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The Influence of RADEC Learning (Read, Answer, Discuss, Explain, Create) assisted by Media Handouts and Students' Curiosity on the Ability to Understand Mathematical Concepts

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Abstract

This research was conducted at MTs Nurul Hidayah with the aim of knowing (1) the effect of the Read, Answer, Discuss, Explain, Create (RADEC) learning model assisted by Handout media on understanding mathematical concepts; (2) the influence of students' curiosity on the ability to understand concepts; and (3) the interaction of the handout-assisted RADEC learning model and students' curiosity about their ability to understand mathematical concepts. The research method used was quasy experiment with the non-equivalent group design. The collection of research data was obtained from tests of students' ability to understand concepts and curiosity questionnaires. This research was conducted on class VIII students of MTs Nurul Hidayah with a total of 60 students who were selected through cluster random sampling technique. Based on hypothesis testing through two-way ANOVA, it was obtained (1) there was an influence of the Read, Answer, Discuss, Explain, Create (RADEC) learning model assisted by Handout media on understanding mathematical concepts, (2) there was an influence of students' curiosity on the ability to understand concepts, (3) there is no interaction of the handout-assisted RADEC learning model and students' curiosity about their ability to understand mathematical concepts.

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INTRODUCTION

Mathematics is a subject that requires students to be able to think analytically and organize(Jeheman et al., 2019). Mathematics is one of the sciences that is taught at all levels of education, from elementary school, high school to university. Mathematics is one of the subjects tested at every level and in the State Examination. In studying mathematics, a student must understand the topic or content of the material gradually because learning mathematics always relates old material to the material to be studied.

The purpose of learning mathematics in schools is to train students to always be truth-oriented by developing a logical, critical, creative, objective, rational, careful, disciplined attitude and able to work together effectively. So it is very important to be owned by every student(Fitriani & Yarmayani, 2018). The initial goal of learning mathematics is to understand mathematical

concepts(Nasution & Hafizah, 2020). The ability to translate, explain from mathematical language to personal language, and be able to apply it in everyday life, and most importantly, being able to relate one concept to another or the ability to understand mathematical concepts(Febriani et al., 2019).

The ability to understand concepts is a skill related to translating global and functional mathematical ideas(Lestari & Yudhanegara, 2018). Understanding of mathematical concepts is a key component of implementing the mathematics learning process, if students are able to interpret many concepts then students will more easily solve problems, because in solving problems it is necessary to have provisions that are based on the concepts they already have. In the ability to understand concepts, students must be able to explain back the material that has been studied and be able to solve various problems or solve mathematical problems according to the concepts they have obtained.

Students are considered to be able to master a concept if students have fulfilled indicators of understanding mathematical concepts(Alzanatul Umam & Zulkarnaen, 2022). Students are said to have a high level of ability if they can reach the level of assessment and create. Students are said to have a moderate level of ability if they can reach the level of applying and analyzing. Students are said to have a low level of ability if they can only remember and understand basic concepts(Ramadhan et al., 2022).

Most students do not understand mathematics because it is taught in a less meaningful and unpleasant way(Pradana et al., 2022). In fact, it shows that the ability to understand students' mathematical concepts in Indonesia is still very low. This is provide by the comparative data of Indonesian students to international students in terms of the cognitive process domain in the 2018 International Student Assessment Program (PISA) released by the Organization for Economic Cooperation and Development (OECD)(Maskur et al., 2020). This is evident from the OECD data (2018), that Indonesia's ranking based on the 2018 PISA scores in the mathematical aspect is in 72nd place out of 78 countries. While the value of TIMSS Indonesia in 2015, which is ranked 44th out of 49 countries with a score of 397.

These results are in line with the results of pre-research regarding the ability to understand concepts carried out at MTs Nurul Hidayah, Semaka, Tanggamus. This can be seen from the results of tests on the ability to understand mathematical concepts given to class VIII at MTs Nurul Hidayah.

Table 1. Concept Understanding Ability Test Results

Class	0 ≤ X < 78	78 ≤ X ≤ 100	Number of Students
VIII B	21	9	30
VIII C	23	7	30
Total	44	16	60
Percentage	73,33%	26,67%	100%

Based on Table 1, it was found that only a few students achieved the minimum completeness criterion score. Many students have not been able to answer pre-research questions according to indicators of understanding of concepts, so it can be said that students' ability to understand concepts is still low.

Factors that cause students' understanding of mathematical concepts to be low are teachers who still apply conventional teaching methods, where the teacher conveys material while students simply listen and pay attention to the material presented by the teacher. The teacher is much more active, while the

students are just silent and listen to the material being taught by the teacher. During the learning process, students are also less active in asking questions about learning material that has not been understood.

Students are also only obsessed with the examples provided by the teacher, so students have difficulty if the questions asked are slightly different from the questions given before. This statement is in accordance with the results of previous research which said that the low ability of students' conceptual understanding was due to teacher-focused learning and students having difficulty working on questions that were different from the sample questions given by the teacher(Masnia & Amir, 2019).

From the case above, we need a teaching method that is able to increase students' understanding of mathematical concepts. An active teaching method is needed so that students can be more involved in learning activities. One of them is by using the Read, Answer, Discuss, Explain, Create (RADEC) learning model(Sopandi et al., 2018). With this model, students are able to connect the material studied with real life or contemporary issues. This model is also one of the choices of learning models that are appropriate to the situation in Indonesia and one of the models that has learning steps that can encourage students to learn actively and productively.

The Read, Answer, Discuss, Explain, Create (RADEC) learning model is a model that directly involves students actively in the learning process, with steps taken from the RADEC abbreviation itself, namely Read means to read, Answer means to answer, Discuss means to discuss, Explain means to explain and Create means to create. so that it can make students more structured in receiving learning(Setiawan et al., 2020). The RADEC learning model has the advantage of making learning more useful for students, and making students active, curious and skilled in communication(Kaharuddin & Hajeniati, 2020).

One of the teaching materials that can support the learning process in the classroom is also needed to increase students' insights, namely handouts. Handouts are teaching materials that contain a summary of material which contains a summary of material originating from several relevant sources(Prastowo, 2015). Handouts are written teaching materials in a concise way to guide students through the learning process and can help students achieve more directed learning, because the Handout contains the core material that will be provided by the teacher during the learning process(Purwanto & Rahmawati, 2017).

Another factor that can affect students' learning outcomes in mathematics is curiosity (Ameliah et al., 2016), because curiosity is an attitude and an attempt to understand more deeply and broadly than what is learned, seen, and heard. Therefore, the low curiosity of students indicates that students are not trying to dig deeper into what they are learning. The hallmark of students who have a high curiosity is students who want to know and are interested in something new, this can be seen when students actively ask teachers or friends during learning(Puspitasari et al., 2015). The curiosity of students rises when they are introduced to a challenging situation.

Previous research that is relevant to this research is research that has been conducted by Maidani et al., (2017), in his research discussing the understanding of the concept by utilizing handout-assisted student studio camtasia media. Research by (Pratama et al., 2020) which discusses the effect of the RADEC learning model on the high-level thinking skills of elementary school students. Research by Salsabila,

(2019) and Sari et al., (2022) regarding the Effect of the Conceptual Understanding Procedures (CUPs) Learning Model Assisted by Media Handouts on the Ability to Understand Concepts.

The novelty in this research is the research object, namely the understanding of mathematical concepts in terms of students' curiosity. Based on the description above, this study aims to determine 1) the effect of the Read, Answer, Discuss, Explain, Create (RADEC) learning model assisted by Handout media on understanding mathematical concepts; 2) the influence of students' curiosity on the ability to understand mathematical concepts; and 3) interaction of the RADEC learning model assisted by handouts and students' curiosity about their ability to understand mathematical concepts.

RESEARCH METHODS

The type of research used is a quasi-experiment. The research design used is The Non-Equivalent Group Design. The population in this study were all students of class VIII at MTs Nurul Hidayah, while the research sample consisted of two groups, namely the experimental group and the control group which were selected by simple random sampling technique. The experimental group is the students who are given the RADEC learning model assisted by handout media (A1), while the control group is the students who are given the conventional learning model (lecture method) (A2).

This study used instruments in the form of tests and questionnaires to collect research data. The object in this study is the RADEC learning model assisted by handout media (X1) and curiosity (X2) as independent variables, while the dependent variable is conceptual understanding (Y). The design of the research design uses 3 categories of curiosity, so the research design uses a 2 × 3 factorial design as follows:

Table 2. Research design

Treatment (A)	Student Curiosity (B)		
	High (B_1)	Medium (B_2)	Low (B_3)
Handout-assisted RADEC model (A_1)	A_1 B_1	A_1 B_2	A_1 B_3
Conventional Model (A_2)	A_2 B_1	A_2 B_2	A_2 B_3

The data analysis technique in this study used a two-way ANOVA test with the stages of the instrument used having been analyzed for its feasibility through validity, reliability, discriminatory power and difficulty level tests. Then, it has gone through the prerequisite test with the analysis of normality and homogeneity tests.

RESULTS AND DISCUSSION

Data collection on the ability to understand mathematical concepts was obtained from the tests given after the model was given to each class (experiment and control). The summary of the results of the observed data on the ability to understand students' mathematical concepts can be seen in the table below:

Table 3. Description of Mathematical Concepts Ability Test Data Description

		Experiment	Control
N	Valid	30	30
	Missing	0	0
Mean		77.83	63.00
Median		78.00	66.00
Mode		88	66
Std. Deviation		11.495	10.939
Range		44	50
Minimum		50	38
Maximum		94	88

Based on Table 3 presented from the SPSS output, it can be said that the ability to understand mathematical concepts of students in the experimental class is

better than that of the control class based on the highest, lowest scores, and measures of central tendency.

In addition, other observational data were also obtained from the results of students' curiosity questionnaires which were given to students in the experimental class and control class before the learning model was implemented. The summary of the results of the student curiosity questionnaire can be seen in the table below:

Table 4. Curiosity Questionnaire Results

Group	Curiosity		
	Low	Medium	High
Experiment	5	16	9
Control	7	16	7

Based on the distribution of questionnaires that have been filled in by students, it shows that the majority of students have moderate curiosity.

Normality test

The normality test is a prerequisite that needs to be carried out to obtain or find out the normality of the data on the concept comprehension ability test and the student's curiosity questionnaire. This test was analyzed with the help of the SPSS 25 application by looking at the sig. generated on the Kolmogorov-Smirnov column. The results of the normality test for the ability to understand mathematical concepts and curiosity are presented in the table below.

Table 5. Normality Test Results Test Ability to Understand Mathematical Concepts

	Group	Kolmogorov-Smirnov[a]		
		Statistic	df	Sig.
Understanding of Mathematical Concepts	Experiment	.112	30	.200*
	Control	.141	30	.130

Based on the SPSS output results in table 5 above, the sig. for the experimental and control classes in Kolmogorov-Smirnov which is greater than α = 0.05. It can be concluded that the research sample comes from a normally distributed population.

Table 6. Curiosity Questionnaire Normality Test Results

	Curiosity	Kolmogorov-Smirnov[a]		
		Statistic	df	Sig.
Understanding of Mathematical Concepts	Low	.123	12	.200*
	Medium	.097	32	.200*
	High	.155	16	.200*

Based on the SPSS output results in table 6 above, the sig. for a curiosity questionnaire with low, medium, and high categories on Kolmogorov-Smirnov which is greater than α = 0.05. From these results it can be concluded that the study sample came from a normally distributed population.

Homogeneity Test

This test is carried out to see whether the variances of the data population are the same or not. The homogeneity test was calculated using the SPSS 25 application with the Test Of Homogeneity of Variance at a significance level of 5%, along with a summary of the results of the homogeneity test of ability to understand concepts and curiosity.

Table 7. Homogeneity Test Results Test Ability to Understand Mathematical Concepts

	Levene Statistic	df1	df2	Sig.
Based on Mean	.005	1	58	.943
Based on Median	.027	1	58	.870

Understanding of Mathematical Concepts	Based on Median and with adjusted df	.027	1	57.970	.870
	Based on trimmed mean	.009	1	58	.926

Based on the SPSS output results on the variance of the experimental and control class data in table 7, the sig. based on the mean of 0.943. These results indicate that the value of the variances is greater than α = 0.05, so it can be concluded that the two variances are homogeneous.

Table 8. Curiosity Questionnaire Homogeneity Test

		Levene Statistic	df1	df2	Sig.
Understanding of Mathematical Concepts	Based on Mean	.302	2	57	.740
	Based on Median	.298	2	57	.744
	Based on Median and with adjusted df	.298	2	52.755	.744
	Based on trimmed mean	.303	2	57	.740

Based on the SPSS output results on the curiosity data variance with the low, medium, and high categories above, the sig value is obtained. based on the mean of 0.740. These results indicate that the value of the variances is greater than α = 0.05, so it can be concluded that the three variances are homogeneous.

Hypothesis Test

Two-Way ANOVA Analysis

This analysis was carried out to answer the research hypothesis whether or not there were differences in categories on the results of the ability to understand mathematical concepts, as well as to see their interaction with students' concept understanding abilities. The results of the analysis obtained through SPSS are as follows:

Table 9. Results of Two Way Anova Analysis

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5284.293[a]	5	1056.859	10.731	.000
Intercept	240524.785	1	240524.785	2442.202	.000
x1	1837.951	1	1837.951	18.662	.000
x2	1877.329	2	938.665	9.531	.000
x1 * x2	219.750	2	109.875	1.116	.335
Error	5318.291	54	98.487		
Total	308113.000	60			
Corrected Total	10602.583	59			

Based on the results obtained from the two-way ANOVA test, the research hypothesis can be concluded that H_{0A} rejected. This is due to the sig value. obtained in X1 (experiment and control group) of 0.000, which means sig < 0.05 so that it can be interpreted that there is a difference between students who are given the RADEC learning model assisted by Handout media and students who are given conventional learning models on the ability to understand mathematical concepts.

In addition, other results are H_{0B} rejected. this is due to the sig value. obtained in X2 (curiosity category) of 0.000, which means sig < 0.05 so that it can be interpreted that there are differences in the categories of low, medium and high curiosity towards the ability to understand mathematical concepts. This is in line with the results of research by (Iqoh et al., 2021) which states that there are differences in high, moderate and low curiosity in the ability to understand students' mathematical concepts. Last,

H_{0AB} accepted. this is due to the sig value. obtained by 0.335 which means sig> 0.05. so it can be concluded that there is no interaction between model factors and curiosity towards the ability to understand mathematical concepts.

Multiple Comparison Test

After obtaining the results of the next study, the research continued the analysis of the rejected null hypotheses, namely H_{0A} and H_{0B} with the aim of seeing how far the differences resulted in each category. This test analysis was carried out using the SPSS 25.0 application with the Scheffe method. The marginal averages in this analysis are summarized as follows:

Table 10. Marginal Average Summary

Model Pembelajaran	Rasa Ingin Tahu			Rataan Marginal
	Rendah	Sedang	Tinggi	
RADEC	65,000	79,438	82,111	75,516
Konvesional	55,857	62,125	72,143	63,375
Rataan Marginal	60,429	70,781	77,127	

The marginal average obtained will be used to compare which model or category is better. Based on Table 10, the marginal average in the RADEC learning model assisted by Handout media is 75.516. while the conventional model is 63.375. These results indicate that the RADEC learning model assisted by Handout media is better than the conventional learning model for students' conceptual understanding abilities.

Follow-up post-ANOVA tests between columns need to be analyzed because there are three categories of curiosity, namely low, medium and high categories. Because the curiosity of students will not have the same impact on students' ability to understand concepts. The further test calculations are calculated using SPSS with the following results:

Table 11. Results of Double Comparison Test between Columns

(I) Curiosity	(J) Curiosity	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Low	Medium	-11.11*	3.359	.007	-19.57	-2.66
	High	-18.08*	3.790	.000	-27.62	-8.54
Medium	Low	11.11*	3.359	.007	2.66	19.57
	High	-6.97	3.039	.081	-14.62	.68
High	Low	18.08*	3.790	.000	8.54	27.62
	Medium	6.97	3.039	.081	-.68	14.62

The calculation results presented in Table 11 show that there is a difference between curiosity in the low category and curiosity in the medium category. In addition, Table 10 shows that the marginal average in the low category is 60.429 and the marginal average in the medium category is 70.781. Based on the marginal average value, it can be concluded that students who have curiosity in the moderate category are better than students who have curiosity in the low category for the ability to understand mathematical concepts.

based on table 11, there is a difference between curiosity in the low category and curiosity in the high category. Can be seen in Table 10, the marginal average results obtained in the low category are 60.429 and the marginal average results in the high category are 77.127. Based on the marginal average value, it can be concluded that students who have curiosity in the high category

are better than students who have curiosity in the low category for the ability to understand mathematical concepts. according to Aningsih & Asih, (2017), students with high curiosity are able to solve all the problems given.

based on table 11, it can be concluded that there is no difference between students who have curiosity in the medium category and have curiosity in the high category. This conclusion can also be seen in Table 10, where the visual category marginal average is 70.781 and the high category marginal average is 77.127. The mean of the two categories showed insignificant differences in the ability to understand students' mathematical concepts.

CONCLUSIONS AND SUGGESTIONS

Based on the results of calculations and analysis that have been obtained from hypothesis testing, it can be concluded that (1) There is an influence of the Read, Answer, Discuss, Explain, Create (RADEC) learning model assisted by Handout media on understanding mathematical concepts. (2) There is an influence of students' curiosity on the ability to understand concepts. (3) There is no interaction of the handout-assisted RADEC learning model and students' curiosity about their ability to understand mathematical concepts.

Based on the conclusions above, there are several suggestions that can be conveyed, namely (1) for future researchers, they can apply this RADEC model to see an increase in other mathematical abilities. (2) For teachers, to prepare themselves before the learning process is carried out so that what is conveyed by the teacher is easy for students to understand so that learning objectives can be achieved. (3) Students need to be encouraged to be active during learning because students need support to be able to develop their abilities.

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