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## TEACHER ADAPTABILITY AS A CATALYST FOR MATHEMATICS LEARNING IN RESOURCE-LIMITED CLASSROOMS: A QUALITATIVE STUDY IN TIMOR-LESTE

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### ABSTRACT

This study examines mathematics teaching practices in secondary schools in Timor-Leste, where limited technology, strict regulations, and changing student learning habits challenge effective instruction. Using a qualitative descriptive approach with semi-structured interviews, the study identifies key classroom strategies, including discussion-based learning, playful activities to maintain focus, and a balance between explanation and practice to manage cognitive load. While collaborative methods enhance participation and peer support, limited self-study habits and restricted access to digital tools hinder deeper learning. Teachers address these constraints through interactive, manual approaches and by contextualizing mathematics in everyday situations. The study highlights teacher adaptability as the primary driver of student engagement and understanding in resource-limited settings, offering insights applicable to similar educational contexts globally.

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## INTRODUCTION

Mathematics remains one of the most essential subjects in secondary education, serving as a foundation for logical reasoning, problem-solving, and the development of analytical skills necessary for both academic success and everyday life. However, in many contexts, including Timor-Leste, mathematics learning is often challenged by students' lack

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of motivation, inconsistent study habits, and limited access to technological resources. These challenges require teachers to adopt flexible, context-sensitive instructional approaches that go beyond simple content delivery. As (2024) and Rahman (2024) assert, learning is most effective when it occurs within social interactions that bridge a learner's current abilities and their potential for development through collaboration and scaffolding. This perspective highlights the importance of teaching methods that actively engage students in constructing meaning rather than passively receiving information.

Globally, researchers have emphasized the role of active learning in mathematics education, which involves problem-solving, discussion, and collaborative tasks that foster deeper understanding (Lombardi & Shipley, 2021; Nilimaa, 2023). In this study's context, discussion-based learning emerged as a central strategy, enabling students to clarify concepts, share problem-solving approaches, and support one another's learning. Such cooperative practices are supported by Tumpa et al. (2022), who argue that group-based tasks increase motivation and achievement through peer accountability and shared goals.

Despite the benefits of interactive learning, the findings also reveal persistent barriers. Students often do not review material outside of school, which, according to Schoenfeld (2022), limits their capacity to internalize knowledge and develop independent learning skills. Moreover, resource constraints and school regulations prohibiting the use of digital devices limit the applicability of Liu's (2024) argument that combining visual and verbal inputs enhances comprehension. In response, teachers rely on manual methods, practical examples, and classroom games to sustain attention, approaches that align with Bureau et al. (2022), which stresses the need to satisfy students' psychological needs for competence, autonomy, and relatedness to promote intrinsic motivation.

The novelty of this study lies in its contextual grounding: it captures how mathematics teachers in Timor-Leste navigate instructional challenges by adapting their pedagogy to resource-limited environments while still fostering engagement and understanding. By focusing on teachers' authentic voices, this research provides insights into how adaptable teaching methods, rather than technological integration, serve as the primary drivers of student participation and comprehension in such settings. These findings contribute to the broader discourse on mathematics education in developing contexts, offering evidence that teacher adaptability, grounded in sound

pedagogical theory, can effectively compensate for structural limitations.

## **METHOD**

This study adopted a qualitative descriptive design to explore mathematics teachers' perspectives and experiences regarding their instructional practices, student engagement, and classroom challenges. The qualitative approach was chosen to capture rich, detailed insights that quantitative methods might overlook, allowing for an in-depth understanding of teachers' reflections in their own words. The research was conducted in a secondary school context, where mathematics teachers were directly involved in daily classroom interactions and could provide firsthand accounts of teaching strategies, student behaviors, and factors influencing learning outcomes.

Data were collected through semi-structured interviews, allowing teachers to elaborate on their responses while ensuring that all key topics related to the study's objectives were covered. The interview guide consisted of open-ended questions focusing on teaching methods, student attitudes, observed difficulties, motivational strategies, assessment practices, and areas for improvement in mathematics learning. This method allowed participants to share their experiences authentically, providing both factual descriptions and personal interpretations.

Each interview was conducted face-to-face in a quiet setting to ensure comfort and confidentiality, with the sessions recorded and later transcribed for analysis. Participants were selected through purposive sampling, targeting mathematics teachers with relevant teaching experience and familiarity with the student population under study. Ethical considerations were strictly observed, with informed consent obtained from all participants and assurances that their identities would remain anonymous.

The data analysis process followed thematic analysis principles, in which interview transcripts were repeatedly read to identify recurring patterns, emerging themes, and significant insights. Coding was conducted manually, grouping similar ideas to form broader categories that directly addressed the research questions. This iterative process enabled constant comparison of participants' responses, ensuring that the findings reflected both shared experiences and unique perspectives. The data's credibility was enhanced through member checking, in which selected participants reviewed summaries of their responses to confirm

accuracy and authenticity.

By combining detailed narrative accounts with systematic thematic analysis, this research method provided a comprehensive understanding of mathematics teaching practices in the selected context. It allowed the teachers' voices to guide the interpretation of the findings, ensuring that the conclusions were grounded in the lived realities of classroom practice.

## RESULT AND DISCUSSIONS

The findings of this study, drawn from semi-structured interviews with secondary school mathematics teachers in Timor-Leste, reveal how teachers navigate instructional challenges in resource-limited classrooms. A prominent approach identified is discussion-based learning, where students collaboratively solve exercises and ask questions when encountering difficulties. One teacher explained,

*"The method used in teaching is discussion-based, as in exercises, where each student can ask questions when they feel confused. We adopted this method because students now solve exercises, and when they find them difficult, they leave them unfinished. That is why we decided to have them discuss during the exercises" [M1].*

This approach aligns with Mulaudzi (2025), which emphasizes that learning occurs most effectively through social interaction and scaffolding within the Zone of Proximal Development. Teachers also employed additional strategies such as pre-tests, brief explanations, and prepared photocopied materials to address students' needs. One teacher noted,

*"During this time, we use different methods, such as a pre-test before class to review previous material, and then we use another method, like giving a short explanation immediately. But students often do not write, so we change the method: they photocopy the material that has been prepared" [M2].*

Time constraints sometimes limited coverage of all subtopics, reflecting principles from Skulmowski & Xu (2022), which suggest that overloading students

with content can reduce comprehension. Students' responses to these methods were generally positive. Collaboration was reported to make exercises easier and increase engagement. As one teacher described,

*"The general behavior of students when using this method... we see a slight change because students, when solving together, feel it is easier since they complement each other" [M1].*

This observation aligns with Zhu et al. (2024), which posits that group-based learning enhances motivation and achievement through peer accountability (Atmoko et al., 2022; da Costa et al., 2019). Nevertheless, teachers noted challenges related to students' self-study habits. As one participant stated,

*"Common difficulties students encounter include hearing the explanation but not reviewing it at home... most students are less diligent in studying and lazy to read the material they have copied" [M2].*

These findings are consistent with Manuel & Jeyanthi (2024), highlighting the importance of independent study for deeper learning. Observations of classroom behavior indicated varying levels of engagement. Some students demonstrated focus and enjoyment, especially during activities such as small games or number-guessing exercises:

*"During learning activities, after explaining, we ask again to keep their concentration. When they do not understand, we play a small game, like guessing numbers, which makes them happy when they guess correctly" [M2].*

Others struggled due to low motivation. This aligns with Alrabai (2021), which emphasizes the roles of competence, autonomy, and relatedness in fostering intrinsic motivation. A significant limitation noted in the interviews was the limited use of technology in lessons due to school policies and facility constraints. One teacher remarked,

*"In mathematics learning activities, we do not use technology because school rules do not allow teachers to use phones... we rely on manual methods only" [M1].*

Despite this, teachers compensated by employing practical examples and interactive exercises, effectively bridging abstract concepts with students' daily experiences. This reflects principles from Giray et al. (2025), suggesting that engagement with multiple modalities enhances comprehension, even when achieved through non-digital means. Assessment practices included board exercises, homework, and periodic tests. Teachers explained that these methods help identify misconceptions and provide immediate clarification:

*"We assess students' understanding of mathematics through exercises they solve on the board and homework... students come to present their answers on the board according to their understanding" [M1].*

This approach aligns with Black and Wiliam's formative assessment principles (Lui & Andrade, 2022). For struggling students, teachers provided additional explanations and contextualized examples:

*"To support students with difficulties, we always motivate them and teach that mathematics is used in everyday life. This makes math easier to understand" [M2],*

Reflecting Tomlinson's Differentiated Instruction Theory (Unal et al., 2022).

In summary, the integration of results and discussion indicates that mathematics instruction in Timor-Leste relies heavily on teacher adaptability, interactive and collaborative methods, and creative strategies to sustain motivation. The use of discussion, practical exercises, and games enhances student engagement and understanding, even without technology. The findings underscore that in resource-limited contexts, effective teaching is shaped less by tools and more by teachers' ability to tailor methods to students' needs, maintain classroom engagement, and compensate for structural limitations.

## CONCLUSIONS

1. The findings of this study highlight that mathematics teachers in Timor-Leste employ adaptable, discussion-oriented, and interactive teaching methods to sustain student engagement and address diverse learning needs.
2. Collaborative activities, games, and contextual examples proved effective in fostering participation and comprehension, especially in the absence of technological tools.
3. Persistent challenges remain, particularly students' inconsistent study habits outside the classroom, limited access to digital resources, and the tendency for time constraints to hinder full coverage of lesson content.
4. These results underscore the crucial role of teacher adaptability in creating meaningful learning experiences within resource-limited environments.
5. The novelty of this research lies in demonstrating that, even without advanced technologies, well-designed pedagogical strategies rooted in social interaction, active learning, and contextual relevance can successfully enhance mathematics learning outcomes.

Recommendations addressed to:

1. Teachers should continue integrating discussion-based activities and cooperative learning to promote peer support, while also incorporating small, engaging tasks, such as short games and practical problem-solving, to maintain motivation.
2. Schools and policymakers should consider gradually introducing accessible, low-cost technological tools or visual aids to diversify instructional methods without violating existing regulations.
3. Targeted programs to cultivate students' self-regulated learning skills could help bridge the gap between classroom learning and independent study.

Professional development initiatives should focus on equipping teachers with innovative, context-sensitive strategies that optimize available resources, ensuring that mathematics instruction remains engaging, relevant, and effective in similar educational settings.

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