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FACTORS INFLUENCING MATHEMATICS ACHIEVEMENT AMONG SECONDARY SCHOOL STUDENTS

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Abstract

Mathematics achievement is a key indicator of students' academic success and an essential foundation for higher education and future career development. However, students' performance in mathematics is influenced by multiple interrelated factors that extend beyond cognitive ability. This conceptual paper examines the major factors influencing mathematics achievement among secondary school students from a theoretical perspective. It discusses the role of student-related, teacher-related, family-related, school-related, curriculum, and technology-related factors in shaping mathematics learning and achievement. The paper is grounded in Constructivist Theory, Social Cognitive Theory, and Socio-cultural Theory to explain how these factors influence students' mathematical understanding and performance. The review highlights that positive learning environments, effective instructional practices, learner motivation, parental support, and appropriate educational resources are critical for improving mathematics achievement. The paper concludes with educational implications for teachers, schools, curriculum developers, and policymakers to strengthen mathematics teaching and enhance students' academic outcomes.

Keywords: *Mathematics Achievement, Secondary School Students, Constructivist Theory, Social Cognitive Theory, Socio-cultural Theory, Educational Implications.*

Introduction

Mathematics is a fundamental component of school education that develops logical reasoning, critical thinking, problem-solving ability, and analytical skills. It serves as the foundation for learning in science, technology, engineering, economics, and many other disciplines. At the secondary school level, mathematics achievement is regarded as an important indicator of students' academic competence and preparedness for higher education and future careers. Consequently, improving mathematics achievement has become a major objective of

educational systems worldwide (National Council of Teachers of Mathematics [NCTM], 2000; National Research Council [NRC], 2001). Students' achievement in mathematics is influenced by a combination of cognitive, psychological, social, and environmental factors. Learner characteristics such as motivation, self-efficacy, study habits, and mathematics anxiety, together with teacher effectiveness, parental involvement, school climate, curriculum, and instructional practices, play significant roles in determining academic performance. These factors interact with one another and shape students' learning experiences and achievement outcomes (Bandura, 1997; Hembree, 1990; Ma & Kishor, 1997).

Educational theories provide a meaningful framework for understanding how these factors influence mathematics learning. Constructivist Theory emphasizes that learners actively construct knowledge through meaningful learning experiences, Social Cognitive Theory highlights the role of self-efficacy and observational learning, and Socio-cultural Theory explains the importance of social interaction and collaborative learning in cognitive development. Together, these theories offer valuable insights into the processes that contribute to mathematics achievement (Piaget, 1972; Bandura, 1997; Vygotsky, 1978). Understanding the factors influencing mathematics achievement is essential for improving the quality of mathematics education and promoting effective teaching and learning practices. A theoretical understanding of these factors helps educators identify barriers to students' mathematical learning and adopt appropriate instructional strategies that enhance conceptual understanding, problem-solving skills, and academic performance. It also provides guidance for curriculum developers, teacher educators, school administrators, and policymakers in designing learner-centred mathematics programmes that address diverse educational needs.

The present paper examines the major factors influencing mathematics achievement among secondary school students from a theoretical perspective. By integrating established educational theories and empirical evidence, the paper aims to provide a comprehensive understanding of the determinants of mathematics achievement and their educational implications for improving mathematics teaching and learning.

Need and Significance of the Study

Mathematics is a fundamental school subject that develops logical reasoning, critical thinking, problem-solving ability, and quantitative skills essential for academic achievement and lifelong learning. It serves as the foundation for higher studies in science, technology, engineering,

and mathematics (STEM) and contributes significantly to scientific advancement, technological innovation, and national development (National Council of Teachers of Mathematics [NCTM], 2000; National Research Council [NRC], 2001). Despite its importance, mathematics continues to be one of the most challenging subjects for many secondary school students. Research has consistently reported considerable variations in mathematics achievement due to differences in learners' cognitive abilities, motivation, teaching practices, family support, school environment, and socio-economic conditions (Ma & Kishor, 1997; Hembree, 1990). These findings indicate that mathematics achievement is influenced by multiple interconnected factors rather than by students' intellectual ability alone.

Understanding the factors influencing mathematics achievement is therefore essential for improving educational quality and promoting equitable learning opportunities. A theoretical examination of these factors enables educators to understand how learning theories explain students' mathematical performance and provides a conceptual basis for developing effective instructional strategies. Such an understanding can support teachers in creating learner-centred classrooms, encourage schools to strengthen academic support systems, and assist parents in fostering positive learning environments (Bandura, 1997; Piaget, 1972; Vygotsky, 1978). The significance of this paper lies in its integration of major educational theories with established research on mathematics achievement. By synthesizing theoretical perspectives and empirical evidence, the paper provides a comprehensive understanding of the determinants of mathematics achievement among secondary school students. The insights presented may be useful for teachers, teacher educators, curriculum developers, educational administrators, researchers, and policymakers in designing evidence-based instructional practices and educational interventions that enhance mathematics learning and improve students' academic achievement.

Theoretical Foundations

Theoretical foundations provide a conceptual framework for understanding the factors that influence mathematics achievement among secondary school students. Educational theories explain how learners acquire mathematical knowledge, develop problem-solving abilities, and interact with their learning environment. Among the various learning theories, Constructivist Theory, Social Cognitive Theory, and Socio-cultural Theory offer comprehensive perspectives on mathematics learning and achievement.

- **Constructivist Theory**

Constructivist Theory, proposed by Jean Piaget, emphasizes that learners actively construct knowledge through interaction with their environment rather than passively receiving information. In mathematics education, students develop conceptual understanding by exploring ideas, solving problems, and connecting new knowledge with prior experiences. Teachers act as facilitators by providing meaningful learning opportunities that encourage inquiry, reasoning, and critical thinking. A constructivist classroom promotes active participation, collaborative learning, and reflective thinking, all of which contribute to improved mathematics achievement.

- **Social Cognitive Theory**

Social Cognitive Theory, developed by Albert Bandura, explains that learning occurs through the reciprocal interaction of personal, behavioural, and environmental factors. A key concept of this theory is self-efficacy, which refers to students' beliefs about their ability to perform mathematical tasks successfully. Students with high mathematical self-efficacy demonstrate greater motivation, persistence, and confidence when solving challenging problems. Observation, modelling, constructive feedback, and positive reinforcement from teachers and peers further enhance students' learning and academic achievement in mathematics.

- **Socio-cultural Theory**

Socio-cultural Theory, proposed by Lev Vygotsky, emphasizes that learning is a social process influenced by interaction with teachers, peers, and the surrounding cultural environment. The theory highlights the importance of guided learning, collaborative activities, and the Zone of Proximal Development (ZPD), where learners achieve higher levels of understanding with appropriate support. In mathematics classrooms, discussion, peer collaboration, and teacher scaffolding facilitate deeper conceptual understanding and strengthen problem-solving skills. Consequently, supportive social and classroom environments play a significant role in improving mathematics achievement among secondary school students.

Factors Influencing Mathematics Achievement

Mathematics achievement is a multidimensional outcome influenced by the interaction of individual, instructional, familial, and environmental factors. Students' performance in mathematics is not determined by a single variable but by a combination of cognitive, motivational, social, and educational influences. A comprehensive understanding of these factors

helps educators design effective teaching strategies and create supportive learning environments that enhance students' mathematical competence.

- **Student-related Factors**

Student-related factors play a fundamental role in mathematics achievement. Cognitive ability, prior knowledge, motivation, self-efficacy, study habits, and learning strategies significantly influence students' understanding of mathematical concepts. Learners who possess confidence in their mathematical abilities, adopt effective study practices, and maintain positive attitudes towards mathematics are more likely to achieve higher academic performance. In contrast, mathematics anxiety, low motivation, and poor self-regulation may adversely affect learning outcomes and reduce students' achievement.

- **Teacher-related Factors**

Teachers are key contributors to students' mathematics achievement. Their subject knowledge, pedagogical competence, classroom management, instructional strategies, and assessment practices directly influence students' learning experiences. The use of learner-centred approaches, problem-solving activities, timely feedback, and continuous assessment enhances conceptual understanding and promotes active participation. Supportive teacher–student relationships also foster confidence, motivation, and sustained interest in mathematics.

- **Family-related Factors**

The family provides the first learning environment for children and plays a significant role in their academic development. Parental education, encouragement, involvement in school activities, and the availability of learning resources at home positively influence mathematics achievement. Students who receive academic guidance and emotional support from their families generally demonstrate greater motivation, regular study habits, and higher levels of academic success.

- **School-related Factors**

School-related factors such as school climate, availability of learning resources, qualified teachers, classroom environment, peer support, and academic leadership contribute substantially to mathematics achievement. Schools that promote collaborative learning, provide adequate instructional facilities, and maintain a positive academic culture create favourable conditions for meaningful mathematics learning and improved student performance.

- **Curriculum and Assessment Factors**

A well-designed mathematics curriculum and effective assessment system are essential for promoting achievement. Curriculum content should emphasize conceptual understanding, logical reasoning, problem-solving, and real-life applications of mathematics. Formative and summative assessments help monitor students' progress, identify learning gaps, and enable teachers to provide appropriate instructional support for continuous improvement.

- **Technology-related Factors**

The integration of technology has transformed mathematics education by providing interactive and engaging learning opportunities. Digital learning platforms, educational software, virtual manipulatives, and online assessment tools enhance students' conceptual understanding, visualization skills, and problem-solving abilities. When used appropriately, technology increases learner engagement, supports individualized instruction, and contributes to improved mathematics achievement.

Educational Implications

The theoretical perspectives on mathematics achievement provide valuable guidance for improving mathematics education at the secondary school level. The following implications may help enhance students' learning outcomes and overall academic achievement.

- **Implications for Teachers**

Teachers should adopt learner-centred, activity-based, and problem-solving approaches that promote conceptual understanding rather than rote learning. They should create a supportive classroom environment, provide constructive feedback, encourage active participation, and use continuous assessment to identify and address students' learning difficulties. Regular professional development can further strengthen teachers' pedagogical and technological competencies.

- **Implications for Schools**

Schools should ensure the availability of adequate instructional resources, technology-enabled learning facilities, and a positive academic climate that supports mathematics learning. They should organize remedial programmes, mathematics clubs, and enrichment activities to strengthen students' interest and competence. A collaborative school environment that promotes teacher–student interaction and peer learning can further improve mathematics achievement.

- **Implications for Parents**

Parents should encourage positive attitudes towards mathematics by providing academic support, monitoring study habits, and maintaining regular communication with teachers. A supportive home environment with adequate learning resources and encouragement can increase students' motivation, confidence, and persistence in learning mathematics.

- **Implications for Curriculum Developers and Policymakers**

Curriculum developers should design competency-based mathematics curricula that emphasize conceptual understanding, critical thinking, problem-solving, and real-life applications. Educational policymakers should support teacher training, strengthen school infrastructure, integrate educational technology, and promote equitable access to quality mathematics education. Such initiatives can contribute to improving mathematics achievement and preparing students for higher education and future career opportunities.

Conclusion

Mathematics achievement is a key indicator of students' academic success and plays a significant role in preparing them for higher education, scientific inquiry, and future careers. As discussed in this paper, mathematics achievement is influenced by a combination of student-related, teacher-related, family-related, school-related, curriculum, and technology-related factors. These factors are interconnected and collectively shape students' learning experiences and academic performance. The theoretical perspectives of Constructivist Theory, Social Cognitive Theory, and Socio-cultural Theory provide a comprehensive understanding of how mathematical knowledge is acquired and how learning environments influence achievement. These theories emphasize active learning, self-efficacy, collaboration, and meaningful classroom interactions as essential components of effective mathematics education. Improving mathematics achievement requires the combined efforts of teachers, parents, schools, curriculum developers, and policymakers. Learner-centred instructional practices, supportive learning environments, effective assessment, parental involvement, and the meaningful integration of technology can significantly enhance students' mathematical understanding and performance. Strengthening these educational practices will not only improve mathematics achievement but also equip secondary school students with the knowledge, skills, and confidence required to meet the academic and professional challenges of the twenty-first century.

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