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EXAMINING MADRASAH TSANAWIYAH STUDENTS' PROBLEM-SOLVING ABILITIES IN SOLVING *MAWARIS*-INTEGRATED FRACTION WORD PROBLEMS

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Abstract. Mathematical problem-solving ability is an essential competency that enables students to apply mathematical concepts in real-life situations. However, many students still encounter difficulties when solving fraction word problems, particularly those involving contextual and religiously relevant situations. This study aimed to investigate the problem-solving abilities of Madrasah Tsanawiyah (MTs) students in solving fraction word problems integrated with *Mawaris* (Islamic inheritance) contexts. A descriptive qualitative approach was employed involving 22 ninth-grade students of MTs Muqimus Sunnah. Data were collected through problem-solving tests, interviews, and documentation and were analyzed based on four indicators of problem solving: understanding the problem, devising a plan, carrying out the plan, and interpreting the results. The findings showed that 27.27% of students were categorized as having high problem-solving ability, 45.45% moderate ability, and 27.27% low ability. Students performed best in understanding the problem and carrying out the solution plan (72.73%), while interpreting the results was the weakest indicator (36.36%). Difficulties mainly arose in translating contextual information into mathematical models, performing fraction operations accurately, and relating solutions to the *Mawaris* context. The study concludes that integrating *Mawaris* into fraction learning provides meaningful contextualization and can support the development of students' mathematical problem-solving abilities while strengthening Islamic values.

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INTRODUCTION

Mathematics learning plays a crucial role in education because it develops students' logical, systematic, critical, analytical, and creative thinking skills (Arnidha & Fatahillah, 2021; Suryawan et al., 2023). Through mathematics, students are expected not only to master concepts and computational procedures but also to apply them in solving problems encountered in various real-life situations. Consequently, problem-solving ability has become one of the primary goals of mathematics education and is recognized as an essential competency for students in the twenty-first century (Da, 2023; Santos-Trigo, 2024; Setiawati et al., 2024).

Problem-solving ability refers to the capacity to understand a problem, develop an appropriate solution strategy, implement the strategy, and evaluate the obtained results (Siswanto & Meiliasari, 2024). According to Polya (1973), mathematical problem solving consists of four stages: understanding the problem, devising a plan, carrying out the plan, and looking back. These stages provide a framework for analyzing how students think and make decisions when confronted with mathematical problems. Therefore, students' problem-solving ability is widely regarded as an important indicator of meaningful mathematics learning.

At the Madrasah Tsanawiyah (MTs) level, fractions are among the fundamental topics that support students' understanding of more advanced mathematical concepts, including ratios, percentages, algebra, probability, and statistics. A sound understanding of fractions enables students to perform mathematical operations accurately and solve contextual problems effectively. However, fractions remain one of the most challenging topics for many students. Previous studies have reported that students frequently experience difficulties in understanding fraction concepts, performing fraction operations, and translating contextual situations into

mathematical representations. Majid (2026) and Wijaya (2017) found that students' numeracy skills in fraction operations were still at a moderate level, particularly when they were required to apply mathematical reasoning in contextual problems. Similarly, Yunita & Widjajanti (2025) reported that inadequate conceptual understanding significantly affects students' ability to solve mathematical problems systematically.

These difficulties become more apparent when students are required to solve fraction word problems (Murjani et al., 2023). Unlike routine computational exercises, word problems require students to interpret contextual information, identify relevant data, select appropriate strategies, perform calculations, and interpret solutions within the given context. In classroom practice, many students tend to focus immediately on calculations without fully understanding the problem situation, resulting in errors and misconceptions (Antara et al., 2022; Mugianto et al., 2021). Such conditions indicate that students' problem-solving abilities in fraction word problems require further investigation.

Freudenthal (1991) and Abu-Rasheed et al. (2023) argue that contextual learning is an effective approach for promoting meaningful mathematics learning. This approach emphasizes the connection between mathematical concepts and students' everyday experiences, allowing learners to actively construct their understanding of mathematical ideas. Furthermore, the integration of authentic contexts that reflect students' social, cultural, and educational backgrounds can improve conceptual understanding and increase students' engagement in the learning process.

Within the context of Islamic education, one authentic context that can be integrated into fraction learning is *Mawaris* (Islamic inheritance distribution) (Sulaiman & Nasir, 2020). The concept of *Mawaris* inherently involves fractions such as one-half, one-third, one-fourth, and one-sixth, which are used to determine the shares of heirs according to Islamic law (Kurniawan et al., 2020; Syarqiyah & Faradiba, 2025). Therefore, *Mawaris* provides a meaningful context through which students can connect mathematical concepts with religious values and real-life applications (Rahayu et al., 2023; Syarqiyah & Faradiba, 2025). Integrating *Mawaris* into fraction word problems may help students understand fractions not merely as abstract numerical concepts but as practical tools used in social and religious contexts.

Several studies have examined students' problem-solving abilities in mathematics and the use of contextual approaches in learning fractions (Sulasmi, 2022; Torres-Peña et al., 2024). However, research specifically investigating students' problem-solving abilities in solving *Mawaris*-integrated fraction word problems remains limited (Noviani et al., 2022). Most previous studies have focused on general daily-life contexts and have not explored how students understand, plan, execute, and interpret solutions within the context of Islamic inheritance distribution (Arruan & Department, 2023; Hadiyanti & Manurung, 2025). This limitation indicates a research gap that warrants further investigation.

The novelty of this study lies in the integration of *Mawaris* as an authentic Islamic context for examining students' problem-solving abilities in fraction word problems. Unlike previous studies that primarily employed general real-life contexts, this study combines mathematical concepts with Islamic values that are closely related to the characteristics of Madrasah Tsanawiyah students (Majid, 2026; Syarqiyah & Faradiba, 2025; Zulfa et al., 2023). This integration is expected not only to provide insights into students' mathematical problem-solving processes but also to contribute to the development of contextual and value-based mathematics learning in Islamic educational settings.

Therefore, this study aims to examine the problem-solving abilities of ninth-grade students at MTs Muqimus Sunnah in solving *Mawaris*-integrated fraction word problems and to identify the difficulties they encounter at each stage of the problem-solving process, including understanding the problem, devising a plan, carrying out the solution, and interpreting the results.

RESEARCH METHODS

This study employed a descriptive qualitative approach to obtain an in-depth

understanding of students' problem-solving abilities in solving *Mawaris*-integrated fraction word problems. The study was conducted at MTs Muqimus Sunnah and involved 22 ninth-grade students as research participants. Participants were selected using purposive sampling because they had completed learning on fractions and had prior experience in solving mathematical word problems.

The primary instrument of this study was the researcher, while supporting instruments consisted of a problem-solving test, interview guidelines, and documentation. The problem-solving test comprised four fraction word problems integrated with *Mawaris* contexts and was developed based on Polya's four problem-solving indicators: understanding the problem, devising a plan, carrying out the plan, and interpreting the results. Before being administered, the test and interview guidelines were reviewed by two mathematics education experts and one experienced mathematics teacher to ensure content validity, contextual relevance, and linguistic clarity.

Data collection was carried out in three stages. First, students completed the problem-solving test individually. Second, students' written responses were scored and categorized into high, moderate, and low levels of problem-solving ability. Third, semi-structured interviews were conducted with selected students representing each category to explore their reasoning processes, solution strategies, and difficulties encountered during problem solving. Documentation, including students' answer sheets, field notes, and supporting records, was also collected to complement the data.

The assessment of students' problem-solving abilities was based on four indicators: understanding the problem, devising a plan, carrying out the plan, and interpreting the results. Each indicator was scored on a scale of 0–4. The total scores were converted into percentages and classified into three categories: high (80–100), moderate (60–79), and low (0–59).

Data were analyzed using the interactive model proposed by Miles, Huberman & Saldaña (1994), which consists of data reduction, data display, and conclusion drawing. Students' written responses were first analyzed according to the four problem-solving indicators. The findings were then compared with interview data to identify students' difficulties and reasoning patterns. To enhance the trustworthiness of the findings, methodological triangulation was employed by comparing data obtained from tests, interviews, and documentation.

RESULTS AND DISCUSSION

Students' Problem-Solving Abilities in *Mawaris*-Integrated Fraction Word Problems

The results showed that the problem-solving abilities of Madrasah Tsanawiyah (MTs) students in solving *Mawaris*-integrated fraction word problems were distributed across three categories: high, medium, and low. The classification was determined based on students' final scores obtained from the problem-solving test. The distribution of students' problem-solving abilities is presented in Table 1.

Table 1. General Categories of Student Problem-Solving Skills

Ability Categories	Value Range	Number of Students	Percentage	General Description
Height	80-100	6	27,27%	Students are able to understand problems, strategize, perform fraction calculations, and interpret results according to the context of the beneficiary well.
Medium	60-79	10	45,45%	Students are quite capable of solving problems, but still have difficulty at the stage of planning solutions or interpreting results.
Low	0-59	6	27,27%	Students have difficulty in understanding the story problem, determining fractional operations, doing calculations, and relating the answers to the context of the inheritance.
Quantity		22	100%	

As shown in Table 1, most students were classified in the medium category (45.45%),

followed by the high category (27.27%) and the low category (27.27%). These findings indicate that although students generally possess basic problem-solving skills, their abilities have not yet reached an optimal level. The dominance of the medium category suggests that students have acquired fundamental knowledge of fractions and can apply basic procedures to solve contextual problems. However, many students still encounter difficulties with problems that require deeper reasoning, interpretation, and decision-making.

The existence of students in the high category demonstrates that some learners were able to understand the problem situation comprehensively, identify relevant information, select appropriate mathematical strategies, and provide accurate solutions. These students generally showed confidence in working with fractions and were able to connect mathematical calculations with the inheritance context presented in the problem. In contrast, students in the low category tended to struggle from the initial stages of problem solving. They often had difficulty identifying important information, misunderstood the relationships among heirs, or performed incorrect fraction operations, which ultimately affected the accuracy of their answers.

To obtain a more detailed picture of students' performance, their abilities were further analyzed based on four problem-solving indicators: understanding the problem, planning a solution, carrying out the plan, and interpreting the results. These indicators were adapted from Polya's problem-solving framework, which emphasizes that successful problem solving involves not only obtaining correct answers but also understanding the problem situation and reflecting on the solution obtained.

Table 2. Capability Overview Based on Troubleshooting Indicators

Troubleshooting Indicators	Number of Able Students	Percentage	Category	General Findings
Understanding the problem	16 students	72,73%	Medium	Most students are able to identify known and questioned information, but there are still students who have not fully understood the context of the inheritance.
Plan the completion	14 students	63,64%	Medium	Students are quite capable of determining a solution strategy, but some still mistakenly turn the story problem into a fractional mathematical model.
Execute the plan	16 students	72,73%	Medium	Most students are able to perform fractional operations, although there are still errors in the calculation steps or the accuracy of the results.
Interpret results	8 students	36,36%	Low	Many students have not been able to write their final conclusions according to the context of the inheritance and have not checked the fairness of the answers.

Table 2 shows that the indicators of understanding the problem and carrying out the plan achieved the highest percentages (72.73%). This suggests that most students were able to identify relevant information and perform fraction operations correctly. Students generally succeeded in recognizing the total inheritance amount, identifying the heirs involved, and determining the fractional shares stated in the problem. This finding indicates that students possessed sufficient procedural knowledge of fractions and could apply basic arithmetic operations to solve inheritance-related tasks.

However, students encountered greater difficulties with planning solutions (63.64%) and, especially, with interpreting results (36.36%). Difficulties in planning solutions were evident when students attempted to transform verbal information into mathematical models. Some students understood the information presented in the problem but were unsure about the sequence of calculations needed to determine each heir's share. This indicates that students still require support in

developing strategic competence, particularly in selecting and organizing appropriate solution procedures.

The lowest achievement was found in the interpretation stage. Many students were able to obtain numerical answers but failed to explain their meaning in the context of the distribution of inheritance. For example, some students correctly calculated the amount received by each heir but did not explain why the distribution was conducted that way or how the results reflected the inheritance rules described in the problem. This finding suggests that students' difficulties were not limited to computational procedures but also involved higher-order thinking processes, particularly when relating mathematical results to real-life contexts.

Overall, these findings indicate that students' problem-solving abilities in *Mawaris*-integrated fraction problems are characterized by relatively strong procedural skills but weaker interpretative and reasoning abilities. Therefore, mathematics instruction should not focus solely on computational accuracy but should also encourage students to explain, justify, and interpret their solutions in meaningful ways.

The dominance of students in the moderate category indicates that most students have acquired basic procedural knowledge of fractions but have not yet fully developed higher-order problem-solving skills. This finding is consistent with Polya (1973), who emphasized that effective problem solving requires not only executing procedures but also understanding problems, planning strategies, and evaluating solutions. The results also support Yunita & Widjajanti (2025), who reported that students' problem-solving performance is strongly influenced by the quality of their conceptual understanding, suggesting that students who possess stronger fraction concepts tend to perform better across all stages of mathematical problem solving.

Students' Errors and Difficulties Across Problem-Solving Stages

To further understand students' difficulties, an analysis was conducted of the types of errors that appeared at each stage of problem solving. The results revealed that students had difficulty understanding problems, constructing mathematical models, performing fraction operations, and interpreting final answers in the context of *Mawaris*.

Table 3. The Form of Student Mistakes in Solving *Mawaris* Integrated Fraction Story Problems

Types of Errors	Forms of Error That Appear	Impact on Answers
Misunderstanding of the problem	Students do not write down information that is known and asked for in full.	Students mistakenly determine the initial steps of completion.
Misunderstanding the context of the heir	Students have not yet understood the relationship of heirs and the meaning of fractions as part of inheritance.	Students incorrectly determine which parts to count.
Mathematical modeling errors	Students are not able to convert story information into a form of fractional operation.	The settlement strategy becomes inaccurate.
Procedural errors	Students mistakenly perform fraction operations, such as equalizing denominators or multiplying fractions by the sum of properties.	The final result of the calculation is incorrect.
Misinterpretation	Students do not write conclusions according to the context of the inheritance.	The final answer does not explain the meaning of the calculation results.

As presented in Table 3, the most frequent errors involved misinterpretation of results and mathematical modelling. Many students were able to obtain numerical answers but failed to explain their meaning in relation to the distribution of inheritance. In addition, some students had difficulty translating verbal information into mathematical expressions involving fractions. These findings suggest that students require further support in developing contextual reasoning and mathematical communication skills.

At the problem-understanding stage, several students failed to identify important information contained in the problem statement. Some students overlooked specific details regarding the number of heirs or the fractional shares assigned to each heir. As a result, they proceeded with calculations based on incomplete or incorrect information. Such errors indicate

that students may not yet be accustomed to carefully analyzing contextual word problems before attempting to solve them.

At the planning stage, students frequently encountered difficulties in determining appropriate mathematical strategies. Although they understood the fractions involved, they often struggled to decide how to combine them or apply them to the total inheritance amount. This difficulty reflects a gap between conceptual understanding and strategic application. Students may know mathematical procedures but still struggle to decide which are most suitable for a particular problem.

Errors were also observed during the implementation stage. Some students incorrectly performed fraction operations, particularly when finding common denominators, simplifying fractions, or calculating fractional portions of inheritance. These procedural mistakes often resulted in inaccurate final answers even when students had correctly understood the problem. Such findings indicate that mastery of fraction concepts remains an important prerequisite for successful problem solving.

The most significant difficulties emerged during the interpretation stage. Many students viewed problem solving as complete once a numerical answer had been obtained. Consequently, they rarely checked the reasonableness of their answers or explained how the results related to the context of inheritance. This tendency suggests that students are more accustomed to routine mathematical exercises than to contextual problems requiring reflection and interpretation. Therefore, teachers should provide learning experiences that encourage students to justify their reasoning and communicate their solutions clearly.

The errors identified in this study indicate that students experience difficulties not only in fraction calculations but also in understanding contextual information and translating it into mathematical models. These findings are in line with Murjani et al. (2023) and Hadiyanti & Manurung (2025), who found that students frequently struggle to identify relevant information, determine appropriate solution strategies, and interpret answers in fraction word problems. According to Polya (1973), weaknesses at the stages of understanding and planning can negatively affect subsequent stages of problem solving, which explains why many students in this study produced incorrect solutions or failed to relate their answers to the inheritance context.

The Contribution of *Mawaris* Context to Fraction Learning

The use of *Mawaris* as a learning context provides meaningful opportunities for students to connect mathematical concepts with Islamic values and real-life situations. Through inheritance distribution problems, students are encouraged to understand fractions not only as numerical entities but also as practical tools used in social and religious contexts. The specific contributions of the *Mawaris* context identified in this study are summarized in Table 4.

Table 4. The Role of *Mawaris* Context in Fractional Story Questions

Aspects of the Role of the Legacy Context	Explanation	Findings in Research
Relating fractions to real life	Fractions are not only understood as numbers, but as part of the division of inheritance.	Students can see that fractions have a function in social and religious life.
Tailoring learning to MTs characteristics	*Mawaris* is close to the Islamic educational environment in the madrasah.	The context of *Mawaris* makes story questions more relevant to the identity and learning experience of MTs students.
Practice understanding of the narrative of the question	Students must understand the story, the relationship of the heirs, and the part received.	Some students still have difficulty understanding the relationship between heirs in the question.
Developing Islamic values	*Mawaris* is related to the values of justice, precision, responsibility, and honesty.	Fractional learning can be directed not only to the cognitive aspect, but also to religious values.
Enhancing the meaning of mathematics learning	Mathematics is understood as a useful science in life.	Students can see the relationship between mathematics, religion, and everyday life.

Based on Table 4, the *Mawaris* context helps make fraction learning more meaningful and relevant to students' experiences in Islamic educational settings. The context enables students to relate mathematics to values such as justice, responsibility, honesty, and accuracy. Unlike conventional fraction problems that often use generic daily-life situations, *Mawaris* problems provide a context that is closely connected to students' religious and cultural backgrounds. As a result, students may perceive mathematics as more relevant and useful in understanding real-life issues.

Another important contribution of the *Mawaris* context is its ability to promote meaningful learning. Students are required not only to perform calculations but also to understand the rationale for the distribution of inheritance. This process encourages them to connect mathematical concepts with broader social and ethical considerations. Through such activities, students can develop a deeper appreciation of both mathematics and Islamic teachings.

The *Mawaris* context also supports the development of critical thinking and reasoning skills. Inheritance problems often involve multiple heirs with different fractional shares, requiring students to analyze relationships, compare quantities, and make logical decisions. These cognitive demands encourage students to engage in more complex forms of mathematical thinking than those typically required in routine exercises.

Furthermore, the integration of Islamic values into mathematics learning may increase students' motivation and engagement. Because the context is familiar and meaningful, students may be more interested in participating in learning activities and more willing to explore mathematical concepts. This finding supports the idea that contextual learning can enhance students' understanding by connecting abstract concepts with authentic situations.

Nevertheless, the findings also indicate that students need sufficient guidance to understand the relationships among heirs and correctly interpret inheritance distributions. Some students found the inheritance context challenging because it involved concepts that were unfamiliar to them. Therefore, the use of *Mawaris* should be integrated not only as a contextual problem but also as part of a broader instructional strategy that includes explanation, discussion, and reflection.

The findings demonstrate that the *Mawaris* context provides meaningful learning experiences by connecting fraction concepts with students' religious and social lives. This result supports Freudenthal's (1991) view that mathematics becomes more meaningful when it is learned through authentic contexts familiar to students. Similarly, Abu-Rasheed et al. (2023) and Sulasmi (2022) argued that contextual learning enhances conceptual understanding and student engagement because learners can relate abstract mathematical ideas to real-life situations. Therefore, integrating *Mawaris* into fraction learning can facilitate deeper understanding while simultaneously strengthening Islamic values relevant to the Madrasah Tsanawiyah environment.

Implications for Mathematics Learning in Madrasah Tsanawiyah

he findings of this study have several implications for mathematics learning in MTs. First, teachers should provide learning activities that emphasize all stages of problem solving, including understanding problems, planning solutions, carrying out procedures, and interpreting results. Particular attention should be given to the interpretation stage because this was the area in which students demonstrated the greatest difficulty. Teachers can encourage students to explain their reasoning, justify their answers, and discuss the meaning of their solutions within the given context.

Second, students need more opportunities to engage with contextual fraction problems that require reasoning and interpretation. Learning activities should move beyond routine computational exercises and include tasks that challenge students to analyze situations, formulate mathematical models, and communicate their conclusions. Such experiences can help students develop more comprehensive problem-solving abilities.

Third, mathematics teachers in Islamic schools may consider integrating contexts that are closely related to students' cultural and religious backgrounds. The findings of this study indicate that *Mawaris* can serve as an effective context for connecting mathematical concepts with Islamic values. Through this integration, students can simultaneously develop mathematical

understanding and strengthen their awareness of ethical principles such as fairness, responsibility, and justice.

Finally, the results suggest that contextual and value-based mathematics learning has considerable potential for improving students' engagement and understanding. Future instructional programs may incorporate *Mawaris*-based worksheets, learning modules, or project-based activities to further enhance students' problem-solving abilities. Future research may also investigate the effectiveness of such instructional interventions in improving students' conceptual understanding, mathematical reasoning, and attitudes toward mathematics.

The positive contribution of the *Mawaris* context found in this study supports the principles of contextual learning proposed by Freudenthal's (1991) , which emphasize that mathematical concepts become more meaningful when they are connected to authentic situations familiar to learners. Through inheritance distribution problems, students are able to see the practical application of fractions in real-life situations, thereby reducing the abstract nature of mathematical concepts.

This finding is also consistent with Abu-Rasheed et al. (2023), who argued that contextual learning environments improve students' engagement and conceptual understanding by connecting learning content with meaningful experiences. In addition, Sulasmi (2022) demonstrated that contextual approaches in fraction learning significantly improve students' understanding of fraction operations because students are encouraged to construct meaning from realistic situations.

The findings further reinforce the work of Noviani et al. (2022), who reported that the integration of faraidh or Islamic inheritance contexts can support students' mathematical problem-solving abilities while simultaneously strengthening their understanding of Islamic values. Therefore, *Mawaris*-based learning may serve as an effective strategy for integrating cognitive and affective learning outcomes within Islamic educational settings.

CONCLUSIONS AND SUGGESTIONS

This study concludes that the problem-solving abilities of Madrasah Tsanawiyah students in solving *Mawaris*-integrated fraction word problems are generally at a moderate level. Students demonstrated better performance in understanding problems and carrying out solution procedures than in interpreting results within the context of Islamic inheritance distribution. The findings indicate that students' difficulties are not only related to fraction operations but also to contextual reasoning and the ability to connect mathematical solutions with real-life situations. The integration of *Mawaris* provides a meaningful learning context that links mathematical concepts with Islamic values and students' social experiences.

Based on these findings, mathematics teachers are encouraged to provide more contextual learning activities and systematically guide students through each stage of problem solving, particularly in interpreting and communicating solutions. Teachers may also develop learning materials and word problems based on Islamic contexts such as *Mawaris*, zakat, and other relevant topics to enhance students' engagement and understanding. Future research is recommended to involve larger samples from different Islamic schools and to investigate the effectiveness of *Mawaris*-based instructional materials or learning models in improving students' mathematical problem-solving abilities.

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