



MATHEMATICS LEARNING DIFFICULTIES IN NUMBER TOPICS: AN ANALYSIS BASED ON THE LEARNING STYLES OF JUNIOR HIGH SCHOOL

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Abstract

Learning difficulties in number concepts remain a common challenge among junior high school students. Although numerous studies have examined students' difficulties in mathematics learning, research that specifically analyzes these difficulties based on students' learning styles in number concepts is still limited. This study aimed to analyze the conceptual, procedural, and principle-related difficulties experienced by seventh-grade students at SMP Negeri 15 Yogyakarta based on visual, auditory, and kinesthetic learning styles. This study employed a descriptive qualitative approach. The participants consisted of 29 students from Class VII C in the 2025/2026 academic year, with six representative participants selected through purposive sampling to represent each learning style. Data were collected through essay tests, learning style questionnaires, and semi-structured interviews validated by experts. The data were analyzed through the stages of data reduction, data display, and conclusion drawing. The findings revealed that students with visual learning styles experienced difficulties in understanding information presented in word problems and determining appropriate solution procedures. Students with auditory learning styles encountered difficulties in understanding fraction operation concepts and applying solution procedures, while students with kinesthetic learning styles experienced difficulties in integrating multiple mathematical concepts when solving word problems. The novelty of this study lies in its in-depth analysis of conceptual, procedural, and principle-related learning difficulties in number concepts based on students' learning styles. The findings are expected to provide teachers with insights for designing learning strategies that accommodate students' learning style characteristics.

Keywords: *Learning Difficulties; Learning Styles; Mathematics*

Abstrak

Kesulitan belajar matematika pada materi bilangan masih menjadi permasalahan yang banyak dialami siswa SMP. Meskipun berbagai penelitian telah mengkaji kesulitan belajar matematika, kajian yang menganalisis kesulitan siswa berdasarkan gaya belajar pada materi bilangan masih terbatas. Penelitian ini bertujuan untuk menganalisis kesulitan konseptual, prosedural, dan prinsip yang dialami siswa kelas VII SMP Negeri 15 Yogyakarta berdasarkan gaya belajar visual, auditori, dan kinestetik. Penelitian menggunakan pendekatan kualitatif dengan desain deskriptif. Subjek penelitian berjumlah 29 siswa kelas VII C Tahun Ajaran 2025/2026, dengan enam subjek utama yang dipilih secara *purposive sampling* untuk mewakili setiap gaya belajar. Data dikumpulkan melalui tes uraian, angket gaya belajar, dan wawancara semi terstruktur yang telah divalidasi oleh ahli, kemudian dianalisis melalui tahapan reduksi data, penyajian data, dan penarikan kesimpulan. Hasil penelitian menunjukkan bahwa siswa bergaya belajar visual mengalami kesulitan dalam memahami informasi pada soal cerita dan menentukan prosedur penyelesaian, siswa bergaya belajar auditori mengalami kesulitan pada pemahaman konsep operasi pecahan dan penerapan prosedur, sedangkan siswa bergaya belajar kinestetik mengalami kesulitan dalam mengintegrasikan beberapa konsep matematika pada penyelesaian soal cerita. Kebaruan penelitian ini terletak pada analisis mendalam mengenai karakteristik kesulitan konseptual, prosedural, dan prinsip berdasarkan gaya belajar siswa pada materi bilangan. Temuan penelitian diharapkan menjadi dasar bagi guru dalam merancang pembelajaran yang lebih sesuai dengan karakteristik gaya belajar siswa

Kata kunci: Gaya Belajar; Kesulitan Belajar; Matematika

INTRODUCTION

Mathematics is a fundamental subject taught at every level of education, from elementary school to higher education. This is because mathematics develops students' critical, logical, and analytical thinking skills. As a broad scientific discipline, mathematics plays an essential role in various aspects of daily life (Hasibuan, 2018). Although mathematics is abstract in nature, it provides practical benefits in solving real-world problems. To effectively apply mathematical knowledge, students must understand and follow the underlying mathematical principles and procedures. Consequently, mathematics contributes significantly to individuals' intellectual development and everyday decision-making (Hermawati et al., 2018). Furthermore, mathematics education promotes the development of students' creativity and potential (Erva et al., 2022). Mathematics learning is expected to help students understand mathematical concepts, strengthen their problem-solving abilities, and recognize the importance of mathematics in everyday life (Indirwan et al., 2021).

Despite its importance, many students continue to experience difficulties in learning mathematics. Learning mathematics not only equips students with cognitive skills but also fosters responsibility, perseverance, and positive character development (Fauzan & Anshari, 2024). However, many students struggle to solve mathematical problems because they have not yet mastered fundamental mathematical concepts (Usman & Kristiawati, 2024). Learning difficulties may arise from both internal and external factors. Internal factors include students' cognitive abilities and their capacity to process learning materials, whereas external factors involve teachers, the learning environment, and the availability of learning facilities (Wites & Delyana, 2022).

Evidence of students' mathematical difficulties can also be observed in international assessments. The Programme for International Student Assessment (PISA), administered by the Organisation for Economic Co-operation and Development (OECD), evaluates students' higher-order thinking skills worldwide. The 2022 PISA results indicated that approximately 99% of Indonesian students were able to solve only Level 1–3 mathematics problems, while only 0.4% successfully answered Level 4–6 mathematics questions (Kemdikdasmen, 2025; Nisa & Faradiba, 2023). These findings suggest that Indonesian students continue to encounter substantial challenges in mathematical reasoning and problem solving. One topic that frequently presents difficulties for junior high school students is number concepts. Students often struggle to understand fundamental concepts before progressing to contextual mathematical problems. Many students can imitate worked examples but cannot explain the underlying concepts. Difficulties are particularly evident in rational numbers, where students experience problems performing arithmetic operations, including addition, subtraction, multiplication, and division. Limited conceptual understanding ultimately hinders students' ability to solve mathematical problems effectively.

Students differ in the ways they process and understand instructional materials. Some students learn more effectively by listening to explanations, whereas others prefer visual presentations, such as written notes or diagrams. These differences are commonly referred to as learning styles, which describe individuals' preferred ways of receiving, processing, and retaining information based on their experiences and learning habits (Wanelly & Fauzan, 2020). According to Kumaidi (2018), three primary learning styles are commonly identified: visual, auditory, and kinesthetic. Although every student may exhibit characteristics of all three learning styles, one style generally becomes dominant.

Understanding students' learning styles is important for teachers because it enables them to design instruction that accommodates students' learning preferences. Although learning styles do not directly increase students' intellectual ability, they can improve learning effectiveness (Muhsana & Adha, 2022). When students recognize their preferred learning styles, they can adapt their learning environments and strategies to maximize learning outcomes (Lestari et al., 2022). Likewise, teachers who understand

students' learning preferences are better able to implement instructional strategies that facilitate conceptual understanding and improve academic achievement (Naja & Sa'o, 2023).

Among the mathematical topics taught in junior high school, number concepts constitute one of the most fundamental areas because they serve as prerequisites for subsequent mathematical learning. The topic encompasses essential concepts such as integer operations, fractions, and word problems. Misunderstanding these foundational concepts may negatively affect students' performance in more advanced mathematical topics. Preliminary classroom observations conducted in Class VII-C at SMP Negeri 15 Yogyakarta revealed that only five of the twenty-nine students achieved scores above the school's Minimum Mastery Criterion (KKTP) on the daily assessment for number concepts, whereas more than 80% failed to meet the required standard. These findings indicate that students continue to experience considerable difficulties in learning number concepts, warranting further investigation into the nature of these learning difficulties. Given the school's minimum achievement standards, it is important to examine students' learning difficulties from an internal perspective, particularly by considering differences in learning styles. Identifying students' dominant learning styles may assist teachers in adapting instructional approaches that minimize learning difficulties, improve conceptual understanding, and ultimately enhance students' mathematics achievement.

Several previous studies have examined the relationship between learning styles and mathematics learning difficulties. Azizi et al. (2022) reported that students with visual, auditory, and kinesthetic learning styles exhibit different patterns of difficulty when solving mathematical problems. Wites and Delyana (2022) found that learning styles influence students' mathematical problem-solving performance. Furthermore, Hana and Malasari (2024), through a systematic literature review, concluded that learning styles constitute one of the factors contributing to mathematics learning difficulties. Nevertheless, previous studies have generally investigated mathematics learning difficulties from a broad perspective and have rarely examined conceptual, procedural, and principle-related difficulties specifically within the topic of number concepts based on students' learning styles.

Accordingly, a clear research gap remains. Existing studies have paid limited attention to comprehensively investigating students' conceptual, procedural, and principle-related difficulties in learning number concepts by integrating analyses of visual, auditory, and kinesthetic learning styles through a qualitative approach. Most previous studies have emphasized learning outcomes or mathematical problem-solving ability without providing detailed descriptions of the specific characteristics of learning difficulties associated with each learning style.

The novelty of this study lies in its comprehensive qualitative analysis of students' conceptual, procedural, and principle-related difficulties in learning number concepts based on visual, auditory, and kinesthetic learning styles. Unlike previous studies, this research not only identifies the types of learning difficulties experienced by students but also explores the distinctive characteristics associated with each learning style through the analysis of written tests and interview data. The findings are expected to provide more comprehensive evidence for designing instructional strategies that better accommodate students' individual learning characteristics.

Therefore, this study aims to identify the learning styles of seventh-grade students at SMP Negeri 15 Yogyakarta, analyze their conceptual, procedural, and principle-related difficulties in learning number concepts based on visual, auditory, and kinesthetic learning styles, and describe the characteristics of mathematics learning difficulties associated with each learning style as a foundation for developing more effective instructional strategies.

METHOD

This study employed a qualitative research approach. According to Niam et al. (2024), a qualitative approach is used to obtain an in-depth understanding of a phenomenon within its natural context. This approach relies on data in the form of participants' words, behaviors, and experiences. Rather than emphasizing numerical measurements, qualitative research focuses on meaning, context, and social processes, enabling researchers to develop a comprehensive understanding of the phenomenon under investigation.

The study was conducted at SMP Negeri 15 Yogyakarta during the second semester of the 2025/2026 academic year, specifically in April 2026. The research site was selected based on preliminary observations indicating that most seventh-grade students experienced difficulties in solving mathematics problems related to number concepts. The participants consisted of 29 seventh-grade students from Class VII-C who had completed instruction on number concepts.

Participants were selected using purposive sampling. Initially, all students completed a learning style questionnaire and a mathematics achievement test on number concepts. The questionnaire results identified 13 students with visual learning styles, 9 with auditory learning styles, 4 with kinesthetic learning styles, and 3 with a combination of two learning styles. Subsequently, six participants were selected for in-depth analysis, consisting of two students representing each dominant learning style (visual, auditory, and kinesthetic). The selection was based on students' test performance, representation of each learning style category, and their ability to provide rich and detailed information during the interview process.

Three research instruments were employed: an open-ended mathematics test, a learning style questionnaire, and a semi-structured interview guide. The open-ended test was designed to identify students' learning difficulties in number concepts, the questionnaire was used to determine students' dominant learning styles, and the interviews were conducted to explore the underlying causes of students' difficulties in solving mathematical problems. Prior to data collection, all research instruments were validated by experts in mathematics education. The validation process resulted in revisions to the content, language, and alignment of the instruments with the research objectives, ensuring their validity and appropriateness for data collection.

Data credibility was established through methodological triangulation by comparing information obtained from the written test, learning style questionnaire, and semi-structured interviews. This triangulation process enhanced the trustworthiness and credibility of the research findings.

Data were analyzed using the interactive model proposed by Miles, Huberman, (2019), which consists of three interconnected stages: data reduction, data display, and conclusion drawing and verification. During the data reduction stage, the researcher selected, categorized, and simplified data obtained from the tests, questionnaires, and interviews according to the research objectives. The data were then presented in narrative form, supported by tables and samples of students' written work to facilitate interpretation. Finally, conclusions were drawn and verified by examining the relationships among the collected data to provide a comprehensive description of students' mathematics learning difficulties in number concepts based on their visual, auditory, and kinesthetic learning styles.

RESULTS AND DISCUSSION

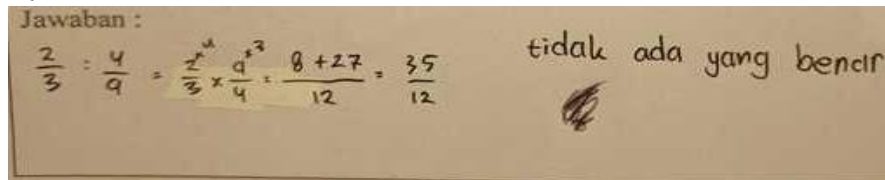
The purpose of this study was to identify the mathematics learning difficulties experienced by seventh-grade students in Class VII-C and to determine their dominant learning styles. Data were collected through a mathematics achievement test, a learning style questionnaire, and semi-structured interviews. The results of the learning style questionnaire administered to 29 students revealed that 13 students had a visual learning style, 9 had an auditory learning style, and 4 had a kinesthetic learning

style. In addition, one student exhibited a combination of visual and auditory learning styles, one demonstrated a combination of visual and kinesthetic learning styles, and one showed a combination of auditory and kinesthetic learning styles.

Based on the mathematics achievement test results, six participants were purposively selected to represent the highest- and lowest-performing students within each dominant learning style category. Consequently, the final research participants consisted of two students with visual learning styles, two students with auditory learning styles, and two students with kinesthetic learning styles. These participants were selected for in-depth analysis through interviews to obtain a comprehensive understanding of the mathematics learning difficulties associated with each learning style.

Analisis Mathematics Learning Difficulties Among Students with Visual Learning Styles

Based on the results of the analysis, students with visual learning styles experienced difficulties in understanding mathematical concepts, applying procedures, and applying mathematical principles. The findings indicate that these three types of difficulties were evident to varying degrees among students with visual learning styles. Figure X presents the responses of the highest-performing student with a visual learning style (V1) on Question 3 and the lowest-performing student with a visual learning style (V2) on Question 4.



Jawaban :

$$\frac{2}{3} : \frac{4}{9} = \frac{2^1 \cdot 3^0}{3^1 \cdot 4^1} = \frac{8 + 27}{12} = \frac{35}{12}$$

tidak ada yang benar

Figure 1. Student V1's Response to Question 3

As shown in Figure 1, the visual learning style participant (V1) experienced difficulties in understanding the fundamental concepts of fraction operations. Although the student recognized that a division operation can be converted into multiplication, an error occurred during the calculation process. Specifically, after correctly transforming the division into multiplication, the student incorrectly applied the multiplication procedure by misusing the numerator and denominator operations. This indicates that the student was able to recall the mathematical rule but failed to apply the underlying concept correctly. During the interview, V1 was able to explain the meaning of the problem, identify the given information, and state the appropriate mathematical formula. Nevertheless, the student made errors while carrying out the solution.

In addition, V1 experienced procedural difficulties in solving the problem systematically. Although the initial step was completed correctly, the student was unable to continue the subsequent steps to obtain the correct final answer. During the interview, V1 explained that the solution to Question 3 required finding the least common multiple (LCM). However, determining the LCM was unnecessary for solving the problem. The student also admitted feeling confused about the solution process and was uncertain about the appropriate sequence of steps. These findings suggest that the student had not yet mastered the procedural sequence required to solve the problem accurately.

Furthermore, V1 demonstrated difficulties in applying mathematical principles. The student incorrectly combined two different arithmetic operations, namely addition and multiplication, despite the fact that each operation follows distinct mathematical rules that cannot be applied interchangeably without proper justification. During the interview, V1 stated that the error occurred because of confusion and forgetting the correct arithmetic procedures. The student also expressed uncertainty regarding the final answer. These findings indicate that the student had not yet developed a sufficient understanding of the fundamental principles governing fraction operations.

The findings for participant V1 are consistent with those reported by Azizi et al. (2022), who found that students with visual learning styles frequently experience difficulties in applying mathematical procedures systematically, even when they understand part of the information presented in a problem. Similarly, Darmono et al. (2021) reported that visual learners often encounter challenges in translating problem information into appropriate solution procedures, particularly for problems involving multiple computational steps. Therefore, the difficulties experienced by V1 were not solely attributable to inadequate procedural knowledge but also reflected an incomplete understanding of the fundamental principles underlying fraction operations.

Jawaban :

$$10.000 \times 12 = 120.000$$

$$10.000 \times 16 = 160.000$$

$$160.000 \div 8 = 20.000$$

hasilnya = ~~80.000~~ 20.000

Figure 2. Student V2's Response to Question 4

As shown in **Figure 2**, the visual learning style participant (V2) experienced difficulties in understanding the concepts presented in the problem. The student failed to distinguish between the two different activities described in the word problem, namely saving money and withdrawing money. This misconception was evident from the student's calculation of IDR $10,000 \times 16$ days, despite the problem stating that the student saved money for only 12 days, while the remaining four days involved withdrawing money. This error indicates that the student did not understand the conceptual difference between the two activities described in the problem. During the interview, V2 was unable to explain the information provided in the question, further confirming the student's limited conceptual understanding.

V2 also demonstrated procedural difficulties by solving the problem unsystematically. Although the student correctly performed the multiplication operation, the solution steps were not organized logically. The student failed to separate the saving and withdrawal processes and incorrectly used division to determine the remaining savings instead of applying subtraction, which was the appropriate operation required by the problem. During the interview, V2 correctly explained how to perform multiplication but was unable to describe the correct sequence of steps needed to solve the problem.

Furthermore, V2 experienced difficulties in applying mathematical principles. The student did not recognize that the remaining balance should be obtained by subtracting the amount withdrawn from the total amount saved. Instead, the student used the result of a division operation, which was mathematically irrelevant to the problem. During the interview, V2 was unable to justify the final answer and admitted that the solution had been produced through guessing rather than by applying an appropriate mathematical strategy.

The findings for participant V2 support those reported by Wites and Delyana (2022), who found that students with visual learning styles often experience difficulties in translating information from word problems into appropriate mathematical models. These findings are also consistent with Azizi et al. (2022), who argued that deficiencies in conceptual understanding negatively affect students' ability to select appropriate procedures and apply mathematical principles when solving problems. Therefore, the difficulties experienced by V2 demonstrate the close relationship among conceptual understanding, procedural competence, and the application of mathematical principles in solving word problems.

Table 1. Analysis of Mathematics Learning Difficulties with Visual Learning Styles

Participant	Question No.3		
	K	P	P
Participant V1	√	√	√
Participant V2	Question No.4		
	K	P	P
	√	√	√

Analysis of Mathematics Learning Difficulties Among Students with Auditory Learning Styles

Based on the results of the analysis, students with auditory learning styles experienced difficulties in understanding mathematical concepts, applying procedures, and applying mathematical principles. These findings indicate that students with auditory learning styles encountered challenges across all three aspects of mathematical learning. Figure X presents the responses of the highest-performing student with an auditory learning style (A1) to Question 3 and the lowest-performing student with an auditory learning style (A2) to Question 5.

The image shows handwritten work for Question 3. On the left, the problem is $\frac{2}{3} \div \frac{4}{9}$. To the right, two incorrect solutions are shown: $A = \frac{8}{27}$ and $B = \frac{3}{2}$. Below these, a long horizontal equation is written: $\frac{2}{3} \div \frac{4}{9} = \frac{2}{9} + \frac{4}{9} = \frac{6}{9}$. To the right of this equation is the text "Ga ada yg bnr" (There is no correct one). On the far left, there is a vertical calculation showing $\frac{3}{3} \times \frac{4}{9} = \frac{12}{27}$, which is also incorrect.

Figure 3. Student A1's Response to Question 3

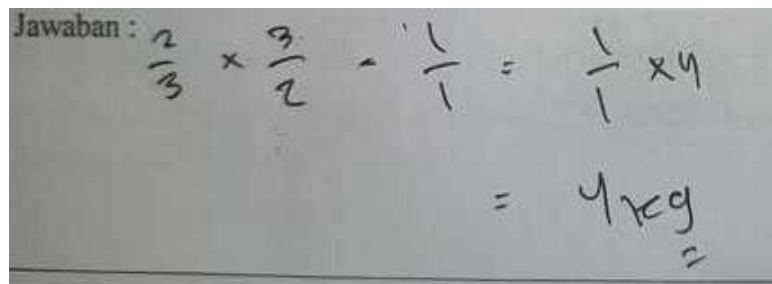
As shown in Figure 3, the participant with an auditory learning style (A1) experienced difficulties in understanding the fundamental concept of fraction division. This difficulty was evident in the student's solution, where the procedures used for fraction addition and subtraction were incorrectly applied by first finding a common denominator and then adding the numerators. In other words, the student mistakenly treated the division operation as if it were an addition operation. During the interview, A1 was able to accurately explain the information provided in the problem. However, the student was unable to explain the concepts underlying fraction division and subtraction, stating that these concepts had been forgotten while solving the problem.

Furthermore, the participant with an auditory learning style (A1) experienced procedural difficulties in applying the correct sequence of steps to solve the problem. Specifically, the student failed to convert the division operation into multiplication, invert the second fraction, and correctly multiply the numerators and denominators. During the interview, A1 incorrectly explained the solution procedure, stating that once the denominators had been made equal, the numerators were transferred and then multiplied to obtain the final answer. This explanation indicates that the student did not understand the correct procedure for solving fraction division problems $\frac{8}{9}$.

Furthermore, the participant with an auditory learning style (A1) experienced difficulties in applying mathematical principles during the calculation process because the student was unable to distinguish between the procedures for fraction division and fraction addition. This finding indicates an inadequate understanding of the fundamental principles governing arithmetic operations involving fractions. During the interview, A1 was able to explain the basic principles of division, multiplication, and addition. The student also acknowledged making errors during the calculations and explained that

these mistakes occurred because the work was completed hastily after noticing that other classmates had already finished the task.

The findings for participant A1 are consistent with those reported by Azizi et al. (2022), who found that students with auditory learning styles tend to understand mathematical concepts through verbal explanations but are more likely to make errors when the information is not retained effectively in memory. Similarly, Wites and Delyana (2022) argued that inadequate conceptual understanding contributes to errors in selecting and applying appropriate mathematical solution procedures. Therefore, the difficulties experienced by A1 suggest that conceptual understanding serves as the foundation for students' successful application of mathematical procedures when solving fraction problems.



Jawaban : $\frac{2}{3} \times \frac{3}{2} = \frac{1}{1} = \frac{1}{1} \times 4$
 $= 4 \text{ kg}$

Figure 4. Student A2's Response to Question 5

As shown in Figure 4, the participant with an auditory learning style (A2) experienced difficulties in understanding the word problem. The student was unable to identify and interpret the information provided in the problem correctly. This difficulty is evident in Figure 4, where the student attempted to solve the problem by multiplying fractions, even though this operation was not appropriate for the given context. These findings indicate that the student had difficulty comprehending the problem situation before selecting an appropriate mathematical strategy $\frac{2}{3}$ and $\frac{3}{2}$. This finding indicates that the student had not yet understood the information presented in the problem, particularly the concept of ratios embedded in the word problem. During the interview, A2 demonstrated a lack of understanding of the problem and was unable to explain any of the information provided. These findings further confirm the students' limited conceptual understanding of the mathematical situation described in the problem.

Furthermore, the participant with an auditory learning style (A2) experienced procedural difficulties in solving the problem. As shown in Figure 4, the student did not separate the calculations for the flour and sugar quantities. Instead, the student directly multiplied the fractions representing the two ingredients, resulting in an inappropriate solution. During the interview, A2 was unable to explain the correct sequence of steps required to solve the problem and could not describe what should be done after multiplying the fractions. These findings indicate that the student had not mastered the procedural steps necessary to solve the word problem correctly.

In addition, A2 demonstrated difficulties in applying mathematical principles. The student failed to recognize the underlying principle required by the problem and immediately multiplied the quantities of flour and sugar without considering that the recipe was to be prepared four times. Instead, each ingredient should have been multiplied separately by four before determining the final quantities. During the interview, A2 was unable to provide any explanation of the solution process, further indicating a limited understanding of the mathematical principles underlying the problem.

The findings for participant A2 support those reported by Wites and Delyana (2022), who found that students' difficulties in understanding information presented in word problems often lead to errors in selecting appropriate solution procedures. Likewise, Azizi et al. (2022) argued that inadequate conceptual understanding negatively affects students' ability to apply mathematical principles

accurately. Therefore, the difficulties experienced by A2 demonstrate the close relationship among conceptual understanding, procedural competence, and the application of mathematical principles when solving word problems.

Table 2. Analysis of Mathematics Learning Difficulties with Auditory Learning Styles

Participant	Question No.3		
	K	P	P
Participant A1	√	√	√
Participant A2	Question No.5		
	K	P	P
	√	√	√

Analysis of Mathematics Learning Difficulties with Kinesthetic Learning Styles

Based on the results of the analysis, students with kinesthetic learning styles experienced difficulties in understanding mathematical concepts, applying procedures, and applying mathematical principles. These findings indicate that students with kinesthetic learning styles encountered challenges across all three aspects of mathematics learning. Figure X presents the responses of the highest-performing student with a kinesthetic learning style (K1) to Question 2 and the lowest-performing student with a kinesthetic learning style (K2) to Question 5.

Jawaban :

$$\frac{7}{8} - \frac{3}{8} = \frac{4}{8} \text{ kg} = 2 : \frac{4}{8} = 2 \times \frac{8}{4} = \frac{8}{2} = 4 \text{ kg kan banyak gula}$$

Figure 5. Student K1's Response to Question 2

As shown in Figure 5, the participant with a kinesthetic learning style (K1) demonstrated difficulties in understanding the concept of fraction division within the context of a word problem. Although the student correctly determined the remaining amount of sugar using fraction subtraction, the student became confused when required to divide the remaining sugar equally into two bags. During the interview, K1 stated that the context of the problem was difficult to understand and explained that only the subtraction operation was understood. These findings indicate that the student had not yet developed a sufficient conceptual understanding of fraction division in contextual mathematical situations.

Furthermore, K1 experienced procedural difficulties while carrying out the solution steps. After obtaining the intermediate result, the student was unable to continue the solution using the correct sequence of mathematical procedures $\frac{4}{8}$. The student applied an incorrect procedure by converting the division operation into multiplication and immediately attempting to simplify the fractions through cross-cancellation without following the appropriate mathematical steps. This error indicates that the student had not yet mastered the correct sequence of procedures for solving fraction operations. During the interview, K1 explained that confusion arose after completing the subtraction operation and admitted to forgetting which step to perform next. These findings suggest that the student experienced difficulty in applying mathematical procedures systematically (Kurudireket et al., 2025)

Furthermore, the participant with a kinesthetic learning style (K1) had difficulty integrating multiple mathematical concepts into a single problem. As reflected in the student's written response, K1 was unable to connect the concepts of fraction subtraction and fraction division in the context of the word problem. Although the subtraction operation was performed correctly, the student failed to apply

the concept of fraction division appropriately. During the interview, K1 stated that the procedure for dividing a fraction by another fraction had been forgotten and also expressed uncertainty when determining the final answer. These findings indicate that the student experienced difficulties in applying the mathematical principles required to integrate multiple fraction operations within a contextual problem (Sari et al., 2024).

The findings for participant K1 are consistent with those reported by Hana and Malasari (2024), who found that students with kinesthetic learning styles tend to experience difficulties when required to integrate multiple mathematical concepts while solving a single problem. Similarly, Azizi et al. (2022) argued that unresolved conceptual difficulties often lead to errors in selecting appropriate procedures and applying mathematical principles. Therefore, the difficulties experienced by K1 suggest that the ability to integrate multiple mathematical concepts is a critical factor in successfully solving word problems involving fraction operations (López-Martín et al., 2022)

Jawaban: Tepung = $\frac{2 \times 2}{3 \times 2} \times \frac{4 \times 6}{1 \times 6} = \frac{4}{6} \times \frac{24}{6} = \frac{96}{6} = \frac{32}{2} = 16 \text{ kg}$

Gula: $\frac{3 \times 3}{2 \times 3} \times \frac{4 \times 6}{1 \times 6} = \frac{9}{6} \times \frac{24}{6} = \frac{216}{6} = 36 \text{ kg}$

Figure 6. Student K2's Response to Question 5

As shown in Figure 6, the participant with a kinesthetic learning style (K2) demonstrated difficulties in understanding the fundamental concept of multiplying fractions by whole numbers. As reflected in the student's written response, K2 unnecessarily converted the whole number into a fraction, even though such a step was not required to solve the problem. This error indicates that the student had not yet developed a sufficient conceptual understanding of fraction multiplication involving whole numbers. $\frac{2 \times 2}{3 \times 2} \times \frac{4 \times 6}{1 \times 6}$. This error indicates that the student had not yet understood that the whole number 4 can be expressed as the fraction before performing fraction multiplication. Consequently, the student failed to apply the correct concept of multiplying a fraction by a whole number $\frac{4}{1}$. During the interview, K2 also stated that the problem was confusing and that the student had forgotten how to solve word problems involving both fractions and whole numbers. The student further explained that the only information understood from the problem was the fractional quantities of flour and sugar, indicating an inability to interpret the remaining information required to solve the problem correctly (Hariyani et al., 2022).

Furthermore, the participant with a kinesthetic learning style (K2) demonstrated procedural difficulties in solving the problem. The student attempted to solve the problem by guessing rather than following the correct procedures for fraction operations. This finding indicates that K2 had not yet mastered the sequence of mathematical steps required to solve the problem accurately $\frac{4}{6} \times \frac{24}{6}$ and $\frac{9}{6} \times \frac{24}{6}$. This error resulted in an incorrect final answer. During the interview, K2 explained that the solution was based solely on the student's own judgment and confidence while working on the problem rather than on an appropriate mathematical procedure.

Furthermore, K2 demonstrated difficulties in applying the principles of fraction multiplication within the context of a word problem. To solve this problem correctly, the student needed to relate the concept of fractions to the proportional relationship between the amount of each ingredient and the number of cakes to be prepared. However, K2 did not recognize that the quantity of each ingredient

should increase proportionally with the number of cakes by applying multiplication. In addition, the student did not verify the final answer. During the interview, K2 stated that the work was not reviewed because the student had become confused by the solution process and no longer understood the written work. These findings indicate that the student experienced difficulties in applying the mathematical principles required to solve contextual fraction problems (Hwang et al., 2023).

The findings for participant K2 support those reported by Wites and Delyana (2022), who found that deficiencies in conceptual understanding negatively affect students' ability to select appropriate solution procedures and apply mathematical principles correctly. Similarly, Hana and Malasari (2024) reported that students with kinesthetic learning styles tend to experience difficulties when required to integrate multiple mathematical concepts in contextual problems involving more than one arithmetic operation. Therefore, the difficulties experienced by K2 suggest that conceptual understanding serves as the foundation for the successful application of mathematical procedures and principles in solving mathematical problems (Irshid et al., 2023)

Table 3. Analysis of Mathematics Learning Difficulties with Kinesthetic Learning Styles

Participant	Question No.3		
	K	P	P
Participant K1	√	√	√
	Question No.5		
Participant K2	K	P	P
	√	√	√

CONCLUSION

The findings indicate that the characteristics of students' mathematics learning difficulties in the topic of numbers vary across learning style groups. Students with visual learning styles generally experienced difficulties in interpreting information presented in word problems and determining appropriate solution procedures. Students with auditory learning styles encountered greater difficulties in understanding fraction operation concepts and applying the correct solution procedures. Meanwhile, students with kinesthetic learning styles experienced challenges in integrating multiple mathematical concepts when solving problems involving more than one arithmetic operation. These differences suggest that learning style is an important factor to consider when designing effective mathematics instruction.

The findings also have important pedagogical implications. Mathematics teachers should design more adaptive instructional strategies that accommodate students' different learning styles. The use of diverse instructional media, the gradual introduction of contextual mathematical problems, and learning activities that emphasize conceptual understanding before procedural application may help reduce students' learning difficulties in the topic of numbers. Furthermore, the results of this study may assist teachers in identifying students' learning difficulties at an early stage, thereby enabling the implementation of more effective and targeted instructional strategies. This study is limited to the topic of numbers and involved participants from only one class in a single junior high school. Therefore, future research is recommended to include a more diverse sample of participants, investigate other mathematics topics, and develop or evaluate instructional strategies tailored to students' learning styles to reduce mathematics learning difficulties more effectively.

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