ISSN: 2581-8651
Vol-7, Issue-3, May-Jun 2025
https://dx.doi.org/10.22161/jhed.7.3.1
Peer-Reviewed Journal

Journal of Humanities and Education Development (JHED)

Strategies for Improving Student Achievement in Mathematics in Grade 10 Board Examinations

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Received: 25 Mar 2025; Received in revised form: 28 Apr 2025; Accepted: 01 May 2025

Abstract— *This study looked into the reasons behind the poor mathematics performance i Grade 10 students in one of the Higher Secondary Schools in Dagana, Bhutan, and considers practical ways to raise their academic standing. The study used a qualitative research methodology, gathering data through group discussions involving four mathematics teachers and one-on-one interview with two mathematics teachers' interviews, two classroom observations. It also involved two focused group with 15 students in each group. The results showed that the main issues influencing students' performance were a lack of student engagement, a dependence on conventional lecture-based teaching techniques, restricted access to learning materials, and little parental participation. Students prefer visual aids, real-world applications, and collaborative learning, on the other hand, teachers recognized the importance of interactive teaching strategies. The study suggests improving teaching strategies, using technology, providing more learning materials, and encouraging teacher-student-parent cooperation in light of these findings. The study emphasized how crucial a student-centered approach is to making mathematics more interesting and useful, which will ultimately boost students' self-esteem, ability to solve problems, and success in board exams.*

Keywords— ***Mathematics, Student Engagement, Student-Teacher Interaction, Qualitative, Board Examinations.***

I. INTRODUCTION

One of the core subjects that is essential to students' academic and career success is mathematics. However, many Grade 10 students in one of the higher secondary schools in Dagana find it difficult to achieve the required levels in mathematics, especially when it comes to board examinations. There is still a large discrepancy between their actual efforts and the intended results in spite of numerous interventions. This study seeks to identify the primary causes of this problem and apply focused strategies to improve students' confidence, mathematical proficiency, and general academic achievement. This study intends to enhance student performance and promote a more positive learning environment in mathematics by tackling important issues such inadequate teaching strategies, a lack of practice, and a lack of learning materials.

II. PROBLEM STATEMENT

This study highlights a persistent issue of Grade 10 students consistently underperforming in academics, particularly in mathematics, in one of the higher secondary schools in Dagana, Bhutan. Despite various measures implemented to enhance academic achievement, a significant gap remains between expected and actual performance levels. Many students score poorly in mathematics during board exams, negatively impacting their overall academic standing and limiting their opportunities for higher education. The challenges of mathematics education in Bhutan arise from various interrelated factors. The curriculum from fourth to 12th grade is described as vast, fragmented, and developmentally inappropriate, which hinders effective student engagement and understanding. It is also seen as laborious and prescriptive, limiting teachers' flexibility to adapt lessons to their students' needs (Dorji & Tshering, 2020). Additionally, gaps in teacher training and insufficient educational resources exacerbate these challenges (Dorji & Tshering, 2020).

Addressing these challenges is crucial to improving students' mathematical competency and fostering greater interest in the subject. The studies also recommend addressing the challenges due to the rising concern over low achievement levels in mathematics, which adversely affect students' future academic and career opportunities (Dorji et al., 2021). Similarly, a comparative study on mathematics education in Bhutan and Japan revealed a deficiency in resources such as modern infrastructure, trained educators, and teaching materials, which affects the overall quality of education (Dorji & Ishii, 2022). Therefore, this study aimed to investigate the root causes of this underperformance and propose targeted interventions to enhance students' academic success in mathematics.

III. OBJECTIVES

1. To determine the main issues causing Grade 10 students to perform poorly in mathematics.
2. To put into practice and assess successful teaching techniques that enhance students' understanding and problem-solving skills.
3. To evaluate how specific interventions affect students' performance in mathematics.
4. To create a conducive learning environment that encourages student engagement.
5. To provide practical recommendations for long-term enhancement of mathematical performance.

IV. PRIMARY RESEARCH QUESTION

What techniques and approaches can help improve students' mathematics performance in board examinations?

Sub Questions

1. How is the learning of mathematics enhanced by interactive teaching methods?
2. How might consistent practice improve mathematical performance?
3. How might self-assurance and motivation increase student involvement?
4. How do technology and educational materials affect test scores?

V. LITERATURE REVIEW

5.1 Students' Study Habits for Performance in Board Examinations

Developing efficient study habits is essential to achieving the best possible results on board exams. Studies confirm that retrieval practice and spaced repetition, two active learning strategies, work much better than passive ones. Compared to merely rereading, Dunlosky et al. (2013) assert that self-testing, in which students actively recollect material, improves long-term retention and understanding. Similarly, spaced repetition – reviewing content at progressively longer intervals – improves memory consolidation and decreases forgetting (Cepeda et al., 2006).

Effective study habits require setting clear goals, keeping track of progress, and employing self-reflection to enhance learning processes, as highlighted by Zimmerman's (2002) work on self-regulation. Students in these cognitive practices are more adept at time management and problem-solving.

In addition, Cavanagh (2019) points out that while some students find structured study programs beneficial, others may find more adaptable, individualized techniques to be more successful. This variety highlights the necessity for flexible study methods that take into account each student's unique demands and learning preferences.

5.2 Practices for Effective Study and Performance

Improving a student's success on board exams requires effective study techniques. Increased long-term retention can be achieved by retrieval practice, in which pupils frequently recollect knowledge. Retrieval practice helps students remember material better during exams and helps them retain their knowledge, as noted by Roediger and Butler (2011).

Another important strategy is to practice exams. Practice exams enable students to become comfortable with exam formats and reinforce learning through repeated retrieval, as shown by Pyc and Rawson (2009). This strategy helps to improve performance and lessen exam anxiety. It is also helpful to encourage students to elaborate on why something is true, a strategy known as "elaborative interrogation." According to Wade et al. (1999), this strategy improves memory retention and fosters deeper understanding. Brewster and Fager (2000) also stress the significance of creating a comfortable study environment. Calm, well-organized areas improve concentration and productivity, and incorporating technology, like educational applications, can result in dynamic, captivating learning opportunities (Johnson et al., 2016).

However, the review identifies several challenges in Bhutan's STEM education, including socioeconomic disparities that restrict access to quality education in rural areas, resource shortages, and an overemphasis on test scores that leads to rote memorization. Additionally, the reliance on traditional, authoritarian teaching methods stifles student engagement and learning. These issues highlight the need for reforms and professional development to improve STEM education quality in Bhutan (Wangmo, 2024).A misalignment between the curriculum and classroom processes hinders effective

learning, and students who struggle with English perform worse overall (Dorji & Ishii, 2022).

VI. CHALLENGES INHABITED AMONGST THE STUDENTS

There exist multiple obstacles that students must overcome to achieve well on board exams. Exam anxiety is a major problem that can affect cognitive processes and lower test performance. Zeidner (1998) discusses a number of studies that show poor exam scores are linked to high levels of test anxiety, indicating that anxiety management strategies may help.

Moreover, students' attitudes and perceptions towards mathematics significantly impact their performance, with positive perceptions fostering greater engagement and effort in learning the subject (Dorji et al., 2021). There are also the extra hurdles of time management and good study abilities. According to Zimmerman (2000).

6.1 Support Mechanisms to Enhance Academic Performance

Support mechanisms are essential for improving students' performance in board exams. A teacher's ability to provide students with formative assessment and tailored feedback greatly enhances their performance. According to Hattie and Timperley (2007), children perform better when they receive regular, constructive feedback that enables them to see their areas of strength and growth. Peer study groups provide cooperative learning opportunities that enhance comprehension and retention (Boud et al., 2001).

Support on both an emotional and psychological dimension is crucial. According to Conley (2008), students' performance can be improved by participating in stress management and resilience programs, which can help them manage the stresses of board exams. Student performance can be greatly enhanced by offering a supportive atmosphere that incorporates counseling and stress-reduction strategies.

VII. RESEARCH INTERVENTIONS

The study used a set of targeted interventions to improve student performance in mathematics. These interventions include:

7.1 Interactive Teaching Methods

Active learning approaches (e.g., collaboration, peer tutoring, inquiry-based learning) were discussed with the goal of shifting from lecture-based instructional methods toward student-centered learning.

7.2 *Regular* Practice *and Problem-Solving Sessions*

A systematic program of practice activities taking account of previous board examination questions as well as real-life problem-solving scenarios were implemented. Weekly math drills and revision exercises were undertaken to reinforce learning methods.

7.3 Confidence-*Building and Motivational Strategies*

Motivational classes, goal setting and positive reinforcement methods are used to address the student's lack of confidence in mathematics. Teachers provide positive feedback and celebrate a student's little academic progress.

7.4 Use of Technology and Supplementary Learning Resources

Computerized Mathematical Software Online Tutorials and Digital Learning Computerized visual aids (graphs, simulations and video lesson) were used to boost the theoretical content, adding visual, contextual information.

VIII. METHODOLOGY

8.1 Research Design

Using a classroom action research (CAR) methodology, this study looked into practical methods and approaches for raising Grade 10 students' board exam scores in mathematics. Action research is preferred because it enables real-world classroom reflection, ongoing evaluation, and practical interventions. The study employed a cycle of preparation, action, observation, and reflection to put strategies into practice and assess how they affect the learning outcomes of students.

8.2 Sample and Sampling

The study was conducted at one of the higher secondary schools in Dagana, Bhutan. The participants include 30 Grade 10 students who have demonstrated consistent difficulties in mathematics. The sample comprises students with varying levels of proficiency to assess how different interventions affect different learning abilities. Additionally, two mathematics teachers and one school administrator were included to provide insights into instructional strategies, curriculum effectiveness, and administrative support.

IX. DATA COLLECTION METHOD

To collect thorough data, a qualitative method was used. The following instruments were employed to gather data:

9.1 Classroom Observation

Students' participation, engagement, and reaction to the strategies used are evaluated by routine observations.

Teaching strategies, student relationships, and approaches to problem-solving are the main topics of the observations.

9.2 Interview

Students were interviewed in a semi-structured manner to get their opinions on how well various strategies work. These resources help in comprehending the viewpoints, self-assurance, and difficulties that kids have when learning mathematics.

9.3 Teacher Interview and Focused Group Discussion

Mathematics Teachers teaching in grade 10 were interviewed one-on-one in order to learn more about their experiences using various teaching methods. Moreover, Teachers' teaching mathematics in other grades were also called for focused group discussion to aid in improving the treatments by drawing on their combined knowledge and experiences.

X. ETHICAL CONSIDERATIONS

Strict adherence to ethical guidelines was maintained to guarantee both the participants' welfare and the validity of the study. Teachers and students were fully told about the goal of the study before giving their informed consent. Anonymizing participant names and safely preserving all data to preserve their privacy helped to ensure confidentiality. Since participation was completely voluntary, neither teachers nor students would be penalized for dropping out at any time.

XI. LIMITATIONS OF THE STUDY

The study has several limitations even though it has shown that the intervention have an impact on students' mathematics learning. The results may not apply to other classes because the study was limited to class 10 students at one of the southern region's higher secondary schools in Bhutan. Since the study is limited to a single academic term, a long-term evaluation of the intervention's effectiveness is not feasible. External elements unrelated to the subject, such as parental support, psychological motivation, and numerical background, may have an impact on students' performance.

XII. ACTION PLAN AND IMPLEMENTATION

To ensure methodical intervention and data collection, the study followed to a planned implementation timeframe. Writing the research proposal, which took place between June 1, 2024, and August 10, 2024, involved reviewing research articles, speaking with experts, and conducting an initial literature appraisal. On August 10, 2024, the proposal was submitted to the Dzongkhag HR for approval; on August 15, 2024, further, it was sent to the Ministry of Education and Skills Development (MoEDS). From September 15, 2024, to November 30, 2024, data was gathered with the use of defined methodology, relevant software, and expert consultations. Following this, data analysis was conducted using the proper analytical techniques from December 1, 2024, to January 30, 2025. Following a particular format and style, the research paper was written between February 1, 2025, and February 27, 2025, and then submitted for peer review. From March 1, 2025, to March 15, 2025, necessary changes were made in response to reviewers' feedback.

XIII. DATA ANALYSIS

Using a qualitative data analysis methodology, this study triangulated data through group discussions, teacher and student interviews, and classroom observations. The study ensured a thorough understanding of the elements influencing students' performance in mathematics and found practical approaches for improvement by cross-analyzing these data sources. The findings revealed a number of recurrent issues regarding *resource availability*, *teaching methods*, *learning challenges*, and *student engagement.*

13.1 Resource Availability

This study found that inadequate access to additional learning resources was a persistent problem. Teachers stated that many classrooms lacked digital learning tools, manipulatives, and visual aids. They noted that most lessons relied heavily on textbooks because resources such as projectors, interactive software, and workbooks were unavailable. Some teachers emphasized that if they had access to visual aids and technology, they could make lessons more engaging and effective for students.

Similarly, student interviews revealed that many students depended entirely on their textbooks, as no additional practice materials were available. Some students expressed frustration over the lack of extra worksheets and learning tools, while others mentioned that they struggled with unreliable internet access when trying to use online resources. During group discussions, students agreed that having access to additional printed worksheets, visual aids, and videos on math topics would significantly improve their learning. They suggested that setting up a digital learning center or improving the school library with more math-related resources would provide better opportunities for practice. These findings suggest that improving resource availability through technology integration and supplementary materials could enhance students' mathematical comprehension and performance.

13.2TEACHING METHODS

Observations in the classroom showed that traditional lecture-based teaching remained the dominant method of instruction. Most lessons followed a teacher-centered approach, where instructors explained concepts, solved problems on the board, and assigned exercises. While this method was sometimes effective, it limited student engagement and opportunities for active learning. There were few chances for students to explore concepts independently, participate in discussions, or engage in practical exercises.

Teacher interviews confirmed this reliance on board and textbook-based instruction. Teachers acknowledged that they primarily explained concepts while students took notes, leaving little room for exploration or discussion. Some stated that they wanted to use interactive teaching strategies such as inquiry-based learning and group problem-solving but lacked the necessary training and resources. Others mentioned that technology-based solutions could improve instruction but emphasized that schools needed better access to tools like projectors, educational software, and digital platforms.

Students also expressed their preferences during group discussions. They indicated that simply listening to lectures and copying from the board made it difficult to understand mathematical concepts. Many felt that real-life examples, step-by-step explanations, and visual aids such as diagrams and videos would make lessons more engaging. Others suggested that working in small groups or discussing problems together would help them understand concepts better instead of relying solely on teacher explanations. These findings highlight the need for a more student-centered teaching approach that fosters conceptual understanding and active participation through interactive strategies and technology-based learning tools.

13.3LEARNING CHALLENGES

The study found that inconsistent practice was a significant challenge affecting student performance. Classroom observations showed that rather than understanding mathematical concepts, many students relied on rote memorization. When asked to explain formulas, students often struggled to articulate their purpose and simply repeated them without comprehension. Teachers noted that this made it difficult for students to apply formulas to different types of problems, as they focused more on memorization than on understanding underlying concepts.

Teacher interviews further revealed that students rarely engaged in problem-solving activities outside of the classroom. Educators pointed out that many students only practiced math when given specific homework assignments, and even then, they often copied from their peers rather than attempting to solve problems independently. Some teachers observed that students in hostels had dedicated study hours but did not always use them for mathematics, instead choosing to focus on subjects they found easier.

Student interviews indicated that many students wanted to improve in mathematics but lacked guidance on how to practice effectively. Some admitted that they only worked through textbook problems and wished for additional worksheets or structured exercises to reinforce their understanding. Others mentioned that household responsibilities made it difficult to dedicate enough time to practice math. These findings suggest that providing structured practice materials, guided study sessions, and opportunities for independent problem-solving could help students develop a deeper understanding of mathematical concepts.

13.4STUDENT ENGAGEMENT

Classroom observations revealed a low level of student participation in math lessons, with many students reluctant to contribute, especially when solving problems on the board. Only a few actively answered questions, while most remained silent. Teachers mentioned that students hesitated to speak up due to fear of making mistakes in front of their peers. They also pointed out that a lack of confidence in explaining their reasoning often led to passive learning.

Student interviews further confirmed that many students perceived mathematics as difficult and stressful, with some admitting that they felt anxious during tests because they struggled to understand certain concepts. Others said that while they enjoyed some topics, they lost confidence when they encountered more challenging problems. Group discussions revealed that many students preferred staying quiet rather than risking embarrassment by giving an incorrect answer. Some students explained that they avoided participating in class to prevent making mistakes in front of others. These findings highlight the need for a supportive learning environment that builds student confidence and encourages active participation in mathematics.

XIV. DISCUSSION ON THE KEY FINDINGS

According to this study the use of traditional teaching methods, a lack of resources, low student engagement, little parental involvement, and bad study habits are some of the main causes of students poor mathematics performance,

14.1 Traditional Teaching Methods and Student Engagement

The prevalence of lecture-based teaching in math classes, as this study found, limited opportunities for active learning and student participation. The aforementioned finding aligns with Wangmo's (2024) claim that Bhutanese classrooms' dependence on conventional, teacher-centered approaches restricts students' engagement and understanding of concepts. Students are not encouraged to investigate mathematical concepts on their own, which makes the lack of inquiry-based learning and group problem-solving even worse. Elaborative interrogation and problem-based learning are two examples of interactive teaching strategies that have been shown to dramatically improve student involvement and comprehension (Wade et al., 1999). Roediger and Butler (2011) also highlight the value of retrieval practice, which might be incorporated into classes to enhance long-term memory and lessen the need for rote memorization.

14.2 LIMITED access to Learning Resources

According to the study, a large number of students only used textbooks, having little to no access to additional learning resources including technology-based resources, practice worksheets, or visual aids. This supports the findings of Brewster and Fager (2000), who stress the importance of a well-equipped learning environment, including digital tools and organized study materials, in enhancing students' focus and academic achievement. Additionally, Johnson et al. (2016) contend that using interactive learning platforms and other educational technologies improves student engagement and gives them access to a wider variety of learning opportunities. According to Wangmo (2024), the lack of these resources in Bhutanese schools still makes it difficult to teach mathematics effectively.

14.3 ANXIETY during tests and a lack of confidence

This study brought to light a number of important issues, including students anxiousness before tests, lack of confidence, and fear of mathematics. Many students said they had trouble understanding abstract ideas and would rather be quiet in class than take the chance of making a mistake. This is consistent with Zeidner's (1998) research, which showed that elevated test anxiety impairs cognitive functions and results in poorer academic achievement. According to Dorji et al. (2021), students' attitudes and views of mathematics also affect how engaged and motivated they are to learn the subject. Students' confidence in mathematics can be greatly increased by addressing these psychological obstacles with stress management techniques and positive reinforcement (Conley, 2008).

14.4 External Support and Parental Involvement

The study found that students receive little academic help outside of the classroom, and parents are not very involved in mathematical instruction. This result is consistent with that of Dorji and Ishii (2022), who found that low student performance in Bhutanese schools was caused by a misalignment between home support and classroom instruction. Additionally, McCormick and McCormick (2001) point out that academic difficulties are more common among students who have low self-efficacy and little external motivation. According Boud et al. (2001), offering structured academic support through peer study groups and tutoring programs could help close this gap and enhance student performance.

14.5 Study Habits and Academic Performance

Another significant problem identified in this study was the lack of regular practice among students. In order to understand mathematical topics, many students resort to rote memorization, which was made worse by a dearth of opportunities for guided practice. Active learning techniques like retrieval practice and spaced repetition have been shown to dramatically improve retention and understanding (Dunlosky et al., 2013; Cepeda et al., 2006). Furthermore, practice tests allow students to become accustomed to test forms and reinforce learning by repeated retrieval, which may lessen students' difficulties with mathematics, according to Pyc and Rawson (2009). In Bhutanese schools, putting these research-based tactics into practice could boost student achievement and reduce their dependency on memory.

14.6 Overcoming These Challenges

A number of interventions need to be taken into consideration in order to enhance mathematics instruction and student performance. According to research, technology-based learning, individualized learning plans, and well-structured revision programs can improve student outcomes (Lamb & Ritchie, 2014; Chen et al., 2015). Additionally, Schunk and Zimmerman (2007) stress the need of individualized academic support, which guarantees that students get the direction they require to overcome learning challenges. According to Zimmerman (2002), students can improve their study habits and time management abilities by being encouraged to use self-regulation and metacognitive techniques.

Overall, the study's findings are consistent with previous studies on successful teaching strategies and the difficulties math students face. Better learning outcomes and higher board test scores can result from addressing these problems using interactive teaching strategies, more readily available resources, psychological support, and organized academic interventions.

XV. RECOMMENDATION FOR IMPROVEMENT

Using interactive teaching strategies like inquiry-based learning and collaborative problem-solving is crucial to raising mathematical (Schunk & Zimmerman, 2007). These techniques should be taught to teachers, and visual aids should be used to help students understand. Students can improve their retention of knowledge by developing better study habits through retrieval practice and spaced repetition (Dunlosky et al., 2013). Independent learning will be supported by addressing resource constraints by offering additional technology and printed materials, as well as peer study groups and tutoring programs (Boud et al., 2001). Improved academic achievement will also result from encouraging self-reflection, controlling exam anxiety, involving parents, and enhancing the bonds between teachers and students (Dorji & Ishii, 2022). These strategies can help students learn in a more supportive environment.

XVI. CONCLUSION

This approach gives an organized structure for methodically investigating and addressing the mathematical difficulties encountered by Grade 10 students. The study intends to create workable, evidence-based solutions to raise student accomplishment on board exams by combining a variety of data collection techniques, focused interventions, and in-depth qualitative analysis. The results will help teachers improve their methods and give kids a better education, which will increase their confidence and proficiency in mathematics.

ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude to all those who have supported and assisted me throughout the course of this research. My sincere thanks go to Dr. Kezang Sherab, Associate Professor at Paro College of Education, who served as my sole supervisor. His unwavering guidance, insightful feedback, and meticulous corrections were instrumental in shaping this research. Without his support, this work would not have reached its present form. I am also deeply grateful to Mr. Dil Bdr. Mongar, a teacher at Gesarling Central School, for serving as the second reader. His thorough proofreading and valuable suggestions significantly contributed to the improvement of this study. My appreciation also extends to Mr. Kinzang Lhendup, Assistant Professor at Paro College of Education, and Mr. Pasang Dorji, teacher at Gesarling Central School, for their encouragement and thoughtful advice throughout the research process.

Lastly, but by no means least, I would like to thank my wife, Changa Lhamo, and our four children for their unwavering moral support and understanding, which greatly motivated me to complete this work

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