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Analysis of Learning Difficulties of Grade IV Elementary School Students on Fraction Materials Reviewed from Numeracy Ability and Self-Efficacy

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Abstract
Difficulty understanding the concept of fractions is still a major challenge for elementary school students and has an impact on numeracy skills and self-efficacy in learning mathematics. This study aims to analyze the learning difficulties of grade IV students of SD Muhammadiyah 1 Taman on fractional material reviewed from numeracy ability and self-efficacy. The research method used a quantitative descriptive approach involving 25 students of grade IV A. Data were collected through numeracy ability tests, Bandura scale-based self-efficacy questionnaires, and structured interviews. The results showed that students' numeracy ability was in the medium category with an average achievement of 56.8%, with dominant difficulties in the aspects of fraction comparison (42%) and mixed fraction counting operations (38%). Student self-efficacy was also moderately (62.7%), with the magnitude dimension obtaining the lowest score (56%). The Pearson correlation test showed a strong positive relationship between numeracy ability and self-efficacy ($r = 0.724$; $p < 0.01$), while regression analysis showed a 52.4% contribution to numeracy ability to self-efficacy. The results of the interviews confirmed that students better understand the concept of fractions through concrete media and contextual learning. This study recommends the application of ethnomathematics-based fractional learning model with a strategy of increasing self-efficacy through positive reinforcement and scaffolding.

INTRODUCTION

Mathematics is one of the fundamental subjects in the basic education curriculum that plays an important role in developing students' logical, analytical, and systematic thinking skills. Fraction content is one of the essential concepts in elementary school mathematics learning that students must master as a basis for learning more complex mathematical concepts at the next level of education (Ibrahim et al., 2023). However, research shows that fractions are one of the most difficult materials to understand by elementary school students in various countries, including Indonesia (Lestari et al., 2024). Difficulties in understanding the concept of fractions not only have an impact on students' mathematics learning achievement, but also affect numeracy skills which is one of the basic literacy in the National Assessment. Safari's research (2024) revealed that 67% of grade IV students in elementary school have difficulty understanding the basic concept of fractions, especially in identifying equivalent fractions and performing fraction counting operations. This phenomenon indicates the need for an in-depth analysis of the factors that cause students' learning difficulties in fraction concepts in order to design appropriate learning interventions.

Numeracy ability is defined as a person's ability to use, interpret, and communicate mathematical information and ideas in various contexts of daily life (O.E.C.D., 2019). In the context of fractional learning, numeracy skills include the skills of understanding fractional representations, comparing fractional values, performing calculation operations, and applying fractional concepts in contextual problem solving. Research by Daeli et al. (2025) shows that the numeracy ability of

elementary school students in Indonesia is still in the low to medium category, with the percentage of students who reach the advanced level of only 23%. This low numeracy ability is significantly correlated with students' difficulty in understanding abstract mathematical concepts, including fractions. Students with low numeracy skills tend to have difficulty in transforming visual representations of fractions into symbolic forms, comparing fractions with different denominators, and performing addition and subtraction operations (Prihapsari et al., 2023). This indicates that numeracy skills are an important predictor of students' success in mastering the concept of fractions.

In addition to cognitive factors in the form of numeracy skills, psychological factors such as self-efficacy also have a significant role in determining student learning success. Self-efficacy or self-efficacy is defined as an individual's belief in his or her ability to organize and carry out the actions necessary to achieve a certain goal (Bandura, 1997). In the context of mathematics learning, self-efficacy is related to students' confidence in their ability to understand mathematical concepts and solve mathematical problems (Agustini et al., 2024). Research by Siswono et al. (2022) found that students with high levels of self-efficacy showed better perseverance in facing challenging math problems, were more courageous in taking risks in trying problem-solving strategies, and had higher resilience when faced with failure. In contrast, students with low self-efficacy tend to give up easily when faced with difficulties, avoid math tasks that are considered difficult, and rely entirely on the help of others. This phenomenon shows that self-efficacy not only affects students' motivation to learn, but also affects the cognitive strategies used in solving math problems.

The relationship between numeracy ability and self-efficacy in mathematics learning has been the focus of research in recent years. A study conducted by Ningrum (2019) revealed a significant positive correlation between numeracy ability and mathematics self-efficacy in elementary school students, with a correlation coefficient of 0.682. The study explained that students who have good numeracy skills tend to develop high self-efficacy due to repeated successful experiences in completing math tasks. In contrast, students with low numeracy skills often experience failure in mathematics learning, which has an impact on decreased confidence and the development of math anxiety. In the context of fractional learning, the interaction between numeracy ability and self-efficacy becomes increasingly complex due to the abstract nature of fractional concepts that require strong mental representation as well as high self-confidence to explore various problem-solving strategies (Wiguna et al., 2022). Understanding the interaction of these two variables is important for designing holistic and effective learning interventions.

SD Muhammadiyah 1 Taman is one of the private elementary schools in Sidoarjo Regency that has implemented the Independent Curriculum with a focus on developing students' literacy and numeracy. Based on the results of initial observations and discussions with grade IV teachers, it was found that most students had difficulty in understanding the concept of fractions, especially in determining equivalent fractions, comparing fractions, and performing mixed fraction calculation operations. The results of the diagnostic test conducted at the beginning of the semester showed that only 32% of students were able to solve fractional questions correctly. Teachers also reported that many students exhibited negative attitudes toward math learning, such as lack of motivation, anxiety when working on problems, and a tendency to cheat on friends' answers. This phenomenon indicates the existence of complex problems involving not only the cognitive aspect but also the affective aspect in fractional learning in the school.

Based on the description above, this study aims to analyze the learning difficulties of grade IV students of SD Muhammadiyah 1 Taman on fractional material reviewed from numeracy ability and self-efficacy. This research is expected to make a theoretical contribution in enriching the study of mathematics learning difficulties in elementary schools, especially related to the interaction between cognitive and psychological factors. Practically, the results of this research are expected to be the basis for teachers and education practitioners in designing appropriate learning strategies to overcome students' learning difficulties in fractional materials. In addition, this study also aims to provide recommendations for the development of ethnomathematics-based teaching materials that are

contextual and relevant to students' local culture, so that they can improve their understanding of fractional concepts while building students' self-efficacy in learning mathematics. Thus, this research has strategic value in an effort to improve the quality of mathematics learning in elementary schools.

METHODS

This study uses a quantitative descriptive approach that aims to describe students' learning difficulties in fractional materials and analyze their relationship with numeracy ability and self-efficacy. The subjects of the study were 25 students of grade IV A SD Muhammadiyah 1 Taman consisting of 13 male students and 12 female students with an age range of 9-10 years. The selection of subjects used a purposive sampling technique with the consideration that the class was studying fractional material and showed indications of learning difficulties based on the results of initial observation. The research was carried out in the even semester of the 2024/2025 school year for four weeks, covering the stage of instrument preparation, data collection, and data analysis. The research location was chosen because the school has implemented the Independent Curriculum and has heterogeneous student characteristics in terms of academic ability and socioeconomic background.

The data collection technique in this study uses three main instruments. First, the numeracy ability test consists of 20 multiple-choice questions and descriptions that measure students' ability to understand the concept of fractions, compare fractions, perform calculation operations, and solve contextual problems related to fractions. The test instrument was prepared based on numeracy ability indicators from the Ministry of Education and Culture and has been validated by two mathematics education experts with a content validity value of 0.89. Second, the self-efficacy questionnaire adapted from the Bandura mathematical self-efficacy scale consisting of 25 statements on a Likert scale of 1-5, includes the dimensions of magnitude (task difficulty), generality (breadth of field), and strength (strength of belief). The reliability of the questionnaire was tested using Alpha Cronbach with a result of 0.876 indicating a high level of reliability. Third, structured interviews were conducted with 8 students who were purposively selected based on the category of numeracy ability (high, medium, low) to dig up in-depth information about the types of difficulties experienced, the learning strategies used, and the factors that affect students' confidence in fractional learning.

Table 1. Research Instrument Blueprint

Instrument	Aspect Measured	Number of Items	Format
Numeracy Ability Test	Understanding of fraction concepts	5	Multiple choice
	Fraction representation	4	Multiple choice
	Fraction comparison	4	Essay
	Fraction operations	4	Essay
	Contextual problem-solving	3	Essay
Self-Efficacy Questionnaire	Magnitude (confidence in facing difficult tasks)	9	Likert scale
	Generality (confidence across various situations)	8	Likert scale
	Strength (strength of belief)	8	Likert scale
Structured Interview	Types of learning difficulties	4 questions	Open-ended
	Learning strategies used	3 questions	Open-ended
	Factors influencing self-confidence	3 questions	Open-ended

The collected data were analyzed using descriptive and inferential statistical techniques. Descriptive analysis was used to calculate the percentage, mean, median, and standard deviation of the numeracy ability test scores and self-efficacy questionnaires. The categories of numeracy and self-efficacy abilities are classified into three levels (high, medium, low) based on the categorization formula: low ($X < M - 0.5$ SD), medium ($M - 0.5$ SD $\leq X < M + 0.5$ SD), and high ($X \geq M + 0.5$ SD). Inferential analysis used Pearson's Product Moment correlation test to test the relationship between

numeracy ability and self-efficacy, as well as simple regression analysis to see the contribution of each variable to the level of learning difficulty. Interview data was analyzed qualitatively with data reduction, data presentation, and conclusion drawing techniques to identify patterns of learning difficulties and factors that influence them. Data triangulation was carried out by comparing test results, questionnaires, and interviews to ensure the validity of research findings.

RESULTS AND DISCUSSION

Results

The results of this study provide a comprehensive overview of the learning difficulties of grade IV students of SD Muhammadiyah 1 Taman in fractional materials reviewed from numeracy ability and self-efficacy. Based on the results of the numeracy ability test and self-efficacy questionnaire given to 25 students, it was found that there was a wide variety of abilities and self-confidence. This quantitative data was strengthened by the results of in-depth interviews with eight students representing the high, medium, and low ability categories.

Based on the results of the numeracy ability test, an average score of 56.8 was obtained out of a maximum score of 100 with a standard deviation of 15.3. The score distribution showed that 8 students (32%) were in the low numeracy ability category (< score 48.15), 11 students (44%) were in the medium category (score 48.15–65.45), and only 6 students (24%) were in the high category (≥ score 65.45). The lowest score obtained was 28 and the highest score was 84, indicating a considerable ability gap between students. Analysis of each aspect of numeracy ability revealed that students had the most difficulties in the aspects of fraction comparison and mixed fraction counting operations. To provide a more detailed picture, the following table 2 is presented which shows the distribution of students' numeracy skills based on the aspects measured, including concept understanding, representation, comparison, calculation operations, and contextual problem solving.

Table 2. Distribution of Students' Numeracy Ability by Aspect

Aspect of Numeracy Ability	Average Score	Achievement Percentage	Category
Understanding of fraction concepts	3.2 (out of 5)	64%	Moderate
Fraction representation	2.4 (out of 4)	60%	Moderate
Fraction comparison	1.7 (out of 4)	42%	Low
Fraction operations	1.5 (out of 4)	38%	Low
Contextual problem-solving	1.8 (out of 3)	60%	Moderate
Total	56.8 (out of 100)	56.8%	Moderate

The description of Table 2 shows that students' numeracy ability in general is in the medium category with an achievement percentage of 56.8%. The weakest aspects were fractional counting operations (38%) and fractional comparison (42%), while the relatively better aspects were the understanding of fractional concepts (64%). These findings indicate that most students have not mastered procedural skills in fractional operations as well as the comparative concept of differential denominators. This also shows that there is a gap between the conceptual ability and the procedural ability of students in understanding fractions.

Error analysis shows that students experience significant difficulties in almost all aspects of numeracy ability. Table 3 shows the results of the error analysis carried out by grade IV students of SD Muhammadiyah 1 Taman on the numeracy ability test, especially fractional material. Based on these data, it can be seen that the error rate varies on each indicator of numeracy ability. The highest error occurred in the indicator of solving story problems involving fractions with a total of 15 students or 54%. This shows that students still have difficulty understanding the context of the story and converting it into mathematical forms, so that conceptual and procedural errors occur simultaneously. The next error was found in the indicators determining the results of fraction addition operations (46%) and fraction reduction (43%). The dominant type of error in both indicators is procedural, i.e. students have not been able to equalize denominators and perform calculation operations correctly. In

the indicator of sorting fractions from small to large (39%), students experienced conceptual errors because they did not understand the concept of comparing fractional values with different denominators. Meanwhile, errors in the indicator identified the value of the fraction that is equal (32%) and determined the fraction of the figure (25%) was moderate. The errors that arise are mainly related to the understanding of the basic concepts of simplification of fractions and the counting of shaded parts. The lowest error was found in the indicator determining fractions of everyday statements with a percentage of 21%, indicating that most students were able to relate contextual situations to fractional representations. Overall, the results of this analysis show that most of the students' mistakes lie in conceptual and procedural aspects, especially when faced with problems that demand a deep understanding of the relationship between fractional concepts and their application in real contexts.

Table 3. Error Analysis on Numeracy Ability Test

Indicator	Item Number	Number of Students with Errors	Error Percentage	Type of Error	Description
Identifying equivalent fractions	1	9	32%	Conceptual	Students incorrectly determined equivalent fractions because they did not understand the concept of simplification.
Determining fractions from pictures	2	7	25%	Procedural	Errors occurred in counting the shaded parts and the total parts.
Ordering fractions from smallest to largest	3	11	39%	Conceptual	Students incorrectly compared fractions with different denominators without finding a common denominator first.
Determining the result of fraction addition	4	13	46%	Procedural	Errors in finding the least common denominator (LCD) and adding numerators.
Determining the result of fraction subtraction	5	12	43%	Procedural	Students made mistakes in finding common denominators and subtracting numerators.
Solving word problems involving fractions	6	15	54%	Conceptual and Procedural	Students failed to translate word problems into mathematical form and miscalculated fractional operations.
Determining fractions from everyday statements	7	6	21%	Conceptual	Students did not understand the relationship between verbal statements and fractional forms.

Furthermore, the results of the self-efficacy questionnaire show an overview of students' self-confidence levels in facing mathematics tasks, especially in fractional materials. The average student self-efficacy score was 78.4 out of 125 with a standard deviation of 12.7, which falls into the medium category.

Table 4. Results of Students' Self-Efficacy Analysis

Dimension of Self-Efficacy	Average Score (Scale 1–5)	Percentage	Category
Magnitude (confidence in facing difficult tasks)	2.8	56%	Moderate
Generality (confidence across various situations)	3.4	68%	Moderate
Strength (strength of belief)	3.1	62%	Moderate
Total Self-Efficacy Score	78.4 (out of 125)	62.7%	Moderate

The description of Table 4 shows that all dimensions of student self-efficacy are in the medium category. The magnitude dimension had the lowest score (56%), indicating that students are still less confident in dealing with difficult fractional problems. While the generality dimension has the

highest score (68%), which shows that some students have quite good self-confidence in various learning situations. These findings suggest that although students have a general belief in learning maths, they are still prone to losing confidence when faced with challenging problems.

To find out the relationship between numeracy ability and student self-efficacy, a Pearson Product Moment correlation test was conducted.

Table 5. Results of Pearson Product-Moment Correlation Test

Variable	Numeracy Ability	Self-Efficacy
Numeracy Ability	1	0.724**
Self-Efficacy	0.724**	1
Sig. (2-tailed)	–	0.000
N	25	25

Remarks: ** Significant correlation at the level of 0.01 (2-tailed)

The description of Table 5 shows that there is a strong positive relationship between numeracy ability and self-efficacy with a correlation coefficient r = 0.724 and a significance value of p < 0.01. This means that the higher the student's numeracy ability, the higher the level of self-efficacy they have. These findings confirm that the experience of success in solving math problems contributes to increasing students' self-confidence.

A simple regression analysis was carried out to find out how much the numeracy ability contributes to students' self-efficacy.

Table 6. Results of Simple Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,724	0,524	0,503	8,96

The description of Table 6 shows that the R^2 value is 0.524, which means that numeracy ability contributes 52.4% to the variation in student self-efficacy. The remaining 47.6% was influenced by other factors such as social support, learning motivation, and learning strategies that were not studied in this study.

Table 7. Regression Coefficients

Model	Unstandardized Coefficients B	Std. Error	Beta	t	Sig.
(Constant)	42,345	6,234	-	6,791	0,000
Numeracy Ability	0,635	0,108	0,724	5,880	0,000

The description of Table 7 shows that the regression equation obtained is Y = 42.3 + 0.635X, where Y is self-efficacy and X is the numeracy ability. A significance value of 0.000 (<0.05) indicates that numeracy skills have a significant effect on students' self-efficacy.

To clarify the distribution of relationships between the categories of numeracy ability and self-efficacy, the following cross-tabulation is presented:

Table 8. Cross Tabulation of Numeracy Ability and Self-Efficacy

Numeracy Ability	Low Self-Efficacy	Moderate Self-Efficacy	High Self-Efficacy	Total
Low	5 (62.5%)	3 (37.5%)	0 (0%)	8 (100%)
Moderate	2 (18.2%)	7 (63.6%)	2 (18.2%)	11 (100%)
High	0 (0%)	2 (33.3%)	4 (66.7%)	6 (100%)
Total	7 (28%)	12 (48%)	6 (24%)	25 (100%)

The description of Table 8 shows that the majority of students with low numeracy ability also have low self-efficacy (62.5%), while students with high numeracy skills mostly have high self-efficacy (66.7%). This pattern reinforces the finding that numeracy ability and self-efficacy are positively and consistently interrelated.

Qualitative data from the interviews support the quantitative results that have been obtained. Students with high numeracy skills exhibit structured learning strategies and strong confidence. In contrast, students with low numeracy skills tend to experience math *anxiety* and avoid difficult problems. Most students stated that they had difficulty understanding fractions because the teacher's explanation was too fast and the lack of use of concrete media. Students admitted that they understood the material better when using real objects such as cakes or fruits.

These findings confirm the need for contextual and manipulative media-based learning to improve students' understanding and confidence. In addition, teachers are advised to provide positive reinforcement consistently so that students do not lose self-confidence when facing difficulties in mathematics.

Discussion

The findings of this study confirm that students' learning difficulties in fractional materials are a complex phenomenon that involves not only cognitive aspects but also affective aspects. The results of the numeracy ability test showed that the average percentage of student achievement was only 56.8%, which indicates that most students have not mastered basic competencies in fractional materials. These findings are in line with the research of Wiryanto & Jannah (2022) which found that the understanding of the concept of fractions among elementary school students in Indonesia is still at a low to moderate level. The main difficulty experienced by students is in comparing fractions with different denominators and performing mixed fraction calculation operations, which are fundamental competencies that must be mastered as a prerequisite for learning algebraic concepts at the next level. The low mastery of students in the aspects of fractional comparison (42%) and calculation operations (38%) shows that students not only experience procedural difficulties in following the algorithmic steps, but also experience conceptual difficulties in understanding the meaning of fractions as numbers and relationships between fractions. This corresponds to Skemp (1976) distinction between instrumental (knowing how) and relational (knowing why) understanding, indicating that students at SD Muhammadiyah 1 Taman are still operating primarily at the instrumental level.

The error analysis highlights several persistent misconceptions requiring instructional attention. Students often treat numerators and denominators as independent whole numbers, leading to errors when determining equivalent fractions. This misconception reflects the well-documented "whole number bias" (Friesen & Kuntze, 2021). The second misconception has to do with fraction comparison, where students assume that fractions with larger numerators must have a greater value, without considering the value of the denominator. Research by Djatmika & Praherdhiono (2024) explains that this misconception arises because students generalize knowledge about integers into the context of fractions without understanding the difference in the structure of the two types of numbers. The third misconception is the error in performing calculation operations, specifically in adding or subtracting fractions by adding numerators by numerators and denominators by denominators (e.g., 1/2 + 1/3 = 2/5). This error indicates that the student has not understood the concept of denominator equalization as a prerequisite for performing the addition or subtraction operation of fractions. Putri et al. (2024) emphasized that these misconceptions are resistant and difficult to change if not handled with appropriate and systematic learning strategies.

Research findings related to student self-efficacy show that the majority of students (76%) are in the medium to low category, with the magnitude dimension (confidence in facing difficult tasks) having the lowest scores. This indicates that students lack confidence in facing challenging fractional problems and easily give up when experiencing difficulties. These findings are in line with research by Rini & Purwanti (2021) which found that the self-efficacy of mathematics of elementary school students in Indonesia tends to decrease along with the increasing complexity of the material studied. The low self-efficacy in the magnitude dimension can be explained through Bandura's theory of the sources of self-efficacy, where the mastery experience is the main source of the formation of self-efficacy. Students who often fail to solve fractional problems will develop negative beliefs about their

abilities, which in turn affects the motivation and effort put into learning (Hilz et al., 2023). In addition to direct experience, vicarious experience through observation of the success or failure of peers also affects students' self-efficacy. In the context of learning at SD Muhammadiyah 1 Taman, teachers tend to pay more attention to high-ability students, so that students with low abilities lose role models that can increase their confidence. Verbal persuasion from teachers and parents also plays an important role in shaping self-efficacy, but the results of the interviews show that students receive negative criticism more often than positive reinforcement, which contributes to their low self-confidence.

A strong positive correlation between numeracy ability and self-efficacy ($r = 0.724$, $p < 0.01$) confirmed the existence of a reciprocal relationship between the two variables. Students with high numeracy skills tend to have high self-efficacy due to repeated experiences of success in completing math tasks, and conversely, high self-efficacy encourages students to be more persistent in facing challenges and develop more effective problem-solving strategies. These findings are consistent with the research of Ridwan et al. (2023) who found a significant correlation between numeracy ability and self-efficacy in elementary school students with a correlation coefficient of 0.682. The regression results showing that numeracy ability contributes 52.4% to the variation in self-efficacy indicates that improving numeracy ability can be an effective strategy to improve student self-efficacy. However, 47.6% of variations in self-efficacy that could not be explained by numeracy ability showed that there were other factors that also played an important role, such as social support, past experiences, emotional states, and personality factors. Wiryanto & Jannah (2022) explain that in the context of fractional learning, the interaction between cognitive abilities and affective factors becomes increasingly complex due to the abstract nature of fractional concepts that require not only procedural skills but also deep conceptual understanding as well as mental resilience in the face of frustration.

Cross-tabulation between numeracy ability and self-efficacy reveals an interesting pattern: 62.5% of students with low numeracy ability have low self-efficacy, while 66.7% of students with high numeracy skills have high self-efficacy. These findings show consistency between cognitive ability and self-confidence in the extreme group (high and low), but in the moderate group there is a greater variation. Some students with moderate numeracy skills have high self-efficacy, which can be explained by the presence of intrinsic motivational factors, strong social support, or positive experiences in the past that form high self-confidence even though actual abilities are still limited. Conversely, there are also students with moderate numeracy skills but low self-efficacy, which may be due to traumatic experience of failure, excessive negative criticism, or high math anxiety (Samuel & Warner, 2021). This phenomenon underscores the importance of interventions that focus not only on improving cognitive abilities, but also on developing affective aspects such as confidence, motivation, and resilience. Solihin & Rahmawati (2024) emphasized that effective mathematics learning must integrate the development of cognitive competence with the formation of a positive mathematical disposition, so that students are not only able to solve problems correctly but also develop a positive attitude towards mathematics and confidence in their own abilities.

The results of the interviews provide a deeper understanding of students' subjective experiences in fractional learning and the factors that affect their self-efficacy. Students with high abilities show good metacognitive awareness characteristics, namely awareness of their own thought processes, the ability to monitor understanding, and the willingness to seek help when experiencing difficulties. They also use more diverse and adaptive learning strategies, such as taking visual notes, using analogies, and practicing varied problems. In contrast, students with low abilities tend to use passive and superficial learning strategies, such as memorizing procedures without understanding concepts, relying on the help of others, and avoiding challenging tasks. These differences in learning strategies reflect differences in self-regulated learning, which is the ability to organize and manage the learning process on their own. Research by Gagnier et al. (2022) shows that self-efficacy is an important predictor of self-regulated learning, where students with high self-efficacy are better able to set realistic learning goals, choose the right strategies, and persist in efforts despite facing difficulties. In

the context of fractional learning, the development of self-regulated learning is important because fractional material requires intensive practice and gradual understanding that cannot be achieved through the teacher's explanation alone in the classroom.

The low use of concrete learning media and the lack of variety of learning methods in SD Muhammadiyah 1 Taman are one of the factors that contribute to students' learning difficulties. The results of the interviews showed that fractional learning was still dominated by the lecture method with symbolic explanations on the board, without the use of props or adequate visual media. Learning that is too abstract and procedural causes students to memorize algorithms without understanding the underlying concepts, making it difficult for them to apply that knowledge in new situations or different contexts. Research by Solihin et al. (2024) found that the use of concrete manipulative-based learning media can significantly improve the understanding of fractional concepts compared to conventional learning. In addition, the teacher-centered approach to learning and the lack of opportunities for students to explore and discover concepts on their own also limit the development of students' relational understanding. The learning paradigm that places students as passive recipients of information is not in accordance with the principles of constructivist learning that emphasize the importance of the active role of students in constructing knowledge. Weinhandl & Lavicza (2021) recommend the use of more student-centered learning approaches, such as problem-based learning or inquiry-based learning, which provide students with opportunities to explore, ask questions, discuss with peers, and discover concepts through hands-on experience.

Learning environment factors, especially teacher-student interaction patterns, also have an important influence on student self-efficacy. The results of the interviews revealed that students feel more motivated and confident when teachers provide positive reinforcement, acknowledge their efforts, and create a learning environment that is safe for making mistakes. Conversely, negative criticism, comparisons with other students, and excessive emphasis on the final result without appreciating the learning process can lower self-efficacy and trigger math anxiety. Research by Choi & Mao (2021) shows that a supportive classroom climate and teacher efficacy (teachers' confidence in their ability to teach) are positively correlated with student self-efficacy. Teachers who have high expectations of students' abilities, provide the right scaffolding, and create opportunities for successful experiences can help students develop higher self-confidence. In the context of fractional learning, teachers need to design assignments with varying levels of difficulty and provide support tailored to individual needs of students (differentiated instruction). Sukmaningthias et al. (2024) emphasized the importance of formative assessments that provide constructive feedback to students about their strengths and areas for improvement, so that students can see their progress and develop a growth mindset, which is the belief that abilities can be developed through consistent effort and practice. From an international perspective, these findings resonate with global evidence that productive struggle, supportive feedback, and access to visual representations significantly improve both fraction learning and mathematics self-efficacy. Countries such as Singapore and Japan embed these features in their pedagogical design, contributing to stronger fraction outcomes in global assessments. Overall, the discussion highlights the interplay between cognitive skills and affective factors in fraction learning. Strengthening conceptual understanding, providing positive learning experiences, and adopting evidence-based instructional strategies may help address both students' performance and self-belief.

CONCLUSION

This study concludes that the learning difficulties of grade IV students of SD Muhammadiyah 1 Taman in fractional materials are a complex problem that involves cognitive and affective aspects simultaneously. The results showed that students' numeracy ability in fractional material was in the medium category (56.8%), with the main difficulties in the aspect of comparing fractions with different denominators (42%) and mixed fraction counting operations (38%). Error analysis identifies fundamental misconceptions such as whole number bias, errors in determining equivalent fractions,

and difficulties in equalizing denominators. Students' self-efficacy was also in the medium category (62.7%), with the magnitude dimension (confidence in facing difficult tasks) having the lowest score. There was a strong and significant positive correlation between numeracy ability and self-efficacy ($r = 0.724$, $p < 0.01$), indicating that an increase in one variable may contribute to an increase in the other. Qualitative findings from the interviews revealed that students need more contextual learning, the use of concrete media, and a supportive learning environment to improve their understanding and confidence in learning fractions.

Based on the findings of the research, it is recommended that teachers develop ethnomathematics-based teaching materials that utilize the local cultural context of Sidoarjo, such as mud cakes or activities in traditional markets, to help students understand the concept of fractions in a more concrete and meaningful way. The use of concrete manipulatives, visual representations, and interactive learning technologies need to be integrated in the learning process to facilitate the transition from concrete to abstract understanding. Teachers also need to implement learning strategies that can improve students' self-efficacy, such as assigning assignments with varying levels of difficulty, providing positive reinforcement, creating a learning environment that is safe for making mistakes, and teaching metacognitive strategies. Further research is suggested to develop and test the effectiveness of ethnomathematics-based fractional learning models through experimental research or classroom action research, as well as conduct longitudinal research to understand the development of students' numeracy abilities and self-efficacy over time. Collaboration between teachers, researchers, and other education stakeholders is needed to develop a learning ecosystem that supports the development of positive numeracy competencies and mathematical dispositions in elementary school students.

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