacher training and workshop be organized for rural school teachers for their professional development. To attract and retain efficient and more qualified teachers in rural schools, the government may offer incentives through salary hike and allowances, housing support by constructing quarters for teachers.
- vi) *School management-based comparison on academic achievement in mathematics:* It was found that students in government schools underperformed in mathematics compared to students in private schools. It is recommended that the Government must organize surprise inspection to government schools more often. It is recommended that the authority should take strong measures against inefficient and unaccountable teachers while trying to create more fertile soil for the students. Parent-teacher meetings should be conducted more frequently in government schools so that parents and teachers work together toward the child's holistic growth and success. Parents must be encouraged to actively participate in their children's academic development in mathematics. It is also recommended that government schools should organize more co-curricular activities like essay writing, mathematics quiz, mathematics competition to motivate students and to make schools learning environment more enjoyable and more competitive.
- vii) *Relationship between academic achievement in mathematics and mathematical aptitude of students:* It was found that there was a significant relationship between academic achievement in mathematics and mathematical aptitude of students. In the teaching-learning process, it is highly recommended that students must be taught and guided based on their mathematical aptitude. Since mathematical aptitude is a predictor of future success in mathematics, it is recommended that students' future career on mathematics and related subjects must be guided based on their mathematical

aptitude. There were some students who have high mathematical aptitude but low academic achievement due to various problems. It is recommended that parents and teachers should encourage students that they have the ability to learn mathematics even if their academic marks were low.

- viii) *Relationship between academic achievement in mathematics and socioeconomic status of students:* It was found that there was a significant relationship between academic achievement in mathematics and socioeconomic status of students. It is recommended that teachers should maintain confidential records of each student's family background, including parental education, occupation, family structure (single-parent, divorced parents, guardianship), home environment, and any socioeconomic challenges. Teachers can use this data to teach and support students with different strategies accordingly. It is recommended that schools implement free mathematics tutoring programs, provide free learning materials, and scholarship opportunities to uplift the economically disadvantaged students.

B. General recommendations:

Improving mathematics education requires a multi-faceted approach that addresses various levels. Here are some key general recommendations:

1. Curriculum and Pedagogical Approaches:

The mathematics curricula currently adopted in most of the schools may not be relevant to meet the needs of the students. There is a need to enrich curriculum beyond textbook and to adopt innovative teaching methods equipped with modern technology and teaching aid. Conceptual understanding should be emphasized and strengthen, not just employing procedural knowledge. Curriculum should be enriched in such a way that it strengthens the foundational concept and enhance critical thinking and basic understanding of mathematics, and therefore shift away from rote learning. Students should be taught and motivated so that they could experience the joy of learning mathematics. Teachers should make learning mathematics interesting

and enjoyable by connecting it to everyday life and encouraging activity-based learning including mathematics games, puzzles, and hands-on experiment.

2. State Government Level:

- i) The government should organise continuous professional development program to enhance the quality and efficiency of mathematics teachers.
- ii) The government should take necessary measures to improve government school by organising random school inspection program to identify areas of improvement needed by assessing the performance of teachers and status of schools.
- iii) Since many students in private school find difficulties in mathematics, some private school also need to be checked and monitored. The government should forbid all the private school to recruit untrained teachers.
- iv) The government should often organise mathematics exhibition, seminar and awareness programme for the promotion of mathematics education among students in Mizoram.
- v) Research on mathematics education must be conducted frequently to know the exact status and problems in Mizoram and the government should take necessary measures based on the research findings.

3. School Level:

- i) Right from the very beginning of the school year, teacher must assess the mathematical aptitude of students so as to develop their mathematical aptitude and to guide each and every student according to their abilities.
- ii) Care must be taken to develop mathematical skills at early age among students right from elementary school stage so that children may have necessary foundational mathematical skills or prior knowledge for learning mathematics at secondary school or at higher education.
- iii) Establishment of mathematics club should be encouraged in the school.
- iv) Mathematics learning resources like digital technology, library, teaching aid, qualified and enthusiastic teachers should be available and accessible.

- v) The school may organised mathematics competition and incentive must be given to those who achieve high marks in order to motivate them and improve their mathematics learning outcomes.
 - vi) Finding of the study may recommend that care must be taken to encounter and deal with students' learning problems according to their family background.
4. Family Level:
- i) Parents should involve more in their child's mathematics learning by encouraging, motivating, supporting and providing learning environment.
 - ii) Gender stereotypes like males are better than females should be eliminated within families. Parents should not undermine the mathematical abilities of female.
 - iii) Parents should cultivate positive attitude toward mathematics so that it may significantly influence their children's mathematics learning and engagement with the subject.
 - iv) While household chores have significant role in developing a child, parents should allow their children to dedicate more time for learning mathematics.

13. Suggestions for further research

The following have been suggested for further research:

1. The present study was carried out on secondary school students, studying in class X of Mizoram state. Similar study can be carried upon the students of different school stages, different age groups, different educational streams.
2. The present study is limited to the state of Mizoram only. In order to have broader perspective, studies can be conducted on comparative study of Mizoram state and other states.
3. The study can also be conducted on mathematics teacher of elementary and secondary school teachers to know their level of mathematical aptitude.
4. Longitudinal studies can be conducted on how mathematical aptitude and socio-economic status impacts academic achievement in mathematics from elementary education to higher education.

5. Similar study can be conducted to examine the impact of gender stereotypes on mathematics education.
6. Study can be conducted on whether parental involvement have impact on academic achievement in mathematics.
7. Study can be conducted to examine the effects of parental education, income and occupation on students' mathematical development.
8. Study can be conducted on whether targeted intervention can mitigate educational disparities in mathematics performance.
9. Study can be conducted to compare how classroom resources, teacher quality and teaching methods in rural and urban areas affect students' learning outcomes in mathematics.
10. A study on the effects of early childhood mathematics education reduces SES related disparities in mathematics performance.