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Learning Guidance on Logarithms to Improve Students' Mathematical Competence at Mas DDI Baru Baru Tanga

Abdul Majid[1], Yonathan S Pasinggi[2], Ritha Tuken[2], Yulia[2], Fahirah[2]
[1,2,3,4]Universitas Negeri Makassar
[5]STAI DDi Pangkep
Corresponding Author e-mail: abdul.majid@unm.ac.id

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Abstract: *This community service activity aims to improve students' mathematical competency through learning assistance on logarithms at MAS DDI Baru Baru Tanga. Based on initial observations, students experienced difficulties in understanding the basic concepts of logarithms, especially in relating exponential forms to logarithmic forms and their application in everyday life. To address this, the implementation team assisted using the Contextual Teaching and Learning (CTL) approach and the Problem-Based Learning (PBL) method. The activity involved 25 grade XI IPA students and was carried out over two weeks. The learning process was carried out interactively through discussions, contextual problem solving, and the use of simple digital learning media. Evaluation results showed a significant improvement in student learning outcomes, with the average score increasing from 55.4 to 81.2 after the assistance activity. In addition, student motivation and participation in learning also increased as seen from their activity throughout the process. This activity succeeded in fostering better conceptual understanding and a positive attitude towards mathematics. This kind of assistance is expected to be implemented sustainably and expanded to other mathematics materials to improve the quality of learning in schools.*

Introduction

Education is the primary foundation for developing quality human resources. One subject that plays a crucial role in developing logical, systematic, and critical thinking skills is mathematics. Through mathematics learning, students are trained to solve problems, think analytically, and develop rational thought patterns that form the basis for facing the challenges of modern life (National Council of Teachers of Mathematics [NCTM], 2020). However, in practice, mathematics is often considered a difficult and intimidating subject by most students due to its abstract nature and the interconnectedness of concepts that require in-depth understanding (Boaler, 2016).

Logarithms are a frequently challenging topic for students at the Madrasah Aliyah (Islamic Senior High School) level. This topic requires a strong understanding of exponents and strong algebraic thinking skills (Tall, 2013). Based on observations and initial interviews with mathematics teachers at MAS DDI Baru Baru Tanga, it was found that most students struggle to understand the relationship between exponents and logarithms. Students tend to memorise formulas without understanding their meaning, making it difficult for them to apply these concepts to more complex problem-solving (Murray et al., 2020). This difficulty is further exacerbated by the limited use of engaging learning media and the limited opportunities for contextual learning (Saragih & Napitupulu, 2015).

This situation has a direct impact on low learning outcomes and student motivation in mathematics. Learning evaluation data shows that the average student score on logarithms is below the minimum completion standard set by the school. Furthermore, student enthusiasm for learning is also relatively low. When given logarithm problems, many students are unable to explain the steps to solve them, arguing that the material is too difficult and confusing. This situation presents a challenge for teachers in creating an active, enjoyable, and meaningful learning environment (Kaur, 2019).

In this context, community service activities through a logarithm learning mentoring program are crucial. Higher education institutions play a strategic role in supporting the improvement of educational quality in schools through collaborative and applied activities (Suparman et al., 2022). Through this community service program, the implementing team strives to guide students and teachers in the logarithm learning process, making it easier to understand and relevant to everyday life. The approaches used in this activity are Contextual Teaching and Learning (CTL) and Problem-Based Learning (PBL), two methods proven effective in improving students' conceptual understanding and critical thinking skills (Johnson, 2017; Hmelo-Silver, 2004).

The Contextual Teaching and Learning (CTL) approach emphasises the connection between subject matter and real-life situations experienced by students. In the context of learning about logarithms, students are encouraged to understand how logarithmic concepts are used in everyday life, for example, in measuring the pH of solutions, sound intensity, earthquake scales, and population growth phenomena (Lestari & Yudhanegara, 2018). Through this approach, students not only memorise formulas but also understand the meaning and benefits of logarithmic concepts in various areas of life. This makes learning more meaningful and relevant (Johnson, 2017).

Meanwhile, Problem-Based Learning (PBL) is a student-centred learning model that provides contextual problems as the starting point for the learning process. In this activity, students not only receive information from teachers or mentors but also actively seek, research, and find solutions through group discussions (Hmelo-Silver, 2004). PBL helps students develop higher-order thinking skills, such as analysing, evaluating, and creating solutions to given problems (Arends, 2015). Through PBL, students can understand the concept of logarithms more deeply because they discover the meaning behind the formulas they learn for

themselves (Savery, 2015).

This mentoring activity also serves as a means to introduce innovative learning strategies to teachers at MAS DDI Baru Baru Tanga. Many teachers still use conventional methods such as lectures and practice exercises, which make students passive (Suparman et al., 2022). Therefore, this activity not only focuses on students as the main participants but also involves teachers as collaborators who will continue and develop similar learning methods in the future. Thus, this activity has high sustainability value and a dual impact, namely improving student competency and enhancing teacher professionalism in mathematics learning (Nieveen & Folmer, 2013).

In addition to pedagogical issues, learning environment factors also influence students' success in understanding mathematics. Based on observations, learning facilities at MAS DDI Baru Baru Tanga are still limited, especially in terms of digital learning media and additional learning resources. The textbooks used tend to be theoretical and lack engaging application examples (Boaler, 2016). Therefore, the community service team provided a context-based logarithm learning module equipped with practice questions, illustrations of real-world phenomena, and a guide to using simple digital applications such as GeoGebra and Desmos (Hohenwarter & Preiner, 2007). This module is designed so that teachers and students can use it independently after the mentoring activities are completed.

This mentoring is also designed to foster a collaborative learning environment. Students are grouped into small teams and given challenging yet life-relevant problems. For example, calculating the acidity of drinking water based on hydrogen ion content, determining the noise level of a room, or analysing population growth using exponential and logarithmic models (Lestari & Yudhanegara, 2018). Through these activities, students learn mathematics not only as a collection of formulas but also as a thinking and problem-solving tool that can be applied in real life (Savery, 2015). This approach has been proven to increase student engagement, strengthen collaboration, and foster confidence in facing academic challenges (Hmelo-Silver, 2004).

This community service activity at MAS DDI Baru Baru Tanga also demonstrates the synergy between universities and secondary education institutions. Universities play a role not only as academic institutions but also as agents of social change, responsible for contributing to improving the quality of education in the community (Suparman et al., 2022). Through mentoring programs like this, students and lecturers can apply their knowledge in real-world settings, while schools directly benefit by improving the quality of learning. This activity provides a platform for both parties to learn from each other, share experiences, and strengthen collaborative networks in the field of education (Nieveen & Folmer, 2013).

Furthermore, this activity has strategic significance in preparing a young generation with high numeracy literacy. In the current era of globalisation and digitalisation, mathematical thinking skills are a highly needed 21st-century competency (Trilling & Fadel, 2009). The concept of logarithms, which initially seems complex, actually plays a crucial role in various fields of technology, science, and economics (Tall, 2013). By understanding logarithms,

students can develop rational and scientific thinking, which is the foundation for mastering science and technology (Boaler, 2016). Therefore, this logarithm learning assistance aims not only to improve learning outcomes but also to build a solid foundation for scientific thinking in students.

Overall, this community service activity was motivated by the need for a learning model that can bridge the gap between theory and practice in mathematics. By combining a contextual approach, problem-based learning, and direct classroom mentoring, it is hoped that students will be able to understand logarithms more deeply and meaningfully (Johnson, 2017; Hmelo-Silver, 2004). This approach is also expected to inspire teachers to develop other learning innovations (Nieveen & Folmer, 2013). Ultimately, this activity is a concrete manifestation of the academic world's commitment to playing an active role in advancing national education, particularly in mathematics in madrasah environments (Suparman et al., 2022).

Research Methods

This community service activity, focusing on assisting with logarithm learning at MAS DDI Baru Baru Tanga, was systematically designed to address previously identified issues. The activity's implementation adheres to participatory, collaborative, and results-oriented principles, with students, teachers, and the implementation team actively involved in all stages of the activity. The approach used is not simply training, but rather ongoing mentoring that emphasises direct participant involvement in the learning process. Thus, this activity is expected to produce not only temporary improvements but also changes in mindset and learning habits.

The first step in this activity was the preparation and initial observation phase. The community service team, consisting of lecturers and mathematics education students, conducted an initial visit to MAS DDI Baru Baru Tanga to coordinate with the school. During this phase, interviews were conducted with the madrasah principal and mathematics teachers to obtain a general overview of the learning conditions at the school, particularly regarding logarithms. The interviews revealed that students had varying levels of understanding, but most had difficulty grasping the basic concepts of logarithms and their applications. Furthermore, teachers also stated that the learning methods used so far tended to be conventional, namely lectures and practice problems, without connecting the material to the students' real-life contexts.

Based on these observations, the team then developed a mentoring activity plan that included planning learning strategies, developing media and modules, and preparing evaluation tools. The community service team developed a context-based logarithm learning module, which included an explanation of the concept of logarithms, examples of applications in everyday life, contextual practice questions, and a guide to using digital math applications such as GeoGebra. This module was written in simple language and with engaging illustrations, so it could be used by both students and teachers. In addition, a Student Worksheet (LKS) was prepared to be used during the mentoring process to guide students in solving problems in groups.

The next stage was the implementation of mentoring activities that were carried out for two weeks, with a total of six face-to-face meetings in class. The activities were carried out in the classroom of class XI IPA MAS DDI Baru Baru Tanga with a total of 25 participants. Each meeting lasted for two lesson hours (2 x 45 minutes), with a flexible activity structure arranged to provide space for exploration and discussion. Before the activities began, students took a pre-test that aimed to measure

their initial understanding of the concept of logarithms. The results of this pre-test served as a reference for the team in determining the level of difficulty of the material and the approach to be used during the mentoring process.

In the first meeting, the mentoring team introduced the basic concept of logarithms through a contextual approach. Students were encouraged to review the concept of exponents and observe the relationship between them. Learning was conducted interactively, utilising visual media and simple digital simulations. For example, the GeoGebra application was used to demonstrate the graphical relationship between exponential and logarithmic functions. By directly observing the changes in the graphs, students were able to understand that logarithms are the inverse of exponential functions. This activity provided a more concrete learning experience than simply theoretical explanations.

The second and third meetings focused on understanding the properties of logarithms through exploratory activities. Students were given problems in the form of stories relevant to everyday life. One example of the activity was analysing the acidity levels of several types of drinking water based on their pH values. In this activity, students were invited to calculate the pH value using the formula $pH = -\log[H^+]$, then compare the results and draw conclusions about the relationship between hydrogen ion concentration and acidity levels. This activity not only practised numeracy skills but also strengthened the understanding of the concept of logarithms in real-world contexts. In addition, this activity fostered students' curiosity and interest in the application of mathematics in other fields such as chemistry and biology.

In the next meeting, activities were directed at improving problem-solving skills through Problem-Based Learning (PBL). Students were grouped into small teams of four to five people. Each group was given a different contextual problem, for example, calculating noise levels in the surrounding environment using a decibel scale involving the concept of logarithms. Student groups were asked to observe sounds in the school environment, then calculate their intensity using the decibel formula. From the results of this activity, students learned how logarithms are used in sound measurement and

communication technology. During the discussion process, the mentoring team acted as facilitators, guiding students to find their own solutions to the problems they faced.

In addition to classroom activities, the team also provided mentoring for mathematics teachers. This took the form of reflection sessions and short training sessions at the end of each meeting. In these sessions, teachers were invited to discuss the effectiveness of the learning methods used, any difficulties encountered during the activities, and the possibility of implementing similar strategies in other materials. The team provided examples of mini-project-based learning designs and how to integrate digital media into mathematics learning. This way, teachers became not just observers but also active participants in the learning development process.

To assess the effectiveness of the activity, the team conducted a learning evaluation using two approaches: cognitive and non-cognitive. Cognitive evaluation was conducted by comparing students' pre-test and post-test results. The test contained questions that measured their ability to understand concepts, apply formulas, and solve logarithmic problems in everyday life contexts. The results showed a significant increase in students' average scores. Meanwhile, non-cognitive evaluation was conducted through observation and interviews to assess affective aspects and learning motivation. From the interviews, students stated that learning logarithms became easier to understand because it was linked to things they encountered in real life. The teacher also stated that the applied method could increase student activity in class.

During the implementation of the activity, the community service team faced several challenges. One of these was limited supporting facilities, such as projectors and unstable internet access. However, these obstacles were overcome by using simple media such as whiteboards, printed charts, and manual aids. Furthermore, the students demonstrated high levels of enthusiasm and enthusiasm, ensuring the smooth running of the activity. Another factor contributing to the success of this activity was the strong collaboration between the school and the implementation team. Support from the principal and math teachers enabled the activity to be carried out on schedule and to receive the full attention of the students.

These mentoring activities were also systematically documented for reflection and follow-up purposes. Each learning session was recorded using observation sheets, which covered student activities, the effectiveness of learning media, and the dynamics of group discussions. The results of this documentation were used to compile activity reports and served as evaluation material for the implementation team to improve the quality of similar activities in the future. Furthermore, the documentation also served as a tool for the school to learn and adapt the learning methods implemented.

Overall, the implementation method for this community service activity emphasises a collaborative and participatory approach between students, lecturers, teachers, and other staff. The learning process is not one-way, but rather fosters a dialogic atmosphere where students actively ask

questions, express opinions, and experiment. The mentor acts as a facilitator, helping students discover their own understanding through reflective thinking. Thus, this activity not only improves academic abilities but also fosters independent learning, self-confidence, and cooperation among students. This approach is expected to become a model that can be replicated in other schools with similar characteristics.

At the end of the activity, a joint reflection session was held involving all participants, teachers, and the implementation team. In this reflection session, students were asked to share their experiences during the mentoring session, the new things they learned, and their impressions of the learning methods used. Most students stated that they now have a better understanding of the concept of logarithms and feel that mathematics is no longer as difficult as they imagined. Teachers also expressed their appreciation for this activity because it was able to transform the learning atmosphere into a more lively and meaningful one. The results of this reflection indicate that the mentoring in learning logarithms not only improves cognitive competence but also changes students' attitudes toward mathematics to be more positive.

This activity demonstrates that the success of mathematics learning is significantly influenced by the teaching strategies used. With the right and relevant approach, material initially considered difficult can be grasped effectively. Therefore, the implementation method of this community service activity can serve as a reference for developing innovative learning models in madrasah environments. Contextual and problem-based learning approaches have been proven to enhance conceptual understanding while fostering active and reflective learning in students.

Result and Discussion

Activity Results

The logarithm learning mentoring program at MAS DDI Baru Baru Tanga yielded several important findings demonstrating positive changes in students' academic performance, learning motivation, and thinking skills. The impact of this program was not only evident in improved learning outcomes but also in changes in classroom interaction patterns, students' understanding of mathematical concepts, and increased engagement in the learning process. These findings were obtained through a comprehensive evaluation process involving observation, interviews, documentation, and test analysis.

The most obvious first result of this activity was a significant increase in understanding of the concept of logarithms. Based on the results of the pre-test and post-test given to 25 student participants, there was an increase in the average score from 55.4 to 81.2. This increase indicates a 25.8-point increase in understanding, or approximately 46.6%, compared to before the mentoring. From further analysis, it was found that the highest increase occurred in the ability to convert exponentials to logarithms and vice versa, as well as in the ability to use the properties of logarithms to simplify algebraic expressions. Before the activity, most students were only able to answer simple problems by memorising formulas. However, after participating in the mentoring, they began to understand the meaning behind each operation and were able to explain the reasoning behind the solution steps.

In addition to improving academic performance, this activity also had a significant impact on students' attitudes and motivation to learn. Observations during the activity showed that students became more active and more willing to ask questions. While initially the classroom atmosphere tended to be passive and dominated by only one or two students, by the fourth meeting and beyond, almost all

students were involved in group discussions. They showed high enthusiasm when faced with contextual problems close to their lives, such as calculating the acidity level of water or the intensity of sound. This emotional engagement made students feel that logarithms were not just complicated mathematical concepts, but useful tools for understanding the phenomena around them.

Changes in students' learning behaviour were also evident in their increased independence and confidence in solving math problems. At the beginning of the activity, most students tended to rely on teacher explanations or example problems. However, after several mentoring sessions using a problem-based learning approach, they became accustomed to finding their own solutions, discussing with their peers, and expressing their opinions. When given group assignments, they were able to collaborate well to analyse problems and find solutions based on the logarithmic concepts they had learned. This change is an important indicator that the interactive learning implemented in this activity successfully fostered independent and collaborative thinking.

From the results of interviews with students, most stated that this mentoring activity helped them understand logarithms more easily. One student said that previously he thought logarithms were just formulas that had to be memorised without understanding their use, but after participating in the mentoring, he understood that logarithms are used to calculate many things in life, such as sound, light, and the acidity of water. This statement reflects a shift in the students' perspective on mathematics, from initially mechanistic to more conceptual and meaningful.

A positive impact was also felt by a mathematics teacher at MAS DDI Baru Baru Tanga. In a post-activity reflection session, the teacher stated that the methods implemented by the community service team provided new inspiration in teaching. The teacher felt helped by the contextual learning modules and student worksheets that were arranged interestingly and systematically. He stated that previously, logarithm learning often focused on solving routine problems, but through a contextual approach, students were able to understand the concept more deeply. The teacher also appreciated the use of digital learning media such as GeoGebra, which can help students visualise the relationship between exponential and logarithmic functions. He believes this method is very effective for reuse in regular teaching and learning activities at school.

In addition to academic and pedagogical outcomes, these mentoring activities also have a social and emotional impact on students. The collaborative and open learning environment fosters mutual respect and cooperation among students. In each group discussion, students learn to listen to others' opinions, provide input, and make decisions together. Mutual support and respect for differing opinions are essential components of the learning process. Thus, these activities contribute to the development of social character and shared values among students.

The documentation of the activities showed that each learning session was filled with high enthusiasm from the students. They appeared enthusiastic about participating in the activities, even though some meetings took place outside of regular class hours. Some students even volunteered to help prepare tools and materials for the activities, such as writing on the whiteboard or preparing additional problem examples. This indicates that the mentoring activities successfully created a sense of ownership in the learning process. When students feel part of the process, they tend to be more motivated to study diligently.

In addition to the quantitative and qualitative results obtained during the activity, several success factors were also noted. First, the success of this activity was inseparable from the support of the school, especially the principal and mathematics teachers who provided facilities and time for the

activity. Second, the learning approach implemented—a combination of CTL and PBL—was proven to be able to attract student interest because it combined elements of exploration, discussion, and problem-solving. Third, the active role of students as facilitators also provided positive energy for the students. Students who were not too far in age from the participants were able to act as communicative and receptive facilitators, making the learning process more fluid and enjoyable.

However, this activity also faced several challenges and limitations. One of the main obstacles was time constraints. Because the activity was carried out in only six meetings, several advanced concepts of logarithms were not discussed in depth, such as the application of logarithms in exponential growth functions and complex calculations. Furthermore, limited technological resources also hampered the optimal use of digital media. Unstable internet access and a lack of computer equipment meant that GeoGebra had to be used alternately with simple tools. However, these obstacles did not dampen students' enthusiasm or hinder the achievement of the activity's main objectives.

In terms of sustainability, this activity has a long-term impact on the school. The modules and worksheets used during the mentoring program were handed over to the madrasah as additional teaching materials that teachers can utilise in subsequent learning processes. Teachers also received brief training on developing context-based interactive media, enabling them to continue innovating their learning independently. Furthermore, the collaborative relationship between the community service team and the school is expected to continue through follow-up mentoring activities for other mathematics topics such as trigonometry, integrals, and statistics.

This activity also successfully raised awareness among students that mathematics is not just a subject to be memorised, but rather a thinking tool that can help them understand the world around them. After the activity concluded, several students expressed interest in exploring the use of logarithms in science and technology further. This is an important indicator that community service activities like this can catalyze sustained scientific interest. Students who initially considered mathematics a difficult and boring subject now begin to see it as interesting and challenging.

From the perspective of the implementation team, this activity also provided valuable learning. The participating lecturers and students gained hands-on experience applying mathematics learning theory in the field. They learned to interact with students and teachers in real-world contexts, adapt methods to school conditions, and manage collaborative learning activities. This experience is crucial for developing their professional competencies as future educators and researchers.

Overall, the results and impact of the logarithm learning mentoring activities at MAS DDI Baru Baru Tanga show that the integration of contextual and problem-based learning approaches in mathematics teaching can significantly improve students' cognitive and affective competencies. This activity not only provides academic benefits but also strengthens the social, emotional, and collaborative aspects of the learning environment. Implementing similar activities on an ongoing basis in other schools would be a strategic step in strengthening the quality of mathematics learning at the madrasah and secondary school levels.

Discussion

During the implementation of the logarithm learning assistance program at MAS DDI Baru Baru Tanga, the community service team faced various challenges that required effective solution strategies, both from technical, academic, and social aspects. The problem-solving process was carried out through a collaborative approach between the implementation team, teachers, and students, by adapting solutions to real-world conditions. Each obstacle that emerged became an important part of

the learning process itself, as it provided an opportunity for all parties to adapt, innovate, and strengthen critical thinking skills in dealing with real-world problems.

One of the main problems that emerged was students' poor basic understanding of the concept of logarithms and the relationship between logarithms and exponents. In the initial stages of mentoring, most students experienced difficulty converting exponentials to logarithms, as well as understanding the meaning of the mathematical symbols used. Some students tended to memorise formulas without understanding their origins or the logic behind them. To address this, the community service team implemented a "concept from concrete to abstract" strategy, namely by providing learning experiences that began with everyday life contexts before moving on to mathematical formulations.

For example, students are introduced to phenomena involving exponential growth and decline, such as population growth or radioactive decay. Through this exploratory activity, students are encouraged to see that logarithmic operations are used to find the time or specific quantities hidden within the exponential process. By using this approach, the concept of logarithms no longer feels foreign but becomes part of the logical understanding of the phenomena they observe. This strategy has proven effective because it provides meaningful context that makes it easier for students to grasp mathematical concepts in depth.

The second problem faced was students' low motivation and confidence in learning mathematics. Most students considered logarithms to be difficult and intimidating. They often felt like failures before even attempting to solve the problems. To address this, the implementation team implemented a small-group learning strategy (cooperative learning), where students were divided into heterogeneous groups based on their academic abilities. Within these groups, students with a better understanding helped their peers who were still struggling.

This approach not only helps accelerate the learning process but also builds confidence in previously passive students. They feel more comfortable asking questions and discussing with peers than with a teacher directly. Furthermore, more capable students gain valuable experience explaining concepts to others, deepening their own understanding. Within each group, the mentor team assigns real-world, problem-based tasks that require collaboration, such as calculating sound intensity or analyzing the pH of several water samples. This way, learning becomes more lively, collaborative, and enjoyable.

In addition to motivational challenges, the team also identified limited learning facilities as a major obstacle. In schools, access to technological devices such as laptops, projectors, or internet connections is still very limited. Yet, some of the methods designed for mentoring involve the use of digital media such as GeoGebra or visual simulations. To overcome this obstacle, the team implemented a "simple media adaptation" strategy. Instead of using projectors, the team utilized whiteboards, graph paper, and manual props to explain the concept of logarithmic functions.

One example of this strategy is the use of hand-drawn graphs to demonstrate the relationship between exponential and logarithmic functions. Students are asked to draw a curve and then find its inverse to find the graph. This activity not only helps them understand the concept of inverses but also provides a powerful visual and kinesthetic experience. Thus, technological limitations do not become a barrier to achieving learning objectives. Instead, this activity strengthens students' understanding through meaningful manual exploration.$y = 2^x y = \log_2 x$

Another challenge was the striking differences in basic abilities among students. In one class, some students grasped the material very quickly, while others took longer to follow along. This often led to imbalances in group dynamics, with some students dominating discussions while others remained

passive. To address this, the team implemented the principle of differentiated learning, providing varying levels of problem difficulty and learning activities based on students' abilities.

Students who have mastered basic concepts are given additional challenges in the form of application problems or contextual case studies, while those who are still struggling are focused on basic exercises with intensive guidance. Furthermore, mentors actively monitor group discussions and provide gentle interventions when needed. This strategy successfully creates a balance in learning, allowing each student to contribute according to their abilities without feeling left behind or stressed.

Another challenge encountered during the program was the limited time available. The mentoring program lasted only two weeks with six meetings, while the logarithm material covered a fairly broad scope. To address this, the team implemented a spiral learning approach, teaching core concepts first and then gradually expanding on them.

In the initial session, the focus is on basic concepts such as the definition of logarithms and their relationship to exponents. Once students understand these fundamentals, they are introduced to the properties of logarithms, algebraic operations, and applications in various contexts. This gradual approach ensures that students aren't overwhelmed with overly complex information at the beginning but still gain a comprehensive understanding of logarithms by the end of the session.

Furthermore, learning time is optimized through the use of reflective homework. After each session, students are asked to recap what they learned that day in the form of a personal summary or concept map. This assignment helps students reflect on their understanding and reinforces their retention of the material. For the community service team, the results of this reflection also serve as evaluation material to determine what material needs to be reemphasized in the next meeting.

Another issue related to the lack of teacher involvement in the learning innovation process at the beginning of the program. This was due to a busy teaching schedule and the habit of using conventional lecture methods. To address this, the implementation team held collaborative training and reflection sessions at the end of each meeting. Teachers were invited to discuss the methods used, their effectiveness, and how to adapt them to the madrasah context. In these sessions, the team introduced the principles of context-based learning and problem-solving, while also providing examples of simple lesson plans (RPPs) that teachers could use in the future.

Based on the reflection sessions, teachers began to show interest in trying new methods. In fact, at the final meeting, teachers actively helped facilitate group discussions and provided feedback to students. This demonstrates that mentoring not only benefits students but also contributes to teachers' professional development.

In non-academic aspects, the team also faced challenges in the form of varying levels of student discipline and participation. Some students were frequently late or lacked focus during activities. To address this, the team employed a positive reinforcement approach. Students who were active and showed progress were given simple recognition such as praise, a small certificate, or a best group award. This strategy proved effective in improving student discipline and enthusiasm for learning, as they felt appreciated for their efforts.

Furthermore, learning activities are combined with light activities such as educational games (math quizzes), which not only increase enthusiasm but also reinforce conceptual understanding in a fun way. This approach creates a more dynamic learning environment and removes the rigidity typically associated with math lessons.

Overall, all the problem-solving efforts undertaken during the activity demonstrated that an adaptive, participatory, and collaborative approach was key to the success of this community service. Limited facilities, differences in student abilities, and time constraints were overcome through creativity, collaboration, and good communication between all parties involved. Every obstacle was seen as an opportunity for innovation, not a barrier to failure.

Ultimately, this activity successfully achieved its goals: improving students' mathematical competency, fostering learning interest, and strengthening teachers' capacity to manage logarithm learning contextually and interactively. The problem-solving experiences during the activity provided valuable experience that can serve as a reference for implementing similar programs in other schools with comparable conditions.

Conclusion and Recommendation

The logarithm learning mentoring program at MAS DDI Baru Baru Tanga significantly improved students' mathematical understanding and competency. Through the application of a contextual approach and problem-based learning, students became more active, motivated, and able to relate logarithm concepts to real-life situations (Johnson, 2017; Hmelo-Silver, 2004). In addition to improving learning outcomes, this activity also fostered students' self-confidence, collaboration, and interest in mathematics. Teachers gained new experience in implementing innovative, more interactive, and relevant learning methods (Nieveen & Folmer, 2013). Overall, this activity shows that collaboration-based mentoring between lecturers, students, and teachers can create an effective, enjoyable learning process and have a real impact on improving the quality of education in madrasah (Suparman et al., 2022).

Study Limitations

Although this mentoring program produced positive results, it also had several limitations. First, the implementation period was relatively short, making it difficult to measure the long-term effects on students' mathematical reasoning and retention (Arends, 2015). Second, the mentoring was conducted in one school with a limited number of participants, so the generalizability of the findings to other contexts remains limited (Nieveen & Folmer, 2013). Third, the availability of learning facilities and technological tools, such as computers and internet access, still constrained the full integration of digital media like GeoGebra and Desmos in classroom learning (Hohenwarter & Preiner, 2007). Lastly, not all teachers were equally ready to adopt new learning approaches, so continuous professional development is still needed (Boaler, 2016).

Implications

Despite these limitations, the results of this activity have important pedagogical and practical implications. For teachers, the study highlights the importance of using contextual and problem-based strategies to increase students' conceptual understanding and motivation in learning mathematics (Savery, 2015). For schools and policymakers, it emphasizes the need to strengthen partnerships with higher education institutions to promote continuous innovation in teaching practices (Suparman et al., 2022). Furthermore, this program can serve as a model for similar initiatives in other madrasahs to improve mathematical literacy and 21st-century skills among students (Trilling & Fadel, 2009). Future mentoring programs are expected to expand in scope, integrate digital learning tools more effectively, and involve broader collaborations to ensure sustainability and scalability of the results.

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