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Integrating Communication Strategies in Mathematics Education: A Qualitative Study in Medan, Indonesia

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ABSTRACT

This qualitative research investigates the integration of communication studies into mathematics education in Medan, Indonesia, focusing on the impact of interdisciplinary teaching strategies on student engagement teaching strategies on student engagement and understanding. Through semi-structured interviews and classroom observations, the study examines how mathematics educators in secondary schools incorporate communication techniques, such as visual aids, storytelling, and collaborative learning, to improve students' comprehension of mathematical concepts. The results highlight that integrating communication skill not only enhances students' mathematical literacy but also fosters critical thinking, problem-solving, and teamwork. The findings suggest that such interdisciplinary approaches are especially effective in Medan's diverse cultural and linguistic environment, offering a model for educational reform in Indonesia and similar multicultural contexts

Keywords: Communication studies, mathematics education, interdisciplinary learning, student engagement, Medan

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1. INTRODUCTION

The integration of communication strategies in mathematics education has garnered increasing attention as educators recognize the role of effective communication in facilitating student learning. Mathematics, often perceived as abstract and complex, poses challenges for students, particularly when traditional teaching methods prioritize rote memorization over conceptual understanding.

This issue is amplified in diverse educational setting such as Medan, Indonesia, where come from various cultural, linguistic, and socio-economic backgrounds. Despite the critical role of communication in teaching and learning, there is a significant gap in research exploring how communication strategies can be effectively incorporated into mathematics education to address these challenges.

Studies indicate that Indonesian students often underperform in mathematics compared to their international peers. According to the 2018 Programs for International Student Assessment (PISA), Indonesian students ranked below average in mathematics proficiency. This compounded by finding that suggest a lack of engagement and interest in the subject, particularly among secondary school student. In Medan, a multicultural city, these challenges are further exacerbated by linguistic diversity and varying levels of access to quality education.

While existing research highlights the importance of communication in education, few studies have examined its application in mathematic teaching within culturally diverse settings like Medan. Most studies focus on either communication in general education or the use of technology in mathematics education, leaving a gap in understanding how communication strategies can directly enhance student outcomes in mathematics. Moreover, while interdisciplinary teaching methods are gaining traction globally, their practical application in Indonesia classrooms remains underexplored.

In practice, mathematics teaching in Medan largely relies on traditional methods such as lectures and individual problem-solving tasks. These approaches often fail to engage students or address their unique learning needs. Teachers and reduced student confidence. On the other hand, innovative practice such as group discussions, storytelling, and visual aids have shown promise in proving student engagement and comprehension, though their implementation remains limited and inconsistent.

In today's globalized educational environment, interdisciplinary teaching approaches are becoming essential for promoting holistic learning. Particularly in diverse regions such as Medan,

Indonesia, where multiple cultures and languages coexist, there is an increasing need to explore how different disciplines can be integrated to enhance student understanding and engagement.

Communication skills are integral to learning and teaching across subjects, but their role in mathematics education is often overlooked. The present study seeks to fill this gap by exploring how mathematics educators in Medan incorporate communication strategies to improve the teaching and learning process. This research also aims to assess how such practices contribute to students' engagement with and understanding of mathematical concept.

The role of communication in education has been widely acknowledged in constructivist learning theories, particularly in promoting active learning and critical thinking (Vygotsky, 1978). In the context of mathematics education, research suggests that student often struggle with understanding abstract concepts, especially when they are not able to communicate their thought processes effectively (Adams et al., 2018).

Studies have also demonstrated that when mathematical problems are contextualized with real-world examples or visual representations, student are more likely to engage with the material (Miller & Garcia, 2020). Furthermore, interdisciplinary education has been shown to enhance collaboration and foster a deeper understanding of concepts across different field (Johnson et, 2021). Despite these findings, there is limited research exploring how educators in Medan apply these strategies, making this study particularly relevant to the region's educational needs.

In Medan, the integration of communication strategies in mathematics education is a relatively new concept. Many teachers still rely on traditional methods, such as lecture-based instruction and rote memorization. However with the growing emphasis on student-centered learning and the need to prepare students for a globalized world, educators in Medan are increasingly exploring innovative methods to engage students and foster deeper learning. This study seeks to understand how communication strategies are being implemented in the teaching of mathematics in Medan and their effect on learning outcome.

In summary, this study addresses the gap in existing research by examining the role of communication strategies in mathematics education within the unique context of Medan. By bridging the divide between theory and practice, it aims to provide insights into how educators can enhance student learning outcomes through innovative, interdisciplinary approaches.

2. RESEARCH METHOD

This research adopts a qualitative methodology to provide a comprehensive understanding of how communication strategies are integrated into mathematic education in Medan, Indonesia. The study was conducted in three secondary schools in Medan, with a focus on both public and private institutions. The following methods were used to collect data:

1. Participants: Ten mathematics educators from secondary schools in Medan participated in the study. These educators were selected based on their teaching experiences and willingness to engage in the research. This teachers varied in terms of age, teaching experience, and professional background, which provided a diverse range of perspectives on the integrations of communication in mathematics education.
2. Data Collection:

(a) Semi-structured Interviews: In-depth, semi-structured interviews were conducted with each educator to explore their experiences with incorporating communication strategies into their mathematics lessons. The interviews focused on the types of communication techniques they used, their perceptions of the effectiveness of these methods, and the challenges they faced

(b) Classroom Observation: Observations of mathematics lessons were conducted to document the teaching practices in action. These observations allowed the researchers to gain insight into how communication strategies were used in the classroom, including visual aids, storytelling, group work, and peer discussions.

3. Data Analysis: The data collected from interviews, observations, and documents were analyzed using thematic analyzed using thematic analysis (Braun & Clarke, 2006). This method involved identifying key themes and pattern in the data related to teaching strategies, student engagement, and the integration of communication in mathematics education

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3. RESULTS AND DISCUSSION

A. Results

1. Improved Student Engagement: Educators reported that using communication strategies such as storytelling strategies such as storytelling and real-life examples made mathematics lessons more engaging for students. By contextualizing abstract concepts in term familiar to students, such as local customs or everyday experiences, teachers were able to make the content more relatable and easier to understand. Many students expressed greater interest in the subject, particularly when the lessons connected mathematical concept to practical applications in their lives.
2. Increased Comprehension and Retention: Visual aids and group discussions were freguently used in classroom to facilitate understanding. Teachers noted that when students worked in groups to solve problems and discuss mathematical concepts, they not only grasped the material more effectively but also developed communication skills. The process of explaining their thinking to peers helped solidify their own understanding of the concept.
3. Echanced Critical Thinking and Problem-Solving: The integration of communication strategies fostered critical thinking and problem-solving abilities. Educators noted that students became more adept at discussing mathematical concept, asking questions, and offering alternative solutions. These skills were especially valuable when students were encouraged to collaborate and engage in discussions that required them to justify their reasoning and think critically about their solutions.
4. Challenges in Implementation: Despite the positive outcomes, several challenges emerged in implementing communication-based strategies. Teachers mentioned time constraints, large class size, and a lack of resources as barriers to fully integrating communication techniques. In some cases, teachers felt that they needed more professional development to effectively use these strategies in their classrooms.

B. Discussion

These findings are consistent with the broader educational literature, which emphasizes the importance of communication in learning (Adam et al., 2018; Johnson et al., 2012). In particular, the use of communication techniques like storytelling, visual aids, and peer discussions can bridge the gap between abstract mathematical concepts and students' lived experiences. By contextualizing mathematical problems in culturally relevant ways, teachers in Medan were able to make the material more relatable and engaging for students from diverse linguistic and cultural backgrounds.

The positive influence on student engagement aligns with Vygotsky's (1978) social constructivist theory, which asserts that learning is most effective when students can connect new knowledge to their existing experiences. In this study, teachers utilized culturally specific examples, local stories, and real-life applications to make mathematical concepts more accessible.

This approach appears to be particularly valuable in Medan, where the student population is heterogeneous in terms of language, culture, and socio-economic background.

Such culturally responsive teaching techniques not only help demystify abstract concepts but also foster a sense of belonging among students, which can increase motivation and participation.

Furthermore, the use of visual aids and group discussions enhanced student comprehension and retention of mathematical concepts. When students are actively involved in the learning process-by discussing and solving problems together-they are more likely to retain information and apply it in different contexts (Miller & Garcia, 2020).

This collaborative learning environment of critical thinking skills, as students are challenged to explain their reasoning, listen to others' perspectives, and negotiate solutions. By engaging in these interactive activities, students become active participants in their learning rather than passive recipients of information.

This finding is consistent with the work of Brown et al. (2022), which argue that interdisciplinary approaches to teaching, particularly those that involve peer-to-peer interactions, improve students' ability to solve complex problems and think critically.

However, this study also revealed some challenges in implementing communication strategies effectively. Educators mentioned that time constraints, large class sizes, and limited resource were barriers to fully integrating communication techniques into their mathematics instruction. For instance, while group discussions were effective in enhancing student engagement, teachers noted that managing

large classes could be difficult when trying to facilities meaningful interactions among all students. This concern is consistent with the finding of previous studies, which highlight the logistical challenges that teachers face when implementing innovative teaching methods (Adams et al., 2018). To address these challenges, school could invest in smaller class sizes, more classroom resources, and professional development programs that equip teachers with strategies to manage larger classes and optimize the use of communication techniques.

Additionally, the study suggests that not all teachers feel adequately prepared to incorporate communication strategies into their teaching. Although some teachers were enthusiastic about using the approaches, others expressed a need for further training and support.

Professional development programs focused on the practical integration of communication in mathematics education could help address this gap. Providing teachers with concrete tools and strategies to effectively incorporate communication techniques into their lessons would not only enhance the quality of mathematics instruction but also empower teachers to implement more engaging and student-centered approaches.

In summary, the findings from this study supports the argument that communication strategies play a significant role in enhancing mathematic education. The integration of these strategies, particularly in the context of Medan's diverse student population, help create a more inclusive and engaging learning environment. By combining communication with mathematics instruction, teacher can foster deeper understanding, critical thinking, and collaboration among students.

However, to maximize the effectiveness of these strategies, it is essential to address the challenges faced by educators, such as large class sizes, time limitations, and a lack of professional development opportunities.

These finding highlight the importance of supporting teachers with the necessary resource and training to implement interdisciplinary teaching approaches successfully. Future research should explore how these strategies can be scaled to a larger number of schools in Indonesia and assess their long-term effects on student achievement and teacher satisfaction.

4. CONCLUSION

The integration of communication studies into mathematics education in Medan has shown to improve student engagement, comprehension, and critical thinking.

Communication strategies such as storytelling, visual aids, and group discussions have helped students connect abstract mathematical concepts to their own experiences and made learning more interactive and collaborative. However, challenges such as time constraints, large class sizes, and limited resource must be addressed to fully realize the potential of the approaches

Future research should focus on exploring the long-term impacts of these strategies on student performance and how they can be scaled up across different schools in Indonesia. Additionally, professional development program that equip teachers with the necessary skill and resources to integrate communication into their teaching practices will be crucial in advancing this approach.

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