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Impact of the Outdoor Mathematical Modelling Model Within Differentiated Learning on Students' Mathematical Literacy Skills

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ABSTRACT

One instructional alternative to address this issue is the application of an outdoor modeling mathematics approach integrated with differentiated learning to accommodate students' diverse abilities. This study employed an experimental method using a posttest-only control group design. The population consisted of all seventh-grade students at SMP Negeri 17 Batanghari, comprising five classes. Three classes were selected through simple random sampling and assigned as Experimental Class I, which applied the outdoor modeling mathematics model in differentiated learning; Experimental Class II, which applied the direct instruction model in differentiated learning; and a control class, which applied the direct instruction model without differentiation. The research instruments included a mathematical ability test, observation sheets to assess the implementation of learning activities by teachers and students, and a posttest in the form of a mathematical literacy test. All instruments underwent content validation by mathematics education experts to ensure alignment with mathematical literacy indicators and learning objectives. The test instruments were also empirically validated using Product Moment correlation and demonstrated acceptable reliability based on Cronbach's Alpha coefficient. Data were analyzed using one-way ANOVA followed by a Tukey post hoc test. The results indicate that the outdoor modeling mathematics model integrated with differentiated learning was more effective in improving students' mathematical literacy skills than direct instruction, both with and without differentiated learning. Observations further showed that the implementation of learning activities in all sample classes was categorized as very good. These findings suggest that the outdoor modeling mathematics model within a differentiated learning framework can serve as an effective instructional alternative for enhancing students' mathematical literacy skills.

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Introduction

Essentially, education involves various strategies and approaches aimed at imparting knowledge, skills, values, and attitudes to individuals so that they develop holistically (Kusumawati et al., 2023). In the field of education, mathematics is considered one of the most important subjects at every level because its benefits can be applied in various aspects of life. Mathematics not only serves as a tool for solving academic problems, but also as a basic skill needed in everyday life. Mathematics learning does not only focus on numbers and calculations, but also helps students develop logical thinking and analytical skills in their surroundings. These skills are known as mathematical literacy (Lestari & Effendi, 2022). Mathematical literacy refers to the ability of students to formulate, apply, and interpret mathematical concepts in various real-life situations (OECD, 2023). Furthermore, literacy is generally defined as an individual's ability to receive and process information, then use that information to solve problems and communicate their knowledge in the context of everyday life (Hanum et al., 2020; Hikmah et al, 2020). PISA 2022 data shows a global decline in mathematical literacy scores of 21 points. Indonesia's score dropped by 13 points, indicating challenges in developing students' mathematical abilities (Kemendikbudristek, 2023). Furthermore, the results of a study conducted by Lestari & Effendi (2022) show that junior high school students' mathematical literacy skills in solving AKM problems are relatively low, as most students have not yet achieved the expected mathematical literacy skill indicators.

At SMP Negeri 17 Batanghari, this challenge is more specific. Based on interviews with mathematics teachers, students' mathematical literacy skills are still low, with most students experiencing difficulties in understanding and applying mathematical concepts in a broader context. The main causes are students' lack of understanding of basic mathematical concepts and the tendency to use conventional learning models, as well as the rare application of differentiated learning, which provides few opportunities for exploration. This is reinforced by the test results given to students during the observation (Khasanah & Fitriani, 2022; Fitriani et al., 2023; Fitriani, 2021), which show that the average score for students' mathematical literacy skills is only 17.88. In addition, many students are still unable to formulate problems mathematically, often make mistakes in using concepts and procedures, and only write down the results of their calculations without providing conclusions or interpretations, so their mathematical literacy skills are still considered low. This shows that learning methods must be more contextual and meet the needs of students.

This condition indicates the need for innovative learning strategies that can improve students' mathematical literacy skills. One learning model that can be used is the *outdoor modeling mathematics* model. Several previous studies have provided evidence that outdoor-based learning and mathematical modeling play an important role in improving students' mathematical literacy skills. Sofnidar et al., (2017) explain that *outdoor learning* is a learning activity designed to take place outdoors, where the location or situation of learning is an important element in the learning process. Furthermore, Sofnidar et al. (2019) found that *outdoor modeling mathematics* learning creates good communication between teachers and students and among students. Learning outside the classroom also provides space for exploration, group work, and contextual problem-solving, all of which support mathematical literacy. Based on the results of research by Maulana (2020) concluded that the school-based *outdoor modeling mathematics* model has a significant effect on students' mathematical literacy skills. This is in line with the findings, Arifani et al. (2021), Badriyana et al. (2023), Danuri et al. (2023), and Faiz et al. (2023) stating that meaningful outdoor learning activities can improve students' literacy skills and their ability to master mathematical concepts and apply them in real-life situations. In line with this, Nugraha et al. (2023) shows that *outdoor learning* with *mobile math trails* supports mathematical modeling activities and provides opportunities for students

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to be directly involved in meaningful mathematical modeling activities, thereby improving students' mathematical literacy skills.

In addition, differentiated learning has been proven effective in accommodating student diversity, improving learning outcomes, and encouraging critical thinking and mathematical literacy skills. Kurnila et al. (2025) emphasize that differentiated learning is effective in accommodating student diversity and can encourage them to be more active in solving mathematical problems. This is in line with the findings of Palupi & Prasetya (2023) and Manik, & Mohidin (2024) which prove that PBL in differentiated learning can improve mathematical literacy in seventh-grade students at SMPN 1 Semarang. Furthermore, Yuniarti et al. (2025) revealed that differentiated learning based on logical thinking skills can improve mathematical literacy skills. In fact, Uhud et al. (2024) also found a positive effect of differentiated learning on improving the mathematical literacy skills of fifth-grade students at SDN Pedurungan Tengah 02, as seen from an increase in the average mathematical literacy skills of 38.93.

From the above explanation, the *outdoor modeling mathematics* model can increase student engagement and understanding through direct learning experiences in real contexts. Differentiated learning also provides opportunities for each student to learn according to their abilities. Thus, the combination of the *outdoor modeling mathematics* model with differentiated learning is believed to be able to improve students' mathematical literacy skills more optimally.

Method

Type of Research

This research was conducted using *an* experimental *posttest-only control group design method*, in which measurements were taken after treatment was given to three groups consisting of two experimental groups and one control group that were selected randomly (R) using simple random sampling techniques from a homogeneous population. The first and second groups were given treatment (X), and the third group was not given treatment. The group that received the treatment was called the experimental group, and the group that did not receive the treatment was called the control group. The research design is presented in Table 1.

Table 1. Research Design

Group	Treatment	*Posttest*
R	X_1	O_1
R	X_2	O_2
R	-	O_3

Explanation:
R: Random sampling
X_1: Applying *outdoor modeling mathematics* in differentiated learning.
X_2: Applying the *direct instruction* model in differentiated learning.
O_1, O_2, O_3 : *Post-test* scores for experiment I, experiment II, and control.

Samples

This study selected grade VII of SMPN 17 Batanghari in the odd semester of the 2025/2026 academic year, which was divided into 5 classes with a total of 126 students to be used as the population. Then, the method applied for sampling was *simple random sampling*, where three classes were selected randomly without considering the levels in the population. The sample determination process was carried out using a permutation technique that took into account the order of the classes to be selected, namely the first order being experiment class I, namely class VII D, with the application of the *outdoor modeling mathematics* model in differentiated learning, the second order being experiment class II, namely class VII C, with the *direct instruction* model in differentiated learning, and the third order being the control class, namely class VII A, with the application of the *direct instruction* model.

Instruments

The instruments in this study included a test of initial mathematical ability, a learning implementation sheet for teachers and students, and a test of mathematical literacy in the form of essay questions on integers. However, before being used, all research instruments were first validated by a validator to produce instruments that were suitable for the research needs. Table 2 shows the results of the research instrument validation.

Table 2. Research Instrument Validation Data

Instruments	Score obtained	Maximum Score	Percentage	Criteria
Initial Mathematical Ability Test	57	60	95	Highly Valid
Assessment Sheet for Learning Implementation by Teachers in Experimental Class I	28	30	93.3	Highly Valid
Student Activity Implementation Assessment Sheet for Experimental Class I	28	30	93.3	Highly Valid
Assessment Sheet for Learning Implementation by Teachers in Experimental Class II	28	30	93.3	Highly Valid
Assessment Sheet for the Implementation of Student Activities in Experimental Class II	28	30	93.3	Highly Valid
Assessment Sheet for Learning Implementation by Teachers in the Control Class	28	30	93.3	Very Valid
Student Activity Implementation Assessment Sheet for Control Class	28	30	93.3	Very Valid
Mathematical Literacy Test Questions	58	60	96.7	Highly Valid

Posttest results were assessed based on indicators of mathematical literacy.

Table 3. Mathematical Literacy Ability Indicators

No	Mathematical Literacy Indicators
1	Formulating problems mathematically
2	Using mathematical concepts, facts, and procedures
3	Interpreting and evaluating mathematical results

Posttest question grid in Table 4

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Table 4. *Posttest* Question Grid Design

Learning Objectives	Mathematical Literacy Ability Indicators	Question No.	Question Type
Reading and writing integers	1	1a	Description
Comparing positive and negative integers	2 3	1b, 1c 1f	Description
Using addition and subtraction operations with integers in everyday contexts	2	1d, 1e	Description
Using multiplication and division operations with integers in everyday contexts	1 2 3	2a, 2b	Description

The *posttest* questions on mathematical literacy were first tested outside the sample class. The results of the trial were used to determine the suitability of the test questions to be administered to the sample class through a testing stage, namely validity and reliability tests. After conducting a validity test on the *post-test* questions, the results showed that all test items had a value of . This indicates that all *post-test* questions were valid and suitable for use.

Table 5. Validity Test Results

No. Item	r_{count}	r_{tabel}
1a	0.457	0.396
1b	0.856	0.396
1c	0.877	0.396
1d	0.744	0.396
1e	0.512	0.396
1f	0.739	0.396
2a	0.948	0.396
2b	0.900	0.396

Cronbach's Alpha calculations can be seen in Table 6, which shows test results indicating a *Cronbach's Alpha* value of 0.781 > 0.60 for question number 1 and 0.810 > 0.60 for question number 2. This leads to the conclusion that the reliability of the test used is high.

Table 6. Reliability Test Results

Reliability Statistics	
Cronbach's Alpha	Number of Items
.810	2

Reliability Statistics	
Cronbach's Alpha	Number of Items
.781	6

Data Collection

Data collection in this study was conducted in several stages. At the beginning of the learning process, students were given a preliminary mathematical ability test to identify their level of readiness to learn and as a basis for grouping students. During the learning process, observers conducted observations to assess the implementation of learning by teachers and student activities in accordance with the learning model syntax applied in each class. After the entire learning series was completed, students from the three sample classes were given a mathematical literacy test (*posttest*) to obtain data on student learning outcomes after the treatment. The data obtained from the initial ability test, observations, and *posttest* were then analyzed to see the differences in the effects of applying the learning model between classes.

Data Analysis

The initial stage of data analysis involved scoring the initial mathematical ability test results to group students according to their learning readiness, namely high, medium, and low. Then, the data from the assessment sheets on the implementation of learning by teachers and student activities in the three sample classes were scored in percentage form to determine the results of the implementation of learning by teachers and student activities. Next, for the results of the mathematical literacy test from the *posttest* scores, the prerequisite assumptions were tested, testing normality and homogeneity. After obtaining normal and homogeneous results, the hypothesis was tested using a one-way ANOVA test followed by a *post-hoc* test (follow-up test), namely the *Tukey* test. The testing was carried out using the SPSS program.

Research Findings

The initial mathematical ability test data of students was processed to obtain student categories based on their learning readiness. The data can be seen in Table 7.

Table 7. Data Collection on Student Learning Readiness

Grade	High	Medium	Low
Experiment I	6	10	10
Experiment II	7	11	8

Based on the results of observations of the implementation sheets completed by teachers and students, as shown in Table 8, the learning process was carried out very well in accordance with the applied model syntax. Therefore, it can be concluded that the learning process in the three classes went very well according to plan.

Table 8. Percentage of Learning Implementation Sheets by Teachers and Students

Observation Sheet	Class	Implementation Score for Each Meeting (%)				Average	Category
		1	2	3	4		
Teacher							
	Experiment I	90.27	93.05	97.91%	98.61%	94.96%	Very Good
	Experiment II	85.18	92.59%	98.14%	99.07%	93.74%	Very Good
	Control	83	89	96	96	91%	Very Good
Students							
	Experiment I	83.33	87.87	96.96%	98.48%	91.66%	Very Good
	Experiment II	81.48	89.81%	94.44%	97.22%	90.73%	Very Good
	Control	81	85	96	96	89.5%	Very Good

Based on the experimental design, the treatments applied in each class were Experiment I (*outdoor modeling mathematics* model in differentiated learning), Experiment II (*direct instruction* model in differentiated learning), and the control class (*direct instruction* model). To present an overview of the *posttest* results, descriptive data are presented in Table 9. This

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data presentation forms the basis for further analysis of the differences in the effects of the three learning models used.

Table 9. Descriptive Statistics of *the Pretest*

Statistics		Experiment 1 (Differentiated OMM)	Experiment 2 (Differentiated Direct Instruction)	Control (Direct Instruction)
N	Valid	26	25	25
	Missing	0	1	1
Mean		75.2362	46.4960	40.8300
Median		77.0800	47.9100	39.58
Mode		79.16	47.91[a]	41.66
Standard Deviation		8.02105	8.97520	12.70043
Variance		64.337	80.554	161.301
Range		33.33	35.42	43.75
Minimum		56.25	22.91	20.83
Maximum		89.58	58.33	64.58
Sum		1956.14	1162.40	1020.75

The *posttest* results were then tested for normality and homogeneity.

Table 10. *Posttest* Normality Test Results

Tests of Normality							
Group		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Value	Experimental Class 1	.168	26	.058	.952	26	.260
	Experimental Class 2	.123	25	.200*	.940	25	.146
	Control Class	.154	25	.129	.945	25	.188

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

In this study, the Shapiro-Wilk test was used to test normality because this test is generally applied to samples with a size < 50. Ningsih et al.,(2019) states that the Shapiro-Wilk test is used in normality testing when the sample size is < 50. In Table 10, the significance values obtained from the *posttest* data for experimental class I are 0.260, experimental class II 0.146, and control class 0.188. This shows that the significance values of the three classes are > 0.05, meaning that the is rejected and the is accepted, which states that the posttest scores for students' mathematical literacy skills in experimental class 1, experimental class 2, and the control class are normally distributed.

Table 11. Results of the Homogeneity Test for *Posttest* Mathematical Literacy Ability

Test of Homogeneity of Variance					
		Levene Statistic	df 1	df2	Sig.
Value	Based on Mean	2.472	2	73	.091
	Based on Median	2,441	2	73	.094
	Based on Median and with adjusted df	2,441	2	64.168	.095
	Based on trimmed mean	2,482	2	73	.091

From the homogeneity test results in Table 11, the significance value obtained is 0.091, which means > 0.05, so it can be stated that the is accepted. Therefore, it can be concluded that the three classes have homogeneous posttest data variance in mathematical literacy.

The assumption test in this study will be tested at the end of the study using the *Tukey* test, but first it will be tested using a one-way ANOVA test. The testing was conducted using SPSS 27 software. The assumption presented is that if the significance value is > 0.05, the post-test of the mean of the research group is accepted, then the test group averages are the same. If the significance is < 0.05, then the post-test of the mean of the research group is rejected, so the post-test of the mean of the research group is accepted. Thus, the test group averages are different.

Table 12. One-Way ANOVA Test Results

ANOVA					
Value					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	17452.916	2	8726.458	85,935	.000
Within Groups	7,412.955	73	101,547		
Total	24,865.871	75			

The significance value obtained from the one-way ANOVA test is 0.000, which means that the p-value is less than 0.05 ($p - value = 0.001$), so the assumption that there are significant differences between classes is accepted. Therefore, it can be concluded that students' mathematical literacy abilities show significant differences in each class. Based on Table 12, the significance value obtained is 0.000, which means that the Sig. value is 0.000 < 0.05, , it can be concluded that there is a significant effect on students' mathematical literacy abilities in the three classes. This means that there is an effect between the application of the *outdoor modeling mathematics* model in differentiated learning, *direct instruction* in differentiated learning, and *direct instruction* on students' mathematical literacy abilities. Because the p-value is accepted ( ), further testing will be carried out using the *Tukey* test to further examine the significant differences in the three groups. The results of the follow-up test from the one-way ANOVA test, namely the *Tukey* test, are shown in Table 13.

Table 13. Results of the *Tukey* Test for Mathematical Literacy Skills

Multiple Comparisons						
Dependent Variable: Score						
Tukey HSD						
(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Experimental Class 1	Experimental Class 2	28.74015*	2.82269	.000	21.9871	35.4932
	Control Class	34.40615*	2.82269	.000	27.6531	41.1592
Experimental Class 2	Experimental Class 1	-28.74015*	2.82269	.000	-35.4932	-21.9871
	Control Class	5.66600	2.85023	.122	-1.1530	12.4850
Control Class	Experimental Class 1	-34.40615*	2.82269	.000	-41.1592	-27.6531
	Experimental Class 2	-5.66600	2.85023	.122	-12.4850	1.1530

*. The mean difference is significant at the 0.05 level.

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In order to see the differences in the application of these learning models, it is necessary to examine the significance values of the SPSS output. Based on the *Multiple Comparisons Output* results, it can be concluded that the significance value for the application of the *outdoor modeling mathematics* model in differentiated learning and the *direct instruction* model in differentiated learning is 0.000, because 0.000 < 0.05, it can be concluded that there is a significant difference in the effect of the application between the *outdoor modeling mathematics* model in differentiated learning and the *direct instruction* model in differentiated learning. Therefore, the difference in the average application of the *outdoor modeling mathematics* model in differentiated learning and the *direct instruction* model in differentiated learning is significant.

The significance value for the application of the *outdoor modeling mathematics* model in differentiated learning and the *direct instruction* model is 0.000, which means that 0.000 < 0.05, so it can be concluded that there is a difference in the effect of application between the *outdoor modeling mathematics* model in differentiated learning and the *direct instruction* model. Therefore, the difference in the average application of the *outdoor modeling mathematics* model in differentiated learning and the *direct instruction* model is significant.

The significance value for the application of the *direct instruction* model in differentiated learning with the *direct instruction* model is 0.122, meaning that 0.122 > 0.05, so it can be concluded that there is no significant difference in the effect of application between the *direct instruction* model in differentiated learning and the *direct instruction* model. Therefore, the average difference in the application of the *direct instruction* model in differentiated learning with the *direct instruction* model is not significant. The similarity of the average application of the learning model is listed in *the Tukey* HSD *output* in Table 14.

Table 14. Results of the Test of Equality of Means for Mathematical Literacy Ability Tests

Value			
Tukey HSD[a,b]			
Group	N	Subset for alpha = 0.05	
		1	2
Control Class	25	40.8300	
Experimental Class 2	25	46.4960	
Experimental Class 1	26		75.2362
Sig.		.119	1

Based on the data in Table 14, subset 1 includes the average scores of the mathematical literacy test using the direct instruction model and the direct instruction model in differentiated learning, while subset 2 includes the average scores of the mathematical literacy test using the outdoor modeling mathematics model in differentiated learning. This shows that there is no significant difference in the average scores of students' mathematical literacy tests in the direct instruction model and the direct instruction model in differentiated learning. In other words, the average scores of students' mathematical literacy tests in the direct instruction model and the direct instruction model in differentiated learning are the same. Conversely, there is a significant difference in the mathematical literacy test scores between the outdoor modeling mathematics model in differentiated learning and the direct instruction model in differentiated learning, as well as between the outdoor modeling mathematics model in differentiated learning and the direct instruction model.

Discussion

From the mathematical literacy test data obtained, prerequisite tests were conducted in the form of normality and homogeneity tests. The results showed that the mathematical literacy test scores of students in experimental class I, experimental class II, and the control class were normally distributed and homogeneous. Furthermore, the mathematical literacy test results were analyzed to determine the significant effect between the mathematical literacy test scores in the three classes, using the One-Way ANOVA statistical test. This analysis was followed by testing the differences between group- s, using the *Tukey Post-Hoc* test to determine which groups were significantly different from one another.

Based on the mathematical literacy test data, the average *posttest* scores for mathematical literacy in the three sample classes were obtained. Experimental class I (*outdoor modeling mathematics model* in differentiated learning) had an average of 75.23, which according to Juniansyah et al. (2023), is in the high category for mathematical literacy ability ( ). Then, the average score of the mathematical literacy test for experimental class II (*direct instruction* model in differentiated learning) was 46.49. According to Juniansyah et al. (2023), the level of mathematical literacy in the range of falls into the moderate category. Meanwhile, the average mathematical literacy test score for the control class (*direct instruction* model) was 40.83. Juniansyah et al. (2023), a mathematical literacy level in the range of falls into the moderate category.

This difference in average scores indicates a significant effect on students' mathematical literacy skills between the outdoor modeling mathematics model in differentiated learning and the direct instruction model in differentiated learning and the direct instruction model. This is supported by the One-Way ANOVA statistical test, which produced a significant value of 0.001, meaning < 0.05. Thus, it can be concluded that there is a significant effect between the outdoor modeling mathematics model in differentiated learning compared to the direct instruction model in differentiated learning and the direct instruction model on improving students' mathematical literacy skills.

Furthermore, the results of a follow-up test with Tukey showed a significant difference in students' mathematical literacy abilities between experimental class I (outdoor modeling mathematics model in differentiated learning) and experimental class II (direct instruction model in differentiated learning), with a significance value of 0.000 ($p-$ value <0.05). There was also a significant difference between experimental class I and the control class (direct instruction model) with a significance value of 0.000 ($p-$value <0.05). However, no significant difference was found between experimental class II and the control class, with a significance value of 0.122 > 0.05.

The results of this study confirm that the outdoor modeling mathematics model in differentiated learning has a greater effect on mathematical literacy skills. This is because the model is oriented towards direct experience and real contexts, allowing students to integrate mathematical concepts with their surroundings, while also being adapted to each student's learning readiness. This is in line with, Sochiba (2022) , which states that direct experience-based learning makes it easier for students to understand the material and strengthens their mastery of the concepts learned in class. Meanwhile, the direct instruction model in differentiated learning and the direct instruction model did not have a significant difference on students' mathematical literacy skills, indicating that differentiation efforts alone are not sufficient to overcome the limitations of this model. The direct instruction model tends to place the teacher at the center of learning, with little room for students to construct knowledge independently. As a result, mathematical literacy skills that require deep understanding, reasoning, and application of concepts in new contexts do not develop optimally.

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These findings are in line with Maulana (2020), who concluded that *outdoor modeling mathematics* learning based on the school environment has a significant effect on students' mathematical literacy skills compared to conventional models. Additionally, Karim (2025) also emphasizes that learning outside the classroom provides opportunities for students to learn through direct experience, which not only strengthens their understanding of concepts but also significantly improves learning outcomes. The characteristics of *outdoor modeling mathematics* learning, which is rarely implemented, generate high enthusiasm among students. The research Sofnidar et al. (2019) supports this finding by showing that students prefer outdoor learning because of the pleasant, real, and integrated environment.

In addition, the application of differentiated learning has also been proven to play an important role in mathematical literacy skills. Findings from the research Uhud et al (2024) reinforce the results found in this study. In their research, it was found that the application of learning that accommodates student diversity has been proven to improve students' mathematical literacy skills, even when there are very large variations in students' initial ability levels. Differentiation not only encourages high-ability students to develop more quickly, but also provides the space and support needed for low-ability students to catch up, so that all students benefit from a more adaptive and needs-centered learning process. Jauhari et al. (2024) emphasize that differentiated learning will only be effective if it is integrated with a learner-centered approach.

The combination of Outdoor Modeling Mathematics and differentiated learning provides opportunities for students to explore mathematical concepts in real contexts without losing individual adaptation (Rokhmawati et al, 2023; Sabila et al., 2024; Shidqiya & Indraswari, 2023). This combination strengthens understanding and mathematical literacy skills because it combines contextual, exploratory, and adaptive learning. From the results of this study, it can be concluded that the main advantage of this study lies in its innovation in combining the outdoor modeling mathematics model with differentiated learning, which is rarely studied simultaneously in the context of mathematical literacy skills. This has been proven to have a significant effect on mathematical literacy skills. In addition to contributing theoretically to the development of differentiation- and context-based learning models, this study also provides practical benefits for educators in designing mathematics learning that is more relevant to students' daily lives.

However, this study also has several limitations. The limited sample size of only three classes and the lack of variation in school contexts make it difficult to generalize the results to other regions or levels of education. In addition, this study did not consider external factors such as learning motivation, teacher support, or family environment, which may also influence mathematical literacy skills. The duration of the model's implementation was also relatively short, making it insufficient to assess the long- fect on students' mathematical literacy development. Therefore, further research is recommended to involve a more diverse sample and a longer duration to describe the impact of the model more comprehensively.

Conclusion

The results of the study show that in the application of the *outdoor modeling mathematics* model in differentiated learning, *the direct instruction* model in differentiated learning, and *the direct instruction* model on students' mathematical literacy abilities in integer material, it can be concluded that the data from statistical analysis using One-Way ANOVA analysis showed a significant result of 0.001. Therefore, it can be concluded that there is a significant effect between mathematical literacy skills in the *outdoor modeling mathematics* model class in differentiated learning and the *direct instruction* model class in differentiated learning and *the direct instruction model.* Furthermore, the *Tukey* test results indicate a significant difference in students' mathematical literacy abilities between the *outdoor modeling mathematics* model class in differentiated learning and *direct instruction* in differentiated learning, with a significance value of 0.000 < 0.05. The same was true between the *outdoor modeling mathematics* model class in differentiated learning and *direct instruction* learning, with a significance value of 0.000 < 0.05. However, no significant difference was found between *the direct instruction* learning model class in differentiated learning and *the direct instruction* learning model*,* with a significance value of 0.122 > 0.05. The results of this study indicate that the application of *outdoor modeling mathematics* in differentiated learning influences students' mathematical literacy skills compared to the *direct instruction* learning model in differentiated learning and the *direct instruction* learning model.

Conflict of Interest

The researcher revealed that there was no conflict interest.

Authors' Contributions

S.F.N. conducted the research by identifying the background of the presented problems, performing the study, processing and analyzing the data, and drafting the research results. S. and D.I. participated in instrument development, data analysis techniques, and finalizing the journal manuscript. All authors have declared that this paper has been read and approved. The contribution percentages are S.F.N.: 50%, S.:25% and D.I.: 25%.

Data Availability Statement

The authors state that the data supporting the findings of this study will be made available by the corresponding author, [S.F.N.], upon reasonable request.

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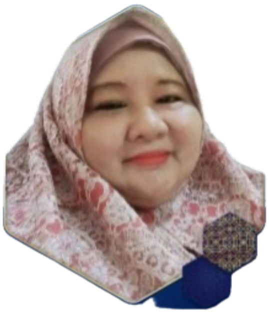	**Dewi Iriani** is a lecturer **in** the Mathematics Education Study Program, Faculty of Teacher Training and Education, University of Jambi. She is an expert in the field of Algebra. She completed her Master's degree in Educational Management at the State University of Jakarta in 2009. Email: dewi.iriani@unja.ac.id