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Effect of the Nearpod-Assisted Read, Observe, Auditory, Review (ROAR) Learning Model on Mathematical Literacy Skills

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ABSTRACT

Mathematical literacy is a crucial competency that students must possess to meet the demands of increasingly complex mathematics learning. However, based on preliminary study results, students' mathematical literacy skills have not yet reached optimal levels. This situation prompted the researchers to conduct a study by implementing the *Read, Observe, Auditory, Review* (ROAR) learning model supported by the *Nearpod* interactive platform. This study aims to determine the effect of implementing the *Nearpod-assisted* ROAR learning model on students' mathematical literacy skills. The research method used was an experimental method of the *quasi-experimental* type. The study population comprised all ninth-grade students at SMP Islam Tias Bangun, consisting of three classes. Sampling was conducted using *cluster random sampling*, resulting in two classes selected as the study sample: an experimental class with 23 students and a control class with 25 students. The experimental class received instruction using *the Nearpod-assisted* ROAR learning model, while the control class used the *Direct Instruction* model. The research instrument consisted of a mathematical literacy test in the form of essay questions that had been tested for validity, reliability, difficulty level, and discriminative power. Data analysis was conducted through prerequisite tests, namely normality and homogeneity tests, as well as hypothesis testing using *the Independent Sample T-Test* with a significance level of 5%. The results of the data analysis indicate that the use *of the NearPod-assisted* ROAR learning model has a significant effect on students' mathematical literacy skills. The novelty of this study lies in the integration of the ROAR learning model with the *Nearpod* interactive medium to encourage active student engagement and develop students' mathematical literacy skills.

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Introduction

In the world of education, mathematics is one of the most important subjects. Mathematics is a discipline that supports technological and scientific advancement, as well as the development of human thinking and analysis. Learning mathematics trains critical thinking skills and serves as the foundation for the development of various fields of study such as computer science, engineering, and economics (Simbolon et al., 2020). Mathematics is also closely related to daily life, ranging from simple matters to those requiring complex thinking; therefore, teachers need to connect mathematics learning to students' real-life experiences to make it more relevant and easier to understand (Prihatinia & Zainil, 2020). Problems in daily life that may arise in various contexts require mathematical skills that go beyond mere calculation and performing mathematical operations; they demand abilities that broadly involve mathematical knowledge, which is referred to as mathematical literacy (Samosir et al., 2023). Therefore, mathematics education must be directed toward strengthening mathematical literacy as a fundamental competency that enables students not only to understand concepts procedurally but also to apply them in various real-life contexts.

Mathematical literacy is an individual's ability to formulate, apply, and interpret mathematics in various contexts, including the ability to engage in mathematical reasoning and use mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena or events (Kusumawardani et al., 2018). Mathematical literacy helps students recognize the role of mathematics in life and assists them in making sound judgments and decisions as constructive, actively engaged, and reflective citizens (Rusmana, 2019). Therefore, mathematical literacy is an essential competency that must be consistently developed throughout the learning process. Strengthening mathematical literacy is becoming increasingly important given that Indonesian students' mathematical literacy skills remain relatively low. This is evident from the results of the Programme for International Student Assessment (PISA), which show that Indonesia ranked 68th out of 81 countries in 2022, with a mathematics score of 366 (OECD, 2023), indicating the low level of mathematical literacy among Indonesian students.

A study conducted by Putra et al.,(2024), in class VIII.10 at SMP Negeri 4 Denpasar, found that students' mathematical literacy skills, as assessed by PISA questions, indicate that in terms of comprehension, students are already able to identify and attempt to solve problems, but are not yet able to arrive at the correct solution. Meanwhile, regarding reasoning, students do not yet fully understand the problems presented, meaning they still struggle to use mathematical concepts, facts, and procedures to formulate and solve problems. This is evident from the tendency of students not to write down all the information from the questions. Another study also noted that the mathematical literacy skills of 10th-grade students at SMA Negeri 1 Singaparna remain relatively low. This is evidenced by students still struggling to identify mathematical elements in problems, construct appropriate models, apply those models to obtain solutions, and interpret solutions in real-world contexts (Sofwatun et al., 2025).

The results of a preliminary study conducted at SMP Islam Tias Bangun revealed that many students still have a low level of mathematical literacy. Based on the eighth-grade students' scores obtained by the researcher and measured according to the indicators and criteria for mathematical literacy, only 28.17% of students scored above the minimum competency threshold (KKTP), while 71.83% scored below it. Furthermore, based on interviews with mathematics teachers at SMP Islam Tias Bangun, it was found that the teaching methods used remain conventional and teacher-centered. Teachers stated that "students tend to be passive and lack enthusiasm in participating in lessons and still rely heavily on the teacher's explanations."

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This situation results in students' mathematical literacy remaining low, and some students have not yet met the Learning Objective Achievement Criteria (KKTP).

Selecting the appropriate learning model is one of the efforts to address these issues. One learning model expected to address these challenges in the learning process is the *Read, Observe, Auditory, Review* (ROAR) model. The ROAR learning model fosters students' knowledge and conceptual understanding by building concepts through direct observation. During the learning process, teachers present real-world examples that encourage students to think more critically about these concepts (Azis et al., 2020). Students who actively participate in the learning process will find it easier to understand the material, as they can ask questions directly about things they do not fully understand. The ROAR learning model is expected to encourage student engagement in learning, thereby helping them better understand mathematical concepts.

The syntax in the ROAR learning model is closely linked to indicators of mathematical literacy. The *Read* stage helps students understand the context of a problem and formulate a mathematical problem. The *Observe* stage trains students to connect real-life situations with appropriate mathematical concepts and models. The *Auditory* stage encourages students to communicate mathematical ideas and reasoning through discussion and interaction. Furthermore, the *Review* stage helps students interpret, evaluate, and reflect on the solutions obtained (Azis et al., 2020). The integration of these stages supports the ability to formulate, apply, and interpret mathematics, which are the primary indicators of mathematical literacy.

The implementation of the ROAR learning model will be more effective if supported by the use of appropriate learning media. The use of learning media in the teaching-learning process can increase interest and spark new curiosity, motivate students, and have a positive psychological impact on learning (Wulandari et al., 2023). Interactive learning media is one type of learning media that can enhance mathematical literacy skills. Interactive learning media help students become more active in the learning process, improve their understanding of concepts or subject matter, enhance independent problem-solving skills, and facilitate the visualization of abstract or hard-to-imagine objects so that they can apply them in daily life (Nareswari & Arfinanti, 2023). In this context, the researcher utilized the *Nearpod* interactive platform to support the learning process.

Nearpod is a platform that enables educators to design digital and modern learning experiences. Through *Nearpod,* teachers can organize lesson materials with various engaging elements, such as virtual illustrations, interactive assessments in the form of games, and educational videos all within a single platform, thereby making learning more interactive, engaging, and innovative (Susanti & Syam, 2017). *Nearpod* connects mathematics to real-life situations, making learning more relevant and easily applicable in daily life. *Nearpod's* features help students become more active and better understand mathematical concepts (Karimah et al., 2024).

Previous research indicates that the ROAR learning model has been used to enhance students' conceptual understanding and *self-efficacy* (Azis et al., 2020; Aryati, 2024). Meanwhile, the use of *Nearpod* in mathematics instruction has been more extensively studied in relation to students' problem-solving skills and learning interest (Mulyani & Firmansyah, 2025; Suandi et al., 2024). However, research specifically examining mathematical literacy skills as a research variable remains limited. Furthermore, the integration of the ROAR learning model with the *Nearpod* interactive platform in the context of developing students' mathematical literacy has not been extensively studied; thus, this study was conducted to contribute novelty to the field. The objective of this study is to determine the effect of the *Read, Observe, Auditory, Review* (ROAR) learning model, supported by *Nearpod,* on students' mathematical literacy.

Method

Research Design

The approach used in this study is a quantitative approach with an experimental research design. The experimental research *design* chosen is *a quasi-experimental design* with a *posttest-only* format, in which the measurement of mathematical literacy test results is conducted only after the treatment has been administered to the experimental and control classes. A quantitative approach was used because this study aims to objectively and systematically measure the effect of *the Nearpod-assisted* ROAR learning model on students' mathematical literacy skills through numerical data analyzed statistically (Siroj et al., 2024). Quantitative methods allow researchers to identify relationships between variables, test hypotheses, and make generalizations from research results (Damanik et al., 2025). The experimental research design was chosen because the researcher directly applies a treatment to the experimental group and compares it with a control group that does not receive the same treatment to observe the resulting differences (Fraenkel et al., 2012). The study utilized two class groups: an experimental class using the ROAR learning model supported by *Nearpod* and a control class using the conventional learning model (*Direct Instruction*).

Population and Sample

The population in this study consisted of all ninth-grade students at SMP Islam Tias Bangun, as shown in the Table 1.

Table 1. Population of 9th-Grade Students at SMP Islam Tias Bangun

Class	Male	Female	Total
IX A	11	12	23
IX B	9	14	23
IX C	10	15	25
Total	30	41	71

The sampling technique used in this study was *cluster random sampling*. *Cluster random sampling* involves dividing the population into several groups, then randomly selecting one of these groups to serve as the sample. Class IX B was selected as the experimental class and received instruction using the ROAR learning model supported by *Nearpod*, while Class IX C was selected as the control class and received instruction using the *Direct Instruction* learning model. The students in the study sample had varying academic abilities. These differences were evident in the presence of students who had achieved mastery of the material and those who had not. This situation reflects the general characteristics of students in mathematics learning.

Instruments

This study used a test as the instrument to collect research data. The test used was a written essay-style test consisting of five questions on algebraic operations. An essay-style test was chosen because it can measure student learning outcomes more comprehensively and address aspects that are difficult to measure objectively (Inayati et al., 2024). The mathematical literacy assessment instrument comprises the following indicators (Vera et al., 2024).

Table 2. Indicators of Students' Mathematical Literacy Skills

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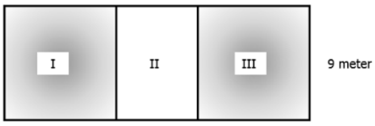
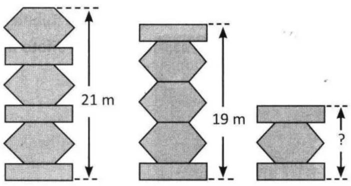
Mathematical Literacy Process Indicators	Content	Context	Question Number
Identifying and formulating problems in real-life situations	Space and shape, quantity	Work	3
	Space and shape, change and relationships	Science	4
Using mathematical concepts, facts, procedures, and reasoning	Change and relationships, quantity	Personal	1
Interpreting results and writing mathematical conclusions	quantity	Work	2
	Changes and relationships	Personal	5

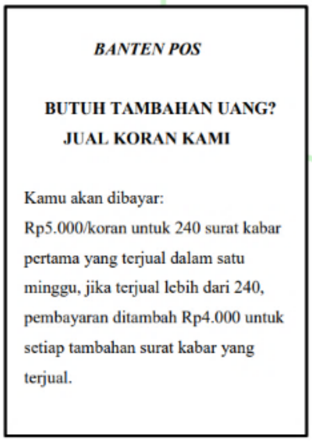
Table 3. Mathematical Literacy Test Questions for Students

No	Question
1	Mr. Kamto is a fruit vendor at the market. He owns an empty rectangular plot of land with an area of 225,m^2 s on which three kiosks will be built. The plan for the kiosks to be built on the plot consists of Kiosk I, Kiosk II, and Kiosk III, as shown in the following figure.  If Kiosk I and Kiosk III have the same area, and the width of all three kiosks is 9 meters, and the combined area of Kiosk I and Kiosk II is 144,m^2 , calculate the areas of Kiosk I, Kiosk II, and Kiosk III!
2	Below are 3 towers of different heights, composed of two shapes: a hexagon and a rectangle.  Calculate: a. The height of each hexagon and rectangle! b. The height of the shortest tower! c. If a new tower is built using 4 hexagons and 6 rectangles, what is the height of that tower?
3	Mount Fuji is an inactive volcano in Japan  The hiking trail on Mount Fuji is 9 km long. Hikers must return from the hike after hiking 18 km by 8:00 PM. Toshi estimates that he can hike up the mountain at an average speed of 1.5 km/h and hike down at twice that speed. These speeds already account for rest and meal breaks. Toshi's friend, Yui, who is more experienced, suggests a different route that is slightly steeper: 8 km up and 8 km down. However, since it is shorter, Yui is confident she can increase her speed. She estimates she can climb at a speed of 2 km/h and descend at a speed of 4 km/h. She must also

return by 8:00 PM at the latest. If x is the time required to climb and y is the time required to descend, then determine:

a. How many hours does Toshi need to complete the round trip, and what is the latest time he must start climbing to return by 8:00 PM?
b. If Yui leaves at 1:00 PM, will she return earlier than Toshi if Toshi arrives at 8:00 PM?

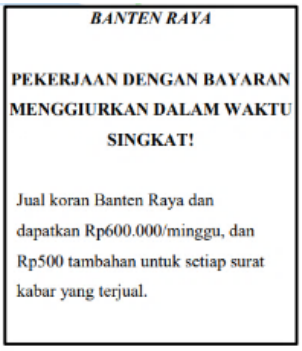
4 In Banten, there are two newspaper companies looking to hire salespeople. The posters below show how much each company pays its salespeople.



BANTEN POS

BUTUH TAMBAHAN UANG?
JUAL KORAN KAMI

Kamu akan dibayar:
Rp5.000/koran untuk 240 surat kabar pertama yang terjual dalam satu minggu, jika terjual lebih dari 240, pembayaran ditambah Rp4.000 untuk setiap tambahan surat kabar yang terjual.



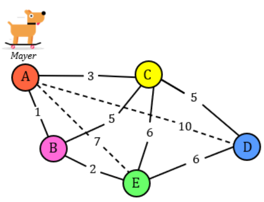
BANTEN RAYA

PEKERJAAN DENGAN BAYARAN MENGGIURKAN DALAM WAKTU SINGKAT!

Jual koran Banten Raya dan dapatkan Rp600.000/minggu, dan Rp500 tambahan untuk setiap surat kabar yang terjual.

Christine sells newspapers for Banten Raya. In one week, she earns Rp740,000. If x states that Christine sold many newspapers, how many newspapers did Christine sell that week?

5 One day, Mayer was walking around several locations. Mayer's route is shown in the image below.



There are 5 locations Mayer stops at: points A, B, C, D, and E. To reach certain points, Mayer expends energy equivalent to the numbers shown in the diagram. For example: Mayer wants to reach point B from point A. The route from A to B requires 1 unit of energy. The route from point B to point E requires 2 units of energy. Therefore, if Mayer walks from A to B, then to E, he spends a total of 3 units of energy. This route can be written as A-B-E. Currently, Mayer is at point A with x units of energy. If Mayer then takes the route A-B-C-A-D-E, and 7 units of energy remain, what was Mayer's initial total energy?

Test data is analyzed based on criteria for students' mathematical literacy skills and scoring procedures for each indicator of mathematical literacy, as follows (Munfarikhatin et al., 2022)

Table 4. Scoring Guidelines for Students' Mathematical Literacy Skills

Mathematical Literacy Process Indicators		Indicator Description	Score	Maximum Score
Identifying and formulating problems in real-life situations		No answer	0	3
		Writing down known information that is incomplete and not entirely accurate	1	
		Writing down known information that is incomplete and stating the problem but not yet appropriate	2	
		Writing down known facts and stating the problem completely, clearly, and appropriately	3	
Using concepts, facts, procedures, and reasoning to find mathematical solutions	Strategies used in the problem-solving phase	No response	0	2
		The method used was inappropriate	1	
		The method used is appropriate	2	
	Performing calculations based on specific rules or formulas	Did not answer	0	2
		Performing calculations but only partially correct	1	
		Performed the calculation clearly and accurately	2	
Interpreting results and writing mathematical conclusions		Did not answer	0	3
		Unable to draw conclusions from a single problem based on observed data	1	
		Presents a sample based on existing facts and can explain it, but the reasoning is not strong. Draws a conclusion but it is not yet accurate	2	
		Understands the nature and connections of the problem that has been solved, explains it, and provides strong reasoning to arrive at the correct conclusion.	3	
Total score				10

The score obtained will then be converted into a grade according to the following criteria:

$$\text{Final Score} = \frac{\text{Earned Score}}{\text{Maximum Score}} \times 100$$

Notes:
Score earned: the score obtained by the student
Maximum score: the maximum possible score for each item

Before the study was conducted, the test instrument first underwent content validation and construct validation. Content validation was performed by three validators with expertise in their respective fields, consisting of two mathematics education lecturers and one junior high school mathematics teacher. This validation process aimed to assess the quality of the questions based on content, construction, and language. The validity results from the three validators met the "acceptable for use" criterion. Following content validation, construct validation—specifically validity and reliability testing—was conducted. The reliability and validity tests of the questions yielded results indicating that the test instrument is valid and reliable, with a value of $r_{hitung} > r_{tabel}$, and a *Cronbach's Alpha* value $(r_{11}) \geq 0{,}70$, thereby confirming the test questions are valid and reliable.

The study was conducted by teaching algebraic operations to the experimental and control classes. Instruction in each class consisted of 4 sessions for the learning process and 1 session for administering *the posttest* on mathematical literacy skills, with each session lasting 2 class periods or 80 minutes. *The* application *of the Nearpod-assisted* ROAR model in the experimental class was as follows: in the *Read* stage, the teacher began the lesson by presenting a contextual problem related to the material. Students were then asked to read the provided reading materials via *Nearpod* and listen to the teacher's explanation. During this stage, the teacher also connected the learning material to real-life contexts. Next, in the *Observe* stage, the teacher plays an instructional video via *Nearpod* and distributes group worksheets. Students observe the displayed video, note down key information, and discuss and answer questions on the worksheet in groups. In the *Auditory* stage, the teacher guides students to connect and explain the concepts derived from the reading and observation stages. Students are also encouraged to express their ideas and connect the concepts of the material to real-life situations. In the final stage, *Review*, the teacher poses discussion questions and asks group representatives to present the results of their discussions. The teacher then reviews the learning material by reinforcing key concepts and summarizing the lesson, after which students take a quiz via *Nearpod* to assess their level of understanding of the material studied.

Data Collection

The data collection method used in this study involved administering a mathematical literacy test, specifically on algebraic operations. The test was conducted to assess students' proficiency based on indicators of mathematical literacy. The test was administered to students at the end of the learning period after they had received instruction using the ROAR learning model supported by *Nearpod* on algebraic operations in the experimental class and the *Direct Instruction* learning model in the control class.

Data Analysis

Data analysis in this study utilized several methods, including descriptive analysis, prerequisite tests, and hypothesis testing. Before conducting hypothesis testing, prerequisite tests were first performed to ensure the data met the necessary basic assumptions, namely the normality test and the homogeneity test. The normality test was conducted to determine whether the data from the students' mathematical literacy proficiency test results were normally distributed or not. The normality test used was the *Shapiro-Wilk* test; this test was chosen because the sample size was less than 50 (Andra Ningsih et al., 2019). In this study, the data from the mathematical literacy test results will be analyzed using *the Shapiro-Wilk test* with the assistance of SPSS 25 software at a significance level of $\alpha=0.05$. The criterion for the normality test is that if the significance value or *p-value* is > 0.05, the data is considered to be normally distributed.

Next, a homogeneity test was conducted to determine whether the data groups on mathematical literacy skills came from a population with equal variances. *The* homogeneity test used was *Levene's Test;* this test was chosen for its ability to assess homogeneity of variance without requiring the data to be normally distributed. *Levene's Test* provides a more robust alternative for testing equality of variances, particularly when the data do not meet the assumption of normal distribution (Sonjaya et al., 2025). In this study, the mathematical literacy test data will undergo *Levene's Test* using SPSS 25 with a significance level of $\alpha=0.05$. The decision criterion for the test is that if the significance value or *p-value* is > 0.05, the data is considered homogeneous or derived from the same population.

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After the prerequisite tests were conducted and the results indicated that the mathematical literacy data were normally distributed and homogeneous, a hypothesis test was then performed. The hypothesis test used was *the t-test* (*Independent Samples T-Test*). The *Independent Samples T-Test* is used to determine whether there is a statistically significant difference in the means between two groups (Munawaroh et al., 2022). This test was conducted to determine the extent to which *the Nearpod-assisted* ROAR learning model influences students' mathematical literacy skills. This influence can be observed through the difference *in posttest* mean scores between the experimental group using the *Nearpod*-assisted ROAR learning model and the control group using the conventional learning model (*Direct Instruction*). This test was conducted using SPSS 25 with a significance level of α = 0.05. The basis for decision-making in *the independent t-test* is that if$Sig. < 0,05$, then the null hypothesis (H_0) is rejected, meaning there is a significant difference and *the NearPod-assisted* ROAR learning model significantly influences students' mathematical literacy skills (Tamimi et al., 2025).

Research Findings

Descriptive Analysis

The results of the analysis of *post-test* data on students' literacy skills indicate that the experimental class, which used the ROAR model supported by *Nearpod,* achieved the highest average score compared to the control class, with an average of 79.04, a highest score of 92, and a lowest score of 64. These data are visualized in the diagram shown below.

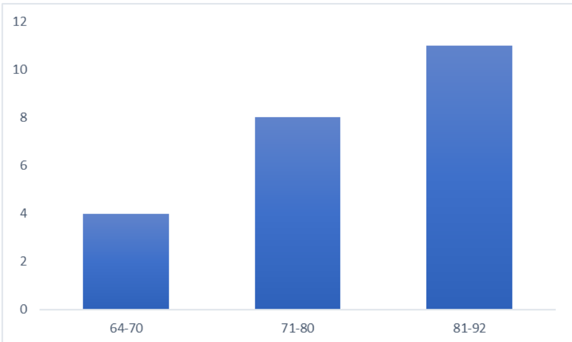

Figure1 . Bar Chart of *Posttest* Results for the Experimental Class

Table 5. Frequency Distribution of *Posttest* Results for the Experimental Class

Test Results	Frequency
64–70	4
71–80	8
81–92	11

The *posttest* results for the control class using the *Direct Instruction* model (direct learning) had the lowest average compared to the experimental class, namely 64.32, with a highest score of 78 and a lowest score of 46. The following is a bar chart of the posttest results for the control class.

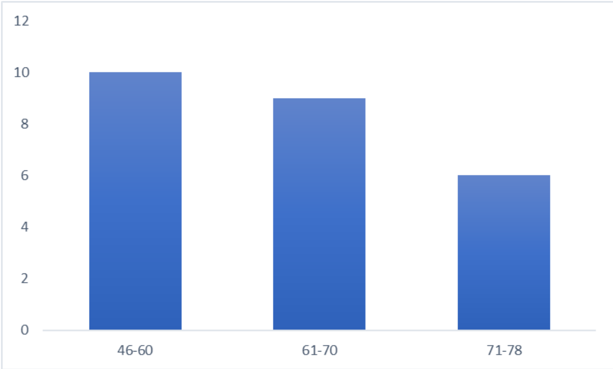

Figure 2. Bar Chart of Posttest Results for the Control Class

Table 6. Frequency Distribution of Posttest Results for the Control Class

Test Results	Frequency
46–60	10
61–70	9
71–78	6

The mean and standard deviation were also calculated and are presented in the following Table 7.

Table 7. Descriptive Statistics

Descriptive Statistics						
	N	Range	Minimum	Maximum	Mean	Standard Deviation
Experiment	23	28	64	92	79.04	7,672
Control	25	32	46	78	64.32	8,654
Valid N (listwise)	23					

Based on these results, it can be concluded that the *Nearpod*-assisted ROAR model is considered more effective in influencing students' mathematical literacy skills.

Prerequisite Tests

Normality Test

The Shapiro-Wilk normality test at a significance level of$\alpha = 0{,}05$ was used to determine whether the data on students' mathematical literacy abilities were normally distributed or not. The data are considered normally distributed if the significance value is greater than 0.05 (Sig > 0.05). This test was conducted using SPSS 25 with the following results.

Table 8. Shapiro-Wilk Normality Test

Tests of Normality				
	Class	Shapiro-Wilk		
		Statistic	df	Sig.
Mathematical_Literacy	Experimental	.962	23	.508
	Control	.952	25	.283

The results of the *Shapiro-Wilk* normality test for mathematical literacy ability show that the significance value obtained for the experimental group was 0.508 (0.508 > 0.05) and for the control group was 0.283 (0.283 > 0.05). Therefore, based on the normality test criteria, it can

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be concluded that the mathematical literacy ability data are normally distributed because the *Sig* value is greater than 0.05.

Homogeneity Test

The data on mathematical literacy skills were subjected to a homogeneity test using Levene's Test to determine whether the data originated from a population with equal variances, or homogeneous. Levene's Test in this study was conducted using SPSS 25 with a significance level of 0.05. The data are considered homogeneous if the significance value is greater than 0.05 (Sig > 0.05). The following are the results of the Levene's Test using SPSS 25.

Table 9. Levene's Test of Homogeneity

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Mathematical Literacy	Based on Mean	.743	1	46	.393
	Based on the median	.800	1	46	.376
	Based on the median and with adjusted degrees of freedom	.800	1	45.966	.376
	Based on the trimmed mean	.793	1	46	.378

The results of *testing* the mathematical literacy ability data using *Levene's Test* show a significance value of 0.354, which means the significance value is greater than 0.05 $(0{,}354 > 0{,}05)$, so the mathematical literacy ability data is considered homogeneous.

Hypothesis Testing

T-Test

The results of the Independent Sample T-Test yielded a significance value of 0.00. This value indicates that the significance level is lower than 0.005. If the significance level is lower than 0.05, it implies that the null hypothesis (H_0) is rejected, meaning there is a significant difference between the mean mathematical literacy scores of the experimental class and the control class. This also indicates that the Nearpod-assisted ROAR learning model has an effect on students' mathematical literacy skills. The results of the Independent Sample T-Test can be seen in the Table 10.

Table 10. Independent Samples T-Test

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Standard Error of the Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Literacy Mathematical	Equal variances assumed	.743	.393	6.215	46	.000	14,723	2,369	9,955	19,492
	Equal variances not assumed			6,247	45,943	.000	14,723	2.357	9,979	19,468

Discussion

The implementation of the ROAR model with Nearpod creates an active learning environment because the ROAR model requires students to share ideas or opinions and engage in discussion with one another. Students showed enthusiasm during lessons using Nearpod, especially when watching videos and taking interactive quizzes. Interactive media encourages students to learn more and makes the classroom atmosphere more lively. The material also becomes easier for students to understand because it is presented with engaging visuals and exercises.

The stages of learning help students understand concepts step by step, starting from acquiring information through reading, reinforcing understanding through observation and listening, to reviewing to deepen their knowledge. The ROAR model combines various learning styles—visual, auditory, and kinesthetic—to create a more active, enjoyable, and meaningful learning experience. Learning with the ROAR model encourages students to learn through various approaches that connect real-world concepts, so that new knowledge can be linked to prior concepts they already possess. This fosters students' motivation to actively seek out, reason through, and understand the material being studied (Azis et al., 2020).

Conceptual understanding plays a crucial role in developing students' mathematical literacy. Mathematical literacy requires students to be able to explain various phenomena they encounter using mathematical concepts. In the problem-solving process, one must possess awareness and understanding of the mathematical concepts being used, involving a series of activities such as exploring, connecting, formulating, determining, reasoning, and thinking mathematically (Miftahul Jannah & Miftahul Hayati, 2024). Thus, students with a strong conceptual understanding are able to explain the steps of a procedure, connect concepts, and choose the appropriate strategies for solving problems. This demonstrates that conceptual understanding serves as a foundation for the development of mathematical literacy, as through deep understanding, students can connect mathematical knowledge to real-life contexts in a meaningful way.

In addition to implementing the right learning model, the use of media to support that model can also influence students' mathematical literacy skills. One tool that can be used to develop students' mathematical literacy skills is Nearpod. Through Nearpod, students who were previously uninterested in reading due to being limited to textbook texts can become more motivated thanks to interactive elements such as quizzes that foster a competitive spirit. Nearpod not only plays a role in supporting the learning process and helping students understand the material more easily, but also functions as a medium that fosters literacy interest, particularly in the context of mathematics learning (Muna & Sulthon, 2025). This aligns with research conducted by Putri & Hidayanto(2025) , which shows that Nearpod can help improve students' understanding of the material, create an engaging and enjoyable learning atmosphere, and make students more focused, active, and motivated in participating in learning. Additionally, Nearpod supports the development of critical and collaborative thinking skills, as well as broadens students' perspectives and competitiveness.

The research results also indicate that the average post-test scores for mathematical literacy were higher in classes implementing the Nearpod-assisted ROAR model compared to those using the conventional Direct Instruction model. This suggests that the Nearpod-assisted ROAR model is more effective in enhancing mathematical literacy. Furthermore, the results of the Independent Sample T-Test indicate that there is a significant difference, and the Nearpod-assisted ROAR learning model has a significant effect on students' mathematical literacy skills.

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The success of the ROAR learning model, supported by Nearpod, in developing students' mathematical literacy skills is closely tied to the theoretical foundations of constructivism and active learning. Constructivism is a theory that emphasizes that knowledge is formed through an individual's active process of processing and interpreting their experiences. The constructivist theory's emphasis on student activity serves as a crucial foundation for developing critical thinking skills and the ability to connect knowledge acquired in educational settings with real-life contexts. Through the integration of theory and real-world experience, a more comprehensive understanding can be formed, enabling students to construct knowledge in a deeper and more meaningful way (Lutfiah et al., 2025). The ROAR learning model supports this process through the stages of Read, Observe, Auditory, and Review, which encourage students to understand the context of the problem, connect various pieces of information obtained, engage in mathematical reasoning, , and systematically reflect on their thoughts. The use of Nearpod supports increased student cognitive engagement through multimedia-based material presentation and interactive learning activities. This aligns with multimedia learning theory, which states that the use of media combining text, images, and sound can enhance students' understanding and retention of received information (Faisal et al., 2024). Thus, the implementation of the ROAR learning model supported by Nearpod media is capable of creating a learning environment that encourages active engagement, critical thinking, and student reflection, thereby significantly influencing the development of mathematical literacy skills.

The novelty of this study lies in the application of the ROAR learning model combined with the Nearpod interactive platform to develop students' mathematical literacy skills. This study does not merely examine the ROAR model or the use of Nearpod separately but integrates both within the learning stages of Read, Observe, Auditory, and Review, which encourage students' active engagement in understanding context, constructing concepts, reasoning, and reflecting on learning outcomes. The results indicate that the Nearpod-assisted ROAR model is more effective than conventional instruction in developing students' mathematical literacy skills. However, the implementation of this approach has limitations due to its reliance on the availability and stability of internet connectivity, which can affect the smooth access to materials and interactive activities; therefore, this must be considered when applying it in different learning contexts.

Conclusion

The implementation of the *Nearpod*-assisted ROAR learning model has been shown to have a significant impact on students' mathematical literacy skills. This is demonstrated by the results of *the Independent Sample t-test*, which showed a significant difference between the class that implemented *the NearPod-assisted* ROAR model and the class that used the *Direct Instruction* model. The results yielded a p-value of$t_{hitung} = 6{,}215$, with a t-value of$sig = 0{,}000 < 0{,}05$. The average mathematical literacy score for students in the experimental class was 79.04, while that of the control class was 64.32. These results demonstrate better mathematical literacy achievement in the experimental class compared to the control class. The ROAR model creates an active, collaborative, and enjoyable learning environment through the stages of reading, observing, listening, and reviewing, enabling students to more easily grasp mathematical concepts in depth and connect them to real-life contexts. *Nearpod* enhances student engagement through interactive features that motivate them to think critically, actively, and independently in their learning.

This study contributes to the development of literacy-based mathematics learning innovations through the integration of the ROAR model and digital learning technologies such as *Nearpod.* However, this study is still limited to the impact of *the Nearpod-assisted* ROAR learning model on students' mathematical literacy skills, and thus has not discussed in depth the internal processes within students that accompany this improvement in skills. This study has not examined how the application of the ROAR model influences other aspects such as learning independence, motivation, and higher-order thinking skills, which likely also play a role in the development of mathematical literacy. Therefore, future research is recommended to examine the influence of *the NearPod-assisted* ROAR model on various other affective and cognitive aspects, as well as to investigate the interrelationships among these aspects in supporting the improvement of students' mathematical literacy.

Conflict of Interest

The author emphasized that during the implementation, analysis, and reporting of the results of this research there were no conflicts of interest, both financial and non-financial.

Auhor Contributions

I.M.P plays the role of the main researcher who understands and formulates research ideas, carries out data collection, conducts data analysis, and prepares initial drafts and revisions of papers based on the results of the thesis. S.A. contributes to the development of theoretical frameworks and research methodologies, guidance on data analysis, and the review and improvement of manuscripts. A.R.J play a role in providing critical review, academic input, and suggestions for improvement to the substance and systematics of paper writing as examiners. All authors stated that they were late in agreeing to the final version of this paper. The percentage of each author's contribution in conceptualizing, writing, and editing the paper is as follows: I.M.P.: 40%, S.A.: 30%, and A.R.J: 30%.

Data Availability Statement

Supporting data for the results of this study can be obtained from the corresponding author, I.M.P., as per reasonable request, as stated by the author.

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