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The Effect of the Realistic Mathematics Education Approach on Improving the Arithmetic Operation Skills of Students with Intellectual Disabilities at the Junior High School Level

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ABSTRACT

The study aims to examine the effect of a Realistic Mathematics Education (RME) approach on improving arithmetic operation skills among students with intellectual disabilities. A quantitative method with a quasi-experimental design, specifically the One-Group Pretest Posttest Design, was employed, involving a pretest, an intervention, and a posttest. The participants consisted of 10 students at Bengalon 4 Junior High School who were identified as having intellectual disabilities. Data were collected through observations and standardised tests that experts had validated. The reliability scores were 0.731 for the pretest and 0.826 for the posttest. The data were analysed using both descriptive and inferential statistics, including normality testing and paired sample t-tests. The results show that the Realistic Mathematics Education approach significantly improves students' arithmetic abilities. The average score increases from 46.00 to 72.50. Additionally, improvements are observed across numeracy indicators, although not evenly distributed. Full mastery is demonstrated on questions 1 and 2 (100% for all three indicators), while questions 3 and 4 show complete mastery of two indicators (100%).

1. Introduction

Mathematics is one of the fundamental subjects taught from elementary to higher education levels. It plays a vital role in human life, as mathematical concepts can be applied in various daily activities such as personal financial management, shopping, traveling, navigation, agriculture, and environmental management (Sari, 2023). According to the KEPKA BSKAP Regulation No. 032 of 2024, mathematics consists of five main content elements: numbers, algebra, measurement, geometry, and data analysis and probability. Among these, the concept of numbers is the most fundamental because it serves as the basis for mastering other mathematical concepts. The main focus of the number element is arithmetic operations, which include addition, subtraction, multiplication, and division. In practice, students begin learning arithmetic operations at the elementary school level and revisit them

in the first semester of Grade VII in junior high school. However, many Grade VII students are still unable to correctly solve problems involving integer arithmetic operations. This difficulty affects their ability to understand other mathematical topics that rely on arithmetic as a foundational skill. Such challenges often occur among students whose intellectual abilities fall below the average for their age group.

According to Public Law (in Suharsiwi, 2017), a condition characterized by below-average general intellectual ability accompanied by deficits in adaptive behavior that occur during the developmental period is referred to as an intellectual disability. Significant impairments in intellectual functioning and adaptive behavior are the defining characteristics of individuals with intellectual disabilities (Purwandari, 2024). Damastuti (2020) further explains that the main characteristic of students with intellectual disabilities is a reduced capacity for concrete reasoning across all developmental stages, which contributes to lower academic performance, particularly in understanding abstract mathematical concepts.

Based on preliminary observations conducted on January 6, 2025, in Class VII D and January 8, 2025, in Class VII C at Bengalon State Junior High School 4 involving 63 students, approximately 6% of students were unable to complete arithmetic problems involving integers. Further identification using instruments developed based on the characteristics of students with intellectual disabilities revealed ten students strongly suspected of having such disabilities. Assessment results on arithmetic operations showed that some students could correctly answer addition and subtraction problems but failed to solve multiplication and division problems. Of the ten students, 40% answered addition problems correctly, 30% answered both addition and subtraction problems correctly, 30% answered randomly, and none were able to correctly solve multiplication and division problems. Moreover, documentation of mathematics learning outcomes in Classes VII C and D during the first semester showed that most students scored below the Minimum Competency Criteria (KKM 75).

One of the main causes of these learning difficulties is the use of traditional, teacher-centered teaching methods. Such approaches emphasize memorization and abstract explanation, which are less effective for students with intellectual disabilities who require concrete and contextual learning. Therefore, an alternative approach is needed, one that emphasizes meaningful and realistic learning experiences. RME approach offers a potential solution to this problem. According to Rangkuti (2019), RME is based on students' real-world experiences, linking mathematical concepts to everyday situations. With teacher guidance, students are encouraged to discover mathematical ideas through meaningful, simple, and contextual problem-solving activities.

The RME approach is grounded in Freudenthal's view that mathematics is a human activity that should be connected to real-life experiences (Rangkuti, 2019). Its core principles include guided reinvention, which gives students opportunities to rediscover mathematical concepts; the use of real-world contexts as starting points for learning; and the facilitation of social interaction to promote discussion and

reflection (Hadi, 2018). The RME learning process emphasizes student engagement in understanding contextual problems, developing mathematical models, and drawing conclusions based on concrete experiences. Previous studies have shown the effectiveness of the RME approach in improving students' arithmetic abilities. Devi Larasati (2023) found that implementing RME improved multiplication skills among students with mild intellectual disabilities at SLB Kembar Karya Pembangunan I Jakarta. Sri Rahmah Nurjannah et al. (2024) also demonstrated that applying RME combined with *Quizizz* media had a significant positive impact on students' mathematical computation skills. Similarly, Lubis and Siregar (2022) revealed that RME significantly enhanced both arithmetic and reading skills among Grade VII students, as it encouraged contextual learning, active participation, and logical reasoning. Furthermore, Saragih and Susetyo (2024) found that using the RME strategy in elementary schools improved multiplication skills among students who had difficulties in basic arithmetic.

Despite these findings, research on the application of RME specifically for students with intellectual disabilities in regular junior high schools remains limited. Most existing studies have focused on elementary or special education settings. Therefore, this study aims to fill this research gap by analyzing how the RME approach can help students with intellectual disabilities at Bengalon State Junior High School 4 improve their arithmetic operation skills involving integers. Theoretically, this study is based on constructivist learning theory, which asserts that learners build knowledge through experience, interaction, and reflection (Fitria et al., 2021). Within this framework, RME provides opportunities for students to construct understanding through real-life experiences, making abstract mathematical concepts more accessible. This aligns with the view of Maslihah (2016), who emphasized that RME embodies social constructivism by facilitating interaction between teachers and students in discovering mathematical concepts through everyday contexts.

Practically, the implementation of RME is expected to enhance students' engagement in mathematics learning through active, contextual, and collaborative activities. Teachers serve as facilitators who guide students to identify problems, develop solutions, and discuss their findings collectively. This approach not only helps students with intellectual disabilities comprehend arithmetic operations more effectively but also increases their motivation and confidence in learning mathematics (Damastuti, 2020). In conclusion, the RME approach represents a relevant and meaningful pedagogical strategy for students with intellectual disabilities. By linking mathematical concepts to real-world experiences, RME can make abstract learning more accessible and functional. Therefore, this study aims to investigate the effect of the RME approach on improving the arithmetic operation skills of students with intellectual disabilities at Bengalon State Junior High School 4.

2. Methodology

This study adopted a quantitative method using a quasi-experimental design to explore how effective the RME approach is in enhancing arithmetic operation skills among junior high school students with intellectual disabilities. The research applied a One-Group Pretest–Posttest Design, where a single group of participants first took a pretest, then underwent learning through the RME approach, and finally completed a posttest to measure their improvement. This design allowed for the comparison of students' mathematical performance before and after the intervention to determine the extent of improvement resulting from the applied treatment.

The study was conducted at Bengalon State Junior High School 4, an inclusive school located in East Kutai Regency, Indonesia, which accommodates students with intellectual disabilities. The research took place over five months, from January to May 2024, and consisted of three stages: preparation, implementation, and conclusion. The preparation stage included a literature review, preliminary observations, problem formulation, and development of research instruments. The implementation stage involved the administration of the pretest, the application of the RME-based learning process, and the posttest. The final stage included data analysis and drawing conclusions based on the findings obtained from the study.

The population consisted of all students at Bengalon State Junior High School 4 identified as having intellectual disabilities, totaling 19 students across 11 classes. The sample was selected using a purposive sampling technique based on specific criteria related to the research objectives. Ten seventh-grade students who exhibited clear indications of intellectual disabilities were selected as the research sample. This focused selection allowed the study to evaluate the effectiveness of the RME approach in a population that required adapted learning strategies. The independent variable in this study was the RME approach, which emphasizes learning mathematics through real-life contexts to help students develop meaningful understanding. The dependent variable was the arithmetic operation skills of students with intellectual disabilities, measured through pretest and posttest scores.

The instruments used in this study were written tests and observation sheets. The written tests, administered before and after the treatment, consisted of four essay items covering addition, subtraction, multiplication, and division of integers, developed in accordance with the mathematics learning outcomes of Phase D in the Merdeka Curriculum (KEPKABSKAP No. 032/H/KR/2024). Observation sheets were used to assess the implementation of the RME approach in the classroom and to evaluate both teacher performance and student engagement during learning. The observations were carried out by a science teacher who served as an external observer. Prior to use, all instruments underwent validity testing using the Product Moment correlation coefficient and reliability testing using Cronbach's Alpha. The instruments were deemed valid and reliable if they met the established criteria outlined by Sugiyono (2016).

The research procedure followed several systematic stages. During the planning stage, lesson plans were developed based on the RME approach, research instruments were prepared, and the pretest was conducted to assess students' initial mathematical abilities. In the implementation stage, the RME approach was applied through contextual mathematical problems, encouraging students to relate mathematical concepts to real-world situations. This was followed by the evaluation stage, in which the posttest was administered to measure learning outcomes after the treatment. Finally, the collected data were analyzed to determine the effectiveness of the RME approach.

Data collection techniques consisted of observation and testing. Observation was used to obtain qualitative data about the learning process and student participation, while the tests provided quantitative data on arithmetic performance. Both the pretest and posttest results were examined through descriptive and inferential statistical analyses. Descriptive statistics, such as the mean and median, were used to provide an overview of students' performance, while inferential statistics were applied to test the research hypothesis. The data's normality was evaluated using the Shapiro–Wilk test, and a paired sample t-test was conducted to determine whether there was a significant difference between the pretest and posttest scores. As stated by Santoso (2014), when the Sig. (2-tailed) value is less than 0.05, it indicates that the RME approach has a significant impact on enhancing students' arithmetic operation skills; conversely, if the value exceeds 0.05, the effect is considered not significant.

3. Results and Discussion

The study was conducted in Grade VII of Bengalon 4 Junior High School, involving ten students identified as having indications of intellectual disabilities. Among them, six were male and four were female, ranging in age from 13 to 15 years old. In general, their academic performance was below average compared to students in regular classes, particularly in understanding arithmetic operations and abstract mathematical concepts. Before the research was implemented, mathematics learning in this class was still conventional and teacher-centered, relying heavily on lectures and textbook exercises. Teachers tended to emphasize final results rather than the students' reasoning processes, which often led to difficulties in comprehending the meaning of arithmetic operations. In addition, the students' limited attention span and short-term memory made it difficult for them to stay focused when learning abstract topics without the support of visual or contextual aids.

The learning environment at Bengalon 4 Junior High School was generally conducive, although resources for students with intellectual disabilities remained limited. The classroom was moderately sized, with adequate lighting and ventilation, and equipped with a whiteboard, individual desks, and the assistance of a special education support teacher during learning activities. During lessons, differences in participation and ability were evident among students. Some were more active when the learning involved interactive or hands-on experiences, while

others were quieter and required more direct guidance. These heterogeneous conditions required adaptive, contextual, and experience-based teaching strategies to ensure that every student had equitable learning opportunities according to their individual needs.

During the implementation of the study, the RME approach was applied over three learning sessions focused on integer arithmetic operations. The researcher acted as the instructor using a validated teaching module, while the mathematics teacher and special education assistant served as observers. The learning process began with the presentation of real-life situations familiar to the students, such as shopping activities, sharing objects, and daily school routines, to introduce mathematical concepts in a meaningful way. Students were encouraged to explore and discover mathematical relationships through guided discussions, demonstrations, and collaborative problem-solving. At the end of each session, a reflection was conducted to reinforce the mathematical ideas developed during the activities. Data collection was carried out through *pretests* and *posttests*, along with observation sheets documenting student engagement and responses throughout the lessons.

To support the implementation of the RME approach, the learning process utilized a Student Worksheet (LKPD) as the main instructional medium. The LKPD was designed contextually to match the characteristics of students with intellectual disabilities and guided them through the process of discovering mathematical concepts step by step. It contained sequences of activities starting from real-life problem contexts, exploration tasks, and conceptual reflection. Each task in the LKPD included clear visual illustrations and simple instructions to ensure comprehension, along with spaces for students to write their observations and reasoning.

The use of the LKPD not only helped students understand arithmetic operations more concretely but also encouraged independent thinking, peer discussion, and the connection between everyday experiences and mathematical concepts. Throughout the lessons, the teacher acted as a facilitator, providing direction when students encountered difficulties and reinforcing correct reasoning. Observation results showed that the contextual LKPD effectively increased student participation, clarified their mathematical thinking process, and created a more enjoyable and meaningful learning atmosphere. The following figure 1 presents an example of the LKPD used during the learning process. The worksheet contains contextual problems and exploratory steps that guide students in understanding integer arithmetic operations progressively.



Figure 1. Contextual LKPD based on Realistic Mathematics Education used in the learning process

Several types of instructional media were used to support the RME-based learning activities. A thermometer was utilized to demonstrate addition and subtraction of numbers through real-life temperature contexts. Number cards and marbles were employed to help visualize basic operations such as addition and subtraction in a tangible manner. Furthermore, the classroom floor was used as a number line, allowing students to physically step forward or backward to represent positive and negative numbers. These media proved effective in capturing students' attention and enabling them to understand the meaning of each arithmetic operation more concretely.

This study collected data throughout the entire research process, starting from instrument preparation to data collection and analysis. The researcher first designed the instruments, which consisted of an observation guide and pre-test and post-test questions. These instruments were then validated by two experts to ensure their suitability. The first expert provided several important recommendations, such as including the research title for clarity, ensuring consistency in table and numbering formats (particularly in items involving temperature, seed division, and pen-related

problems), and refining the quality of the questions to align with the students' cognitive levels. Additionally, the expert suggested differentiating the pre-test and post-test questions more clearly to measure students' understanding effectively and including an assessment rubric to explain the scoring criteria for each item.

The second expert emphasized that several test items were still abstract and did not fully reflect the RME approach. For example, one problem asked about Hasan buying 133 sapodilla seedlings, focusing solely on numerical division without visual or contextual support. The expert recommended adding visual elements such as an image of a farmer placing seedlings into pots to make the tasks more concrete and realistic. Furthermore, it was suggested that the problems should follow a gradual level of difficulty to reflect the guided reinvention stages in RME and that the test duration should be adjusted based on the students' abilities and the total number of questions.

After applying both experts' feedback, the pre-test and post-test instruments for assessing arithmetic ability among students with intellectual disabilities were revised and deemed appropriate for use. The improved instruments were then piloted with ten seventh-grade students on Wednesday, March 26, 2025, to test their validity and reliability. The pilot included four pre-test and four post-test items. The analysis results showed that all pre-test items were valid and reliable, with a Cronbach's Alpha value of 0.731, and all post-test items were also valid and reliable, with a Cronbach's Alpha value of 0.826. Therefore, the instruments were considered consistent and suitable for data collection in this study.

Based on descriptive statistical analysis, the arithmetic ability of students before applying the RME approach (pre-test) showed that the lowest score was 25, and the highest was 70, with an average of 46.00, a median of 40.00, and a standard deviation of 16.799. The distribution of scores indicated that six students (60%) were in the very low category (below 55), two students (20%) were in the low category (55–69), and two students (20%) were in the moderate category (70–80). The pattern of this score distribution can be seen in Figure 2, which displays the pre-test arithmetic ability results of the students.

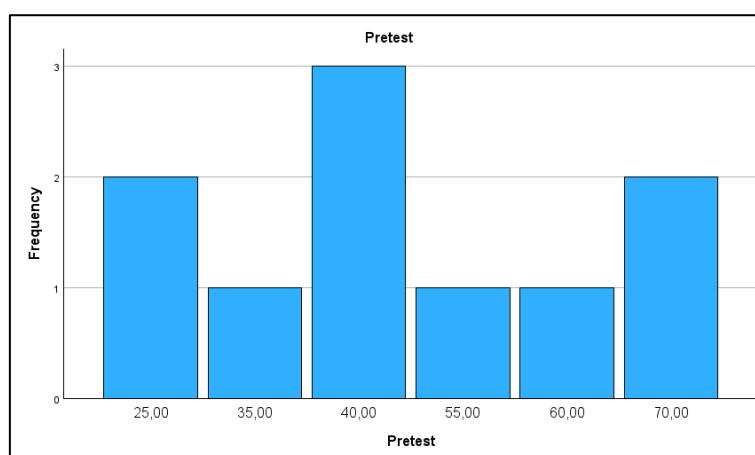


Figure 2. Pre-test Arithmetic Ability Results

The chart shows that most students scored below 55, indicating that their arithmetic ability was still quite low before the implementation of the Realistic Mathematics Education approach. After implementing the RME approach, the post-test results demonstrated significant improvement. The lowest score increased to 65, while the highest reached 90, with an average of 72.50, a median of 70.00, and a standard deviation of 7.91. The score distribution revealed that three students (30%) were in the low category (55–69), five students (50%) were in the moderate category (70–79), one student (10%) was in the high category (80–89), and one student (10%) was in the very high category (≥ 90). This improvement pattern is presented in Figure 3, which depicts the post-test arithmetic ability results.

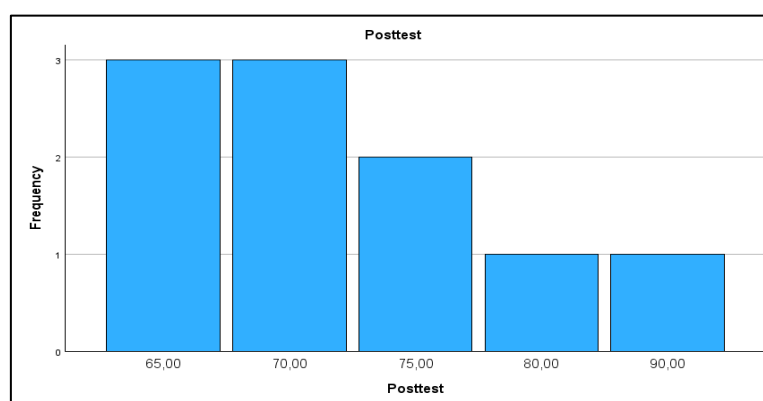


Figure 3. Post-test Arithmetic Ability Results

The diagram illustrates a noticeable shift in student performance, with most students moving from the low to moderate and high categories. Nearly all participants showed progress in their arithmetic skills after being taught through the RME approach, highlighting its effectiveness in enhancing conceptual understanding. When comparing the pre-test and post-test scores, the average increased from 46.00 to 72.50. This result clearly demonstrates that applying the Realistic Mathematics Education approach had a positive impact on improving arithmetic abilities among students with intellectual disabilities. The improvement is illustrated in Figure 4, which compares the average pre-test and post-test scores.

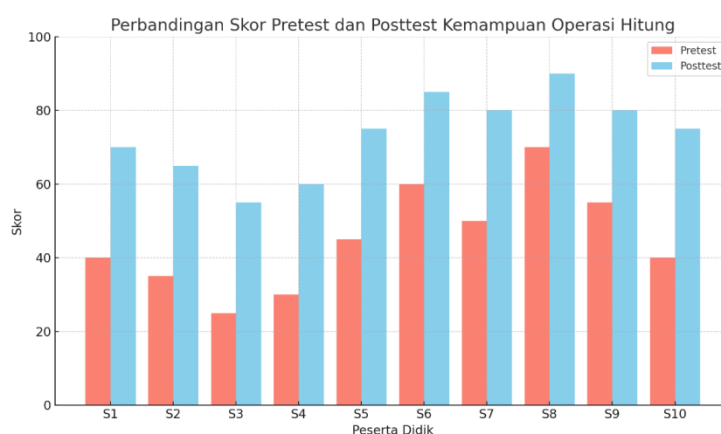


Figure 4. Comparison of Pre-test and Post-test Scores

The figure confirms a significant improvement between the average pre-test and post-test results. These findings support the conclusion that learning activities grounded in real-life contexts, supported by visual aids and interactive exploration, effectively foster deeper comprehension of basic mathematical operations in a more meaningful and engaging way. This improvement also indicates that students were not only able to recall mathematical concepts but could apply them in practical situations, demonstrating enhanced problem-solving skills and conceptual understanding. Furthermore, the integration of contextual learning strategies appeared to increase students' motivation and active participation during lessons, contributing to a more positive and collaborative classroom environment.

Normality Test

The normality test was conducted to determine whether the pretest and posttest data on the arithmetic operation skills of students with intellectual disabilities were normally distributed. In this study, the Shapiro–Wilk test was performed using SPSS software. The results of this normality test are presented in Table 1, titled The Results of the Normality Test for the Pretest and Posttest of Arithmetic Operation Skills of Students with Intellectual Disabilities in Grade VII of Junior High School 4 Bengalon, as shown below. These results served as the basis for determining the appropriate statistical test to analyze the effectiveness of the RME approach.

Table 1. Results of the Normality Test for the Pretest and Posttest of Arithmetic Operation Skills of Students with Intellectual Disabilities in Grade VII of SMPN 4 Bengalon Tests of Normality

Kolmogorov-Smirnov				Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.240	10	.109	.900	10	.221
<i>a. Lilliefors Significance Correction</i>						
Tests of Normality						
Kolmogorov-Smirnov				Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Posttest	.224	10	.168	.863	10	.083
<i>a. Lilliefors Significance Correction</i>						

Based on Table 1, the results of the Shapiro–Wilk normality test indicate that the significance value for the pretest of arithmetic operation skills was 0.221, while the significance value for the posttest was 0.083. Since both values are greater than 0.05, it can be concluded that the pretest and posttest data on the arithmetic operation skills of students with intellectual disabilities are normally distributed. Therefore, the normality assumption is satisfied, and the data meet the requirements to proceed with hypothesis testing using the paired sample t-test. This finding confirms that the data are suitable for parametric analysis, ensuring the reliability and validity of the subsequent statistical testing.

Hypothesis Testing

The hypothesis test applied in this study was the t-test (paired sample t-test), which aimed to determine whether there was a significant effect between the RME approach and students' arithmetic operation skills. The test compared two different mean values from the same group of samples to see whether there was a meaningful change in students' performance after the implementation of the RME approach. The test was conducted using a significance level of 0.05 ($\alpha = 5\%$) between the dependent and independent variables. The criteria for decision-making were as follows: if the significance value was greater than 0.05, then H_0 was accepted and H_1 was rejected; conversely, if the significance value was less than 0.05, then H_0 was rejected and H_1 was accepted. The results of the paired sample t-test are shown in Table 2 Paired Samples Statistics.

Table 2. Paired Samples Statistics

Paired Samples Statistics				
	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Pretest	46.0000	10	16.79947	5.31246
Posttest	72.5000	10	7.90569	2.50000

Based on Table 2, it can be seen that the mean score of the pretest was 46.00, while the mean score of the posttest was 72.50. This difference of 26.50 indicates a significant improvement in the arithmetic operation skills of students with intellectual disabilities after being taught using the RME approach. This finding suggests that the implementation of the RME approach helped students better understand arithmetic operations and improved their overall performance. Further analysis using the paired sample t-test is presented in Table 3 Results of the Paired Sample t-test.

Table 3. Results of the Paired Sample t-test

Paired Samples Test									
Paired Differences		95% Confidence Interval of the Difference				Significance			
Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	One-Sided p	Two-Sided p	
Pair 1 Pretest - Posttest	26.50000	13.13393	4.15331	35.89544	17.10456	6.380	9	< .001	< .001

According to Table 3, hypothesis testing was conducted using SPSS version 30, and the results revealed a significance value of less than 0.001, which means $0.001 <$

0.05. In addition, the calculated t-value (t_h) was 6.380 with a degree of freedom (df) of 9. Since the calculated t-value exceeded the critical t-value ($6.380 > 2.262$), it can be concluded that there was a statistically significant difference between the pretest and posttest scores. Based on these findings, the hypothesis testing results indicate that H_0 is rejected and H_1 is accepted. This confirms that the RME approach has a significant and positive impact on enhancing the arithmetic operation skills of students with intellectual disabilities at Junior High School 4 Bengalon. These results also demonstrate that the RME approach effectively supports meaningful learning experiences that improve students' understanding of mathematical concepts.

During the administration of the pretest and posttest, the researcher not only focused on analyzing the overall test scores but also conducted a detailed examination of students' responses based on the indicators of arithmetic ability established for this study. This analysis aimed to gain a deeper understanding of students' strengths and weaknesses in each aspect of arithmetic skills, such as understanding and solving problems, knowing the basic operations, and completing calculation tasks accurately. By analyzing their responses in relation to these indicators, the researcher was able to identify specific areas where students showed improvement after the implementation of the RME approach. The comprehensive results of this analysis on the indicators of arithmetic ability are presented in Table 4 and Table 5 below.

Table 4. Analysis of Pretest Answers on Arithmetic Ability Indicators

No.	Resp onde nt	Indicators of Arithmetic Ability											
		Understanding and Solving Problems				Knowing the Basics of Arithmetic Operations				Able to Solve Problems			
		1	2	3	4	1	2	3	4	1	2	3	4
1	1	✓	✓	✓	✓	✓				✓			
2	2	✓	✓										
3	3	✓	✓										
4	4	✓	✓										
5	5	✓	✓	✓	✓	✓	✓			✓	✓		
6	6	✓	✓										
7	7	✓	✓										
8	8	✓	✓										
9	9	✓	✓	✓	✓	✓	✓			✓	✓		
10	10	✓	✓	✓		✓				✓			
Percentage		100 %	100 %	40 %	30 %	40 %	20 %	0%	0%	40%	20%	0%	0%

Table 5. Analysis of Post-test Answers on Arithmetic Ability Indicators

No.	Respondent	Indicators of Arithmetic Ability											
		Understanding and Solving Problems				Knowing the Basics of Arithmetic Operations				Able to Solve Problems			
		1	2	3	4	1	2	3	4	1	2	3	4
1	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	2	✓	✓	✓	✓	✓	✓	✓		✓	✓		
3	3	✓	✓	✓	✓	✓	✓			✓	✓		
4	4	✓	✓	✓	✓	✓	✓			✓	✓		
5	5	✓	✓	✓	✓	✓	✓	✓		✓	✓		
6	6	✓	✓	✓	✓	✓	✓			✓	✓		
7	7	✓	✓	✓	✓	✓	✓			✓	✓		
8	8	✓	✓	✓	✓	✓	✓			✓	✓		
9	9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
10	10	✓	✓	✓	✓	✓	✓			✓	✓		
Percentage		100 %	100 %	100 %	100 %	100 %	100 %	40 %	20 %	100 %	100 %	10 %	0 %

Based on the data presented in Table 4, the pretest results show that for question number 1, 100% of students were able to identify the problem in the question; however, only 40% of them understood the basic concept of addition operations and were able to solve the problem correctly. For question number 2, all students (100%) could identify the problem, but only 20% of them understood the subtraction operation and solved it accurately. In question number 3, 60% of students did not attempt to answer and only rewrote the question, while 40% could only understand and restate the problem. For question number 4, 30% of students could understand and restate the problem, while the remaining 70% were unable to comprehend it.

From the data in Table 5, it is evident that the post-test results showed a significant improvement in each indicator of students' arithmetic ability. In question number 1, 100% of students were able to restate the problem in mathematical form, identify the basic arithmetic operation needed, and solve the question with correct steps and answers. Similarly, for question number 2, all students could restate the problem mathematically, identify the operation, and solve it correctly. For question number 3, 10% of students could complete all stages from restating the problem to providing the correct answer, 30% could restate and identify the operation correctly, while 60% could only understand and restate the problem. In question number 4, 20% of students successfully restated and identified the arithmetic operation correctly, while 80% were able to understand and restate the problem.

Furthermore, observations were conducted during the implementation of the treatment. Based on the observation results, the teaching and learning process proceeded well and followed the steps of the RME approach as outlined in the learning module. The observation results of the teacher's performance indicated

that the researcher implemented the learning stages effectively, with a 100% achievement rate in both the first and second meetings. This shows that all learning stages were carried out according to the RME approach. The student observation sheets also revealed a positive trend. During the first meeting, more than 50% of students successfully implemented the RME approach, with an effectiveness rate of 80%. The remaining 20% showed that less than half of the students were able to compare and discuss problem-solving results. In the second meeting, the implementation of the RME approach improved significantly, reaching 100%. Students were able to apply the learning strategies effectively and demonstrated good understanding of integer arithmetic operations.

Discussion

The increase in the average score from 46.00 in the pretest to 72.50 in the posttest demonstrates that the RME approach has a significant impact on the arithmetic operation skills of students with intellectual disabilities. This finding aligns with the study by Donna Evelina Saragih and Budi Susetyo (2024), which reported that the RME approach effectively enhances the mathematical abilities of children with learning challenges. Similarly, Lubis and Siregar (2022) found that RME improved both arithmetic and reading skills among regular junior high school students, highlighting that the contextual learning principles employed resonate well with the needs of learners with intellectual disabilities. Furthermore, Juandi, Kusumah, and Tamur (2022) emphasized through a meta-analysis that the RME approach consistently contributes to increased conceptual understanding and problem-solving abilities across various educational levels, reinforcing its universal applicability in mathematics instruction.

The RME approach reflects constructivist principles, where learners actively construct understanding through meaningful contexts closely connected to their daily lives. For students with intellectual disabilities, engaging in concrete, real-world problem scenarios facilitates comprehension of abstract mathematical concepts, particularly in operations with whole numbers. The observed score improvement is further supported by a t-test that yielded a significance value of 0.001 (<0.05), indicating acceptance of the alternative hypothesis. A supportive classroom environment and active student engagement contributed positively to this improvement, consistent with the findings of Arianti et al. (2025), who emphasized that a conducive learning atmosphere coupled with active participation directly correlates with gains in mathematics performance. Kaymak, Maksutkan, and Yildiz (2023) also noted that recent research trends in RME increasingly focus on integrating contextual and technology-based media, which enhances engagement and understanding an aspect that aligns with the positive outcomes of this study. Therefore, the intervention appears not only statistically effective but also pedagogically meaningful. A supportive learning environment, positive teacher-student interactions, and strategies that encourage active involvement can facilitate conceptual understanding and enhance academic achievement in measurable ways, aligning with constructivist theory emphasizing active learning.

However, the improvement was not uniform across all indicators, particularly in multiplication and division items, which showed more modest gains. This may be attributed to the complexity of the problems or limitations in students' ability to perform multi-step operations, which require deeper conceptual understanding and higher-order thinking skills, such as mathematical reasoning and problem-solving. This aligns with the characteristics of students with intellectual disabilities, which include cognitive limitations, slower information processing, and difficulties in grasping abstract concepts (Mumpuniarti & Purwandari, 2024). To address these challenges, the RME approach can be combined with concrete learning media tailored to the characteristics of students with intellectual disabilities. Visual aids can help learners visualize calculation processes and better understand mathematical concepts. Furthermore, differentiated instructional planning is crucial to accommodate the diversity of learners. Flexible implementation allows each student the opportunity to achieve optimal learning outcomes according to their potential. This is consistent with Misykah and Panggabean (2022), who found that concrete media positively contribute to mathematics learning outcomes, and Meiningtias et al. (2022), who reported that visual infographic media effectively enhance learning outcomes by promoting active engagement and understanding. In addition, Marei and Abo Loum (2024) demonstrated that the RME approach significantly improved proportional reasoning and conceptual understanding, showing its adaptability for various mathematical domains, while Putri, Juandi, and Turmudi (2023) highlighted its role in developing students' mathematical literacy through realistic and contextual learning designs.

A notable limitation of this study is the use of a one-group pretest-posttest design without a control group, which restricts the ability to isolate the effect of the RME intervention from other external factors. Improvements in arithmetic operation skills may also be influenced by increased student motivation or support from accompanying teachers. Therefore, while the results indicate significant gains, generalization should be approached cautiously. Future research is recommended to adopt experimental designs involving control groups and explicitly measure the influence of intervening variables. These findings carry important implications for teachers in inclusive classrooms. There is a clear need to develop more adaptive and contextualized teaching strategies, such as the RME approach, to accommodate diverse learning needs. Teachers should be reflective in selecting approaches that promote active engagement and provide meaningful, concrete materials to bridge cognitive gaps in inclusive learning environments.

4. Conclusion

The findings of this study indicate that the RME approach significantly improves the arithmetic operation skills of students with intellectual disabilities, particularly in whole number operations. Evidence for this includes the increase that is confirming the effectiveness of RME in enhancing mathematical abilities. Based on these results, it is recommended that teachers consider RME as a flexible and adaptive instructional approach tailored to the individual needs of students with intellectual disabilities, designing learning materials and tasks grounded in real-life

contexts while emphasizing both mathematical reasoning and problem-solving processes. School principals are encouraged to support the implementation of RME by facilitating the use of concrete learning media, creating interactive and meaningful learning environments, and providing teacher training on the approach within inclusive settings. Additionally, future researchers are advised to explore RME applications across other mathematical topics, such as measurement and fractions, and to adopt experimental designs with control groups to strengthen external validity. Overall, integrating RME into teaching practices can enhance student engagement, foster deeper conceptual understanding, and promote inclusive, effective mathematics learning for students with diverse cognitive abilities.

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