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WORDWALL–ASSISTED RME: IMPROVING STUDENTS' MATHEMATICS UNDERSTANDING AND LEARNING ACTIVENESS ON ELEMENTARY SCHOOL

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ABSTRACT

Mathematical understanding in Elementary School is very important as a foundation for deeper understanding at the next level. However, in reality, what occurs in the field shows that mathematical understanding in Elementary School remains very low, as evidenced by several problems, including many students still experiencing difficulties with multiplication operations. The objective of this study is to determine the development process, effectiveness, and feasibility of the RME approach, assisted by Wordwall, in improving the mathematical understanding and learning activeness of Elementary School students. In this study, the research and development (R&D) method was used with the Borg and Gall model. The research subjects were from one of the Elementary Schools in Karawang, comprising a control class and an experimental class. The instruments in this study used a mathematical understanding ability test, a student learning activeness questionnaire, a validation instrument, and an observation sheet. The research data were analyzed using normality testing, homogeneity testing, and the Mann–Whitney test, based on the validation results and product trials. Research findings indicate that the development of a Realistic Mathematics Education (RME) approach assisted by Wordwall, conducted through the Borg and Gall development stages, has been declared highly feasible based on expert validation results. There was a significant improvement in mathematical understanding within the experimental class. According to the N-Gain test results, the enhancement of students' mathematical comprehension and learning engagement fell into the "high" category. Consequently, the Realistic Mathematics Education approach assisted by Wordwall can be considered an effective and feasible learning strategy for elementary school students.

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INTRODUCTION

Mathematics in Elementary School is a very crucial subject, and there should be no errors in understanding the basic concepts of mathematics, because these basic concepts will continue to be studied more deeply at the next level of education, and are used to solve daily problems (Sihombing et al., 2023). In the world of Elementary School-aged children, mastery of mathematical competencies is very important, and mathematics is used every day, from waking up until going back to sleep (Setiawan, 2020). Mathematical conceptual understanding is the understanding of students regarding principles, concepts, and methods, which are then used as a method to solve the problems presented (Sengkey et al., 2023).

However, the reality that occurs in the field is that many elementary school students view multiplication as the burden of memorizing tables as an abstract material, so they do not understand the concept. In addition, learning is one-way and conventional, which makes students tend to be passive in the learning process, making mathematics learning uninteresting. According to Manik et al. (2024), mathematics understanding remains very low because students face several problems during classroom instruction.

Mutmainna and Nurnnah (2023) state that students generally experience difficulties in understanding basic concepts, making it difficult to solve problems. In the study by Amalia et al. (2022), students often experienced difficulties in multiplication and division operations in Grade IV, which should have been well understood to continue learning at higher grades. In line with Ariani et al. (2023), students' understanding of multiplication concepts often involves conceptual errors, namely errors in processing information and applying it. According to Claudia et al. (2020), teachers explain multiplication material only based on textbooks provided by the school, making it less effective, and the learning media used are also less realistic.

In a study by Yanti et al. (2023), student learning engagement was categorized as low, one of the causes being the lack of instructional media usage. Student learning engagement manifests in the form of involvement in solving problems, the courage to ask questions when they do not understand the material, the confidence to answer questions posed by the teacher, participation in discussions to resolve issues, and the ability to present group results (Irwan & Kamarudin, 2021). According to Hariyanto et al. (2023), learning engagement is a crucial aspect of education that determines the level of student learning outcomes achievement. To improve student engagement, new innovations must be developed to make learning more appealing, so that motivation arises naturally (Hariandi & Cahyani, 2018).

Based on the existing problems, a learning approach is needed as a solution that can assist students to improve their mathematical understanding abilities and student learning activity. The development of the Realistic Mathematics Approach is considered an effective teaching approach that integrates real-world contexts into the learning process. The Realistic Mathematics Approach can relate mathematical concepts to the real-life context of students, serve as a reflection for students, encourage active discussion, and function as a model (Najwa & Sunanto, 2025). By implementing this approach, it is expected that students can develop better understanding and learning activeness in mathematics. The Realistic Mathematics Education approach encourages critical thinking, problem-solving, and effective communication among students, which makes students more active in mathematics learning (Aisyah & Madio, 2021).

In the current digital era, the integration of technology into learning has become very important in efforts to improve learning outcomes. In the study by Subtianah (2022), the integration of technology in education can support student activeness and participation, improve the quality of learning, and prepare students to face the demands of an increasingly digital future. According to Wahyudi and Jatun (2024), the integration of technology in education, especially for Elementary School students, is a very important effort to improve the quality of learning and enrich students' experiences. According to Nuroktavia et al. (2026), the application of a realistic mathematics approach assisted by Canva has been proven to improve the ability to understand basic mathematical concepts. By using the realistic mathematics approach assisted by YouTube, it can be chosen as an alternative learning media that is very suitable for use in improving students' understanding of mathematical concepts (Rangkuti & Siregar, 2019). In the study by Nurul et al. (2024), the interactive learning media Wordwall serves as an effective technology-based learning strategy and can increase students' learning activeness. By using a Wordwall application, it can help present abstract material in the form of an interactive visual game and trigger student involvement. In addition, there is feedback provided on the Wordwall application so that students can immediately correct their misunderstandings independently.

Based on the above description, the purpose of this study is to examine the development process, feasibility, and effectiveness of the Realistic Mathematics Approach, as assisted by the Wordwall application, in improving students' understanding and learning activeness. In this research, we can synchronize the principles of contextual learning that are oriented towards real life with interactive Wordwall applications so as to create a new strategy that can not only improve mathematical understanding but can effectively trigger student learning activity through the use of fun digital materials.

METHOD

The research method used in this study was the Research and Development (R&D) method, selected because it aligns with its characteristics. Research and Development (R&D) is a research process aimed at developing a new product or improving and updating an existing product. This study referred to the Borg and Gall model (Waruwu, 2024). This study consisted of five main stages: needs analysis, validation by several experts followed by revision, limited trial with revision, extensive trial with revision, and large-scale product testing.

This study was conducted at one of the Elementary Schools in Karawang Regency during the second semester of the 2025–2026 academic year. The subjects of this study were second-grade students in an Elementary School, and the sampling technique was random. The limited trial was conducted with one teacher and 10 students. It was then continued with an extensive trial conducted in a single class of 32 students. The next stage was product testing, using a pretest–posttest control group design with two classes, each with 34 students. One class served as the experimental class, receiving treatment using the Realistic Mathematics Approach assisted by the Wordwall application, while the other class served as the control class using a conventional learning model.

The data collection techniques in this study included observation, interviews, and questionnaires. Meanwhile, the data processing procedures produced qualitative and quantitative data. The qualitative data were obtained from analyzing needs, feedback, and suggestions from experts, teachers, and students. Before the assessment instruments were administered, they were first validated using a Likert scale with a range of 1–5 as follows.

$$p = \frac{f}{n} x\, 100\%$$

Description:

P : Percentage of responses

f : Frequency of responses

n : Number of respondents

The quantitative data can be converted into qualitative data using the criteria according to (Amini & Ginting, 2024), as follows:

Table 1. Score Interpretation

Category of creative thinking	Results (%)
80 % < x ≤ 100 %	Very Good
60 % < x ≤ 80 %	Good
40 % < x ≤ 60 %	Fair
20 % < x ≤ 40 %	Poor
0 % < x ≤ 20 %	Very Poor

To determine improvement in students' mathematical understanding, the N-gain test can be used. According to Harianja et al. (2024), the N-gain can be calculated using the following formula:

$$g = \frac{s_{post} - s_{pre}}{s_{maks} - s_{pre}}$$

Description:
g : N-Gain

spre : Pretest score

spost : Posttest score

smaks : Maximum test score

The average N-gain obtained can be interpreted using the following categories, with the criteria as follows:

Table 2. N-Gain Score Criteria

Kriteria	Keterangan
g > 0,7	High
0,3 < g ≤ 0,7	Medium
g ≤ 0,3	Low

RESULTS AND DISCUSSION

Results

1. **Development Process of the Realistic Mathematics Approach Assisted by the Wordwall Application**

This study used the Borg and Gall development model, which produced a product in the form of a Realistic Mathematics Approach assisted by the Wordwall application. In accordance with the established procedures, this study was conducted through ten steps as follows:

a. Research and Information Collecting Stage

The first stage, information collecting, was the preliminary study. At this stage, the existing problems and needs were analyzed using interviews with a Grade V classroom teacher. Based on the interview results, several problems were identified as the basis for developing the learning model, including the finding that students' basic mathematical ability remains a major challenge, one of which is the weak mastery of multiplication material. Multiplication material is very important because it serves as a prerequisite for higher grades. Students' inability to master multiplication affects subsequent mathematics materials that are more complex, such as fractions, calculating the area of plane figures, and others. During the interview process, the teacher stated that, in multiplication, students relied solely on memorization rather than developing a strong understanding.

In addition, low student learning activeness in the classroom was identified. There was dominant passive behavior; students were afraid to ask questions, and they tended to daydream when the teacher was explaining, so that when submitting their work, they often copied answers from their peers without understanding the problem-solving process. As a solution to these problems, the Realistic Mathematics Approach, assisted by the Wordwall application, was considered highly relevant. The Realistic Mathematics Approach invites students to learn mathematics through real-life contexts they encounter in their daily lives. Thus, multiplication material, which is often considered abstract, becomes more concrete and meaningful. By using the Realistic Mathematics Approach, students are guided to construct their own mathematical understanding through the processes of horizontal and vertical mathematization.

The use of the Wordwall application as a learning medium aims to increase students' activeness in learning by enhancing their interactive engagement. Its game-based features make it highly suitable for Elementary School students. With its various features, Wordwall can transform mathematics exercises, often perceived as boring, into more enjoyable and challenging activities. This condition indicates that the combination of the Realistic Mathematics Approach and Wordwall can foster student-centered learning, thereby strengthening students' understanding of basic multiplication concepts and significantly increasing their activeness in classroom activities. Therefore, this approach can serve as a solution to the existing problems. Numerous problems arise in the process of teaching and learning mathematics, including students' understanding and interest in learning, and the main cause of these problems is the use of ineffective learning methods (Wiryana & Alim, 2023). Mathematics learning is often considered difficult for students to understand, and one factor influencing this difficulty is the teacher's teaching method (Permatasari, 2021). In mathematics, understanding concepts is challenging; however, multiplication plays a significant role as a fundamental skill for solving more complex mathematical problems. Repeated difficulties with multiplication affect students' ability to learn subsequent material (Hasibuan et al., 2025). Low learning activeness among Elementary School students during the learning process is reflected in students' lack of confidence to ask questions, reluctance to answer when asked directly, and the tendency of most students to remain silent during discussions (Puspita Sari et al., 2022).

b. Planning

The second stage, planning, was the initial stage of product development. At this stage, product planning was carried out, including defining the stages of the learning approach and the instructional materials to support the implementation of the learning process, which were intended to address existing problems and were adjusted to students' needs. The objectives to be achieved were determined, the mathematical abilities to be targeted were selected, and a learning approach was developed by first creating a prototype. The presentation used the Realistic Mathematics Approach, with assistance from the Wordwall application. This model development stage consisted of presenting the material using the steps of the Realistic Mathematics Approach, assisted by the Wordwall application as follows:

Table 3. Steps of the Realistic Mathematics Approach Assisted by Wordwall

Stage	Activity
1	Stating learning with real-world contexts (the use of context) by presenting contextual problems through Wordwall
2	Using models (the use of models), where students transform real-world problems from Wordwall into mathematical models

3	Utilizing students' construction results, where students are given the freedom to solve problems in the student worksheet based on the Realistic Mathematics Approach
4	Interactivity (interactivity), involving student–teacher interaction through quizzes on Wordwall to strengthen understanding in an interactive and collaborative manner
5	Interactivity (interactivity), involving student–teacher interaction through quizzes on Wordwall to strengthen understanding in an interactive and collaborative manner

In addition to using the steps of the Realistic Mathematics Approach assisted by Wordwall, supporting instructional materials are required to ensure that the learning process runs optimally. The supporting instructional materials are as follows:

Table 4. Developed Instructional Materials

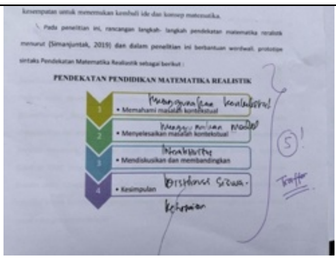
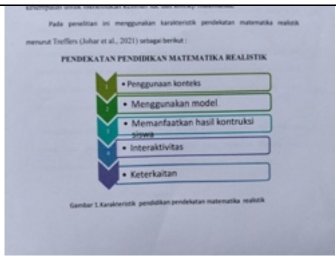
Material	Function
Learning Module	The learning module is used as a guide for the structured learning process using the Realistic Mathematics Approach
LKPD (Student Worksheet)	The student worksheet is designed to enable students to discover mathematical concepts independently and to guide them in constructing their own understanding through contextual problem-solving activities
Learning Media (Wordwall)	Wordwall is used as an interactive and engaging digital reinforcement tool to increase students' enthusiasm and to help visualize the relationship between groups of objects in real contexts and multiplication symbols or numbers
Pretest	Identifies students' initial ability and readiness before learning the material
Posttest	Measures students' level of understanding after using the Realistic Mathematics Approach and Wordwall
Questionnaire	Measures non-cognitive aspects, specifically students' learning activeness

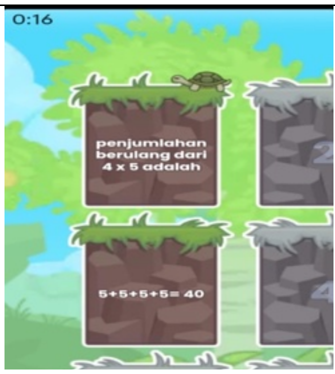
The instructional materials were developed and used to support the development of the Realistic Mathematics Approach, beginning with the initial limited trial.

c. Develop preliminary form of product

The third stage, developing a preliminary form of the product, was the validation stage. At this stage, the product was validated by a subject-matter expert, an education expert, and an ICT expert to assess whether the product's appearance and content aligned with its objectives. Based on the validation results, feedback was obtained from several experts, and revisions were carried out in accordance with these suggestions, which are presented in Table 5.

Table 5. Expert Validation Results

No	Initial Validation	Final Validation	Description
1			The steps of the Realistic Math ematics Approach basedonTreffers wereadded totheprototype

2			Improvementswer e madetoreadability andthecorrectiono ftypographicalerro rs intheprototype

Based on the table above, several changes were made between the initial and final validations, and these changes were adjusted in response to the validators' suggestions to ensure a product that is feasible for use.

d. Preliminary Field Testing

The fourth stage, preliminary field testing, was the limited trial stage. After validating and revising the development of the learning approach assisted by Wordwall, the next stage was to conduct a limited trial with 10 students and one teacher. The limited trial was conducted to obtain initial feedback, including students' perceptions of the readability of the developed learning approach. The data collection method used in this limited trial was to administer a questionnaire to students about the use of the Realistic Mathematics Approach, assisted by the Wordwall application.

e. Main Product Revision

The fifth stage, main product revision, was the stage of revising the product based on the results of the limited trial. At this stage, several improvements were made, including revisions to the supporting instructional materials, particularly the student worksheet, which was adjusted to align with the steps of the Realistic Mathematics Approach. These revisions were made to improve the development of the Realistic Mathematics Approach in accordance with the suggestions from the limited trial. The changes are presented in the following table:

Table 6. Product Revision

Initial Product	**After Revision**
	

Based on the table above, several changes were made, including improvements in sentence structure to make it more understandable for students and modifications to the display, which was previously darker and was revised to a brighter appearance.

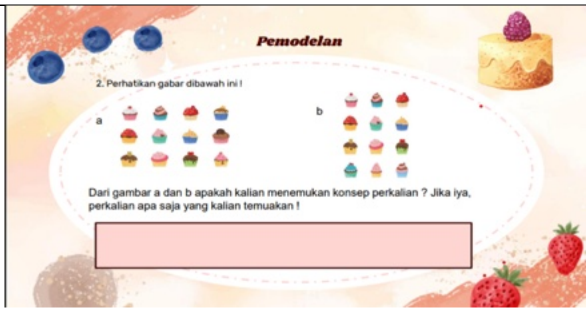
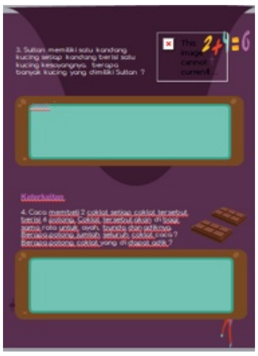
f. Main Field Testing

The sixth stage, main field testing, was an extensive trial conducted at one public Elementary School in Karawang, specifically in Grade 2C, with 32 students and one teacher. This extensive trial was conducted after revising the product based on the limited trial. The purpose of this stage was to assess the readability of the developed learning approach on a broader scale than in the previous stage. To obtain data from this extensive trial, questionnaires were administered to students regarding the use of the Realistic Mathematics Approach assisted by the Wordwall application.

g. Operational Product Revision

The seventh stage, operational product revision, was conducted after obtaining feedback and suggestions from the extensive trial to ensure the product was feasible and ready for use. At this stage, several additional suggestions were obtained, including the following:

Table 7. Operational Product Revision

Initial Product	After Revision
	
	

Based on Table 7 above, in the first image, additional suggestions were obtained: there were changes in the layout and color aspects to become brighter and more attractive, and in the modeling stage, the initial images (models) were placed side by side without clear separation, which caused confusion. After the revision, the images became clearer as labels a and b were added, making them easier for students to identify. For the second image, the display color was changed to a brighter tone, and the question wording was improved to make it clearer.

h. Operational Field Testing

The eighth stage, operational field testing, was conducted after the extensive trial and revision. At this stage, product validation was carried out again on the Realistic Mathematics Approach, assisted by the Wordwall application. This stage allowed the evaluation of how well the product could be used to address the problems identified during the initial preliminary study. In this product-testing stage, there were two classes, each with 34 students. Class A served as the experimental class that received treatment using the Realistic Mathematics Approach, while Class B served as the control class that received conventional learning treatment. The data obtained from this stage consisted of pretest and posttest results from both the control and experimental classes. After the learning process, students were given a questionnaire to measure their self-confidence.

i. Final product revision

The ninth stage, final product revision, was the final improvement stage following field product testing. This stage represented the final phase. Due to time limitations, the study was conducted only up to the final product revision stage.

2. Feasibility of the Realistic Mathematics Approach

At the feasibility testing stage, validation was conducted to ensure that the developed Realistic Mathematics Approach assisted by the Wordwall application met the established quality standards. This validation involved experts as validators to examine the product from various aspects, including content, instructional design, language, and ease of use through the digital platform. The evaluation results served as a reference for improving the product before its implementation in the next stage. Based on the experts' overall assessment, the instruments and media were categorized as highly valid and met the feasibility criteria, with several suggestions for improvement. This validation process involved three lecturers as experts in education, subject matter, and ICT. The instruments used included questionnaires and interviews to review the developed product. After receiving suggestions for improvement, revisions were conducted, and the product was revalidated to achieve optimal results. The validation results are presented in the following table:

Table 8. Validation Results of Three Experts

Category of Creative Thinking	Initial Percentage	Criteria	Final Percentage	Criteria
Validator 1	68%	Feasible	84%	Highly Feasible
Validator 2	77%	Feasible	90%	Highly Feasible
Validator 3	77%	Feasible	91%	Highly Feasible
Average			88.33%	Highly Feasible

Based on the table above, after the revision was carried out, the average feasibility score from the three validators was 88.33%, which can be categorized as highly feasible. Thus, the developed Realistic Mathematics Approach assisted by the Wordwall application, after revision, is highly feasible for use.

3. User Response to the Realistic Mathematics Approach Assisted by Wordwall

Based on the limited field trial, the developed learning approach product was implemented with 10 students to assess the readability and practicality of using the media in mathematics learning. The primary focus at this stage was to examine the extent to which the Wordwall-assisted learning approach could be understood and found engaging, thereby encouraging students to be active learners and able to solve contextual problems. The recapitulation results of the limited trial are presented in the following table:

Table 9. Recapitulation of Practicality Assessment by Students in the Limited Trial

	Percentage	**Interpretation**
Teacher	84%	Very good
Students	83.25%	Very good
Average	83.63%	Very good

Based on Table 9 above, the product's practicality was categorized as good, with a percentage of 83.63%. After obtaining the readability results, interviews were conducted with students about the product's inadequacies to obtain more detailed responses. After conducting the limited trial and making revisions based on the feedback obtained, the study proceeded to a broader trial conducted with 32 students, with the recapitulation results as follows:

Table 10. Recapitulation of Practicality Assessment by Students in the Extensive Trial

	Percentage	**Interpretation**
Teacher	86.25%	Very good
Students	85.08%	Very good
Average	85.66%	Very good

Based on Table 10 above, the results of the extensive trial indicate a high level of practicality of the Realistic Mathematics Approach assisted by Wordwall. The average percentage was 85.66%, which falls within the very good interpretation category. Thus, this finding provides strong evidence that the developed Realistic Mathematics Approach, assisted by Wordwall, is not only feasible but highly feasible and can be implemented during the product testing stage in the experimental and control classes.

4. Effectiveness of the Realistic Mathematics Approach Assisted by Wordwall in Improving Students' Mathematical Understanding Ability and Learning Activeness

a. Students' Mathematical Understanding Ability

Table 11. Statistical Description of Students' Mathematical Understanding Ability

Data Statistics	**Control Class**					
	Pretest	**Posttest**	**N-Gain**	**Pretest**	**Posttest**	**N-Gain**
Mean Score	4,00	31,67	0,69	3,85	36,73	0,82
Maximum Score	7	42	0,95	6	44	1
Minimum Score	1	20	0,42	1	26	0,53
Maximum Ideal Score	44	44	44	44	44	44
Normality Test	0,060	0,102		0,251	0,002	
Homogeneity Test	0,375			0,375		
Mann–Whitney Test		0,002			0,002	
t-Test	0,317			0,335		

Based on Table 11 above, the pretest results for the control class were 4.00, and for the experimental class, 3.85. This indicates that there was no significant difference between the control and experimental classes. Thus, it can be concluded that both classes had the same level of mathematical understanding ability. After implementing learning using the Realistic Mathematics Approach, assisted by the Wordwall application, there was an improvement in achievement in the experimental class. The average posttest score of the experimental class was 36.73 out of an ideal score of 44. This result produced an N-gain value of 0.82, which is categorized as high. This indicates a very good level of effectiveness of the Realistic Mathematics Approach assisted by the Wordwall application. Meanwhile, the control class using conventional learning obtained an average posttest score of 31.67 with an N-gain of 0.69, which is categorized as moderate. Although both classes showed improvement, the experimental class demonstrated a higher quality of mathematical understanding compared to the control class. This can be demonstrated through several stages in detail as follows:

1). Pretest Analysis of Students' Mathematical Understanding Ability

Table 12. Results of the Pretest Normality Test of Students' Mathematical Understanding Ability

Class	**Shapiro-Wilk**		
	Statistic	**Df**	**Sig.**
Experimental	0,055	34	0,060
Control	0,046	34	0,251

Based on the Shapiro–Wilk test results, the significance value for the control class was 0.060, and the significance value for the experimental class was 0.251. Since the significance values for both classes were greater than 0.05, both classes were considered normally distributed. Therefore, the next step was to conduct the homogeneity test.

Table 13. Homogeneity Test of Pretest on Students' Mathematical Understanding Ability

		Levene Statistic	df1	df2	Sig.
Pretest Results	Based on Mean	0,799	1	66	0,375

Based on the output, the significance value of Levene's test for equality of variances was 0.375 > 0.05; H0 was accepted. Thus, the variance of the data between the control and experimental classes was homogeneous. Since both variances were homogeneous, the analysis was continued with the t-test.

Table 14. t-Test of Pretest on Students' Mathematical Understanding Ability

		t-test for Equality of Means		
		t	Df	Sig. (2-tailed)
Postest	Equal variances assumed	0.382	66	0,704

Based on Table 14 above, the t-value was 0.382, and the significance (2-tailed) was 0.704; therefore, H0 was accepted, and Ha was rejected. Thus, it can be concluded that there was no significant difference between the experimental class and the control class.

2) Posttest Analysis of Students' Mathematical Understanding Ability

Table 15. Results of the Posttest Normality Test of Students' Mathematical Understanding Ability

Class	**Shapiro-Wilk**		
	Statistic	**Df**	**Sig.**
Experimental	0,094	34	0,002
Control	0,111	34	0,105

Based on the Shapiro–Wilk output, the significance value for the control class was 0.105, which was greater than 0.05, and the significance value for the experimental class was 0.002, which was less than 0.05. Thus, it can be concluded that the data were not normally distributed. Therefore, the analysis proceeded with the Mann–Whitney test.

Table 16. Results of the Mann–Whitney Test of Posttest on Students' Mathematical Understanding Ability

	Result
Mann-Whitney U	322,000
Asymp. Sig. (2-tailed)	0,002

Hypothesis Testing

H0 : There is no difference in scores between the experimental class (Realistic Mathematics Approach assisted by Wordwall) and the control class (conventional learning).

Ha : There is a difference in scores between the experimental class (Realistic Mathematics Approach assisted by Wordwall) and the control class (conventional learning).

Based on the test statistics output, the Asymp. Sig. (2-tailed) value was 0.002, which is less than the 0.05 probability threshold. Therefore, H0 was rejected, and Ha was accepted. This indicates that there was a difference in scores between the experimental class using the Realistic Mathematics Approach assisted by Wordwall and the control class using conventional learning in terms of students' understanding ability.

b. Students' Learning Activeness

Table 17. Description of Student Learning Habits Statistics

Data Statistics	**Control Class**			**Experimental Class**		
	Initial Scale	**Final Scale**	**N-Gain**	**Initial Scale**	**Final Scale**	**N-Gain**
Mean Score	38.20	53,32	0,36	38,14	72,20	0,81
Maximum Score	41	62		44	77	
Minimum Score	31	49		32	58	
Maximum Ideal Score	80	80		80	80	80
Normality Test	0,009	0,230		0.001	0,711	
Homogeneity Test		0,220			0.220	
Mann–Whitney Test	0,375			0,375		

Based on Table 17, the implementation of learning using the Realistic Mathematics Approach, assisted by the Wordwall application, in the experimental class had a greater impact on students' learning activeness than the control class that used conventional learning. This can be seen from the average achievement after the learning treatment in each class. This finding can be demonstrated through several stages in detail as follows:

1). Pretest Analysis of Students' Learning Activeness

Table 18. Results of the Pretest Normality Test of Students' Learning Activeness

Class	**Shapiro-Wilk**		
	Statistic	**Df**	**Sig.**
Experimental	0,912	34	0,001
Control	0,878	34	0,009

Based on Table 18 above, the significance values for the experimental class (0.001) and the control class (0.009) were both below 0.05. Therefore, the data were not normally distributed. Thus, the analysis was continued with the Mann–Whitney test.

Table 19. Results of the Mann–Whitney Test of Pretest on Students' Learning Activeness

	Result
Mann-Whitney U	507,000
Asymp. Sig. (2-tailed)	0,375

H0 : There is no difference in students' learning activeness between the experimental class (Realistic Mathematics Approach assisted by Wordwall) and the control class (conventional learning).

Ha : There is a difference in students' learning activeness between the experimental class (Realistic Mathematics Approach assisted by Wordwall) and the control class (conventional learning).

Based on the test statistics output, the Asymp. Sig. (2-tailed) value was 0.375, which is greater than the 0.05 probability threshold. Therefore, H0 was accepted, and Ha was rejected, which means that there was no difference in students' learning activeness between the experimental class (Realistic Mathematics Approach assisted by Wordwall) and the control class (conventional learning).

2). Posttest Analysis of Students' Learning Activeness

Table 20. Results of the Posttest Normality Test of Students' Learning Activeness

Class	Shapiro-Wilk		
	Statistic	**Df**	**Sig.**
Experimental	0,978	34	0,711
Control	0,959	34	0,230

Based on Table 20 above, the significance values for the experimental class (0.711) and the control class (0.230) were both greater than 0.05. Therefore, the data were normally distributed. Since both datasets were normally distributed, the analysis proceeded with the homogeneity test.

Table 21. Homogeneity Test of Posttest on Students' Learning Activeness

		Levene Statistic	df1	df2	Sig.
Posttest Results	Based on Mean	1,531	1	66	0,220

Based on Table 21 above, the significance value was 0.220 > 0.05; therefore, H0 was accepted, indicating that the variances of both groups were homogeneous. Since the data were homogeneous, the analysis proceeded with the two-mean test.

Table 22. t-Test of Posttest on Students' Learning Activeness

		t-test for Equality of Means		
		t	Df	Sig. (2-tailed)
Postest	Equal variances assumed	-11,33	66	0,000

Based on Table 22 above, the significance value (2-tailed) was 0.000, which is less than 0.05. Therefore, it can be concluded that there was a very significant difference in students' learning activeness between the control class and the experimental class.

Discussions

The development process for the Realistic Mathematics Approach, assisted by the Wordwall application, was conducted through the Borg and Gall stages. Through needs analysis, prototype development, expert validation, limited trial, extensive trial, and product testing, this development was declared feasible for use. During the initial development process, several findings were identified, including the successful integration of technology into the Realistic Mathematics Approach to meet the demands of the current digital era. Based on data from the experimental and control classes, there was an improvement in mathematical understanding, with the experimental class achieving higher results than the control class. The improvement observed in the experimental class occurred as a result of learning using the Realistic Mathematics Approach, in which the teacher utilized real-life contexts that could be easily imagined by students as a foundation for understanding the material, thereby enabling students to understand it more effectively (Malik et al., 2024). The implementation of the Realistic Mathematics Approach within the Merdeka Belajar framework can improve the quality of education at all levels, enhance students' and teachers' creativity, and promote more innovative learning through the integration of technology (Purba, 2022).

The feasibility of the Realistic Mathematics Approach assisted by the Wordwall application was categorized as highly valid and feasible for use in Elementary School learning. The validation process was conducted in several stages, involving subject-matter and media experts. Meanwhile, teachers and students validated the product's practicality, with results indicating that it was highly practical. By using the Realistic Mathematics Approach, students showed strong interest in solving problems because they were aligned with real-life situations. The use of the Wordwall application further enhanced students' interest in actively participating in learning. According to Yupinus et al. (2020), instructional materials developed using the Realistic Mathematics Approach are highly valid and effective. This finding is consistent with the view that the use of the Realistic Mathematics Approach is effective in improving students' critical thinking ability and learning achievement.

The effectiveness of the Realistic Mathematics Approach, assisted by the Wordwall application, was shown to improve Elementary School students' mathematical understanding. This finding is consistent with the study by Sari et al. (2022), which reported that the Realistic Mathematics Approach has a strong effect on improving students' mathematical understanding, particularly at the Elementary School level. According to Yulianty (2019), teachers can use the Realistic Mathematics Approach to improve students' mathematical understanding ability. Learning using the Realistic Mathematics Approach and conventional learning produce different outcomes, where students who receive learning through the Realistic Mathematics Approach demonstrate higher understanding ability compared to those in the control class (Bakoban et al., 2022).

The effectiveness of the Realistic Mathematics Approach assisted by the Wordwall application was shown to increase Elementary School students' learning activeness. Several indicators of students' learning activeness include students being enthusiastic in participating in learning, having the confidence to ask questions, having the confidence to answer questions, and being able to present their understanding in front of the class (Rikawati & Sitinjak, 2020). In the study by L. Ariani and Sari (2023), the Realistic Mathematics Approach was found to be effective in increasing students' learning motivation. The Realistic Mathematics Approach can improve students' learning motivation, self-confidence, and creativity (Sari et al., 2022). In addition, the Realistic Mathematics Approach can increase students' interest in learning (Herzamzam, 2024).

CONCLUSION

1. The development process of the Realistic Mathematics Approach assisted by the Wordwall application was carried out through clearly structured stages based on the Borg and Gall model, starting from needs analysis, prototype planning, expert validation, limited trial,

extensive trial, product testing, and revision to obtain a product that is aligned with students' needs.

2. The feasibility of the Realistic Mathematics Approach assisted by the Wordwall application has been proven to meet the standards for implementation in Elementary School learning. This feasibility assessment was based on expert evaluation of the relevance and depth of the content, which were aligned with real-life contexts and integrated with the steps of the Realistic Mathematics Approach and the digital game features available in Wordwall.
3. The effectiveness of the developed Realistic Mathematics Approach assisted by the Wordwall application plays an effective role in the learning process. The Realistic Mathematics Approach stimulates students to construct concepts independently through real-life situations, while Wordwall functions as a motivational reinforcement and an interactive evaluation tool that enhances students' activeness during the learning process.
4. For future research, it can be conducted to explore various other types of educational games that are more diverse to improve the understanding and learning activity abilities of elementary school students.

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