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Students' Mathematical Problem-Solving Skills in Statistics Using an E-LKPD-Assisted Problem-Based Learning Model

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ABSTRACT

This study aims to analyze the effect of the RME approach assisted by Change-It! media on the mathematical representation ability of fourth-grade students. The RME approach was chosen because it provides opportunities for students to build their own mathematical understanding through situations close to their lives, while the Change-It! media is used to help students transform concrete data into various forms of representation. This study uses a quantitative and quasi-experimental approach as its research method. The design used is a nonequivalent control group design and the sampling technique used is purposive sampling. The population in this study were all fourth-grade students in Cimalaka District with the selected samples being Mandalaherang I Elementary School as the experimental class and Cimalaka III Elementary School as the control class. The instrument used was a mathematical representation ability test. The results of this study are that the RME approach assisted by Change-It! media has a significant effect on the mathematical representation ability of fourth-grade students.This is proven by the results of statistical data tests,The average final mathematical representation ability of students after being given the Change-It! media-assisted RME approach was 69.74 with an N-Gain value of 0.55, which is included in the medium category of improvement and the effect of the Change-It! media-assisted RME approach on mathematical representation ability is 54.76%. Meanwhile, the average final mathematical representation ability of students after being given the conventional approach was 48.95 with an N-Gain value of 0.27, which is included in the low category of improvement and the effect of the conventional approach on students' mathematical representation ability is 78%. It is concluded that there is a difference in the influence between the Change-It! media-assisted RME approach and the conventional approach on the mathematical representation ability of fourth-grade students on pictogram material.

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Introduction

Mathematics is a field of study that makes a significant contribution to human life. Wijayanti, Maulana, & Isrok'atun (2023) state that mathematics contributes to other fields of study, as evidenced by the large number of fields that utilize mathematics.Mathematical representation skills are an important competency that students need to master in mathematics learning. NCTM (in Hijriani et al., 2018) defines representation as the process of translating a problem into another form, for example from an image to a symbol or vice versa. Meanwhile, Sari et al. (2023) explains that mathematical representation is the ability to express ideas and solutions to mathematical problems in various forms, such as words, symbols, or figures. According to Wilujeng and Yeni (in Handayani & Juanda, 2018) there are five reasons why mathematical representation skills are important for students. First, representations can accommodate differences in student abilities. Second, representations help understand abstract concepts and quantities. Third, representations can serve as a bridge to building more concrete representations. Fourth, representations support the development of qualitative reasoning through concrete forms. Fifth, representations help develop quantitative reasoning through more abstract forms.

The importance of mathematical representation skills was also put forward by Dahlan and Juandi (in Hijriani et al., 2018) which states that this ability is the basis for students in solving mathematical problems. In addition, Wiryanto (in Sunanti et al., 2022) emphasizes that mathematical representation is necessary to understand abstract mathematical concepts. However, the mathematical representation abilities of elementary school students are still relatively low. Shahira et al. (2025) found that most students were unable to identify important elements in pictogram and bar chart materials, such as symbols, scales, how to read data, and how to compare data. Similar findings were also obtained. Rosyida et al. (2024) which shows that the mathematical representation ability of students at SDN 2 Semampir is in the medium category. The results of the study showed that 25.3% of students were in the high category, 41.5% in the medium category, and 33.2% in the low category. To strengthen these findings, the researcher conducted an interview with one of the fourth-grade elementary school teachers in Sumedang Regency in November 2025. The results of the interview showed that students still had difficulty in representing data in pictograms and converting data into scaled pictograms.

This low level of mathematical representation ability is inseparable from various obstacles in mathematics learning in schools.Wiryana & Alim (2023) revealed that many students lose motivation to learn because they perceive mathematics as a difficult and boring subject. This occurs because learning often doesn't begin with problems relevant to students' lives, making it difficult for them to connect new information with their own experiences. Furthermore, Handayani & Juanda (2018) stated that low mathematical representation skills are also caused by teacher-centered learning, where teachers directly provide problem-solving procedures or concepts. As a result, students tend to memorize formulas without understanding the concepts, thus limiting their ability to express mathematical ideas.

On the other hand, the Independent Curriculum currently implemented in Indonesia emphasizes the importance of meaningful and contextual learning. Setiadi (2024) explained that one of the main characteristics of the Independent Curriculum is learning that is relevant to students' real-life experiences. Presenting material that is close to their lives can increase engagement and facilitate understanding of the concepts being studied. Furthermore, the Independent Curriculum also provides teachers with the flexibility to adapt learning to students' needs and abilities, giving them greater opportunities to develop and express their ideas.

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
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These characteristics align with the Realistic Mathematics Education (RME) approach, which is considered an alternative solution to address students' low mathematical representation skills. Freudenthal (Maulana, in Tim Dosen, 2025) states that contextual or real-world problems should be the starting point in mathematics learning. According to him, because mathematics originates from human activities in everyday life, mathematics learning also needs to be linked to the real world that is close to students. In addition, the RME approach encourages students to use various strategies in solving problems. Thus, students are required to build conceptual understanding through their own thinking processes, rather than simply memorizing solution procedures.

For learning to be more interesting and meaningful, the support of interactive learning media is also needed. Audie (in Abdurrochim et al., 2022) stated that with learning media, the process of communicating material to students will not take much time and can increase students' learning motivation. Meanwhile, Tafonao and Talizaro (in Aeni et al. 2022) stated that learning media are tools used to convey learning messages and increase students' creativity and focus in learning. From this opinion, it can be understood that learning media are tools used to convey messages in the learning process. Nurdin (in Aeni et al., 2022) explained that learning media is divided into three types, namely print media, electronic media, and internet media. The function of learning media as conveyed by Nurrita (in Safitri et al., 2023) includes a communication function that facilitates interaction between students and teachers, a motivational function that can increase enthusiasm for learning, a meaningful function that helps improve understanding of the material, a perception-aligning function that helps students have the same understanding of the material, and an individualistic function with which, Harsiwi & Arini (2020) concluded that the use of interactive learning media can increase student motivation during the learning process. Therefore, this study utilized the Change-It! learning media, an interactive media designed to help students understand the concept of mathematical representation in pictogram material. Therefore, this study utilized the Change-It! learning media, an interactive media designed to help students understand the concept of mathematical representation in pictogram material.

This study applies the Realistic Mathematics Education (RME) approach with the help of Change-It! media through five main characteristics that are fully integrated in the pictogram learning process. Learning begins with the use of everyday contexts (phenomenological exploration) through a voting mechanism for things that students like on the Change-It! media to create a meaningful learning experience. Next, the use of models occurs when the voting data is transformed from a concrete form into a simpler pictogram visual model. In this process, the aspect of students' active contribution (students' contribution) is highly emphasized because students are required to construct their own understanding independently when thinking about how to simplify the image without losing the meaning of the data. The entire process is supported by interactive characteristics (interactivity) that are created when students interact directly in voting and transferring their data. Finally, this approach applies the principle of intertwining where students not only learn to present pictogram data, but also integrate it with other mathematical concepts such as counting, comparing data quantities, and interpreting information in an integrated manner.

Although research on the influence of the RME approach on mathematical representation skills has been widely conducted, research that combines the RME approach with digital-based interactive media is still relatively limited. In addition, there are still research gaps in the aspects of the material and subjects studied. Research on mathematical representation skills on pictogram material with fourth-grade elementary school students as subjects is still rare. Based on these conditions, this study aims to examine the influence of the Realistic Mathematics

Education approach assisted by Change-It! media on students' mathematical representation skills on pictogram material.

Method

Settings

This research uses a quantitative approach with an experimental method. Muhajirin et al. (2024) explain that quantitative research is a research approach that focuses on statistical or mathematical tests, the results of which are referred to as quantitative descriptive analysis. On the other hand, Arifin (2017) said that the experimental method is applied to analyze the effect of treatment on something. According to Tuckman (Arib et al., 2024) experimental methods are divided into four types, namely pre-experiments, pure experiments, factorials, and quasi-experiments. The purpose of this study is to find out the effect of the Change-It! media-assisted RME approach on participants' mathematical representation abilities, so this study will use a quasi-experimental method. The research design that will be used in this study is a Nonequivalent Control Group, the research design is as follows.

Table 1. Research Design

Sample	Pretest	Treatment	Posttest
Experimental Group	O_1	X	O_2
Control Group	O_3		O_4

Information:
O_1, O_3 : Pretest
O_2, O_4 : Posttest
X : Change-It! media-assisted RME approach

Population and Sample

The population of this study was all fourth-grade students in Cimalaka District who met the same criteria: a minimum of 30 fourth-grade students from A-accredited schools, using the Merdeka Curriculum, having a smartboard or projector, and not yet learning pictogram material. The population was 665 across 17 schools. In research, a sample is defined as a part of the population selected for research and the research results can represent the entire population (Sugiyono, in Subhaktiyasa, 2024). In this study, samples were taken using purposive sampling techniques. According to Sugiyono (in Maharani & Martin, 2018) purposive sampling is a sampling technique based on the criteria required for the study. The sample criteria in this study were a minimum of 30 fourth-grade students from A-accredited schools, using the Independent Curriculum, having a smartboard or projector, and not yet studying pictogram material. Based on the criteria mentioned above, SDN Mandalaherang I was selected with 44 fourth-grade students. Furthermore, SDN Cimalaka III was selected as the control group with 47 fourth-grade students.

Instruments

Research instruments are tools researchers use to collect research data to make it easier to analyze. In this study, the instruments used were written test sheets and observation sheets.

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v6i3.5359 Volume 6, No 3, July - September 2026, pp. 1112 –1127

Test Questions

The written test consisted of descriptive questions, administered before and after the treatment. Eight questions were administered, aligned with the mathematical representation indicators used in this study. The following are examples of questions from each mathematical representation indicator used in this study.

Table 2. Example Questions

Aspects of Mathematical Representation	Question Indicator	Sample Question
Visual representation	Given a question, students are able to present data or information from diagram form into pictogram form.	Look at the following bar chart which shows the number of story books read by Andi, Sarah, Bima, and Ajeng during one month!  Convert the data in the bar chart into pictograms by using images to represent 2 books!
Visual representation	Presented with questions, students are able to make pictograms from the story questions given.	A bookstore has a stock of stationery that hasn't been properly recorded. The store employee reports the following data: • The number of notebooks is 60. • The number of pencils is 30 pieces. • The number of erasers is 40 pieces. Create a pictogram from the stationery data above! Choose one image to represent several objects, for example, one pencil image represents five pencils!
Mathematical equation or expression	Given a question, students are able to read the pictogram and then answer the question with a mathematical sentence.	The following is Mr. Udin's gallon sales data for 4 days. **Day** / **Sale** Monday Tuesday Wednesday Thursday signifies 3 gallons Based on the data above, calculate the difference in gallon sales between Monday and Wednesday.
Written words or text	Presented with questions, students are able to read the pictograms and then answer the questions with written text.	Look at the pictogram below which shows the results of Mother's gardening! **Fruit** / **Amount** Durian Banana Mango

Aspects of Mathematical Representation	Question Indicator	Sample Question
		Mother said that the durian harvest is greater than the mango harvest. Does this statement align with the data in the pictogram? Explain your reasoning in writing!

Test Instrument Development Techniques

Before being used in research, this test instrument was tested for validity and reliability, the results of which are as follows.

Table 3. Test Instrument Validity Criteria

Correlation Coefficient	Criteria
$0.90 \leq rxy \leq 1.00$	Very high
$0.70 \leq rxy \leq 0.90$	High
$0.40 \leq rxy \leq 0.70$	Medium
$0.20 \leq rxy \leq 0.40$	Low
$rxy < 0.20$	Very Low

Table 4. Results of the Validity Test of the Test Instrument Content

Item Question	Correlation Coefficient	Sig. (2-tailed)	Criteria	Interpretation	Information
1	0.574	0.001	Valid	Medium	Used
2	0.509	0.004	Valid	Medium	Used
3	0.634	0,000	Valid	Medium	Not used
4	0.781	0,000	Valid	High	Used
5	0.832	0,000	Valid	High	Not used
6	0.902	0,000	Valid	High	Used
7	0.744	0,000	Valid	High	Used
8	0.681	0,000	Valid	Medium	Used
9	0.795	0,000	Valid	High	Not used
10	0.393	0.032	Valid	Low	Not used
11	0.708	0,000	Valid	High	Used
12	0.540	0.002	Valid	Medium	Used

During the instrument trial, a total of 12 questions were used, and 30 students participated in the trial. Based on the validity test results, all questions were declared valid, but only 8 questions were used in this study. The following are the reliability test criteria for the mathematical representation ability test instrument.

Table 5. Instrument Reliability Criteria

Correlation Coefficient	Reliability
$0.90 \leq r11 \leq 1.00$	Very high
$0.70 \leq r11 \leq 0.90$	High
$0.40 \leq r11 \leq 0.70$	Medium
$0.20 \leq r11 \leq 0.40$	Low
$r1 < 0.20$	Very Low

Source: Lestari & Yudhanegara (in Alfajri et al. 2019)

The following are the results of the reliability test on the mathematical representation ability test instrument.

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v6i3.5359 Volume 6, No 3, July - September 2026, pp. 1112 –1127

Table 6. Results of the Reliability Test of the Test Instrument

Reliability Coefficient	Number of Questions	Interpretation
0.893	12	High

Based on Table 6, the value information is obtained Cronbach's Alpha 0.893, it can be concluded that the material representation ability test instrument has a high category reliability coefficient so it can be used in this study.

Data Collection

Data collection technique in this study used tests in the form of a pretest and a posttest after the subjects were given treatment. The tests were used to measure cognitive abilities in the form of mathematical representations of students in pictogram material. The learning design to be implemented in the experimental class is as follows.

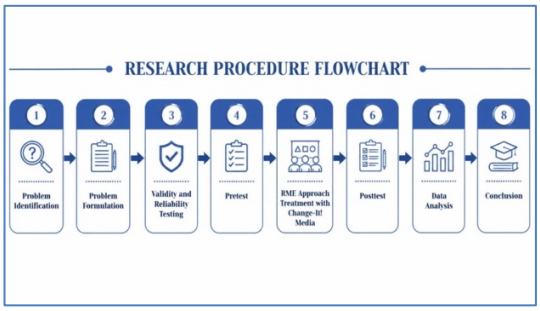

Figure 1. Research Procedures

The following is documentation during the implementation of learning using the RME approach assisted by Change-It! media.

Figure 2. Learning Process in Experimental Class

The following is the Change-It! media used as learning media in the experimental class.

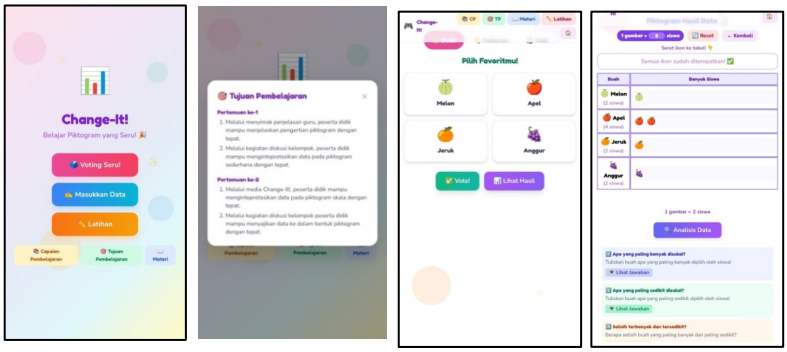

Figure 3. Example Learning Media

Data analysis

The research data will be analyzed using statistical analysis for quantitative data and descriptive analysis for qualitative data, namely observational data. For quantitative data, a normality test will be used to determine whether the data distribution is normal. A homogeneity test will then be performed to determine whether the data have the same or different variances. Then the data hypothesis test will be carried out through several statistical tests. The first is to see if there is a difference in the average between the two dependent samples, in this study are the results of the pretest and posttest in the experimental class, then the results of the pretest and posttest in the control class, then the Paired Sample T-Test will be used if the data is normally distributed, but if it is not normally distributed the Wilcoxon test will be used. Then to see the difference in the average of two independent samples, the Independent Sample T-Test is used if the data is normally distributed, and the Mann-Whitney test if the data is not normal. To see the increase in mathematical representation ability after the sample is given treatment, an N-Gain calculation will be carried out. In addition to calculating the increase through the N-Gain calculation, a determination coefficient calculation is also carried out to see how much influence the treatment given has on mathematical representation ability.

Research Findings

The results of statistical tests conducted on the experimental and control classes showed that both classes experienced an increase in mathematical representation skills after being given their respective treatments. The following are the results of the statistical tests on the experimental and control classes.

Table 7. Normality Test Results

Class	Mark	Average Value	Shapiro–Wilk Normality Test	
			Sig.	Information
Experiment	Pretest	34.06	0.012	Non-normally distributed
	Posttest	69.74	0.067	Normally Distributed
Control	Pretest	31.33	0.065	Normally Distributed
	Posttest	48.95	0.192	Normally Distributed

Based on Table 7, the pretest scores for the experimental class indicate a non-normal distribution. Furthermore, the posttest scores for the experimental class indicate a normal distribution. Furthermore, because the pretest data were non-normally distributed, a Wilcoxon test (w-test) was used to test the difference in means. Meanwhile, the pretest and posttest scores for the control class showed a normally distributed data. Therefore, the paired sample t-test (t-test) will be used to test the difference in means in the control class. The following are the results of the test of the difference in means in the experimental and control classes.

Table 8. Results of the Pretest Posttest Average Difference Test

Class	Mark	Sig. (2-tailed)	Information
Experiment (W-Test)	Pretest Posttest	0,000	There was a significant average difference between the initial and final abilities of students in the experimental class.
Control (t-test)	Pretest Posttest	0,000	There was a significant average difference between the initial and final abilities of students in the experimental class.

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
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Referring to Table 8, the Wilcoxon test results show a difference in the average pretest and posttest scores in the experimental class. In other words, there is a difference in the initial and final mathematical representation abilities of students after being treated with the RME approach assisted by Change-It! media. Meanwhile, the t-test results indicated a difference in the average pretest and posttest scores in the control class. In other words, there was a difference in the initial and final mathematical representation abilities of students after being given the conventional approach. Furthermore, to see how much improvement in mathematical representation ability occurred in the experimental class and in the control class, an N-Gain calculation was carried out, the results of which are as follows.

Table 9. N-Gain Calculation Results

Class	Average Poerhsttes	Average N-Gain	Category
Experiment	69.74	0.55	Medium
Control	48.95	0.27	Low

Based on calculations, the average N-Gain value obtained in the experimental class was 0.55, falling into the moderate increase category. Meanwhile, the average N-Gain value obtained in the control class was 0.27, falling into the low increase category.

Table 10. Results of N-Gain Perindicator Accounts

No	Indicator	N-Gain	Category
1	Visual Representation (from diagrams to pictograms)	0.62	Medium
2	Visual Representation (from story problems to pictograms)	0.57	Medium
3	Mathematical Expression	0.62	Medium
4	Words	0.33	Medium

Based on Table 10, it is obtained that the indicators Visual representation (from diagrams to pictograms) and mathematical expression indicators have an N-Gain value of 0.62, which is greater than the N-Gain value of other indicators. Thus, it can be concluded that students' mathematical representation abilities increased inindicatorvisual representations (from diagrams to pictograms) and indicators of mathematical expressions. To determine the extent of influence each treatment had on mathematical representation ability, which increased by 0.55 in the experimental class and 0.27 in the control class, the coefficient of determination was calculated. However, to determine the coefficient of determination, a correlation coefficient is required. If the data is normally distributed, the calculation uses the Pearson test, but if the data is not normally distributed, the calculation uses the Spearman test. Because the pretest data in the experimental class was not normally distributed, the correlation coefficient value obtained using the Spearman test was 0.74. Next, the coefficient of determination was calculated as follows.

$$KD = r^2 \times 100\%$$
$$KD = 0{,}74^2 \times 100\%$$
$$KD = 54{,}76\%$$

From the calculation results above, a coefficient of determination of 54.76% was obtained. This shows that the RME approach assisted by Change-It! media has an influence of 54.76% on improving the mathematical representation abilities of students in the experimental class.

Meanwhile, in the control class, the correlation coefficient was obtained from the Pearson test results with a correlation value of 0.79.Next, the coefficient of determination is calculated as follows.

$$KD = r^2 \times 100\%$$
$$KD = 0{,}79^2 \times 100\%$$
$$KD = 62{,}41\%$$

From the calculation results above, we obtainThe coefficient of determination is 62.41%, this shows that the conventional approach has an influence of 62.41% on improving the mathematical representation abilities of students in the control class.

Initial Ability Analysis

An initial ability analysis was conducted to determine whether there were differences in the initial abilities of students in the experimental and control classes. The following are the results of the initial ability statistical test.

Table 11. Statistical Test Results of Pretest Values for Experimental Class and Control Class

Class	Average	Normality Test (Shapiro-Wilk)		Mean Difference Test (Mann-Whitney U)	
		Sig.	Information	Sig.	Information
Experiment	34.06	0.012	Non-normally distributed	0.669	There is no difference in the average pretest scores of the experimental class and the control class.
Control	31.33	0.065	Normally Distributed		

Because the data in the experimental class was not normally distributed, the average difference test was carried out using a U-test and the results showed that there was no difference in the initial abilities of students in the experimental class and the control class.

Final Capability Analysis

The analysis of differences in final abilities between students in the experimental and control classes was conducted through several stages of statistical testing. These stages included a normality test as a prerequisite, followed by a homogeneity of variance test using Levene's test, and a mean difference test using the Independent Samples t-test. The results of the statistical testing on the posttest data for both classes are presented in the following table.

Table 12. Statistical Test Results of Posttest Values for Experimental Class and Control Class

Class	Average	Normality Test (Shapiro-Wilk)		Homogeneity Test (Levene's Test)		Mean Difference Test (t-test)	
		Sig.	Information	Sig.	Information	Sig.	Information
Experiment	69.74	0.067	Normally Distributed	0.784	The data has the same variance	0,000	There is a difference in the average posttest scores of the experimental class and the control class.
Control	48.95	0.192	Normally Distributed				

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
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From the results of the statistical test, it was found that the posttest data in the experimental and control classes had a normal and homogeneous distribution, so that the average difference test was carried out using the Independent Sample T-Test, which resulted in a difference in the average final mathematical representation ability of students. To find out which treatment was better, it was seen from the average posttest of the two classes. Referring to the table, it is known that the average posttest score in the experimental class was higher than the control class, so it was concluded that the RME approach assisted by Change-It! media had a better influence on students' mathematical representation abilities.

N-Gain Calculation Analysis

The analysis of the N-Gain calculation in the experimental and control classes was conducted through several stages of statistical testing. These stages include a normality test as a prerequisite test, followed by a test for mean differences using the Mann-Whitney U test. The results of the statistical testing on the N-Gain data for the two classes are presented in the following table.

Table 13. Results of the N-Gain Statistical Test for the Experimental-Control Class

Class	Average N-Gain	Normality Test (Shapiro-Wilk)		Mean Difference Test (Mann-Whitney U)	
		Sig.	Information	Sig.	Information
Experiment	0.55	0.058	Normally Distributed		There is a difference in the average N-Gain value in the experimental class and the control class.
Control	0.27	0,000	Non-normally distributed	0,000	

Discussion

Effect of the Change-It! Media-Assisted RME Approach on Students' Mathematical Representation Ability in Pictogram Material

From the results of the statistical test, the calculation of the N-Gain value obtained showed that the increase in mathematical representation ability in the experimental class was 0.55 or 55%, which is included in the moderate increase category. From the calculation of the coefficient of determination value, the result was 54.76%, which means that the RME approach assisted by Change-It! media had an effect of 54.76% on increasing students' mathematical representation ability up to 55% in the experimental class. After calculating the increase in N-Gain per indicator, the results of the indicator were obtained.visual representation (from diagrams to pictograms) and mathematical expression indicators have an N-Gain value of 0.62, which is greater than the N-Gain value of other indicators. Then the N-Gain calculation was also carried out between the experimental class and the control class, from the results obtained it was concluded that there was a difference in the average N-Gain value between the experimental class and the control class.

The improvement in mathematical representation skills after being given the RME approach assisted by Change-It! media is in line with Jean Piaget's Cognitivism theory which states that elementary school students will more easily understand the material if learning starts from concrete things. The use of Change-It! media in the RME approach functions to visualize abstract concepts in pictogram material so that they appear more concrete to students. On the other hand, the use of Change-It! media is in line with Mayer's Multimedia Learning theory, Mayer (in Faisal et al., 2024) who stated that students will more easily absorb information if the learning media used combines visual, text, and audio elements. Using Change-It! media

allows students to obtain information from data visualizations and text instructions in the media, narrated by the teacher.

The findings of this study are in line with research conducted by (Ramadhani et al., 2025), the research results stated that the RME approach had a significant influence on the mathematical representation abilities of fourth grade students in geometry material. Another study was conducted by Parno (2020) which found that the RME approach can improve students' mathematical representation skills in the field of plane geometry. The results of this study are also in line with research Zega & Mendrofa (2023) which states that interactive learning media that combines visuals and sound is effective in improving students' representational abilities. Improved mathematical representation skills can occur due to the application of the RME approach, which makes learning start from events close to students. This makes it easier for students to understand information because the adaptation process in their brains does not require a long time, because the new information they receive is related to events they are familiar with. Another factor is the use of Change-It! media, which makes it easier to visualize abstract data into something more concrete or easier to imagine. In addition, Change-It! media, which is also interactive, allows students to play an active role in seeking information in class, this is in line with the characteristics of the RME approach, namely interactivity. This condition makes the knowledge they can obtain based on the results of exploration and teacher guidance rather than instantaneous. Thus, the material presented will be understood rather than memorized, so the retention period of the concepts that have been taught will be longer. The results of this study indicate that the Change-It! media-assisted RME approach can improve students' mathematical representation skills. Therefore, the Change-It! media-assisted RME approach can be used as an alternative learning method for teachers in the classroom.

Influence of Conventional Approaches on Students' Mathematical Representation Abilities in Pictogram Material

After calculations were carried out, there was an increase in the mathematical representation ability of students in the control class by 0.27 or 27% and was included in the low category of improvement. After testing the coefficient of determination value, a value of 62.41% was obtained, which means that the expository approach contributed 62.41% to the mathematical representation ability of students which increased to 27% in the control class. The success of the expository approach in improving mathematical representation skills in the control class was influenced by the characteristics of the approach itself. However, in practice, there are weaknesses of the expository approach, students with visual learning styles cannot be optimally accommodated, because, as previously explained, this approach emphasizes verbalism (Nababan et al., 2023). Therefore, the expository approach has a lower influence than the RME approach assisted by Change-It! media on students' mathematical representation skills. Furthermore, the expository approach facilitated classical mathematics learning in the control class, although the results were not optimal. This was demonstrated by the N-Gain calculation, which increased by 0,27. Therefore, it can be concluded that the conventional approach had a positive effect on students' mathematical representation skills, although the increase in representation skills was relatively low. Therefore, innovation in learning strategies is needed to address the challenges in mathematics learning in the future.

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Difference in the Effect of the Change-It! Media-Assisted RME Approach and the Conventional Approach on Students' Mathematical Representation Ability in Pictogram Material

The experimental class was given the RME approach assisted by Change-It! media, while the control class was given the conventional approach. The N-Gain value in the experimental class reached 0.55 while in the control class it reached 0.27. This indicates that there has been an increase in mathematical representation abilities in both classes. However, the results of the calculation of the average posttest score showed that the experimental class had a higher average than the control class, namely 69.74 > 48.95. This indicates that the experimental class has a better influence on improving students' mathematical representation abilities. The difference in the increase in representational ability in the experimental and control classes is certainly influenced by the differences in the behavior provided. In the experimental class, according to Treffers (in Afriansyah, 2016) the RME approach encourages students to discover their knowledge gradually through modeling and guided by teacher guidance. This allows students to understand the concepts of the material presented, allowing them to manipulate these concepts in other questions. Meanwhile, in the control class, Nababan & Sari (2023) this suggests that the teacher has already developed a concept for the material to be presented, thus directly presenting students with the concept without any steps to discover it. This results in students tending to use the same solution when presented with another example problem, leading to confusion.

Another difference lies in the teaching aids or media used. The experimental class used Change-It! media, while the control class used Snack's Survey. Both media have almost the same concept, namely a means of collecting data. In Change-It! media, students are asked to choose their favorite things, then the results of all students' choices will appear in the form of symbols, these symbols are what students must simplify the number of so that they can be transformed into pictograms. In Change-It! media, there is a change scale feature so students will know the process of simplifying the number of symbols or data from their voting results. Meanwhile, Snack's Survey media is only used to record students' favorite foods, students will come forward one by one and choose the food they like. The data simplification process is not displayed in this media, but is explained directly by the teacher. From the description above and looking at the higher N-Gain value of the experimental class and clarified by the average final ability value of the experimental class which is higher than the control class, it can be concluded that the RME approach assisted by Change-It! media has a better influence on improving the mathematical representation abilities of students in grade IV on pictogram material.

Conclusion

The RME approach assisted by Change-It! media applied to the experimental class had a positive influence on the mathematical representation ability of fourth-grade students on pictogram material. Likewise, the conventional approach applied to the control class had a positive influence on the mathematical representation ability of fourth-grade students on pictogram material. There was a difference in the influence given between the RME approach assisted by Change-It! media in the experimental class and the conventional approach in the control class. This difference was evidenced by the higher average final ability score in the experimental class than in the control class, namely 69.74 > 48.95. The increase in N-Gain in the experimental class was 0.55, while in the control class there was an increase in N-Gain of 0.27. Thus, it can be concluded that the RME approach assisted by Change-It! media had a

better influence on the mathematical representation ability of fourth-grade students on pictogram material.

Conflict of Interest

The authors declare that there are no conflicts of interest.

Auhor Contributions

W. conceived the research ideas presented and collected the data. The other two authors (I. and A.N.A.) actively participated in the discussion of the results and the approval of the final version of the manuscript. All authors confirm that they have read and approved the final version of this paper. The total percentage contributions to the conceptualisation, drafting and revision of this paper are as follows: W.: 40%, I.: 30%, and A.N.A.: 30%.

Data Availability Statement

The authors state that the data supporting the results of this study will be provided by the corresponding author, [W.], upon reasonable request.

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