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The Influence of the Student Teams Achievement Divisions (STAD) Approach on Assurance, Relevance, Interest, Assessment, and Satisfaction in Improving Mathematical Understanding

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Abstract: The ability to understand mathematics is a fundamental skill that every student must possess, as it helps them master other mathematical concepts. However, many students demonstrate low mathematical comprehension skills. One contributing factor to this issue is the use of learning models that fail to provide students with opportunities to actively engage in the learning process. This often results in difficulties for students in understanding mathematical material. Therefore, a solution is needed to address this problem, one of them is the application of the Student Teams Achievement Divisions (STAD) cooperative learning model combined with the ARIAS approach. This research aims to examine the mathematical understanding abilities of eighth-grade students on function material by applying the STAD cooperative learning model with the ARIAS approach. The research population consisted of all eighth-grade students at MTs Ma'arif NU 1 Sokaraja. Using a convenience sampling technique, the research sample included 53 students: class VIII A as the experimental group and class VIII B as the control group. This study employed a quantitative research method with an experimental design using a pre-test and post-test control group setup. Data collection was conducted through observation and tests in the form of pre-tests and post-tests. The collected data were analyzed using t-test for two independent samples, preceded by prerequisite tests such as normality and homogeneity tests. The analysis revealed a significance value of 0.000 in the post-test data, which is less than 0.05, indicating a significant difference between the average scores of the experimental and control groups. Based on these findings, it can be concluded that the STAD cooperative learning model combined with the ARIAS approach positively impacts the mathematical understanding abilities of eighth-grade students.

Keywords: mathematical understanding ability; ARIAS models; STAD model

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A. Introduction

The rapid development of science and information and communication technology era The current global climate has an impact on the acceleration of changes in society's demands in various ways aspect of life. The demands of global society indirectly make the world become competition in creating various innovations to support aspects of life. Need There are efforts to keep pace with the rapid growth of science and technology in the 21st century, namely by preparing quality, superior and creative human resources. Education is a valuable vehicle and

investment in efforts to improve quality of human resources. Increasing human resources is supported by improving the quality of education, because of human is the main product of education (Sutiawan, 2009). So, it can be concluded that through quality education and being able to develop students' potential.

Through quality education, a nation can face a bright future better. However, currently Indonesia is facing major challenges internal, namely related to the quality of education. It could be said that the quality of education is still low resulting in a low level of ability to face global life competition which has an impact on the progress and prosperity of the country's existence. Learning needs to be designed to be structurally aligned with the learning process which emphasizes active student learning (Hailikari et al., 2022).

To be able to make changes to improve the quality of education, it is necessary the existence of learning that guides students to be able to think critically, logically, systematically, and creative so that they can face various challenges independently with full sense self-confidence (Hirzi et al., 2022). These competencies are needed so that students can have and develop the ability to acquire, manage and utilize capabilities to live in circumstances that are always changing, uncertain, and competitive. these competencies can be obtained through learning mathematics. Mathematics is a universal science that underlies the development of modern technology, has an important role in various disciplines and advances human thinking power (Kusumaningsih, 2022). The rapid development in various aspects of life today also based on developments in mathematics. What is expected to emerge is the ability to understand mathematics. One of the goals of learning mathematics According to Santrock who stated in the book Hendriana (2021) states that the ability to understand concepts are the main aspect of learning. As a fundamental aspect, ownership This ability really supports the development of students' mathematical abilities others (Hendriana et al., 2021). Comprehension is not just about memorizing, understanding information, but more than capable of giving meaning and representing it again information received in different forms.

However, facts in the field show that students' mathematical understanding is still poor low, there are still many students who misunderstand mathematical concepts. That too happened to students at MTs Ma'arif Nu 1 Sokaraja. One mathematics teacher said that, students' mathematical understanding abilities, especially class VIII, are still low. Teacher Students have difficulty understanding teaching material. the teacher has to repeat it over and over again explain the material being taught and sometimes even have to repeat the material previously still within its scope. Apart from that, the comprehension ability is low mathematics is also characterized by students having difficulty explaining a concept again, students Difficulty classifying statements according to the prerequisites that form a statement concept, students have difficulty in making examples according to the concept, students have difficulty in represent a statement in the form of a mathematical representation, and students still confused about how to solve story problems according to the algorithm in the concept. This can happen due to lack of practice working on questions, lack of motivation to learning, less interested in the learning model applied by the teacher or activities Learning does not provide opportunities for students to be actively involved learning.

Students' low mathematical understanding abilities will not improve as well immediately, but requires teacher intervention in it. Deal with this, teacher can make several choices regarding the application of the model. Alternative learning models which is thought to be able to facilitate students to improve their understanding abilities mathematically based on the problem description above is a type of cooperative learning model STAD with the ARIAS approach.

The STAD type cooperative learning model is one type of learning cooperative applied to deal with the heterogeneity of student abilities. process learning divides students into several groups containing 4-5 people with varying abilities for collaboration and elaboration with peers within solving problems (Gusniar, nd). Through the STAD type cooperative model, student difficulties are overcome in understanding concepts can be overcome because smarter students can become tutors peers for their group friends during the discussion process. Apart from that, there is Assessment encourages students to play an active role in mastering the material independently, not above group name, because group success is obtained based on the development of the score quiz each member. And having awards for the best groups can motivate students to study the material taught. Apart from that, by using the ARIAS approach in the learning process will make students actively construct concepts because has been provided with teaching that prioritizes aspects of assurance, relevance and interest. The aim is to attract students' interest in learning by knowing the relationship between The material taught is related to everyday life, motivating students to continue increase students' self-confidence during learning to play an active role. Cooperative type STAD with the ARIAS approach, a combination of both learning models, will help students to improve mathematical understanding through peer tutoring in collaboration groups and teacher teaching as initial capital of knowledge.

Based on the description of the problem above, it is important to carry out this research, this is in line with the importance of students' possession of mathematical understanding abilities. Therefore It is necessary to apply the STAD type cooperative learning model with the ARIAS approach as an effort to improve the mathematical understanding abilities of class VIII students by conducted research entitled "The influence of the STAD type cooperative learning model with the ARIAS approach to increasing students' mathematical understanding abilities class VIII at MTs Ma'arif NU 1 Sokaraja”.

B. Methods

The type of research used in this research is quantitative research with apply experimental methods. Experimental research is a research activity with The aim is to assess the influence that arises on students as a result of being given a action or testing a hypothesis between an action and another action as comparison (Payadnya & Jayantika, 2018). The treatment in question is the application of the model STAD type cooperative learning with the ARIAS approach. In this research, which being the independent variable is the STAD type cooperative learning model with the approach ARIAS and the dependent variable are students' mathematical understanding abilities.

The design used in the research was Pre-test and Post-test Control Group. The research began by giving a pre-test to the experimental and control classes before given treatment. Then

treatment is given in the form of implementing a learning model STAD type cooperative with the ARIAS approach in experimental and method classes conventional in the control class. The next step is that both classes are given a post-test for find out the increase in students' mathematical understanding abilities after it is carried out different treatment.

The research was conducted at MTs Ma'arif Nu 1 Sokaraja which is located on Jl. Kyai Akhmad Mursyid Dusun II RT 04/03 Sokaraja Lor Village, Sokaraja District, Banyumas Regency, in the odd semester of the 2023/2024 academic year from 03 September-10 October 2023. The population in this study were students of class VIII MTs Ma'arif Nu 1 Sokaraja consists of 5 classes, namely classes VIII A, VIII B, VIII C, VIII D, and VIII E with the number of students a total of 120. A sample is a subset of the population that represents the whole symptoms observed by researchers (Haryana & Novianti, 2020). Through convenience sampling techniques where respondents are taken based on convenience and willingness to spend time help researchers (Malawi & Maruti, 2016). From the five classes, researchers took samples from class VIII A, totaling 30 students as the experimental class and class VIII B totaling 25 students as the control class.

The data used in this research was obtained through observation and test activities. Observation is a data collection technique through careful observation and recording systematically (Malawi & Maruti, 2016). Observations were carried out by two observers. Meanwhile, the test instrument used is a description test, namely a test that contains a series questions whose answers are descriptive or explanatory. Description test applied to The experimental and control classes were in the form of a pre-test given before carrying out the research. Meanwhile, the post-test is given after the research is carried out.

Data obtained through observation and tests are then analyzed. Observation data used to analyze how researchers' activities apply the model STAD type cooperative learning with the ARIAS approach through scoring observation sheet. Meanwhile, to find out whether there is an influence of cooperative type STAD with the ARIAS approach to improving mathematical understanding abilities students are tested by testing pre-test data and post-test data using prerequisite tests and t-test. The prerequisite tests are the normality test and homogeneity test. All three tests were carried out using the help of the SPSS version 23 application. The normality test was used to test whether the data for both classes is normally distributed or not. Decision making criteria if the data is normally distributed so the significance value is ≥ 0.05 . On the other hand, if the value is significant ≤ 0.05 then the data is not normally distributed (Muhammad Aqil & Efendi, 2021). Meanwhile, test homogeneity to test whether the data for both classes come from a population with variance the same or not. The test decision making criteria is if the value is significant Homogeneous test > 0.05 means the data variance is homogeneous. On the other hand, if the significance value of the test homogeneous < 0.05 , then the data variance is not (Muhammad Aqil & Efendi, 2021). After test The prerequisites are met, namely normal and homogeneous distribution, then the data is analyzed with t-test. The way the analysis works with the t-test is to compare the class average values experimental and control class average values. The decision making criteria in the t-test are: if the significance value (2-tailed) > 0.05 then H_0 is accepted and H_1 was rejected (Susanto, 2010). The hypothesis is as follows:

$H_0 : \mu_1 = \mu_2$: There is no difference in the average value between the control class and the experimental class

$H_1 : \mu_1 \neq \mu_2$: There is a difference in the average value between the control class and the experimental class.

C. Results and Discussion

1. Data Analysis Description of the Application of the Type Cooperative Learning Model STAD with the ARIAS Approach

Researchers apply the STAD type cooperative learning model with an approach ARIAS in the experimental class. At the same time two observers made observations of researcher activities in implementing the learning model used. ability level research in teaching is calculated by adding up the total scores which are then divided The number of aspects in the observation sheet is 11. The following are guidelines for decision making Researcher ability criteria:

Table 1. Criteria for Researcher Ability

Ability Level	Criteria
$3,25 \leq x \leq 4,00$	Excellence
$2,5 \leq x \leq 3,25$	Good
$1,75 \leq x \leq 2,5$	Weak
$1 \leq x \leq 1,75$	Enough

Results of observations by two observers regarding the application of the cooperative learning model STAD type with the ARIAS approach can be seen from the table as follows:

Table 2. Number of School Samples based on Research Locations

No	Observed	Observer 1	Observer 2	Average
1	Opening greetings and prayer	4	4	4
2	Attending to student attendance	4	4	4
3	Provide motivation to in till an attitude of self-confidence and play active role during learning	3	4	3,5
4	Presenting material and convey goals and benefits learning	3	3	3
5	Form students into groups small and guide the discussion	4	4	4
6	Provide student opportunities ask	4	4	4
7	Provide student opportunities present and respond discussion results	4	4	4
8	Guiding in concluding the material what was studied	3	3	3
9	Give quizzes to students	3	3	3
10	Give credit to best group	4	4	4
11	Close the lesson with prayer and greetings	4	4	4
	Total	40	41	40,5
	Average	3,63	3,72	3,68

Based on the table above, the results of observations made by observer 1 and observer 2 respectively obtained scores of 3.63 and 3.72 with the average score for both of them being

3.68. According to the scoring guidelines in table 12, the average value obtained by the researcher is in the interval $3.25 \leq x \leq 4.00$, which means the researcher's ability to apply the STAD type cooperative learning model with the ARIAS approach implements this method Very good.

2. Data Analysis of the Influence of the STAD Type Cooperative Learning Model with ARIAS Approach

The data used to measure the effect of the cooperative learning model type STAD with the ARIAS approach consists of pre-test and post-test result data from the class experimental and control class. Here's the explanation:

a. Analysis of Pre-test Data for Experimental Class and Control Class.

Pre-test data was obtained before implementing the STAD with the ARIAS approach in the experimental class and conventional methods in the class control. The results of the pre-test data are presented in the following table:

Table 3. Data on Pre-test Score for Eksperimental Class and Control Class

No.	Class Code Experiment	Pre-test Score	Class Code Control	Pre-test Score
1	A1	33,3	B1	60,0
2	A2	46,7	B2	33,3
3	A3	53,3	B3	46,7
4	A4	66,7	B4	26,7
5	A5	26,7	B5	53,3
6	A6	33,3	B6	26,7
7	A7	53,3	B7	33,3
8	A8	66,7	B8	60,0
9	A9	60,0	B9	20,0
10	A10	40,0	B10	40,0
11	A11	60,0	B11	33,3
12	A12	46,7	B12	53,3
13	A13	60,0	B13	66,7
14	A14	20,0	B14	53,3
15	A15	40,0	B15	66,7
16	A16	53,3	B16	46,7
17	A17	26,7	B17	46,7
18	A18	66,7	B18	40,0
19	A19	33,3	B19	46,7
20	A20	20,0	B20	40,0
21	A21	20,0	B21	46,7
22	A22	33,3	B22	53,3
23	A23	26,7	B23	46,7
24	A24	40,0	B24	26,7
25	A25	26,7	B25	40,0
26	A26	60,0	B26	46,7
27	-	-	B27	46,7

Statistical results of the mathematical understanding ability scores for both classes are presented following table:

Table 4. Statistical Data on Pre-test Score

Description	Experimental Class	Control Class
Amount of Students	26	27
Highest Score	66,7	66,7
Lowest Score	20,0	20,0
Total Score	1113,3	1180,0
Average	42,8	43,7

Based on the statistical table above, it shows that the pre-test scores for both classes has the lowest and highest values of 20.0 and 66.7. In the experimental class it was obtained The average score was 45.4 with a total of 26 students, while in the control class with the number of students was 27 people, the average score was 43.7. The difference in the average pre-test scores between the tw is 0.9 which indicates that the initial abilities possessed by students are not much different or can be called the same. To prove that the initial abilities of students in both classes are the same Hypothesis testing is carried out using the t-test through prerequisite tests in the form of normality tests and t-tests homogeneity, here is the explanation:

1) Normality Test

the normality test is used to find out whether the data comes from the same population normally distributed or not. The normality test used uses the KolmogorovSmirnov with the help of SPSS version 23. Data is said to be normal if the test value is significant Kolmogorov-Smirnov ≥ 0.05 . The following are the results of the pret-test data normality test for the experimental class and control:

Table 5. Pre-test Data Normality Test Result

	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Hasil	.119	53	.061	.943	53	.014

a. Lilliefors Significance Correction

Based on table 4.5, the Kolmogorov Smirnov column shows the significance value the pre-test data for the experimental and control classes was 0.061, indicating a significance value of ≥ 0.05 . So it can be concluded that the pre-test data is normally distributed.

2) Homogeneity Test

The homogeneity test was carried out to find out whether the data for the two classes came from population with the same variance or not. Homogeneity testing in this research using the Levene test assisted by the SPSS version 23 application. Data is said to be homogeneous if it is homogeneous homogeneous test significance > 0.05 . The following are the results of the homogeneity test of the experimental class pre-test da and control speed:

Table 6. Pre-test Data Homogeneity Test Result

Test of Homogeneity of Variance	
----------------------------------------	--

		Levene Statistic	df1	df2	Sig.
Hasil	Based on Mean	3.387	1	51	.072
	Based on Median	2.768	1	51	.102
	Based on Median and with adjusted df	2.768	1	50.999	.102
	Based on trimmed mean	3.367	1	51	.072

The table above shows a significance value of 0.821. This matter shows that the significance value obtained is more than 0.05, then H0 is accepted and H 1 rejected. Thus, we can conclude that there is no significant difference between the pre-test scores of the experimental class and the control class, it could be said to be ability the mathematical understanding of students in both classes is the same. So the type of cooperative learning model STAD with the ARIAS approach can be applied in experimental and methods classes conventionally applied to the control class

3) T-test

In the t-test the researcher used two hypotheses, namely:

H0 : $\mu_1 = \mu_2$: There is no difference in the average value between the control class and the experimental class

H1 : $\mu_1 \neq \mu_2$: There is a difference in the average value between the control class and the experimental class.

T-test decision making criteria, namely if the significance value (2-tailed) > 0.05 then H 0 accepted and H1 rejected. The following are the test results on the pre-test data for both classes:

Table 7. T-test Result Pre-test Data

		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	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Hasil	Equal variances assumed	3.387	.072	.227	51	.821	.8880	3.9156	-6.9729	8.7490

The table above shows a significance value of 0.821. This matter shows that the significance value obtained is more than 0.05, then H0 is accepted and H 1 rejected. Thus, we can conclude that there is no significant difference between the pre-test scores of the experimental class and the control class, it could be said to be ability the mathematical understanding of students in both classes is the same. So the type of cooperative learning

model STAD with the ARIAS approach can be applied in experimental and methods classes conventionally applied to the control class.

b. Post-test Data Analysis for Experimental Class and Control Class

Post-test data was obtained after applying the learning model to the experimental class and control class. This data is used to measure students' final abilities regarding the subject mathematical understanding ability after being given different treatment. As for postThe test is presented in the table as follows:

Table 8. Data Nilai Post-test

No.	Class Code Experiment	Post-test Score	Class Code Control	Post-test Score
1	A1	66,7	B1	66,7
2	A2	66,7	B2	53,3
3	A3	93,3	B3	60,0
4	A4	86,7	B4	46,7
5	A5	60,0	B5	53,3
6	A6	73,3	B6	53,3
7	A7	93,3	B7	73,3
8	A8	86,7	B8	73,3
9	A9	73,3	B9	46,7
10	A10	60,0	B10	86,7
11	A11	86,7	B11	46,7
12	A12	80,0	B12	73,3
13	A13	86,7	B13	80,0
14	A14	60,0	B14	60,0
15	A15	86,7	B15	80,0
16	A16	73,3	B16	60,0
17	A17	80,0	B17	53,3
18	A18	93,3	B18	66,7
19	A19	60,0	B19	53,3
20	A20	73,3	B20	46,7
21	A21	60,0	B21	86,7
22	A22	66,7	B22	80,0
23	A23	80,0	B23	66,7
24	A24	66,7	B24	46,7
25	A25	66,7	B25	53,3
26	A26	86,7	B26	66,7
27	-	-	B27	46,7

Statistical results of mathematical understanding ability scores for experimental classes and classes The control class on the post-test questions is presented in the following table:

Table 9. Statistical Data on Post-test Value

Criteria	Experiment Class	Control Class
Amount of Students	26	27
Highest Score	93,3	86,7
Lowest Score	60,0	46,7
Total Score	1966,7	1680,0
Average	75,6	62,2

The table above shows that there are differences in post-test scores in the classes sample. The experimental class had the highest and lowest scores of 93.3 and 60.0 respectively The

average score obtained from 26 students was 75.6. Meanwhile, the control class has value The highest and lowest were 86.7 and 46.7 with an average value of 62.2 obtained of 27 students. The difference in average scores between classes is 13.4 which indicates ability Mathematical understanding in students after being given treatment in the learning process different. This will be proven through prerequisite tests and t-tests as follows:

1) Normality Test

The normality test is used to test whether the experimental class and post-test data the control class is normally distributed or not. This research uses the KolmogorovSmirnov with the help of SPSS 23. Following are the results of the post-test data normality test:

Tabel 10. Post-test Data Normality Test

Test of Normality					
Kolmogorov-Smirnov ^a			Shapiro-Wilk		
Statistic	Df	Sig.	Statistic	df	Sig.
.112	53	.096	.941	53	.012

The Kolmogorov Smirnov table above shows that the significance value of the postthe experimental and control class test was 0.096 which indicates ≥ 0.05 . So that it can it was concluded that the post-test data was normally distributed.

2) Homogeneity Test

The homogeneity test is used to determine whether the post-test data for the two classes are original from a population with the same variance or not. Homogeneity testing uses a test levene with the help of the SPSS version 23 application. The following are the results of the second post-test data homogeneity t class:

Table 11. Post-test Data Homogeneity test

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Hasil	Based on Mean	.547	1	51	.463
	Based on Median	.374	1	51	.544
	Based on Median and with adjusted df	.374	1	49.631	.544
	Based on trimmed mean	.492	1	51	.486

Based on the results of the Levene test in the table above, it shows the significance calculation amounting to $0.463 > 0.05$, it can be concluded that the results of the experimental class post-test data and control is homogeneous.

3) T-test

In the t-test the researcher uses two hypotheses, namely: $H_0 : \mu_1 = \mu_2$: There is no difference in the average value between the control class and the experimental class $H_1 : \mu_1 \neq \mu_2$: There is a difference in the average value between the control class and the experimental class. T-test decision making criteria, namely if the significance value (2-tailed) > 0.05 then H_0 accepted and H_1 rejected. The following are the test results on the pre-test data for both classes:

Tabel 12. T-test Result Post-test Data

		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	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Result	Equal variances assumed	.547	.463	3.923	51	.000	13.4202	3.4207	20.2875	6.5530

In the table above, it shows the acquisition of a significance value of 0.000. This matter shows that the significance value obtained is less than 0.05 then H₁ accepted and H₀ rejected. Thus, we can conclude that there are significant differences between post-test scores for the experimental class and control class, can be said to be comprehension ability the mathematics of students in both classes is different. So it can be said that the learning model STAD type cooperative with the ARIAS approach has an effect on improvement mathematical understanding ability of class VIII students. In this research, the STAD type cooperative learning model with the approach ARIAS has an effect on increasing mathematical understanding abilities. So that its application can be one way for teachers to improve their abilities students' mathematical understanding. This is supported by research conducted by Achmad Syahroni in 2018 with the title "Improving Student Activities and Learning Outcomes by using the ARIAS learning model with a jigsaw type cooperative model setting in Class XII IPS-3 MAN 2 Hulu Sungai Selatan. The results of this research are: increase in cognitive learning outcomes from an average learning outcome score of 60.06 by category low in cycle I to 83.68 in cycle II (Syahroni, 2018). In other research that conducted by Sari Fauziyah Simatupang and friends entitled "The Influence of Models Learning Assurance, Relevance, Interest, Assessment, Satisfaction and Model Co-op-Co-op Type Cooperative Learning on Concept Understanding and Ability Students' Mathematical Problem Solving Ability in Class XI MA Student Matrix Material Al-Wasliyah 12 Perbaungan Q.A 2020/2021". This research shows that there is an influence ARIAS and Co-op-Co-op learning models on the ability to understand concepts and problem solving with f count (4.525) > f table (3.23) (Simatupang et al., 2022). Then research by SAM Hetina, N. Parwati, I WP Astawa in 2018 entitled "Improving Learning Activities and Understanding of Mathematics Concepts for Middle School Students through the Application of Models ARIAS Learning". The results of this research indicate that the application of the model ARIAS learning increases learning activities and understanding of mathematical concepts Class IV students at SD N 2 Campang Raya Bandar Lampung TP. 2016/2017" (Hertina et al., 2018).

D. Conclusion

Application of the STAD type cooperative learning model with the ARIAS approach conducted by researchers on class VIII students at MTs Ma'arif Nu 1 Sokaraja was carried out

very well Good. This is proven by the average value obtained from observations by two people observers during 2 meetings was 3.68 which indicates the application of learning it's been done very well. Application of the STAD type cooperative learning model The ARIAS approach has an effect on increasing understanding abilities mathematics class VIII students at MTs Ma'arif NU 1 Sokaraja. This can be seen from the results of data analysis post-test using the t-test with an independent sample test of $0.000 < 0.05$, meaning H_0 rejected and H_1 accepted. H_1 accepted indicates there is a difference in understanding ability students' mathematics between experimental classes and control classes. These differences can also be seen in the statistical data of the average value of the experimental class and control class. Class average score experiment, namely 75.6, higher than the control class mean value, namely 62.2, with a difference significant of 13.4.

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Development of Android-Based Learning Media to Improve Students' Mathematical Communication Skills in Social Arithmetic

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Abstract: Mathematical communication skills refer to students' ability to convey mathematical ideas, either orally or in writing, as well as their ability to understand and interpret the mathematical ideas of others. At MTs Negeri 2 Purbalingga, students exhibit a low level of mathematical communication skills due to the continued reliance on conventional learning media, which do not actively engage students. The selection of appropriate and innovative learning media plays a critical role in addressing this issue. As advancements in science and technology progress rapidly, it is essential to integrate technology into learning media to enhance student engagement and learning outcomes. Therefore, the objective of this research is to develop valid and effective Android-based interactive learning media to improve the mathematical communication skills of seventh-grade students in social arithmetic at MTs Negeri 2 Purbalingga. This study employs the Research and Development (R&D) method to achieve this goal. The findings indicate that the developed Android-based learning media are valid and suitable for use. Validation results show high percentages from various assessments: material experts (91.66%), media experts (93.3%), teacher assessment (92.5%), small group test assessment (88.81%), and field tests assessment (92.68%). Furthermore, the Android-based learning media developed is effective in improving students' mathematical communication skills. The t-test results show a significance value of 0.000, which is less than the threshold of 0.05, indicating that the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted. In conclusion, the Android-based learning media developed in this study are both valid and effective in enhancing students' mathematical communication skills, making them a valuable tool for teaching social arithmetic.

Keywords: android; learning media; mathematical communication skills

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A. Introduction

The development of increasingly advanced times has resulted in almost all aspects also changing. One of the changes that we can feel is the increasingly rapid development of technology and has become an important thing in human life. It is said to be important because the influence of this technology is very large, many human activities depend on technology. Both in the economic, social, mass media, telecommunications, and even education fields cannot be separated from the influence of technology.

Education is one of the things that is mandatory or the main need that a person must have. The better the education, the better the quality of life will be. The quality of the nation's life

depends on education, as stated in the preamble to the 1945 Constitution. It is stated that one of the goals of the Indonesian State is to make the nation's life intelligent. In accordance with this goal, efforts to improve the quality of education must be given serious attention so that human resources can be greatly increased. Education today must be adapted to developments in the 21st century so that students' competence increases, so they can face competition and global challenges (Pratiwi, 2019).

Mathematics is a scientific study which includes patterns of structure, change and space. In essence, mathematics is a deductive science, structured about patterns and relationships, a language of symbols, and the queen and service of knowledge (Amelia Rosmala, 2021). Mathematics as a deductive science means that mathematics requires proof of truth. Mathematics as a structured science means that mathematical concepts are arranged hierarchically and start from undefined elements, defined elements, axioms and theorems.

Mathematics as a language of symbols means that mathematics is written using symbols that are valid, comprehensive and have a solid meaning. The process of searching for truth in mathematics is also long and requires proof with theorems, properties and postulates after proof. This long process and requires seriousness is the reason why many students experience difficulties in learning mathematics. Many students think that mathematics is a difficult subject, even calling it a horror subject. Mathematics is the basic science for studying other sciences, therefore it is very important for teachers to ensure that the learning process that occurs in the classroom can be successful as expected.

To make this happen, all efforts are made so that students' abilities during the learning process can increase. One of the abilities that students must have in learning mathematics is mathematical communication skills. Communication is a way to convey a message from the messenger to the recipient of the message to inform them either directly or through the media (Nur Zaharah, 2021).

Mathematical communication is the ability to convey mathematical ideas or thoughts, both orally and in writing, as well as the ability to understand and accept other people's mathematical ideas carefully, well and appreciatively in order to increase understanding of mathematical concepts (Hafiziani Eka Putri 2020). There are two reasons for the importance of mathematical communication that students must have and develop. First, mathematics is language, meaning that mathematics is not only a thinking tool, a tool for creating models, or solving problems, but mathematics can be used as a tool or medium to communicate ideas or thoughts clearly, accurately and comprehensively. The second reason is mathematics learning as social activity, what is meant by this is as a social activity in mathematics learning and also as a tool for interaction and communication between teachers and students (Rianti Rahmalia, 2020).

Students' mathematical communication skills really need to be developed, because mathematical communication can be used to increase students' understanding of the benefits of mathematics itself (Hafiziani Eka Putri, 2020). The aim of mathematical communication is so that students have the ability to communicate a situation or problem by conveying ideas in the form of symbols, tables, diagrams, or other media so that they can communicate events around them into mathematical symbols (Nur Zaharah, 2021). Students must master

mathematical communication skills (Ismayanti, 2021). Students' mathematical communication skills really need to be developed, because mathematical communication can be used to increase students' understanding of the benefits of mathematics itself (Hafiziani Eka Putri, 2020).

In mathematical communication, students have the opportunity, encouragement, and support to speak, write, read, and listen to mathematical equations. Mathematics can be communicated mathematically because it is often taught through symbolic, written and oral communication (Hestu, 2021). Mathematical communication skills are one of the causes of students' psychological development and effectiveness as well as influencing mathematics learning outcomes (Rianti Rahmalia, dkk, 2020). Teachers really try to ensure that students' communication skills are good and improve, because mathematical communication skills are a requirement for solving a problem and can develop their abilities by selecting ideas and then explaining them (Rindu Riyanti, 2021).

Studying mathematical concepts through 3 stages, namely enactive, iconic, and symbolic. The purpose of the enactive stage is the stage of learning by manipulation, the iconic stage is the stage of learning using pictures, and the symbolic stage is the stage of learning mathematics through symbols or symbols. Every mathematical concept can be presented correctly if the learning media used is also appropriate (Sufri Mashuri, 2019). Thus, mathematics learning media has a very big role in conveying mathematics material to students.

The learning process is said to be good if there is an activity or communication between the teacher and the students (Putri, 2020). Apart from that, one influential aspect is the use of learning media. There are five components in the definition of learning media, namely as an intermediary for providing material in the learning process, as a learning resource, as a means of helping students to stimulate learning, as an effective tool, and as a tool for acquiring and improving students' abilities siswa (Muhammad Hasan, 2021). If these five components can be implemented well, they will have an impact on achieving successful learning in accordance with the desired goals.

There are many types of media that teachers can use in the teaching and learning process, but teachers must be selective in choosing the media they will use. In this digital era, teachers must be more innovative in using media so that students do not get bored and lazy in learning. Technology that is integrated into the learning process is one way to achieve learning goals, because technology is no longer considered something (Muhammad, 2021). The use of technology can also create meaningful learning and increase student enthusiasm through various activities. Good learning media can not only increase students' motivation and desire to learn independently, but can also play a role in overcoming learning boredom (Rohmah, 2021).

Alternatives in developing learning media that are easy to use, interesting, informative and interactive so that students' interest in the mathematics learning process can increase. One way is by utilizing advanced technology in the form of smartphones. The one that is most in demand is Android. The Android operating system with various types of application development is able to create visualization learning media. Android-based learning does not

allow students to be monotonous with text alone, teachers can create audio, visual and even animation elements to help students understand learning material (Husein Hamdan, 2020).

Media in the learning process can be in the form of software and hardware which are a small part of technological development. One use of learning media is using an Android device (Ketut Sepdyana Kartini, 2020). Apart from being used as a communication tool, Android can be used as a tool in the teaching and learning process, namely in the form of interactive learning media.

Meanwhile, interactive learning is defined as a teaching method that actively involves students in the learning process. This interactive learning media must have features that allow users to be actively involved in interacting both directly and through the development media. Teachers act as facilitators so they are required to develop their creativity and innovation in creating learning media (Tedi Setiadi, 2022).. An example of learning media innovation is by utilizing technological developments, one of which is Android devices.

Based on preliminary observations that were carried out at MTs Negeri 2 Purbalingga by conducting interviews with one of the class VII mathematics teachers at MTs Negeri 2 Purbalingga, namely Mr. Arifin, S.Pd., the results showed that students still lacked mastery regarding mathematical communication skills. One of the materials is social arithmetic. This is characterized by students' low ability to solve problems related to mathematical communication skills, especially if the questions given are in the form of story problems. Students have difficulty in working on social arithmetic problems because usually the problems are presented in the form of story problems and students find it difficult to understand the meaning and translate the questions into mathematical form, students' skills in translating into mathematical sentences are still low, and there are also those who make mistakes in perform the arithmetic operation. The learning method applied by Mr. Arifin is using lecture and discussion methods. The drawback of this method was stated by Mr. Arifin that students would quickly feel bored and less interested in the material being presented. Teachers have also used various methods to improve students' abilities. However, the limitations of learning media are also one of the obstacles for teachers in delivering material.

One of the efforts that can be made is to improve the learning process that occurs in the classroom by using appropriate learning media. Through innovation in the form of Android-based interactive learning media, it can be an effort to improve students' mathematical communication skills in learning material regarding social arithmetic so that student learning achievement increases and the learning process can be said to be successful. This interactive learning media is the development of a learning media in the form of an Android application that can be used without an internet network and is packaged in an attractive form with a combination of animation, text and audio which is interactive because it has feedback. This Android-based interactive learning media contains daily activities related to mathematics, namely social arithmetic.

Previous research was conducted by Dina Rahmawati with the title "Development of Interactive Learning Media Based on Islamic Context to Improve Mathematical Communication Skills in Class VII SPLDV Material". The results showed that the development of interactive learning media was valid and effective for improving students'

mathematical communication skills siswa (Dina Rahmawati, 2021). Second, research conducted by Laili Nur Faizah with the title "Development of Android-Based Interactive Learning Media for Mathematics Subjects in Class X Science MAN 1 Cilacap" (Laili Nur Faizah, 2021).. This research also states that the development of Android-based interactive learning media is valid for mathematics subjects.

The third research was conducted by Lovieanta Arriza with the title "Development of Interactive Multimedia Based Mathematics Learning Media Using Adobe Flash on Circle Material for Class VIII of An-Nur Prima Islamic Private Middle School". This research states that the development of interactive multimedia-based mathematics learning media is practical and effective in mathematics learning (Lovienta Arriza, 2020). Lastly, there is research conducted by Unggul Pradana with the title "Development of Educational Game Learning Media Using a Contextual Approach to Improve Students' Mathematical Understanding Ability in Class VIII Statistics Material". This research aims to develop educational game learning media with a contextual approach to improve class VIII students' mathematical understanding abilities in statistics material. In this research, the results showed that educational games were valid and effective in improving students' mathematical solving abilities siswa (Unggul Pradana, 2022).

Based on these problems, the aim of this research is to develop valid and effective Android-based interactive learning media to improve students' mathematical communication skills in class VII social arithmetic material at MTs Negeri 2 Purbalingga.

B. Methods

1. Types of Research

Researchers use the Research and Development (R&D) type of research, namely research by producing products and testing the effectiveness of these products. R&D research is a process used to develop and validate products (Muhammad Shaleh Assingkily, 2021). The learning media created is an Android application. When developing learning media, you need to pay attention to the development model. What is used in this research is the ADDIE development model. The ADDIE development model has 5 stages, namely Analysis, Design, Development, Implementation, and Evaluations (Cecep Kustandi, 2020).

The analysis stage is carried out to find out problems and solutions in the learning (Rayanto, 2020). The design stage is where the researcher designs the design for the learning media that will be developed. The development stage in the ADDIE model includes activities to realize the product design that has been created, the aim is to produce and validate the media being developed (Cecep Kustandi, 2020). The implementation stage means that the product that has been created must be tested first so that it can be said to be valid and its usefulness can be proven (Rayanto, 2020). The evaluation stage is the final stage. After carrying out the previous four stages, the next step is to provide an evaluation using both formative evaluation and surmative evaluation.

2. Data Selection

a. Population

The population is all the objects or subjects in the research. In this research, the population is class VII students at MTs Negeri 2 Purbalingga. Researchers took a population from 8 classes of class VII students, totaling 276 students.

b. Sampling

The sample used in this research used a purposive sampling technique. What is meant by purposive sampling is a sampling technique which is chosen deliberately so that it can provide information in the form of data with certain considerations (Bagus Sumargo, 2020). The samples in this research were class VII A with 34 students as the control class and class VII D with 34 students as the experimental class.

3. Data Collection Techniques

In this research we collected data using questionnaires and test questions. A questionnaire is a data collection technique where respondents are asked a series of questions. Responses from respondents received in this questionnaire can be collected and used as research data (Rifka Agustianti et al., 2022). Meanwhile, tests are data collection techniques by giving questions to research subjects (Agustianti et al, 2022). The test was carried out in two stages, namely pre-test and post-test. The pre-test is given before testing learning media development products, while the post-test is given after testing learning media development products.

Apart from collecting data for hypothesis testing, there are instrument tests, namely validity and reliability tests. The validity test stage consists of two parts, namely content validity test and item validity test. The content validity test consists of 4 stages, namely media expert validation test, material expert validation test, mathematics teacher trial, and small group trial. Whether it is said to be valid or not depends on the average of the assessment results from material experts, media experts, teacher assessments, and small group trials. The criteria for an instrument to be valid are that the expert has accepted the instrument without any further improvements.

Item validity is carried out to determine the number of valid and invalid instrument items. To measure whether an instrument is valid or not, researchers need to test its validity first. Validity is a measurement standard that shows the accuracy or validity of an instrument. The formula for testing the validity of test items is using *product moment correlation* (Sri Wahyuning, 2021).

Meanwhile, the reliability test is a test to determine the extent to which the measurements of an instrument remain consistent even though it has been tested many times on the same subjects and conditions. Reliability testing is used to measure the consistency of research instruments and see whether the instrument can provide the same or relatively the same score

each time it is used. The formula used to calculate the reliability of an instrument is the *Alpha Cronbach* formula (Wahyuning, 2021).

4. Data Analysis Techniques

After all the data has been collected, the data is then analyzed to provide a hypothesis whether the model under study has met the expected hypothesis or not. There are two stages carried out, namely the analysis prerequisite tests including the normality test and homogeneity test, while the hypothesis test includes the t-test.

a. Prerequisite Test

The data analysis prerequisite test aims to find out whether the data can continue hypothesis testing or not.

1) Normality Test

The normality test is used to find out whether the data is normally distributed or not, in other words whether the sample used in the research can represent the entire population (Wayan Widana, 2020). The method used by researchers is Kolmogorov Smirnov with the assumption that the data will be normally distributed (H1 is rejected and H0 is accepted) if the normality value obtained is greater than the significance level (0.05).

2) Homogeneity Test

The homogeneity test is a prerequisite test that must be proven whether two or more groups of sample data come from a population with the same variance or not. It can also be interpreted that the homogeneity test is a test carried out to find out whether the data variance from the sample is homogeneous or not (Widana dan Muliani, 2020). In testing the data, researchers used the SPSS version 22 application with a significance limit of 0.05. Data will be homogeneous if the data processing results are above the 0.05 level.

3) Hypothesis Test

This research will use the t test with independent samples. It is said to be independent because the data from one two groups does not depend on the data from the second group. The t-test was carried out to determine the effect of Android-based interactive learning media whether it was effective in improving students' mathematical communication skills or not. This test was carried out by comparing the results of the average value of the experimental class and the control class. The t-test decision is made by comparing the calculated sig and the α value of 5% or 0.05. If the value (sig) $<$ 0.05 then H0 is rejected and H1 is accepted.

C. Results and Discussion

1. Desain Experimental

In this research, the experimental class, namely class VII D, totaling 34 students, was treated with the use of Android-based interactive learning media that had been developed.

Meanwhile, the control class was class VII A, which consisted of 34 students and was not treated with Android-based interactive learning media. The application of Android-based interactive learning media is measured using the results of test questions, namely pre-test and post-test. Data collection was carried out in 6 meetings with the aim of measuring the use of Android-based interactive learning media in learning in the experimental class and learning without media in the control class.

2. Data Collection and Analysis

The pre-test data on students' mathematical communication abilities consists of 8 questions which are adjusted to indicators of mathematical communication abilities. Pre-test questions were given to class VII A as the control class and class VII D as the experimental class. The following are the results of the pre-test scores for both classes.

Table 1. Pre-test results for control and experimental classes

No.	Information	Pre-test	
		Eksperimen	Kontrol
1.	Highest score	66	62
2.	Lowest score	24	25
3.	The number of students	34	34
4.	Average	41,06	41,41

Based on the table above, it can be seen that the pre-test scores for the experimental class and the pre-test for the control class before being given different treatment regarding the use of learning media. In the experimental class, the highest score was 66, the lowest score was 24, and the average was 41.06. Meanwhile, the highest score for the control class was 62, the lowest score was 25, and the average was 41.41. Based on these results, it can be concluded that the experimental class and control class have average results that are not much different so that the experimental class and control class do not have significant differences.

After knowing the initial capabilities of the control class and experimental class, the next step is implementing learning by applying Android-based interactive learning media in the experimental class and conventional learning in the control class. Then, to see the results of the influence of learning, post-test questions were given. The following are the results of the post-test scores for the two classes.

Table 2. Post-test results for control and experimental classes

No.	Information	Pre-test	
		Eksperimen	Kontrol
1.	Highest score	97	75
2.	Lowest score	65	50
3.	The number of students	33	34
4.	Average	82,79	63,03

Based on the table above, it can be seen that the post-test scores for the experimental class and the post-test for the control class after being given different treatment regarding the use of learning media. In the experimental class, the highest score was 97, the lowest score was 65, and the average was 82.79. Meanwhile, the highest score for the control class was 75, the lowest score was 50, and the average was 63.03.

3. Data Analysis Technique

a. Prerequisite Test

1) Normality Test

The normality test is used to determine whether the data is normally distributed or not, in other words whether the sample used in the research can represent the entire population. The method used by researchers is Kolmogorov Smirnov using the SPSS Version 22 application as follows.

Table 3. Normality test results

		Tests of Normality					
		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Class	Statistic	df	Sig.	Statistic	df	Sig.
result	Pretesteksperimen	,141	34	,086	,949	34	,112
	Posttesteksperimen	,145	34	,068	,941	34	,066
	Pretestkontrol	,148	34	,058	,951	34	,135
	Posttestkontrol	,150	34	,051	,935	34	,044
a. Lilliefors Significance Correction							

Based on the test results above, the significant value of the Kolmogorov Smirnov test in the control class pre-test was 0.058 and the experimental class was 0.86. Meanwhile, the post-test value for the control class was 0.51 and the experimental class was 0.68. So the significant values of the two classes are above the 0.05 significance level. Therefore, H1 is rejected and H0 is accepted, with the conclusion that the data from both sample classes are in a normal distribution.

2) Homogeneity Test

The homogeneity test is a prerequisite test that must be proven whether two or more groups of sample data come from a population with the same variance or not. In testing the data, researchers used the SPSS version 22 application as follows:

Table 4. Homogeneity test results

		Test of Homogeneity of Variance			
		Levene Statistic	df1	df2	Sig.
Results	Based on Mean	,077	1	66	,782
	Based on Median	,083	1	66	,774
	Based on Median and with adjusted df	,083	1	65,677	,774
	Based on trimmed mean	,092	1	66	,763

From the table above, it shows that the significant value is 0.782, which is > 0.05 , so H1 is rejected and H0 is accepted. So, the data from the pre-test scores meets the assumption of homogeneity. This means that the two classes were homogeneous (same) in terms of students' mathematical communication abilities before learning was carried out.

b. Hypothesis Test

After carrying out the validation test, the next step is the t-test to answer the second problem formulation, namely how effective the development of Android-based interactive learning media is on mathematical communication skills in class VII social arithmetic material

at MTs Negeri 2 Purbalingga. The t-test was carried out using the SPSS version 22 program and based on these results the following results were obtained.

Table 5. T-test results

		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	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
H	Equal variances assumed	2,049	,157	9,914	66	,000	18,912	1,908	15,103	22,721
	Equal variances not assumed			9,914	64,339	,000	18,912	1,908	15,101	22,722

Based on the test results listed in the significance section (2-tailed), namely 0.000, where $0.000 < 0.05$, then H_0 is rejected and H_1 is accepted, which means that Android-based interactive learning media is effective in improving students' mathematical communication skills in social arithmetic material at MTs Negeri 2 Purbalingga.

4. Discussion

The expert validation test was used to answer the first problem formulation, namely how valid the development of Android-based interactive learning media is on mathematical communication skills in class VII social arithmetic material at MTs Negeri 2 Purbalingga. Whether it is said to be valid or not depends on the average of the assessment results from material experts, media experts, teacher assessments, and small group trials.

Android-based interactive learning media is valid based on the results of material expert validation which got a percentage of 91.66% with a very valid category, media expert validation which got a percentage of 93.3% with a very valid category, and mathematics teacher validation got a percentage of 92.5% with very valid category. This is also supported by the results of the product attractiveness questionnaire that Android-based learning media is very interesting to use in learning mathematics, social arithmetic material with an average percentage of 92,68%, which is in the very interesting category. Based on the four discussions above, it can be concluded that Android-based interactive learning media is valid for improving students' mathematical communication skills in class VII social arithmetic material at MTs Negeri 2 Purbalingga.

After carrying out the validation test, the next step is the t-test to answer the second problem formulation, namely how effective the development of Android-based interactive learning media is on mathematical communication skills in class VII social arithmetic material at MTs Negeri 2 Purbalingga. Based on the test results listed in the significance section (2-tailed), namely 0.000, where $0.000 < 0.05$, then H_0 is rejected and H_1 is accepted, which means that Android-based interactive learning media is effective in improving students' mathematical communication skills in social arithmetic material at MTs Negeri 2 Purbalingga.

D. Conclusion

Android based interactive learning media is valid based on the results of material expert validation which got a percentage of 91.66% with a very valid category, media expert validation which got a percentage of 93.3% with a very valid category, and mathematics teacher validation got a percentage of 92.5% with very valid category. This is also supported by the results of the product attractiveness questionnaire that Android-based learning media is very interesting to use in learning mathematics, social arithmetic material with an average percentage of 92,68%, which is in the very interesting category. Based on the four discussions above, it can be concluded that Android-based interactive learning media is valid for improving students' mathematical communication skills in class VII social arithmetic material at MTs Negeri 2 Purbalingga.

Android based interactive learning media is effective in improving students' mathematical communication skills. Based on calculations using SPSS Version 22, the test results listed in the significance section (2-tailed) are 0.000, where $0.000 < 0.05$ then H_0 is rejected and H_1 is accepted. So it can be concluded that learning using Android-based learning media is effective in improving students' mathematical communication skills in class VII social arithmetic material at MTs Negeri 2 Purbalingga.

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Analysis of Mathematical Concept Understanding Based on Students' Learning Interest in Solving Algebraic Problems

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Abstract: This research aims to analyze the influence of the level of learning interest on the mathematical concepts understanding among seventh-grade students at As-Subkiyah Junior High School in Kota Bekasi, specifically when solving algebraic problems. Understanding mathematical concepts serves as a critical foundation for effective mathematics learning; however, many students face challenges in grasping these concepts. The study employs a descriptive qualitative research method. Data were collected using learning interest questionnaires and tests designed to assess students' comprehension of mathematical concepts. The research subjects consisted of seventh-grade students at As-Subkiyah Junior High School in Kota Bekasi. The results show that students' comprehension of mathematical concepts is significantly influenced by their level of learning interest. Students with high learning interest demonstrate excellent comprehension and mastery of all tested indicators. Students with moderate learning interest exhibit sufficient comprehension, although they master only some of the tested indicators. Meanwhile, students with low learning interest struggle to understand mathematical concepts and are only able to master a small portion of the tested indicators. The study also identified common errors in understanding, such as misconceptions about variables, terms, coefficients, and constants in algebraic expressions.

Keywords: algebra; mathematical concept comprehension; student learning interest

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A. Introduction

Science and technology have evolved significantly year by year, with the field of education being the most prominent. All forms of learning processes can be carried out easily. One of the things that can be done in the learning process is through education. According to Law of the Republic of Indonesia No. 20 of 2003 Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and state. education is a learning process that has the aim of improving personal quality (Mutmainah & Nuha, 2023). Education deals with the learning process carried out by each person with the aim of changing and shaping personalities that are in accordance with positive values in society and culture. To achieve effective educational facilities that are able to convey knowledge, a learning process is needed. Student self-motivation and teacher support are important components in fulfilling students' learning needs to achieve learning goals (Bureau et al., 2022).

Learning is a process of interacting with each other, where instruction is given by an educator or teacher, and the receipt of information and understanding occurs in students (Suardi, 2018). The role of teachers in applying educational principles and learning theories is a major factor in achieving educational success. Learning can be interpreted as communication and interaction between teachers and learners, sometimes with the help of various learning resources or media. Therefore, learning is defined as a communication process that facilitates relationships between teachers and learners with other learners, involving learning experiences. One of the subjects that must be studied is mathematics.

Mathematics is a way to find answers to problems faced by humans, namely a way of using information, knowledge of shape and size, knowledge of counting (Khasanah & Setiaji, 2023). Mathematics is one of the subjects that can change the way of human thinking, especially in the modern era based on information and communication technology. To keep up with the development of science and technology, understanding mathematics is very important because mathematics serves to develop the ability to calculate, measure, and apply mathematical formulas in everyday life. In the school environment there are several lessons provided, one of which is mathematics learning.

Mathematics learning can be interpreted as the process of gaining new knowledge and experience about mathematics through a series of planned and structured activities (Ulva, M, & Rizki, A, 2020). The purpose of developing students' thinking in mathematics learning is to form logical thinking skills, so that students are not only proficient in calculations, but also able to use reason and logic. It is important to remember that mathematics is an abstract and unreal concept because it consists of numbers and symbols. Because each learner has a different thinking pattern, therefore, it is necessary to analyze the comprehension ability of learners by understanding the objectives of learning mathematics first.

In accordance with the objectives of mathematics learning according to Permendiknas No. 58 of 2014 it is explained that mathematics has the aim of developing students' ability to understand mathematical concepts, connect these concepts, and apply them efficiently and appropriately in solving problems. The ability to understand this concept is included in cognitive aspects, especially in the context of mathematics subjects and is often referred to as the ability to understand mathematical concepts. In the process of learning mathematics, understanding concepts is an important key in learning, especially in mathematics.

Understanding mathematical concepts is very important for students to learn mathematics in the process of learning and solving problems, both in the learning process itself and in real life (Hidayana, 2022). Heris, et al emphasized that this ability is important in learning mathematics to obtain meaningful knowledge (Heris, et al., 2017). According to Ela Suryani, concept understanding is a person's ability to understand or understand a concept after it is known or remembered (Suryani, 2019). In the context of learning mathematics, students need to have a strong understanding of these concepts, because these concepts become the foundation for higher-order thinking skills. Lessons are not only given to be memorized, but also to ensure students understand the concepts of the material taught (Maulana, 2019).

The ability to understand students' mathematical concepts can be seen through various signs or clues. According to the National Education Standards Agency (BSNP), it mentions

indicators that show the ability to understand mathematical concepts, namely: Restating concepts that have been studied, Classifying objects according to certain properties (according to their concepts), Giving examples and not examples, Presenting concepts in various forms of mathematical representation, Developing necessary or sufficient conditions of a concept, Using, selecting, utilizing certain procedures or operations, and Apply problem-solving concepts or algorithms (BSNP, 2006).

One of the main goals in mathematics education is to ensure that students have a solid understanding of mathematical concepts. Therefore, the achievement of mathematics learning objectives is a shared responsibility of teachers and students. But in practice, mathematics learning often focuses on a theoretical approach, with the provision of problems and example exercises that encourage students to record every concept of mathematics presented, without really understanding the concept. One of the factors that affect student achievement is interest in learning.

Interest is not something that is inherent in a person, but is something that can be developed and influenced over time. Therefore, it is possible to understand and influence one's interest in something. Building an interest in a particular subject can encourage more learning. Interest can be a trigger for motivation when someone is in a state of freedom to choose, the midat can encourage them to teach what they want (Zebua, 2021). Some experts, among whom have put forward their views on interest, such as being seen actively and feeling interested in a particular activity are vivid examples of interest, while an individual's determination to fully focus on learning is also an important aspect of interest.

Learning interest is the psychological aspect of a person through symptoms such as arousal, desire and feeling like to change behavior through activities such as seeking knowledge and experience (Sirait, 2016). In other words, interest in learning is a person's attention, liking and interest in learning which is reflected in their enthusiasm, participants and activeness in the learning process. This results in individuals who have an interest in learning tend to be highly motivated, which in turn leads to deep concentration of the learning material, thus facilitating deep understanding. Students who are interested in learning can be seen as follows: 1) a sense of liking or pleasure in learning activities, 2) a sense of interest in learning, 3) awareness to learn without being asked, 4) participating in learning activities, 5) paying great attention to learning (Septiani et al., 2020).

It can be concluded that a person's interest in learning manifests when they begin to change their behavior, turn their attention to certain things, and continuously develop the skills and talents they learn. In addition, they are also able to face challenges without external encouragement or outside pressure. The indicators of interest in learning include, feelings of pleasure in learning, student linkage in learning, student involvement during learning, diligent in studying and diligently doing mathematical tasks, diligent and disciplined in studying and having a study schedule (Hendriana, 2017).

Mathematics is often considered a challenging subject for some students, especially on algebraic material. Algebra is a branch of mathematics that studies mathematical structures, as well as relationships and quantities (Hidayani, 2012). In algebra, we manipulate mathematical symbols and formulas to understand the underlying patterns and properties of mathematics.

Algebra is applied in many fields, including physics, computer science, engineering, and economics, making it one of the important tools in problem solving in various disciplines. With concepts such as equations, matrices, and group theory, algebra helps us unearth deep insights into the world of mathematics and provides a solid foundation for understanding and solving problems in a variety of contexts.

Algebraic form problems involve the use of symbols and letters to represent values or variables in a mathematical expression (Hasibun, 2015). In these problems, students are usually given information in natural language or in the form of problem statements, and they must convert it into appropriate mathematical expressions based on relevant algebraic concepts. It involves the use of variables, mathematical operations such as addition, subtraction, multiplication, and division, as well as the application of algebraic laws such as distribution. Algebraic form problems aim to test students' understanding of algebraic concepts and their ability to apply them to solve problems in a variety of mathematical contexts.

This research can provide a foundation to identify areas that require improvement in mathematics learning approaches, especially in terms of understanding algebraic concepts, so that student learning outcomes can be improved. The problem of algebraic forms is one aspect that requires a strong understanding of concepts. A strong understanding of mathematical concepts is an important foundation for students' ability to solve math problems, including those related to algebra. The role of teachers and teaching methods in overcoming students' difficulties as well as increasing their interest in mathematics are factors to be considered in this study.

The interview conducted by researchers on mathematics subject teachers at MTs As Subkiyah Kota Bekasi, is in line with some of the explanations above, namely according to his narrative the problem that often occurs in mathematics learning in grade VII students is the lack of understanding of concepts in mathematics learning. Judging from student learning interests, there are differences in how to understand learning between students. Some students find learning mathematics an interesting learning to follow, some students also find mathematics difficult and unpleasant, so they lose interest in learning. In addition, understanding mathematical concepts is also a frequent problem. Some students only memorize formulas for solving methods without understanding the basic concepts, making it difficult to apply these mathematical concepts in everyday life.

From the description above, this study aims to analyze the ability to understand mathematical concepts in algebraic form material in terms of student learning interests in the high, medium or low categories.

B. Methods

The method used in this study is qualitative research. Qualitative methods are research approaches used to understand, describe, and explain social phenomena and human behavior in depth, without quantitatively measuring or calculating (Helaluddin, 2019). Qualitative research is a research method used to understand and explain social, cultural, or human behavior phenomena in a more in-depth and descriptive way (Anggito, A, & Johan, S, 2018). The qualitative method in this study uses a type of descriptive research supported by data

obtained through words from data sources (observed students) both written and oral. This research was conducted at MTs As-Subkiyah Kota Bekasi which is located Jl. Raya Mustikasari, Pengasinan, Rawalumbu, Kota Bekasi, West Java.

The study dimension is an aspect or element that is the center of attention in an analysis or research. This helps the researcher or analyst to guide their focus and limit attention to a particular aspect of the topic under study. The dimensions of the study in this study are questionnaires, tests and interviews.

In determining the subject of qualitative research using sampling techniques. A sampling technique is a method used in research to select a portion of the population in a representative manner so that the data obtained can be used to make generalizations about the population as a whole (Sumargo, 2020). The sampling technique applied in this study is purposive sampling, where researchers selectively select participants based on certain criteria and objectives that are relevant to the research question or topic being studied. Grade VII students are subjects for learning interest questionnaires as well as tests of ability to understand mathematical concepts. The source of information chosen in this study was students' learning interest in the high, medium and low learning interest categories, then a concept understanding ability test was carried out and then the interview process was carried out again.

In this study, several methods used to collect data needed for research purposes include:

1. Questionnaire

In the context of this study, questionnaires were used to identify each student's learning interests. Through the use of questionnaires, data regarding students' learning interests can be collected. Indicators of interest in learning include, feelings of pleasure in learning, student linkage in learning, student involvement during learning, diligent in studying and diligent in doing mathematical tasks, diligent and disciplined in learning and having a study schedule (Hendriana, 2017).

In measuring through questionnaires, researchers use the Likert scale as a measurement tool. There are four alternative answers to the learning interest questionnaire, namely: SS (Strongly Agree), S (Agree), TS (Disagree), and STS (Strongly Disagree). SS to STS answers are given a score of 4 to 1. The questions in the learning interest questionnaire that the researchers conducted had 19 questions. As for the questionnaire, there are 4 alternative answers, for more details can be seen in the following table:

Table 1. Alternative Learning Interest Answers

Description (optional)	Score	
	(+)	(-)
Totally Agree	4	1
Agree	3	2
Disagree	2	3
Strongly Disagree	1	4

The learning interest data that has been obtained will be interpreted in several categories, namely high, medium, and low using the range of the Likert scale as follows:

Table 2. Scale of Determination and Grouping

Score Range	Information
58 – 76	Tall
38 – 57	Keep
19 – 37	Low

2. Test

Data collection through technical tests is carried out by providing a test instrument consisting of a set of questions to obtain data on the ability to understand students' mathematical concepts, especially on algebraic form material. The form of the test used in this study is 7 points of description questions containing indicators of understanding mathematical concepts (BSNP, 2006) which is the focus of research. The description question is a test of the ability to understand mathematical concepts of algebraic form material given to students. Then the researcher described the ability to understand the concept of grade VII MTs As-Subkiyah students in Kota Bekasi.

3. Interview

Interviews were conducted on all students of each level of study interest who had completed the written test, with the aim of a deeper understanding of student responses when answering the written test. The researcher applies a semi-structured interview method, which refers to presenting questions tailored to the subject's situation. Interview guidelines are used by researchers to ensure that interviews are directional, do not deviate from other topics, and do not forget important parts.

4. Documentation

Documentation is very important in this study to record information such as student names, results of learning interest questionnaires, as well as student responses to concept comprehension tests

The presentation of data in this study includes the results of questionnaires about learning interests, tests of the ability to understand mathematical concepts, and interviews based on indicators of the ability to understand mathematical concepts such as, restating a concept, classifying objects according to certain properties according to the concept, providing examples and not examples of a concept, presenting concepts in various forms of mathematical representation, developing the necessary and sufficient conditions of a concept, use, utilize and select specific procedures or operations, and apply them problem-solving concepts or algorithms.

The study distributed questionnaires of interest in learning and presented test questions on the ability to understand mathematical concepts to students. Next, data on students' learning

interest levels are grouped by questionnaires, and information taken from test results and interviews is summarized and collected. Data reduction in this study focused on students by referring to indicators of students' concept understanding ability which was based on grouping the level of interest in learning from questionnaires filled out by grade VII MTs As Subkiyah Kota Bekasi students.

In qualitative research, the hope is to come to conclusions that are groundbreaking findings that have never been revealed before. These findings can be in the form of descriptions or descriptions of objects that were previously uncertain or just assumptions, and after research, they now become clearer. This conclusion describes the results of data collection methods that have been carried out by researchers. The conclusion found in this study is in the form of an analysis of understanding mathematical concepts of grade VII MTs As-Subkiyah Kota Bekasi students in terms of learning interest.

The validity of the data is strengthened through the use of triangulation. Triangulation is an approach in research that combines various methods, data sources, or viewpoints to verify or validate research results with the aim of gaining a deeper understanding and better reliability. In addition to collecting data, triangulation can also test the credibility of data with various data collection techniques and data sources (Sugiono, 2013). In this case, researchers apply source triangulation, which involves collecting data from multiple sources to ensure the accuracy of information. Using this source triangulation, researchers can verify the validity of the data by matching data from several participant sources, based on written test results and interview data.

C. Results and Discussion

1. Research Results

This research was carried out at MTs As-Subkiyah Kota Bekasi with the subject of this research being grade VII students. The purpose of this research is to describe the ability to understand students' mathematical concepts when viewed from learning interests.

The study was carried out 4 times face-to-face, namely on November 19, November 20, November 27 and November 28, 2023. As for data collection in the form of data from questionnaires classifying learning interests, then a test of the ability to understand concepts was carried out on 31 subjects.

Based on the results of the questionnaire scores from the answers of 31 students who have been corrected, the scores obtained are grouped into three categories, namely the categories of students with high, medium, and low interest in learning. The criteria for the level are based on the range of the Likert scale as follows:

Table 3. Likert Scale Score Range

Score Range	Information
58 – 76	Tall
38 – 57	Keep
19 – 37	Low

The following are the results of the class VII Learning Interest questionnaire with a total of 31 students, according to the category limit:

Table 4. Results of Learning Interest Questionnaire

No.	Student Code	Score	Category
1.	AH	60	Tall
2.	KIS	63	Tall
3.	AZ	38	Keep
4.	CKN	44	Keep
5.	DRR	46	Keep
6.	DAJ	51	Keep
7.	FZ	51	Keep
8.	GAI	48	Keep
9.	ILH	50	Keep
10.	AF	40	Keep
11.	MKA	40	Keep
12.	MS	45	Keep
13.	MTA	49	Keep
14.	MHK	49	Keep
15.	MIS	44	Keep
16.	NAP	44	Keep
17.	NO	41	Keep
18.	NAT	44	Keep
19.	RR	41	Keep
20.	RAL	50	Keep
21.	RAD	50	Keep
22.	RNT	43	Keep
23.	RNH	42	Keep
24.	SOK	51	Keep
25.	SS	48	Keep
26.	SN	46	Keep
27.	ZJ	56	Keep
28.	DDD	39	Keep
29.	MKBR	34	Low
30.	MNR	37	Low
31.	NA	36	Low

From the table above, it can be observed that from 31 students there are 2 students who have a high level of interest in learning, 26 students who have a moderate level of interest in learning, and 3 students who have a low interest in learning. Furthermore, researchers conducted concept comprehension ability tests on 31 subjects to explore information about how students' concept understanding when viewed from learning interests. The following data on the results of tests conducted by researchers on 31 subjects from each level of learning interest:

Table 5. Student KPKM Results

No.	Indicators	Research Results
1.	Restate concepts that have been learned	<p><u>High, Medium, Low</u> a. Students answer correctly that is, it consists of 2 tribes that have 1 counting operation.</p> <p><u>Low</u> a. Students answer 3 terms namely $5x + 8y - 6$ then students think that 2 terms are 2 different variables and students do not understand the concept of tribes. b. Students perceive that $2y$ is 2 tribes and students do not understand the concept of tribes</p>
2.	Classify objects according to specific properties	<p><u>High, Medium, Low</u> a. In variables, students name all letters attached to numbers. b. In variables, students only mention the initials of the letters, namely x and y.</p>

No.	Indicators	Research Results
		<p>c. In the coefficient, students do not write the number 1 even though the number is not written, namely x and xy² have a coefficient of 1.</p> <p>d. At constant, the student answers correctly which is 7, and in the syllable, the student answers correctly which is 6</p> <p><u>Keep</u></p> <p>a. On the coefficient, the student names all the numbers attached to the letter.</p> <p>b. In the coefficient, the student mentions 3 and 2 which are the binders of the variables.</p> <p>c. On a constant, the student answers 6y which is the last term that has numbers and letters.</p> <p>d. In tribes, students do not answer questions related to tribe, so students do not understand related to tribe.</p> <p><u>Low</u></p> <p>a. In terms, students answer 5 terms and the student considers numbers that have no variables, namely constants are not calculated</p> <p><u>High, Medium</u></p> <p>a. The student answers correctly that is, giving an example of an algebraic form of term 3 consisting of 3 terms and there are 2 counting operations, and which is not an example of an algebraic form of term 3 is more than or less than 3 terms.</p> <p><u>Medium, Low</u></p> <p>a. Students mention similar and unsimilar algebraic forms, which are not examples and are not examples of algebraic forms of term 3, but if calculated there are 2 terms which are not examples of algebraic forms of tribe 3, then students do not understand the problem</p> <p><u>Low</u></p> <p>a. Students give examples and not examples of algebraic forms of terms 3 which are both terms 3, because students think $6x + 4y - 8x$ on the variable x is not counted 2 but 1 because the variables are the same, so x and y which have 2 terms which are not examples of algebraic forms of term 3, then students do not understand the problem</p>
3.	Provide examples instead of examples	<p><u>High, Medium, Low</u></p> <p>a. Students correctly present concepts from pictures into algebraic form.</p> <p><u>Keep</u></p> <p>a. In the picture of money, students do not write answers because students assume the money is put in a piggy bank.</p> <p>b. Students add both piggy banks and students assume that piggy banks are a kind and have room to put money.</p> <p><u>Low</u></p> <p>a. Students add a picture of a chicken piggy bank and the money to 10y, because the student thinks the money is put in the chicken piggy bank</p>
4.	Presenting concepts in various forms of mathematical representation	<p><u>High, Medium, Low</u></p> <p>a. Students do not share the results of their weekly savings and students do not understand the story</p> <p><u>High, Medium</u></p>
5.	Developing necessary conditions and sufficient	

No.	Indicators	Research Results
	conditions of a concept	<p>a. Students provide correct solutions and correct answers.</p> <p><u>Keep</u></p> <p>a. Students do not provide ways to solve the question and the answer results are not correct, so students do not understand the problem.</p> <p><u>Medium, Low</u></p> <p>a. Students do not provide a way to solve the problem, but the results given are correct</p>
6.	Using, selecting or utilizing specific operations	<p><u>High, Medium, Low</u></p> <p>a. The student does not provide a way to solve the question and the answer results are not correct, then the student does not understand the problem.</p> <p><u>High, Medium</u></p> <p>a. Students provide how to solve calculation operation problems on algebraic forms correctly.</p> <p><u>Keep</u></p> <p>a. Students give answers by mentioning variables, coefficients, constants and students do not understand the problem</p> <p><u>Medium, Low</u></p> <p>a. The student gives a way to solve the problem, but the results given are incorrect, and the student does not understand the calculation operations on the algebraic form</p>
7.	Apply concepts or algorithms to problem solving	<p><u>High, Medium</u></p> <p>a. Students provide steps to solve the problem correctly.</p> <p><u>Keep</u></p> <p>a. Students do not provide steps to solve the question and the answer results are not correct, then students do not understand the problem.</p> <p>b. Students give answers by mentioning variables, coefficients, constants, and students do not understand the problem</p> <p><u>Medium, Low</u></p> <p>a. Students provide steps to solve the problem, but the results given are not correct, then students do not understand the calculation operations on algebraic forms.</p> <p>b. The student does not give an answer and the student does not understand the question.</p> <p><u>Low</u></p> <p>a. Students answer the questions by simplifying the results in length and width in the fields and students do not understand the questions</p>

Based on the presentation of the data above, there is evidence of student findings on the ability to understand mathematical concepts (KPKM) as follows:

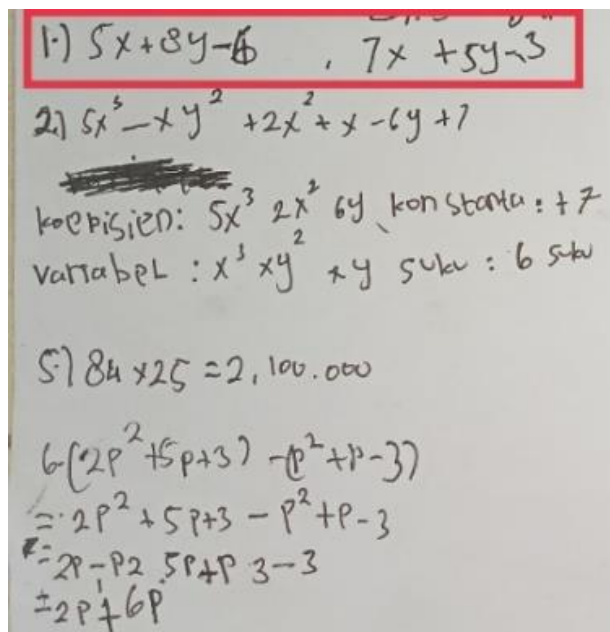


Figure 1. Answering the Three Tribes

Interview results:

Q: What form of algebra did you make?

N: Tribe 2 ka

Q: Why do you say the tribe is tribe 2?

N: Because the variable x equals y different so there are 2

From the interview results showed that, students think 2 terms are 2 different variables and in constant is not considered a tribe, then students do not understand the concept of tribe.

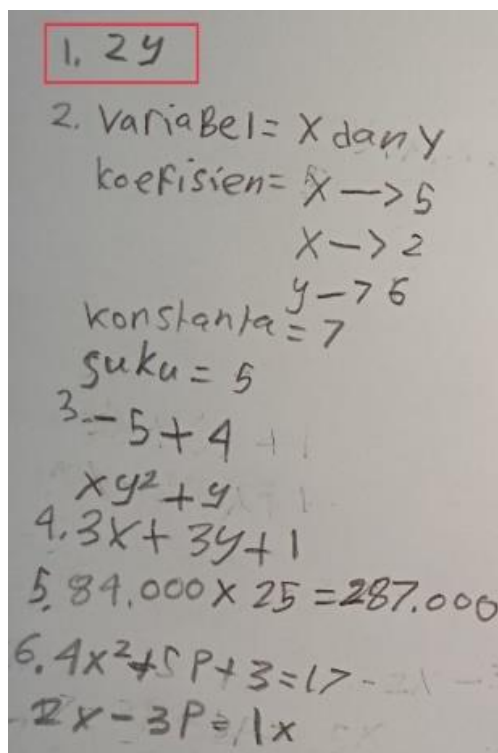


Figure 2. Answer 2y

Interview results:

Q: What form of algebra did you make?

N: 2 ka

Q: Why do you say the tribe is tribe 2?

N: Because 2y is 2 tribes

From the interview results show that, students view 2y as 2 terms consisting of 2 and y, so students do not understand the concept of tribes.

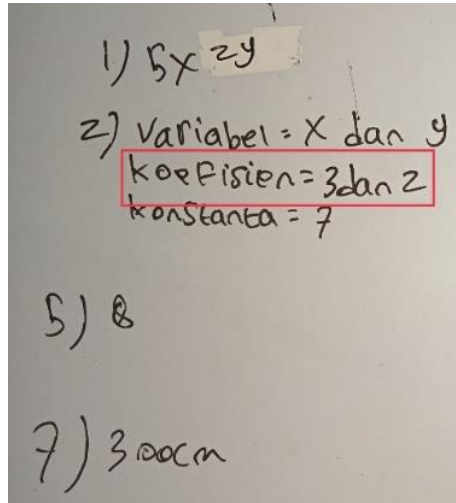


Figure 3. On the Coefficient of Answering the Power of the Variable

Interview results:

Q: How do you mention the variables, coefficients, constants and terms in question number 2?

N: If the letter variable, its power coefficient, the number constant

Q: The tribe?

N: Gatau ka

From the interview results show that, students think coefficient is rank, so students do not understand the concept of coefficient.

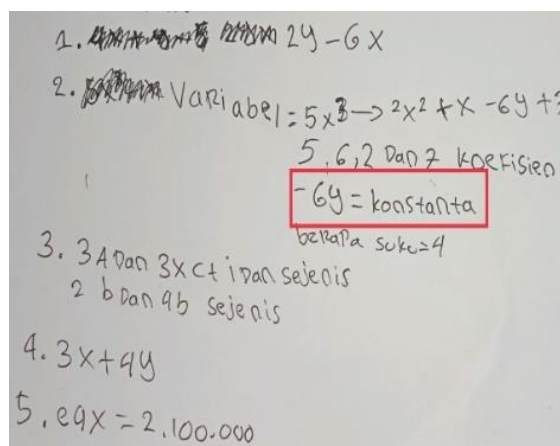


Figure 4. On the 6y answering constant

Interview results:

Q: How do you mention variables, coefficients, constants, and terms in question number 2?

N: The variable is a letter, a number coefficient, a number constant equal to the last letter

From the interview results show that, students think constants are numbers and letters on the right, so students on constants do not understand the concept of constants.

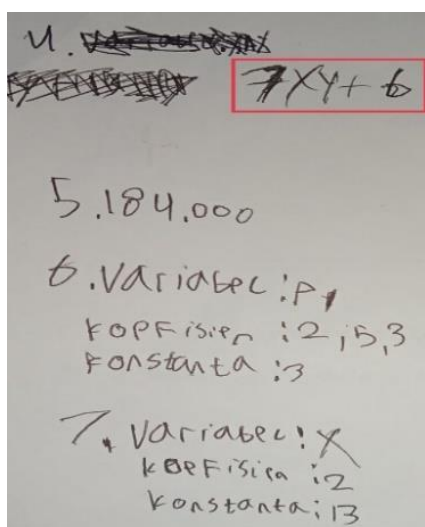


Figure 5. Adding 2 Piggy Banks

Interview results:

Q: How do you determine the result of the algebraic form?

N: 7 from his piggy bank plus 6 money

Q: Is the piggy bank added?

N: Both piggy banks ka so added

From the results of the interview, it shows that, students think piggy banks are a kind and have space to put money.

2. Discussion

The following is a discussion of research results related to the ability to understand mathematical concepts of grade VII MTs As Subkiyah Kota Bekasi students in terms of learning interest.

a. High Learning Interest Student Category

From the results of the questionnaire, there were 2 students who were included in the category of high interest in learning. AH subjects scored 60 and KIS subjects scored 63 in the learning interest questionnaire. In the indicator of restating the concept that has been learned, the student has answered correctly, that is, stating the algebraic form of term 2. On the indicator of classifying objects according to certain properties, the student has answered correctly, but there is a mistake in the mention of variables and coefficients. On indicators give examples and not examples students have answered correctly, that is, give examples and not examples of

algebraic forms of term 3. In the indicator of presenting concepts in various forms of mathematical representation, students have answered correctly, that is, re-presenting concepts from pictures into algebraic form. In the indicator of developing necessary conditions and sufficient requirements, a concept has been answered correctly, but there are students who do not understand related to the story. In the indicators of using, selecting or utilizing certain operations students have answered correctly, but there are students who do not understand calculating operations on algebraic forms. In the indicator of applying concepts or algorithms to problem solving, students have answered correctly, namely applying concepts to problem solving with appropriate steps.

This is in line with research conducted by Rizky Aoliya Nurdiyana, et al, stating that students' high interest in learning in mathematics contributes to improving their mathematical comprehension abilities. Therefore, a high level of interest in learning becomes an important factor in improving mathematics understanding during the learning process (Nurdiyana., 2022).

Thus, it can be concluded that students' interest in learning in the high category in class VII MTs As Subkiyah Kota Bekasi is able to meet the indicators of the ability to understand concepts, meaning that students in the high learning interest category can be said to be able to understand mathematical concepts well.

b. Student Category Medium Learning Interest

From the results of the learning interest questionnaire, there were 26 students who were included in the medium learning interest category. In the indicator of restating the concept that has been learned, some students have answered correctly, but there is 1 student who thinks that 2 terms are 2 different variables, so the student does not understand the concept of tribe. In the indicator of classifying objects according to certain properties, some students have answered correctly, but some are wrong, namely there are errors in variables and coefficients, then there are students who say the coefficient is the power of a variable, then on the constant there are students who answer $6y$ is the last term that has numbers and letters, and in the student term answers 5 terms that there are constants that are not calculated. In the indicator of giving examples and not examples, some students have answered correctly, but there are some that are wrong, namely, students give answers with similar and unsimilar variables that are not examples and not examples of algebraic forms of term 3, then students do not understand the problem. In the indicator presenting concepts in various forms of mathematical representation, some students have answered correctly, but there are some that are wrong, first on the picture of money students do not write answers, because students assume the money is put in a piggy bank. Second, students add both piggy banks, and students assume that piggy banks are a kind and have space to put money in, and third, students add a picture of a chicken piggy bank and money becomes $10y$, because students think the money is put in a chicken piggy bank. In the indicators of developing necessary conditions and sufficient requirements of a concept, some students have answered correctly, but there are some who are wrong first, students do not divide the results of savings per week. Second, students do not provide a way to solve the question and the answer results are not correct, and third, students do not explain how to solve but the results given are correct. In the indicators of using, selecting or utilizing certain operations,

some students have answered correctly, but there are some who are wrong first, do not provide a way of solving the problem and the answer results are not correct. Second, students give answers by mentioning variables, coefficients, constants that are not the answer to the problem, and third, students give ways to solve the problem but the results given are incorrect and the student does not understand the calculation operations in algebraic form. In the indicator of applying concepts or algorithms to problem solving, some students have answered correctly, but there are some who are wrong first, students do not provide steps to solve the problem and the answer results are not correct. Second, students give answers by mentioning variables, coefficients, constants that are not the answer to the question. Third, students provide steps to solve the problem but the results given are not correct, and fourth, students do not give answers and students do not understand the problem.

This is contrary to the research of Indah Husna, et al, stating that students with moderate mathematical abilities have a good mathematical understanding, are able to explain back the concepts that have been learned, can group the objects that make up the concept, are able to connect various mathematical concepts, and can apply these concepts in various forms of mathematical representation (Husna et al., 2020).

Thus, it can be concluded that the ability to understand mathematical concepts of students interested in learning is medium class VII MTs As Subkiyah Kota Bekasi is able to meet only a few indicators, meaning that students in the category of medium interest in learning can be said to have not been able to understand mathematical concepts well.

c. Student Category Low interest in learning

From the results of the learning interest questionnaire, there were 3 students who were included in the low interest in learning category. MKBR subjects obtained a score of 34, MNR subjects a score of 37, and NA subjects a score of 36. In the indicator of restating the concept that has been learned, students have answered correctly, but there are some things that are wrong, namely students think that 2 terms are 2 different variables and students think that $2y$ is 2 terms, then the student does not understand the concept of tribe. In the indicator of classifying objects according to certain properties, some students have answered correctly, but there are some that are wrong, namely, there is an error in the mention of variables and coefficients, and in the term students answer 5 terms in which there are constants that are not calculated. In the indicator giving examples and not examples, students answer incorrectly that is, students give answers with variables that are similar and not similar, which are not examples and not examples of algebraic forms of terms 3, and students give examples that are not examples of algebraic forms of terms 3 are algebraic forms of terms 3, but students think that variables x and y have 2 terms, Then students do not understand the concept of tribe. In the indicator of presenting concepts in various forms of mathematical representation, students have answered correctly, but there is a wrong student, that is, students add pictures of chicken piggy banks and money, because students think the money is put in the piggy bank of chickens. In the indicator of developing necessary conditions and sufficient requirements for a concept, students answered wrong, namely students did not divide the results of savings per week, and students did not provide a way to solve the problem but the results given were correct. In the indicator of using, choosing or utilizing certain operations, students answer incorrectly, that is,

students do not provide ways to solve questions and the answer results are not correct, then students give ways to solve questions but the results given are not correct, then students do not understand calculating operations in algebraic forms. In the indicator of applying concepts or algorithms to problem solving, students answer incorrectly, namely students provide steps to solve the problem, but the results given are not correct, then students do not give answers and students answer questions by simplifying the results in length and width in the fields, then students do not understand the problem.

This is in line with Junitasari and Fanny Hayati research, which states that students with low interest in learning have not achieved all standards of mathematical comprehension ability (Junitasari, & Fanny, H, 2019). In this study, it was also seen that students with low interest in learning have not been able to achieve the indicators well.

Thus, it can be concluded that the ability to understand mathematical concepts of students in the low learning interest category of class VII MTs As Subkiyah Kota Bekasi has not been able to meet the indicators of the ability to understand the concepts mastered, namely students in the low learning interest category can be said to have not been able to understand mathematical concepts correctly.

From the results of this study, researchers can conclude that there are several findings in grade VII MTs As Subkiyah Kota Bekasi students. The first finding is that students think tribes are different variables and on constants do not belong to tribes. The second finding is, $2y$ is 2 terms consisting of 2 and y . The third finding is, students answer on the coefficient is the power that is in the variable. Keemoat's finding is that students answer to a constant is 1 term consisting of numbers and letters attached and is on the right. The fifth finding is that in the math representation problem students add 2 pictures of piggy banks that have different shapes, and students think piggy banks are a kind and have space to put money in.

In indicators develop necessary conditions and sufficient conditions for a concept, indicators use, choose or utilize certain operations, and indicators apply concepts or algorithms to problem solving, that is, these indicators become the main problem, because students who answer correctly are very small, then most of the mistakes are lack of accuracy in understanding story problems, and students do not understand counting operations in algebraic forms. It can be concluded that students who have a high interest in learning show a very good understanding of mathematical concepts, so that those with high interest in learning have a high understanding of concepts. Students interested in learning are having a fairly good understanding of concepts, but it can affect their lack of accuracy, too sure, confidence and they tend not to evaluate the results of the answers, resulting in incorrect answers in solving a problem. Then, students with low interest in learning, get a category that is not good in the ability to understand concepts, because they tend not to be able to control their learning activities and cannot evaluate their own learning outcomes.

D. Conclusion

Based on the results of research and discussion, it was concluded that the ability to understand students' mathematical concepts when viewed from learning interest, that is, based on the results of the ability to understand mathematical concepts in grade VII students with

high, medium, and low levels of learning interest, it can be concluded that subjects with high learning interest have a very good understanding of concepts, mastering all indicators. Students with moderate interest in learning are quite capable, despite mastering only 4 out of 7 indicators. Students with low interest in learning have not been able to understand mathematical concepts well, only mastering 3 out of 7 indicators. It can be concluded that in the indicator of developing necessary and sufficient conditions of a concept, the indicator chooses, uses or utilizes certain operations, and the indicator applies concepts or algorithms to problem solving, in these indicators there is a major problem for grade VII MTs As Subkiyah Kota Bekasi students, because the percentage of students who answer correctly is very low, then most of the errors are found in the lack of accuracy in understanding the problem Stories and students do not yet understand about calculating operations on algebraic forms.

There are several findings in grade VII MTs As Subkiyah Kota Bekasi students. The first finding is that students think tribes are different variables and on constants do not belong to tribes. The second finding is, $2y$ is 2 terms consisting of 2 and y . the third finding is, students answer on the coefficient is a power that is in the variable, the fourth finding is, students answer on the constant is 1 term consisting of numbers and letters attached and is on the right. The fifth finding is, in the mathematical representation problem students add 2 pictures of piggy banks that have different shapes and students think piggy banks are a kind and have space to put money.

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The Influence of Peer Groups on Academic Performance in University-Level Mathematics Courses in: A Case Study of Morogoro Municipality

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Abstract: This study investigates the influence of peer groups on students' academic performance in university-level mathematics courses, with a specific focus on Morogoro Municipality. The research aims to examine the dynamics of peer interactions and their impact on students' learning outcomes in mathematics. A mixed-methods approach was employed, combining quantitative analysis of academic performance data with qualitative exploration of peer group dynamics through interviews and surveys. The study population included students from higher education institutions in Morogoro Municipality, with a sample of 200 students randomly selected from four universities. Data were collected using questionnaires and interviews to gather information on peer interaction patterns, academic performance, and demographic characteristics. The quantitative data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS) version 20, with Chi-square tests applied to determine correlations between peer group dynamics and academic achievement. The findings indicate that peer groups significantly influence students' attitudes, study habits, and academic performance in mathematics. Positive peer interactions encourage collaboration, motivation, and deeper understanding of mathematical concepts contribute to improved academic performance. Meanwhile, negative peer influences such as social distractions and peer pressure can hinder academic progress. The results highlight the importance of understanding how peer groups shape students' academic behaviors and outcomes. These insights can inform the development of educational interventions and support systems to foster positive peer interactions and enhance learning outcomes in mathematics at the university level.

Keywords: peer groups; university students; mathematics courses; academic performance

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A. Introduction

The achievement of academic excellence at university level is influenced by various interdisciplinary factors (Alhosani et al., 2023). Among these, the dynamics of peer interaction within academic settings play a pivotal role. Peer groups exert significant social influence on adolescents, impacting decisions ranging from everyday choices to long-term educational plans (Ragelienė & Grønhøj, 2020). While primary socialization with parents may not always mediate peer influence, secondary socialization with peers often correlates with risky behaviours (Tomé et al., 2012). Peer groups, defined as close-knit, similar-aged friends engaging in shared activities, wield considerable influence due to the extensive time

adolescents spend with them compared to adults (Filade et al., 2019). Behavioural decisions, acting as mediators between peer influence and academic achievement, are crucial in shaping student outcomes (Gebresilase & Zhao, 2023). The collective behaviour and attributes of peer groups can profoundly impact individuals' actions, especially in education.

Academic performance, defined as the attainment of educational goals and the ability to retain and communicate knowledge, is vital for both individual success and national development (Ozcan, 2021). The impact of peer groups on academic performance is evident in education policy discussions, with studies showing that peer group study approaches enhance understanding and problem-solving skills in mathematics (Filade et al., 2019).

Additionally, research suggests that stronger students within peer groups can positively influence overall academic performance (Yu et al., 2023). However, concerns arise regarding the negative influence of peer groups on academic performance, as evidenced by studies highlighting a decline in performance among university students influenced by peers.

The university environment presents a unique amalgamation of academic, social, and personal challenges that can significantly affect students' overall performance (Wang et al., 2024). Beyond peer interactions, factors such as faculty support, curriculum design, and personal motivation also contribute to academic success (Anderson et al., 2018). Effective faculty guidance and support systems are essential for providing students with the necessary resources and mentorship to excel academically (Fountain & Newcomer, 2016).

Moreover, the structure and content of mathematics courses themselves can impact students' academic performance (Cabuquin & Abocejo, 2023). Courses that are well-designed, engaging, and tailored to students' diverse learning styles can foster a deeper understanding of mathematical concepts and facilitate better academic outcomes (Arthur et al., 2017). Innovative teaching methods, such as interactive lectures, collaborative learning activities, and real-world applications, can enhance students' comprehension and retention of mathematical principles (Ordu, 2021).

Furthermore, individual characteristics and experiences, such as prior academic background, self-efficacy beliefs, and socio-economic status, also influence academic performance (Hayat et al., 2020). Students who possess a strong sense of self-efficacy and resilience are better equipped to overcome academic challenges and persist in their studies. Additionally, socio-economic factors can impact students' access to resources, such as textbooks, technology, and academic support services, which can further influence their academic performance.

Within the realm of peer interactions, it's crucial to acknowledge the diverse nature of peer groups and their influence on academic performance. Peer groups can vary widely in terms of their academic attitudes, study habits, and goals. Some peer groups may foster a culture of academic excellence, where members support and motivate each other to strive for high achievement (Kindermann, 2016). In contrast, other peer groups may prioritize social activities over academic pursuits, potentially leading to distractions and detracting from students' focus on their studies.

Furthermore, the quality of peer relationships within these groups can have a significant impact on academic performance. Positive and supportive peer relationships can provide students with encouragement, constructive feedback, and collaborative learning opportunities, all of which can enhance their academic outcomes (Wentzel & Watkins, 2002). Conversely, negative peer relationships characterized by competition, envy, or peer pressure to engage in risky behaviours may undermine students' academic progress and well-being (Moldes et al., 2019).

In addition to peer influence, the broader socio-cultural context in which students are immersed can shape their academic experiences and outcomes. Factors such as cultural norms, societal expectations, and institutional policies can influence students' perceptions of academic success, their motivation to excel, and their access to educational opportunities (Alam & Mohanty, 2023). It is essential for universities to consider these contextual factors and strive to create an inclusive and supportive academic environment that values diversity and promotes equitable access to education.

Moreover, the role of technology in peer interactions and academic performance cannot be overlooked. With the widespread availability of digital platforms and social media, students have new avenues for connecting with peers, sharing academic resources, and collaborating on academic projects (Aleksandrova & Parusheva, 2019). However, excessive screen time and online distractions can also pose challenges to students' academic focus and productivity (George et al., 2023). Universities must navigate the opportunities and challenges presented by technology to foster positive peer interactions and support students' academic success in the digital age.

B. Statement of the Problem

Understanding the influence of peer groups on academic performance in mathematics courses at the university level is paramount for optimizing educational processes and improving school system organization. Despite the extensive research on peer effects in education, particularly regarding older students, there remains a notable gap in understanding the specific impact of peer dynamics on academic achievement in mathematics courses at the university level. While numerous studies have explored the correlation between peer relationships and overall academic performance, there is a scarcity of longitudinal examinations of these links, particularly within the context of mathematics education.

Furthermore, within the Tanzanian academic landscape, research on the influence of peer groups on academic performance has predominantly focused on secondary school levels, leaving a significant void in understanding how peer interactions specifically affect students' performance in mathematics courses at the university level. This gap in research becomes particularly pertinent given the transition to university, where students often experience greater autonomy and reduced parental supervision, potentially intensifying the influence of peer groups on academic outcomes.

Therefore, this study seeks to bridge this gap by investigating the influence of peer groups on students' academic performance in mathematics courses at the university level in Tanzania. By examining the dynamics of peer interactions and their impact on academic achievement

within the context of mathematics education, the study aims to provide valuable insights into the factors that contribute to success or challenges in this academic domain. Understanding the role of peer groups in shaping students' performance in mathematics courses is crucial for designing targeted interventions and support systems that can enhance academic outcomes and promote student success in this critical subject area.

C. Purpose of the study

This research paper aimed to explore the influence of peer groups on students' academic performance, particularly focusing on mathematics courses at the university level. Specifically, the study sought to attain three objectives, which included:

1. Investigate whether patterns of socialization among peers impact students' academic performance in mathematics courses.
2. Determine if there is a variation in the influence of peer groups on academic performance in mathematics courses between male and female students.
3. Explore whether the influence of peers on students' academic performance in mathematics courses varies with the students' age.

D. Research Questions

The study aimed to address the following research questions

1. How do peer socialization patterns impact the academic performance of university-level mathematics students?
2. To what extent does the influence of peer groups on academic performance differ between male and female students in mathematics courses at the university level?
3. How does the influence of peers on academic performance vary with the age of university-level mathematics students?

E. Significance of the study

These findings are anticipated to hold significant relevance for researchers and educational professionals, contributing to the advancement of literature concerning the influence of peer groups on academic performance among university students in Mathematics courses. Moreover, policymakers stand to benefit from these findings, as they can utilize the study's recommendations to formulate strategies aimed at mitigating the adverse effects of peer pressure on students.

F. Limitation of the study

A minor limitation of this study was the inability to encompass all university students within respective universities, as some students in other institutions were on holiday sessions.

G. Literature review

The concept of peers and peer groups, as described by Castro Giovanni (2002), involves a group of individuals of similar age, abilities, and backgrounds, who often exhibit resemblances in individual traits. Given adolescents' extensive interaction with peers compared

to other adults, understanding the influences and pressures within peer dynamics becomes crucial.

Academic performance, as defined by Al-Abyadh and Abdel Azeem(2022), encompasses the knowledge, skills, and achievements acquired through formal education. Kathryn (2010) extends this definition to include excellence across various academic disciplines and extracurricular activities, underscoring the multidimensional nature of academic achievement. Steinberg (2005) emphasizes the interconnectedness of academic performance with cognitive, emotional, and social development, highlighting the significant influence of parental involvement and home environments on students' academic success.

Parental involvement emerges as a critical factor in students' academic success, as highlighted by Utami (2022) and Shumox & Lomax (2001). Parenting styles, as elucidated by Yao(2023), shape children's social competence, while higher levels of parental engagement positively impact children's self-esteem, peer relationships, and overall academic performance, as noted by Akomolafe (2016). Seth (2010) further emphasizes the role of parental surveillance of homework and responses to grades in shaping students' motivation and achievement, with authoritative parenting associated with higher academic success, as supported by Hoang et al.,'s (2022) findings.

Family dynamics play a crucial role in shaping individuals' lives, particularly when both parents provide care. Nan Li's (2015) research underscores diverse effects of peer and teacher support on educational aspirations across ethnicities, stressing parental communication. Yu et al's., (2023) study suggests that peer support alone might not independently impact academic achievement, especially among Asian students with strong cultural values.

Research demonstrates that peer interactions and cultural contexts significantly impact academic performance. Studies Aldhafri et al., (2020) and Rivers (2008) emphasize the importance of peer relationships, particularly among students with authoritative parents, which may extend to university-level Mathematics courses. Furthermore, Butler-Barnes et al., (2015) highlight a positive correlation between peer support and academic achievement among diverse student populations, including African American, Latino, and European American students. Additionally, Felix's (2014) study in Kenya underscores the role of school environment and peer influence in shaping academic performance, suggesting implications for university-level Mathematics students.

Gender dynamics also play a role in academic pursuits, as evidenced by research showing disparities in STEM fields and gender stereotypes in secondary schools (Makarova et al., 2019). Friendship groups and peer pressure can significantly influence students' academic interests and motivation, especially among adolescents (Nelson & DeBacker, 2008). Furthermore, studies on peer teaching and network interactions highlight the potential of peer strategies to enhance academic achievement (Garrote,2020)

As individuals transition into adulthood, peer networks become more integrated and continue to influence academic outcomes. However, the influence of peer groups may not always correlate positively with academic performance, as seen in studies examining peer effects on secondary school students (Olalekan, 2016). Despite this, institutions such as

colleges and universities can play a pivotal role in shaping peer dynamics and fostering positive academic outcomes (Fidale et al., 2019). Understanding the complex interplay between peer relationships, cultural contexts, and academic performance is essential for educators and policymakers to support student success.

H. Research Methodology

This was a quantitative study that aimed to investigate the influence of peer groups on university students' academic performance in Mathematics courses within selected universities in Morogoro Municipality. Utilizing the Chi-square statistical analysis tool, the research examined whether significant differences existed in peer group influence at specific times. The study encompassed all students in higher education institutions in Morogoro Municipal, with a sample of 200 students randomly selected from four universities. Data collection methods included questionnaires and interviews, while analysis employed Statistical Package for the Social Sciences (SPSS) version 20. The collected quantitative data were coded and subjected to Chi-square computation to align with the research objectives.

I. Results and Discussion

The findings of the study suggest that peer influence among university students encompasses various factors, including age, gender, and interaction patterns. Despite a majority of students falling within the 20-25 age range and a higher representation of males(60.5%) than females (39.5%) within the sample, no significant gender-based differences were observed in peer dependence for academic decisions. Furthermore, while engagement in group discussions was common across genders and universities, it did not significantly correlate with academic performance. The tables below substantiate the results.

Table 1: Distribution of respondents by age

Age	Frequency	Percent
16-20	10	5.0
20-25	137	68.5
26 and above	53	26.5

Source: *Field data (2023)*

The table indicates that only 5.0% of respondents were aged 16 to 20, while the majority (68%) were fresh-from-school university entrants.

Table 2: Distribution of respondents by sex

Sex	Frequency	Percent
Males	121	60.5
Females	79	39.5

Source: *Field data(2023)*

The results indicate that 60.5% of respondents were males (121) and 39.5% were females (79).

Table 3:Extent to which students depend on their friends in decision making

Sex	Level of dependent on friends			
	P/School	Ordinary level	A-level	College and above
Males	18(14.9)	41(33.9)	24(19.8)	38(31.4)
Females	11(13.9)	34(43.0)	15(18.9)	19(24.2)

Note: Numbers in the brackets represent percentages

The chi-square analysis found no significant difference between males and females in depending on their peers for academic decision-making (Chi-square = 2.022, df = 3, p = 0.568 > 0.05).

Table 4: Students responses on the degree of belonging to a peer group

Sex	Belongingness to a peer group			
	S-disagree	Disagree	Agree	Strongly agree
Males	6(5.0)	13(10.7)	81(66.9)	21(17.4)
Females	4(5.0)	10(12.7)	46(58.2)	19(24.1)

Source: Field data (2023)

The chi-square test revealed that the difference in peer group belongingness between males and females was not statistically significant (Chi-square = 1.796, df = 3, p = 0.616 > 0.05).

Table 5: Students responses about places of interaction with their peers university wise

Name of University	Place of interaction with peers					
	Hostel	Class	Cafeteria	Off-campus	Out campus	In-campus
SUA	9(18.0)	17(34.0)	0(0.0)	4(8.0)	6(12.0)	14(28.0)
MUM	6(12.0)	10(20.0)	4(8.0)	7(14.0)	14(28.0)	9(18.0)
MZUMBE	11(22.0)	14(28.0)	2(4.0)	11(22.0)	6(12.0)	6(12.0)
JUCO	10(20.0)	15(30.0)	0(0.0)	4(8.0)	9(18.0)	12(24.0)

Source: Field data (2023)

The Chi-square test indicated that the variation between public and private universities was not statistically significant (Chi-square = 24.294, df = 15, p = 0.060 > 0.05).

Table 6: Views of respondents about their engagement in group discussion.

Engagement in group discussion with friends

University	S-Disagree	Disagree	Agree	Strongly Agree
SUA	7(14.0)	8(16.0)	17(34.0)	18(36.0)
MUM	3(6.0)	3(6.0)	18(36.0)	26(52.0)
MZUMBE	3(6.0)	3(6.0)	23(46.0)	21(42.0)
JUCO	2(4.0)	2(4.0)	22(44.0)	24(48.0)

Source: *Field data (2023)*

The Chi-square analysis indicated that engagement in group discussion among students of various study years within their respective universities was not statistically significant (Chi-square = 12.385, df = 9, p = 0.192 > 0.05).

Additionally, the study noted variations in the influence of peer spending on clothing and pocket money expenditure, although these factors did not emerge as significant predictors of academic performance. Female students tended to seek more peer counselling on lifestyle issues, but this did not translate into significant differences in academic performance compared to males. Tables below indicate the results

Table 7: Respondents’ views on the influence of peers’ pocket money spending on clothing style.

Sex	Various ranges of pocket money spending influenced students' clothing styles.				
	2000-3000	3000-4000	4000-5000	5000>	I don't know
Males	49(40.5)	30(24.8)	21(17.4)	14(11.6)	7(5.8)
Females	28(35.4)	30(38.0)	15(19.0)	5(6.3)	1(1.3)

Note: *Numbers in the brackets represent percentage*

The influence of socialization on clothing style, considering gender and pocket money spent, was not statistically significant according to Chi-square analysis (Chi-square = 6.978, df=4, p=0.137>0.05).

Table 8: Respondents’ views on their peers’ spending per day against performance.

Sex	Amount in (Tshs)	Academic performance(High, Low, Moderate)		
Males	2000-3000	11(9.1)	15(12.4)	1(0.8)
	3000-4000	9(7.4)	21(17.4)	2(1.7)
	4000-5000	4(3.3)	10(8.3)	1(0.8)
	5000 and above	3(2.5)	8(6.6)	1(0.8)
	I don't know	15(12.4)	17(14.0)	2(1.7)
Females	2000-3000	7(8.9)	11(13.9)	0(0.0)

3000-4000	8(10.1)	14(17.7)	1(1.3)
4000-5000	5(6.3)	6(7.6)	0(0.0)
5000 and above	3(3.8)	2(2.5)	0(0.0)
I don't know	10(12.7)	12(15.2)	0(0.0)

Source: *Field data (2023)*

Chi-square analysis indicated that the difference in pocket money spent by peers between males and females was not statistically significant for both males (Chi-square = 4.226, df = 10, p=0.937>0.05) and females (Chi-square = 3.647, df =8, p=0.887>0.05).

Table 9: Respondents' views on spending of pocket money by peers sex wise.

Sex	Spending of pocket money by peers(Tshs)				
	2000-3000	3000-4000	4000-5000	5000 and above	I don't know
Males	27(22.3)	32(26.4)	16(13.2)	12(9.9)	34(28.1)
Females	18(22.8)	23(29.1)	11(13.9)	5(6.3)	22(27.8)

Source: *Field data (2023)*

The chi-square analysis indicated that the disparities in awareness among respondents regarding the pocket money spent by peers between males and females were statistically insignificant (Chi-square = 0.871, df = 4, p = 0.929 > 0.05).

Table 10: Students responses on the influence of taking exams together with peers.

Sex	Taking exams together with peers influence on academic performance			
	S-disagree	Disagree	Agree	Strongly Agree
Males	10(8.3)	23(19.0)	75(62.0)	13(10.7)
Females	04(5.0)	16(20.3)	47(59.5)	12(15.2)

Note: Numbers in the brackets represent percentage.

The Chi-square analysis revealed that the difference between males and females on this aspect was statistically insignificant (Chi-square = 1.542, df = 3, p = 0.673 > 0.05).

The advantages and disadvantages of peer groups were acknowledged by students across different years of study and types of universities, with no significant variations noted. Despite these diverse influences, the overall impact of peer groups on academic performance did not exhibit significant differences between genders or universities, underscoring the intricate nature of peer dynamics in shaping student outcomes.

Table 11: Responses of students on the performance of mathematics courses.

Sex	Peers' influence on performance of mathematics courses
-----	--------------------------------------------------------

	Strongly disagree	Disagree	Agree	Strongly agree
Males	31(25.6)	46(38.0)	34(28.1)	10(8.3)
Females	28(35.4)	28(35.4)	19(24.1)	4(5.1)

Source: *Field data(2023)*

The chi-square test analysis indicates that there was no significant difference in the influence of peers on the performance of mathematics courses between females and males. This suggests that gender does not play a significant role in how peers influence performance in mathematics courses. With a Pearson Chi-square value of 2.644 and 3 degrees of freedom, along with a p-value of 0.450 (>0.05), the data suggests that both genders are similarly influenced by peers when it comes to their performance in mathematics courses.

Table 12: Students’ views by sex on the contribution of peer advice to performance.

	Males	Females
Yes	99(81.8)	63(79.7)
No	22(18.2)	16(20.3)

Source: *Field data(2023)*

The chi-square test analysis reveals that there is no statistically significant difference between male and female students. The analysis yielded a chi-square value of 0.133 with 1 degree of freedom and a p-value of 0.715, which is greater than the commonly used significance level of 0.05. Therefore, based on this analysis, there is no significant difference between male and female students.

Relating these findings to academic performance in mathematics courses, it appears that while peer influence plays a role in various aspects of university life, including decision-making and social interactions, its direct impact on academic performance in mathematics courses may be nuanced and multifaceted. Factors such as individual study habits, teacher quality, and intrinsic motivation likely interact with peer influence to determine academic outcomes in specific subjects like mathematics. Therefore, future research in this area could explore these interactions further to gain deeper insights into the dynamics of peer influence on academic performance in mathematics courses specifically.

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Comparison of Discovery Learning and Reciprocal Teaching Learning Models on Mathematical Critical Thinking Skills

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Abstract: Mathematical critical thinking ability is a crucial skill and must be possessed by students. This study aims to compare discovery learning and reciprocal teaching models on students' mathematical critical thinking skills. This research was conducted on eighth-grade students of MTs Ma'arif NU 1 Wangon, with a sample of VIII A and VIII D classes totaling 68 students. The sampling technique used simple random sampling where the sampling process was taken in a lottery. The research was conducted by giving two different treatments to two classes, experimental class I with discovery learning model and experiment II with reciprocal teaching model. The research method used was quasi-experimental design. The data collection method employed tests in the form of pretest and posttest description questions. Data analysis techniques used normality test, homogeneity test and hypothesis testing. The average posttest result in experimental class I was 81.3 which was in the very high category. Furthermore, the average posttest result in experimental class II was 73.4 which was in the medium category. Based on the analysis of the t-test of two independent samples, the significance value was 0.000 which was smaller than the level limit of 0.05. So, the findings show a significant difference in students' mathematical critical thinking abilities between the two learning models, with the discovery learning model being more effective.

Keywords: comparison; discovery learning; mathematical critical thinking skills; reciprocal teaching

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A. Introduction

The rapid development of science and technology demands changes or improvements in the quality of Human Resources (HR). One way to improve the quality of Human Resources is by improving the quality of education. This is in line with the national education objectives contained in the National Republic Law no. 20 of 2003 chapter 1 paragraph 1 as follows:

"Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble morals, and the skills needed by themselves, society, nation and state" (Nasional, 2003).

Mathematics is one of the basic sciences that is developing rapidly in the world of education and has an important role in human life, because almost all science and technology requires mathematics as the basis for learning. Apart from that, mathematics is also a tool that

can help solve problems in human life, mathematics is also able to improve critical, systematic, logical and creative thinking skills (Hasratuddin, 2013).

Critical thinking is part of thinking skills, which relates to what to do or believe in each situation or activity (Hasratuddin, 2013). Ennis said that the ability to think critically is a process of thinking ability that occurs within a person and aims to make rational decisions about something that can be believed to be true. So, critical thinking skills are skills that can solve problems and then produce reliable knowledge. A person who thinks critically is someone who can think and can be responsible for the decisions taken and the answers given.

According to Rochaminah, critical thinking is defined as the process of thinking accurately to obtain relevant and reliable knowledge. This process involves reasoning, reflective thinking, responsibility, and thinking skills (Rochaminah, 2008).

Indicators of critical thinking abilities according to Ahmad Susanto are as follows (Susanto, 2019): 1) Analyzing skills, 2) Synthesizing skills, 3) Problem recognition and solving skills, 4) Conclusion skills, 5) Evaluation/judgment skills

The importance of critical thinking skills is also shown by PISA (Program for International Student Assessment). PISA in the world of mathematics education is an international assessment organized by the OECD (Organization For Economic CO-Operation and Development). PISA is an international study of the reading, mathematics and science literacy achievements of school-aged students aged 15 years. One of the aims of PISA is to assess students' mathematical knowledge in solving problems in real life. PISA type questions are questions that have high-level thinking ability standards which can improve students' critical thinking skills. The results of the PISA report state that Indonesia ranks 72nd out of 78 participating countries in the field of mathematics with a score of 379 (Girsang, 2022)

Based on preliminary tests or pre-research conducted at MTs NU Wangon in class VIII B with a total of 36 students, the results obtained were that students' mathematical critical thinking were still lacking. This can be seen from the average percentage of correct answers from the 36 students, namely 34%. Apart from that, the researcher also conducted an interview with the class VIII mathematics subject teacher at MTs NU Wangon, namely Mrs. Sri Kuntari, S.Pd., from the results of the interview conducted on December 12 2023, it was discovered that there were still many students who considered mathematics to be a difficult subject and critical thinking skills are still low.

Apart from interviews, researchers also made observations during learning activities and it was seen that learning in the classroom still tended to be teacher-centred or conventional. As a result, students experience difficulties in interpreting, analyzing, evaluating and inferring a given problem because students are only fixated on what is explained by the teacher, students are passive when learning in class, and do not explore their own knowledge so that only one-way learning occurs and students' mathematical critical thinking become less than optimal.

Based on the problems presented, students' understanding of critical mathematical thinking skills needs further attention. So we need a solution to this problem, namely by choosing an appropriate learning model. One of the factors that influences critical mathematical thinking skills is the learning model used in learning by teachers. Therefore, it is hoped that

teachers can use appropriate learning models to have a positive influence on students' mathematical critical thinking.

One learning model that is thought to be able to improve critical mathematical thinking skills is the discovery learning model. Munandar stated that using the discovery learning method is not only related to discovery but can also improve creative thinking (Munandar, 2020). According to Hamalik, quoted by Oktaviani, the discovery learning model is where groups of students are brought into a problem to find answers to structured questions (Oktaviani et al., 2018). The steps or syntax in Discovery Learning are as follows: stimulation, problem statement (problem identification), data collection (data collection), data processing (data processing), verification (proof), and generalization (generalization).

The advantage of the discovery learning model is that it can help students to improve their abilities and understanding because they carry out the process of discovering results so they can continue to remember a lesson. Meanwhile, the weakness of discovery learning is that there is mental readiness to learn. If there are students who are less intelligent, they will find it difficult to think and do things related to the learning being carried out (Asih et al., 2019).

Based on Khoerul Umam's research, another learning model that can also improve students' mathematical critical thinking skills is the reciprocal teaching learning model, because this learning model requires students to be active in learning. Reciprocal teaching or reciprocal learning in mathematics provides students with a platform to improve various cognitive skills while creating an engaging and fun learning environment (Umam, 2018). According to Trianto, reciprocal teaching is a constructivist approach based on the principle of asking questions, asking metacognitive skills through teaching and modeling by educators. 10 The teacher only serves as a facilitator and guide in learning, namely clarifying or providing explanations regarding material that cannot be solved independently by students (Hidayat, 2018).

The aim of the Reciprocal Teaching model is to help students, or without the presence of a teacher, be more active in understanding writing. This strategy was chosen not only to understand the reading but also to provide opportunities for students to learn to pay attention to their own learning and thinking. (Hidayat, 2018) The dialogue structure of interaction between group members requires the participation of all students and maintains new relationships between students with different abilities.

The stages in implementing the reciprocal teaching learning model according to Suyatno, quoted by Dayat Hidayat, are (Hidayat, 2018): teachers provide material, discuss in groups, students make questions related to the material, students present the results of the discussion, question and answer with other students or groups, and generalize or conclude. The advantages of reciprocal teaching are: a) Developing student creativity, b) Fostering cooperation between students, c) Students learning independently, d) Students are motivated to learn. Meanwhile, the disadvantage of the reciprocal teaching learning model is that it takes a long time and is very difficult to implement if students' knowledge of the prerequisite material is lacking.

Thus, discovery learning and reciprocal teaching models make it possible to improve critical thinking skills. The reason for comparing the learning models is discovery learning and reciprocal teaching, both of which are learning models based on constructivism. Another

similarity when viewed from the indicators is that both types of assignments are group in nature and the main aim of learning in both models is to improve critical thinking skills. So that later we can find out which learning model further improves students' critical mathematical thinking skills.

Based on the description above, the author is interested in conducting research entitled "Comparison of Using Discovery Learning and Reciprocal Learning Learning Models on the Mathematical Critical Thinking Ability of Class VIII Students at MTs Ma'arif NU 1 Wangon".

B. Methods

1. Types of Research

The type of research carried out in this research is experimental research. The type of experiment in this research is a quasi experiment. Quasi-experiment is research that applies a treatment or action but environmental conditions can influence the research results that cannot be controlled (Maulana, 2017). The quasi-experiment aims to determine the comparison of discovery learning and reciprocal teaching models on the mathematical critical thinking of class VIII students at MTs Ma'arif NU 1 Wangon. The design of this research is a non-equivalent control group design. In this design, a pretest is given at the beginning and a posttest is given after the treatment is given with the aim of finding out the differences in the conditions of the two classes.

2. Data Selection

a. Population

Population is a generalized area consisting of objects/subjects that have certain qualities and characteristics determined by the researcher to be studied and then conclusions drawn (Seviarica et al., 2021). In other words, the population is all the objects to be studied. Then the population in this study was all class VIII students at MTs Ma'arif NU 1 Wangon, totaling 334 students.

b. Sampling

The sample is part of the number and characteristics of the population (Sugiyono, 2013). This sampling technique uses a simple random sampling technique. Simple random sampling is a sampling technique from a population that is carried out randomly without paying attention to levels or strata in the population, with the assumption that the population is homogeneous (Sugiono, 2015). Sampling was taken by lottery to take two experimental classes. In this case, each class is seen as a group unit, then each class is randomized by lottery. Then another drawing was carried out to determine which class would be used as experimental class I and experimental class II. Experimental class I was given discovery learning model treatment, namely class VIII A, and experimental class II was given reciprocal teaching learning model treatment, namely class VIII D.

3. Data Collection Techniques

Interviews are a data collection method used by researchers when conducting preliminary observations to find the problems to be studied. Apart from that, interviews are also used when

researchers want to get in-depth information about respondents' views, especially when the number of respondents is limited or small (Sugiyono, 2013, p. 137). Researchers conducted interviews with class VIII mathematics teachers at Mts Ma'arif NU 1 Wangon as part of the initial observation.

Observation is a technique for collecting data by observing and recording the behavior or conditions being studied (Firdiansyah, 2015). This observation is carried out by looking at the situations and conditions related to the research. Then, in this observation, data will be obtained and you will find out about activities during the research process. In this case the researcher will make direct observations (Danar Paramita et al., 2021).

Test instruments are used to collect data about student learning outcomes. A test is also a systematic procedure in a standardized form which is then given to students to complete and answer (Sanjaya, 2011). In this research, tests were used to measure students' mathematical critical thinking at MTs Ma'arif NU 1 Wangon

Apart from collecting data for hypothesis testing, there are instrument tests, namely validity and reliability tests. The validity test stage consists of two parts, namely content validity test and item validity test (Sahir, 2021). Content validity shows the extent to which questions, tasks or items in a test or instrument are able to represent the behavior of the sample subjected to the test as a whole and proportionally (Matondang, 2009). Expert validation is carried out by 2 validators.

Item validity is validity that is measured by quantities that use criteria to determine the validity of the items of the test (Ahyar et al., 2020). In this research, to find the validity correlation coefficient, the product moment Pearson correlation validity test was used (Purwanto, 2018).

Meanwhile, the reliability test of an instrument is the constancy or consistency of the instrument, if it is given to the same subject even by different people, different times, or different places, then the results will be the same or relatively the same (not significantly different) (Usmadi, 2020).

4. Data Analysis Techniques

After all the data has been collected, the data is then analyzed to provide a hypothesis whether the model under study has met the expected hypothesis or not. There are two stages carried out, namely the analysis prerequisite tests including the normality test and homogeneity test, while the hypothesis test includes the t-test.

a. Prerequisite Test

The data analysis prerequisite test aims to find out whether the data can continue hypothesis testing or not.

1) Normality Test

The purpose of carrying out a normality test is to find out whether the data is normally distributed or not. In this study, because the samples used by researchers were more than 50 people, normality testing used the Kolmogorov Smirnov test (Usmadi,

2020). The method used by researchers is Kolmogorov Smirnov with the assumption that the data will be normally distributed (H_1 is rejected and H_0 is accepted) if the normality value obtained is greater than the significance level (0.05).

2) Homogeneity Test

The homogeneity test is a statistical test procedure which aims to show that two or more groups of data samples are taken from a population that has the same variance. 36 The homogeneity test in this review uses the Levene test. Levene's test is used to test the similarity of several populations (Sianturi, 2022). In testing the data, researchers used the SPSS version 22 application with a significance limit of 0.05. Data will be homogeneous if the data processing results are above the 0.05 level.

3) Hypothesis Test

After the data is normally distributed and the variance of the two data is homogeneous, then a two independent sample t test is carried out. The t test for two independent samples aims to determine the comparison of the difference between two calculated means from two independent samples. The significance level limit uses 5% with the assumption that if the test result is <0.005 then H_0 is rejected and H_1 is accepted (Rodliyah, 2021).

C. Results and Discussion

1. Data Collection and Analysis

The pretest is used to determine students' critical mathematical thinking before being given treatment. In experimental class I and experimental class II, the mathematics teacher still carries out the same treatment on geometric material (cubes and blocks). The following are the results of the pretest on the mathematical critical thinking skills of experimental class I and experimental class II students.

Table 1. Pre-test results for experimental I and experimental II classes

No.	Information	Pre-test	
		Eksperimen I	Eksperimen II
1.	Highest score	47	41
2.	Lowest score	13	13
3.	The number of students	34	34
4.	Average	28,2	27,3
5.	standard deviation	9,6	7,0

Based on the table above, it can be seen that for experimental class I with a total of 34 students, the highest pretest score was 47. Meanwhile, the lowest score for the class was 13, the standard deviation value was 9.6, and the average score obtained was 28.2. Furthermore, based on the table above, it is known that for experimental class II with a total of 34 students, the highest pretest score was 38. Then the lowest score for the class was 11, the standard deviation value was 8.1 and the average score obtained was 27.3.

After the experimental I and experimental II classes were given treatment by the researcher, the two classes were given posttest questions. In terms of flat-sided geometric

shapes, they are prisms and pyramids. The results of students' mathematical critical thinking in experimental class I and experimental II are shown as follows:

Table 2. Post-test results for experimental I and experimental II classes

No.	Information	Pre-test	
		Eksperimen I	Experimental II
1.	Highest score	96	93
2.	Lowest score	73	60
3.	The number of students	34	34
4.	Average	81,5	73,4
5.	Standard Deviation	6,6	8,5

Based on the table above, it can be seen that for experimental class I with a total of 34 students, the highest posttest score was 96 and the lowest score for this class was 73, so the average score obtained was 81.5. Furthermore, based on the table above, it is also known that for experimental class II with a total of 34 students, the highest posttest score was 93 and the lowest score for this class was 60. So the average score obtained was 73.4.

2. Data Analysis Technique

a. Prerequisite Test

1) Normality Test

The normality test aims to find out whether the data is obtained a normal distribution or not. The following are the results of the pretest normality test for experimental class I and experimental II:

Table 3. Normality test pretest class results

Tests of Normality							
	Kelas	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Pretest	1	,112	34	,200*	,945	34	,087
	2	,111	34	,200*	,972	34	,518

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

Based on the SPSS output above, it can be seen that the significance value of the Kolmogorov Smirnov test in experimental class I is 0.200 and experimental class II has a value of 0.200. This means that both experimental classes are above the significance level of 0.05. Therefore it can be concluded that experimental classes I and II have a normal distribution

Then the results of the posttest data normality test for experimental class I and experimental II are as follows:

Table 4. Normality test posttest class results

Tests of Normality							
	Kelas	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
PostTest	1	,144	34	,070	,923	34	,020
	2	,140	34	,090	,956	34	,181

a. Lilliefors Significance Correction

Based on the table above, it can be seen that the significance value of the Kolmogorov Smirnov posttest in experimental class I obtained a value of $0.70 > 0.05$, while in experimental class II obtained a value of $0.90 > 0.05$. This means that both experimental classes are above the 0.05 significance level. Therefore it can be concluded that experimental classes I and II have a normal distribution.

2) Homogeneity Test

The purpose of carrying out a homogeneity test is to determine the similarities in the variants of the research data obtained. The homogeneity test in this study used the Levene Test. In this study, the homogeneity test was carried out using SPSS Statistics 22. The following are the results of the homogeneity test of pretest data for experimental classes I and II:

Table 5. Homogeneity pretest results

		Test of Homogeneity of Variance			
		Levene			
		Statistic	df1	df2	Sig.
Pretest	Based on Mean	3,919	1	66	,052
	Based on Median	3,627	1	66	,061
	Based on Median and with adjusted df	3,627	1	62,319	,061
	Based on trimmed mean	3,987	1	66	,050

From the table above it is known that in the "Based on Mean" section the significance value is 0.052. Where $0.052 \geq 0.05$ so H_0 is accepted and H_1 is rejected. Thus, the pretest score data from the two experimental classes have met the homogeneous assumption, which means that the two classes were homogeneous or the same in terms of mathematical critical thinking before being given treatment. Next, the homogeneity test data for experimental class I and II posttest data are as follows:

Table 6. Homogeneity posttest results

		Test of Homogeneity of Variance			
		Levene			
		Statistic	df1	df2	Sig.
PostTest	Based on Mean	2,295	1	66	,135
	Based on Median	1,991	1	66	,163
	Based on Median and with adjusted df	1,991	1	61,064	,163
	Based on trimmed mean	2,066	1	66	,155

From the table above it is known that in the "Based on Mean" section the significance value is 0.135. Where $0.135 \geq 0.05$ so it can be concluded that the scores from the two experimental classes are homogeneous

3) Hypothesis Test

After the data is normally distributed and the variance of the two data is homogeneous, the next step is to carry out a t test for two independent samples. In this research, we aimed to find out the comparison of students' mathematical critical thinking using different learning models in two experimental classes. The following are the results of the t test of pretest data for experimental class I and experimental II:

Table 7. T-test pretest class results

		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	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pretest	Equal variances assumed	3,919	,052	,449	66	,655	,912	2,031	-3,144	4,967
	Equal variances not assumed			,449	60,451	,655	,912	2,031	-3,151	4,974

Based on the table above, the significance section (2-tailed) is 0.655. Where $0.655 \geq 0.05$ then H_1 is rejected and H_0 is accepted. So the pretest data shows that the two sample classes have the same initial in students' mathematical critical thinking. $H_0 : \mu_1 = \mu_2$ which means that the results of the values for experimental class I and experimental II are not significantly different. Thus, it can be said that experimental classes I and II have the same critical mathematical thinking.

Then for the t test results of the posttest data for experimental class I and experimental II, the following results were obtained:

Table 8. T-test posttest class results

		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	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
PostTest	Equal variances assumed	2,295	,135	4,349	66	,000	8,029	1,846	4,343	11,716
	Equal variances not assumed			4,349	61,904	,000	8,029	1,846	4,339	11,720

Based on the table above, in the equal variances assumed and equal variance not assumed sections, there are two significance values, namely 0.000, where $0.000 < 0.05$, which in this study uses the equal variance assumed significance value because in the

homogeneity test it is known that the data variants are homogeneous. So, it can be concluded that the significance value is $0.000 < 0.05$, which means H_0 is rejected and H_1 is accepted. So it can be concluded that there is a significant difference between the mathematical critical thinking of students who use the discovery learning model and the reciprocal teaching learning model in class VIII flat-sided geometric material at MTs Ma'arif NU 1 Wangon.

3. Discussion

Based on the pretest results from experimental class I and experimental class II, it shows that students' mathematical critical thinking are relatively the same. This can be seen from the average pretest score for experimental class I of 28.2 and for experimental class II of 27.3, both classes are both in the low category. This shows that students' mastery of critical mathematical thinking skills between experimental classes I and II before the treatment was given was low.

In contrast to the posttest results, students' critical mathematical thinking skills became better. This can be seen from the posttest results for experimental class I which got an average of 81.5 which was in the very high category and experimental class II got an average of 73.4 which was in the high category. Thus, it shows that the ability to think critically mathematically on geometric material in both classes after being treated with discovery learning and reciprocal teaching models got different average scores.

Then, in testing the hypothesis, a two independent sample t test was carried out, the results of testing the pretest data obtained a significance of 0.655. Where $0.655 \geq 0.05$ then H_1 is rejected and H_0 is accepted. Then the results of posttest data testing showed a significance of $0.000 < 0.05$. Where $0.000 < 0.05$ then H_0 is rejected and H_1 is accepted. So it can be concluded that there is a difference between the discovery learning model and the reciprocal teaching learning model on the mathematical critical thinking of class VIII students at MTs Ma'arif Nu 1 Wangon.

Apart from that, based on the posttest average results between experimental class I which was given the discovery learning model, it was found to be 81.3 and experimental class II, which was given the reciprocal teaching model, got an average of 73.5. Where the average of experimental class I is higher than the average of experimental class II. In conclusion, it can be said that the results of students' mathematical critical thinking taught using discovery learning are higher than the learning outcomes of students taught using the reciprocal teaching model. Nevertheless, the results of

The posttest shows that the application of the discovery learning model and the reciprocal teaching learning model can each improve students' mathematical critical thinking. However, from the statistical data, the discovery learning model is more effectively used in the learning process to improve critical thinking skills.

D. Conclusion

The mathematical critical thinking of students who use the discovery learning learning model are proven to be better than students who use the reciprocal teaching learning model. This can be seen based on the average posttest results for experimental class I and experimental

class II. Experimental class I got an average of 81.3 and experimental class II got an average of average of 73.4.

Then, based on the results of the hypothesis test using the t test for two independent samples, a (2-tailed) value of 0.000 was obtained, which means it was smaller than 0.05, so H_0 was rejected and H_1 was accepted. So it can be concluded that there are significant differences between discovery learning learning models and reciprocal teaching on students' mathematical critical thinking

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The Effect of Interactive Multimedia-Based Discovery Learning on Students' Ability to Understand Mathematical Concepts

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Abstract: This research was conducted based on the low ability to understand mathematical concepts of seventh-grade students at MTs Al-Masruriyyah Baturraden. The researchers chose an interactive multimedia-based discovery learning model to address students' ability to understand mathematical concepts. The aim of this research was to find out how it was implemented and whether there was an influence of interactive multimedia-based discovery learning on students' ability to understand mathematical concepts. The research employed a quantitative approach using experimental methods. The population of this research was all seventh-grade students (60 in total), with a sample of 19 students from class VII A, and 21 students from class VII C. Data collection methods were carried out by observation and tests. Data analysis techniques used normality tests, homogeneity tests, and t-tests. Based on the results of the t-test on the post test, a value of $0.001 < 0.05$ was obtained, so H_1 was accepted. So, it can be concluded that there is an influence between the interactive multimedia-based discovery learning model on the ability to understand mathematical concepts.

Keywords: discovery learning; interactive multimedia; understand mathematical concepts

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A. Introduction

Mathematics is a science that has an abstract nature, where the ability to understand concepts is the main key in solving mathematical problems. In education, mathematics is taught sequentially, starting from the simplest material to the more complex (Yolanda, 2020). The goal is for students not only to memorize formulas, but to master the material and be able to apply it in a learning context. Quality in the learning process has an important role in student success (Rosmala, 2021).

The ability to understand mathematical concepts is a strong basis for solving problems in mathematics learning. Mathematics not only teaches students numbers, but also develops their critical, logical and analytical thinking skills. With the ability to understand good mathematical concepts, students can recognize patterns, make conclusions, and make sensible decisions in everyday situations (Afrianti, 2021).

In the teaching and learning process, most of the knowledge is only conveyed by the teacher, while students act as recipients of information. Students tend to only memorize concepts without strong ability to apply these concepts when faced with related mathematical

problems. In fact, they often experience difficulty in identifying and formulating problems, so they have difficulty solving mathematical problems (Silalahi et al., 2023).

Based on the results of preliminary observations at MTs Al – Masruriyah Baturraden in class VII on November 18 2023. These observations interviewed one of the mathematics teachers who showed that students' ability to understand mathematical concepts was still low. This provides context that some students may not be fully ready to face the new level of difficulty presented by mathematics material in MTs/SMP. Apart from that, the results of the daily test scores which are the teacher's benchmark for understanding how much students have mastered the material that has been given are still quite low. This is due to students' lack of concentration and focus when the teacher delivers the material, this can be seen from students who tend to remain silent and just listen without active involvement. This makes learning mathematics less interesting. Apart from that, many students have difficulty understanding the mathematics problems given by the teacher, they do not understand the concept of solving them, and have limitations in solving problems and have a low level of reasoning. The use of conventional methods by teachers is also an obstacle, because they rarely use learning media, making students feel bored and unpleasant in the learning process.

From the problems above, the learning model that can help in the mathematics learning process is the Discovery Learning model. This learning model is a learning process that does not provide complete knowledge to students, but rather involves them in organizing and developing the knowledge and skills needed to solve problems. (Hermawan et al., 2024). There are six steps in the Discovery Learning model, including: (a) stimulation or providing stimulation, (b) statement or identification of the problem. (c) data collection, (d) data processing, (e) verification, (f) drawing conclusions or generalizations. (P. N. Budiastuti et al., 2023) So from these six steps carried out by students, students will be more active in learning activities.

For this reason, a solution that can support the Discovery Learning model is using interactive multimedia-based learning. Because the problem faced by students is a lack of enthusiasm for learning in class, teachers must provide a pleasant classroom atmosphere in mathematics learning, one of which is using interactive multimedia-based learning.

Interactive multimedia is a media delivery system that displays material in the form of video recordings with computer control to viewers or students. In this media, it not only provides the experience of seeing and hearing videos and their sound, but also allows students to provide active responses (Setyawati et al., 2020). Not only in the process of delivering the material provided using interactive media. Before starting learning, the teacher can give a quiz in the form of a game created using the Wordwall application, the aim of which is to make students enthusiastic about starting learning. This can also be used as a brain warm-up. Wordwal is a web-based application that can be used to create various learning media such as quizzes, matching pairs, anagrams, random word games, word searches, grouping, and so on. (Arimbawa, 2021). Apart from that, quizzes are also given when the material has been presented, media-assisted quizzes created using Quizizz. Quizizz is a software that can be used by teachers to implement teaching evaluation. Quizizz can be used as a formative evaluation tool in interactive form.

Referring to the background explanation above, the researcher considers that media and mathematics learning models are needed that suit students' needs. Therefore, researchers conducted research with the title "The Effect of Interactive Multimedia-Based Discovery Learning on the Ability to Understand Mathematical Concepts.

B. Methods

1. Type Of Research

The type of research applied in this research is quantitative research. Quantitative Research is a scientific research process carried out systematically to explore phenomena, elements and their relationships (Syahrizal & Jailani, 2023). Quantitative research methods are used to investigate certain populations or samples, with sampling techniques usually carried out randomly. Data collection is carried out through research instruments, and data analysis is carried out statistically or quantitatively to test the hypotheses that have been formulated (Hildawati et al., 2024).

The research design applied in this research is an experimental research design. Experimental research is a type of research conducted to test hypotheses regarding causal relationships through treatment, as well as to test changes that occur as a result of the treatment (Jaya, 2020). In this research, the treatment given was multimedia-based discovery learning on students' ability to understand mathematical concepts.

2. Data Collection

a. Populations

Population is the totality of units or individuals in the form of people, institutions and objects whose characteristics are to be studied. In this population, researchers will take class VII students at MTs Al-Masruriyah Baturraden classes A, B, and C.

b. Sampling

A sample is a part taken from the entire object to be studied to represent the entire population (Jaya, 2020). This sample will be taken into 2 classes as a control class and an experimental class. The experimental class is class VII A with 19 students, while the control class is class VII B with 21 studentssiswa.

3. Data Collection Techniques

Data collection techniques are the first step in a research that will be carried out, because the aim of a research is to obtain data. The data collection techniques used by researchers are observation and tests. Observation is a method of systematically observing or recording symptoms that appear on a research object (Mertha Jaya, 2020). A test is a series of questions, exercises, or other tools used to measure a person's skills. In this research, the type of test applied is a description test (essay) which will be given to each class at the beginning of the research (pretest) and at the end of learning (posttest). This method is used by researchers to measure the ability to understand mathematical concepts of class VII students at MTs Al-Masruriyyah Baturraden.

The instrument test used is a validity and reliability test. The validity test used is the content and item validity test. There are 2 stages of content validity testing, namely validity testing by media experts and mathematics teacher testing. An instrument is declared valid if the expert has accepted it without any improvements to the instrument.

Validity test is a test used to see whether a tool is valid or not (Sugiharni, 2018). To find the validity correlation coefficient in this research, the Pearson product moment correlation coefficient was used.

Reliability testing is the consistency of research results using various research methods in certain conditions of time and place (D. Budiastuti, 2022). In this study, the Cronbach alpha coefficient was used to determine the reliability of the test instrument.

4. Data Analysis Technique

The data analysis techniques in this research are divided into two, namely implementation data analysis and influence data analysis. The purpose of analyzing implementation data is to assess its implications for research questions. The researcher's interpretation and point of view are significant aspects at this stage. Before drawing conclusions, researchers need to verify and double-check the data that has been collected.

To understand the impact of using a multimedia-based discovery learning model on the ability to understand mathematical concepts in class VII students, data analysis is needed. The data analysis method applied in this research includes testing analysis prerequisites and hypothesis testing.

a. Prerequisite Test

This test is carried out to determine whether the data can be continued to the hypothesis testing stage or not.

1) Normality Test

The normality test is carried out to determine whether the data taken comes from a population that has a normal distribution or not. In this research, the normality test uses the Kolmogorov-Smirnov method with the criterion that if the Kormogorov-Smirnov (sig) significance value is ≥ 0.05 , then the data is considered to have a normal distribution, with a confidence level of 5%. Conversely, if the Kormogorov-Smirnov sig value is < 0.05 , this indicates that the data does not have a normal distribution.

2) Homogeneity test

The homogeneity test is used to determine whether several population variants are the same or not. The homogeneity test can be carried out if the data group is normally distributed. The basis for homogeneity decision making is that if the significance value is ≥ 0.05 then H_0 is rejected and H_1 is accepted, if the significance is < 0.05 then H_0 is accepted and H_1 is rejected.

b. Hypothesis Test

The hypothesis test used in this research is the t-test, with independent samples. After the data is normally distributed, a t-test is carried out to find out whether the application of interactive multimedia-based discovery learning is effective on the ability to understand mathematical concepts by comparing the results of the average value of the experimental class with the control class. The t-test decision is taken by comparing with the calculated t with an α value of 5% or 0.05. If the calculated t value is >0.05 , then H_0 is accepted and H_1 is accepted.

C. Result And Discussion

1. Experimental Design

This research used an experimental class, namely class VII A with a total of 19 students. The class was treated with interactive multimedia-based discovery learning. Meanwhile, the control class used was class VII C, which consisted of 21 students and was not given any treatment. This interactive multimedia-based discovery learning is measured by pre-test and post-test results. Data collection was carried out 3 times to determine the ability to understand mathematical concepts in the experimental and control classes.

2. Data Collection and Anaysis

The pretest data on students' ability to understand mathematical concepts consists of 7 questions adjusted to indicators of ability to understand mathematical concepts. Pretest questions were given to the experimental class and control class, namely class VII A and C.

Table 1. Pretest results for experimental and control classes

No.	Information	Pretest	
		Experimen	Control
1.	Highest score	71	82
2.	Lowest score	37	25
3.	The number of students	21	19
4.	Average	57,43	54,79

Based on the table above, it shows that the experimental class pretest score has the highest score of 71 and the lowest score is 37. So the average pretest score for the experimental class is 57.43. On the other hand, the pretest score for the control class has the highest score of 82 and the lowest score of 25. So the average pretest score for the control class is 54.79.

The next step is to carry out interactive multimedia-based discovery learning in the experimental class and conventional learning in the control class. After that, students were given a posttest to measure students' ability to understand mathematical concepts. The following are the posttest scores for the experimental and control classes, namely:

Table 2 Posttest results for experimental and control classes

No.	Information	Pretest	
		Experimen	control
1.	Highest score	96	100
	Lowest score	75	29

The number of students	21	19
Average	86,10	67,79

Based on the data from the table above, it shows that the posttest score for the experimental class has the highest score of 96 and the lowest score of 75. So the average posttest score for the experimental class is 86.10. On the other hand, the posttest score for the control class has the highest score of 100 and the lowest score of 29. So the average posttest score for the control class is 67.79. Based on these results, it can be concluded that the experimental class and control class have very different average results. The experimental class had a higher average score than the control class. So the experimental class and control class have significant differences.

3. Data Analysis Technique

a. Prerequisite Test

1) Normality test

The normality test of the posttest data is using the results of the posttest scores for the experimental class and control class. In this research, researchers used a normality test with the Kolmogorof Smirnov method as follows.

Table 3 Pretest Normality Test for Experimental and Control Classes

		Tests of Normality					
		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	kelas_pretest	Statistic	df	Sig.	Statistic	df	Sig.
hasilpretest	pretest eksperimen	,158	21	,184	,908	21	,050
	pretest kontrol	,154	19	,200*	,970	19	,780

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

Based on the test results above, the significance value of the Kolmogorof Smirnov test on the experimental class pretest results was $0.184 > 0.05$ and the control class pretest results were $0.200 > 0.05$. Based on the Kolmogorov Smirnov test decision making criteria, the significance values of the two classes are above the 0.05 significance level. Thus, H_1 is rejected and H_0 is accepted. So the conclusion is that the pretest data for the experimental class and control class are in a normal distribution

Table 4 Normality Test Results

		Tests of Normality					
		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	kelas_posttest	Statistic	df	Sig.	Statistic	df	Sig.
hasil_posttest	posttest Eksperimen	,161	21	,163	,930	21	,140
	posttest Kontrol	,105	19	,200*	,947	19	,350

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

Based on the test results above, the significance value of the Kolmogorov Smirnov test in the experimental class posttest results was $0.163 > 0.05$, while in the control class it was $0.200 > 0.05$. Based on the Kolmogorov Smirnov test decision making criteria, the significance values of the two classes are above the 0.05 significance level. Thus, H_1 is rejected and H_0 is accepted. So the conclusion is that the posttest data for the experimental class and control class are in a normal distribution.

2) Homogenities Test

The homogeneity test is used to determine whether there is significant variation between several populations. According to the basis of homogeneity decision making, H_1 is rejected and H_0 is accepted if the significance value is ≥ 0.05 . If the significance value is < 0.05 , H_1 is accepted and H_0 is rejected. The homogeneity test results for the experimental and control class posttest questions can be seen here.

Table 5 Pretest Data Homogeneity Tests

Test of Homogeneity of Variance						
		Levene Statistic	df1	df2	Sig.	
pretestresult	Based on Mean	2,490	1	38	,123	
	Based on Median	1,620	1	38	,211	
	Based on Median and with adjusted df	1,620	1	30,681	,213	
	Based on trimmed mean	2,446	1	38	,126	

Based on the table above, it is known that the significance value is 0.123. Where $0.123 > 0.05$ so H_1 is rejected and H_0 is accepted. Thus, the data from the pretest results have fulfilled the assumption of homogeneity, which means that the two classes, namely the experimental class and the control class, are homogeneous or the same in terms of students' ability to understand mathematical concepts before learning is carried out.

Table 6 Posttest Homogeneity Test for Experimental Class and Control Class

Test of Homogeneity of Variance						
		Levene Statistic	df1	df2	Sig.	
posttestresult	Based on Mean	19,080	1	38	,000	
	Based on Median	18,742	1	38	,000	
	Based on Median and with adjusted df	18,742	1	22,081	,000	
	Based on trimmed mean	19,225	1	38	,000	

From the table above, it appears that the significant value is 0.000 where < 0.05 so that H_0 is rejected and H_1 is accepted. So, the posttest score data is not homogeneous. This means that the two classes from the posttest data are not homogeneous in terms of students' ability to understand mathematical concepts after learning with different treatments.

b. Hypothesis Test

The next step is to test the hypothesis using the t-test. The t-test was carried out to determine whether the effect of interactive multimedia-based discovery learning was effective in improving students' ability to understand mathematical concepts by comparing the results of the posttest scores for the experimental class and the control class. This test was carried out using the SPSS version 22 program and based on these results the following results were obtained:

Table 7 t-test data for experimental pretest and control pretest

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
hasilpretest	Equal variances assumed	2,490	,123	,652	38	,518	2,639	4,045	-5,550	10,828
	Equal variances not assumed			,642	32,745	,525	2,639	4,108	-5,722	11,000

Based on the table above, the test is listed in the significance section (2-tailed), namely 0.518. Where $0.518 \geq 0.05$ then H_1 is rejected and H_0 is accepted. So, the pretest data shows that the two sample classes have similarities in students' ability to understand mathematical concepts. $H_0: \mu_1 = \mu_2$, which means that the results of the experimental class and control class values are similar. Therefore, it can be said that the experimental class and the control class have the same ability to understand initial mathematical concepts.

Table 8 Posttest data t-test for experimental class and control class

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
hasil_posttest	Equal variances assumed	19,080	,000	3,537	38	,001	17,358	4,907	7,424	27,292
	Equal variances not assumed			3,391	21,166	,003	17,358	5,119	6,718	27,999

Based on the test results listed in the significance section (2-tailed), namely 0.001, where $0.001 < 0.05$, then H_0 is rejected and H_1 is accepted. So, the data from the posttest scores from the experimental class and the control class shows a difference in the magnitude of the influence between the use of interactive multimedia-based discovery learning and learning without using media. So it can be concluded that this interactive multimedia-based discovery learning has an effect in improving students' ability to understand mathematical concepts in class VII social arithmetic material at MTs Al-Masruriyah Baturraden.

4. Discussion

Researchers used interactive multimedia-based discovery learning as the independent variable and the ability to understand mathematical concepts as the dependent variable. Based on the observers' assessments, observer 1 saw the interactive multimedia-based discovery learning model, the class VII mathematics teacher, got a total score of 54 with an average of 3.6. Meanwhile, observer 2, an 8th semester student, got a total score of 56 with an average of 3.73. According to the assessment criteria guidelines, the criteria are very good with a range of $3.25 \leq x \leq 4.00$. The average value is 3.66. Thus, the interactive multimedia-based discovery learning model works very well. The results of the analysis of pretest questions on the ability to understand mathematical concepts to understand the initial conditions before the learning given by the researcher.

The results show that the pretest questions for the experimental class and control class are comparable, with an average of 57.43 for the experimental class and an average of 54.79 for the control class. This data shows that the averages of the two classes are comparable or at the same level. Apart from that, based on the table above, the test is listed in the significance section (2-tailed), namely 0.518. Where $0.518 \geq 0.05$ then H_1 is rejected and H_0 is accepted. So, the pretest data shows that the two sample classes have similarities in students' ability to understand mathematical concepts. $H_0: \mu_1 = \mu_2$, which means that the results of the experimental class and control class values are similar. Therefore, it can be said that the experimental class and control class have the same ability to understand basic mathematical concepts.

In contrast to the results of the posttest question analysis, the experimental class which used interactive multimedia-based discovery learning treatment got an average score of 86.10 and the control class which only used conventional learning got an average score of 67.79. The research results are more effective than conventional approaches. Based on the test results listed in the significance section (2-tailed), namely 0.001, where $0.001 < 0.05$, then H_0 is rejected and H_1 is accepted. So, the data from the posttest scores from the experimental class and the control class shows a difference in the magnitude of the influence between the use of interactive multimedia-based discovery learning and learning without using media. So it can be concluded that interactive multimedia-based discovery learning has an effect in improving students' ability to understand mathematical concepts in class VII social arithmetic material at MTs Al-Masruriyah Baturraden.

D. Conclusion

Interactive multimedia-based discovery learning is very effective in teaching mathematics in schools, especially for Class VII students at MTs Al-Masruriyah Baturraden.

Then, choosing discovery learning combined with interactive multimedia can improve students' ability to understand mathematical concepts. The results of the observation sheet meet the very good criteria with a range of $3.25 \leq x \leq 4.00$. The average value is 3.66. With this, interactive multimedia-based discovery learning works very well.

Application of interactive multimedia-based discovery learning to the ability to understand mathematical concepts through an independent sample t test (t-test). Based on the test results listed in the significance section (2-tailed), namely 0.001, where $0.001 < 0.05$ then H_0 is rejected and H_1 accepted. So, the data from the posttest scores from the experimental class and the control class shows a difference in the magnitude of the influence between the use of interactive multimedia-based discovery learning and learning without using media. So it can be concluded that interactive multimedia-based discovery learning is effective in improving students' ability to understand mathematical concepts in class VII social arithmetic material at MTs Al-Masruriyah Baturraden. Based on the posttest scores, the experimental class obtained an average score of 86.10, while the control class obtained an average score of 67.79. The results of this research indicate that there is an influence of interactive multimedia-based discovery learning on students' ability to understand mathematical concepts in class VII social arithmetic material at MTs Al-Masruriyah Baturraden.

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The Influence of High School Students' Mathematical Curiosity on Interest in STEM Learning

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Abstract: The study had explored the influence of high school students' mathematical curiosity on their interest in STEM (Science, Technology, Engineering, and Mathematics) learning. Using a quantitative approach, the study had involved 271 students from various high schools, who had filled out a questionnaire regarding their level of mathematical curiosity and interest in STEM learning. Regression analysis had been conducted to identify the relationship between the two variables. The study's results had revealed a significant relationship between mathematical curiosity and interest in STEM learning, with a p-value of <0.05 . This finding had indicated that students' mathematical curiosity had simultaneously influenced students' interest in STEM learning with several indicators that had significantly affected interest in STEM learning, namely the desire to detail information and enthusiasm for learning. The implications of these results had highlighted the importance of designing teaching strategies that could trigger students' mathematical curiosity to increase their engagement in STEM fields.

Keywords: interest; mathematical curiosity; STEM

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A. Introduction

Curiosity is an important cognitive aspect that motivates individuals to explore and understand their surroundings. Curiosity is also a desire to know that is accompanied by positive emotions, increased blood flow, and exploratory behavior (Peterson & Cohen, 2019). Mathematical curiosity refers to students' internal drive to explore and understand mathematical concepts in mathematics education. Curiosity can be directed to improve understanding of mathematical concepts through several ways related to the components of curiosity (Anderson & Dean, 1963; Peterson & Cohen, 2019). Curiosity theory, as explained by Piaget and Vygotsky, emphasizes the important role of curiosity in the learning process. Piaget argued that curiosity is a primary driver in cognitive development, where individuals continue to adapt and build mental structures through interactions with their environment. In contrast, Vygotsky highlighted the importance of social and cultural interactions in facilitating the development of curiosity and cognitive abilities (Rabindran & Madanagopal, 2020; Wardani et al., 2023). In mathematics, curiosity can be recognized through several signs, such as questions in-depth understanding of mathematical concepts, a desire to explore topics beyond the curriculum, and creativity in solving problems. Intrinsic motivation theory suggests that students with high mathematical curiosity tend to be more active in learning because they feel challenged and motivated to dig deeper into knowledge. They seek answers to existing

questions, continually ask new questions, and seek innovative solutions (Peterson & Cohen, 2019).

Mathematics curiosity is influenced by various factors, including attitudes toward mathematics, previous experiences, and support from teachers and peers. Students with positive experiences in mathematics and support from the learning environment usually show higher levels of curiosity. Mathematics curiosity in students is influenced by a variety of complex factors. One of the most significant factors is the influence of inspirational teachers. A study conducted in the 1960s showed that students who had inspirational teachers in mathematics or science tended to have higher levels of curiosity. Inspirational teachers not only provide academic knowledge but also motivate students to ask questions, form hypotheses, and test hypotheses. This can be seen from a survey showing that 83.41% of Kansas High School students interviewed felt that they had inspirational teachers, and 17.36% of them had inspirational teachers in science. Awareness of knowledge gaps is also an important factor in increasing mathematics curiosity. Students aware of knowledge gaps in mathematics will be more likely to find and understand concepts they do not yet know. This can encourage them to seek information and understand deeper concepts. In addition, increased blood flow or a sense of urgency also plays an important role. Students who feel increased blood flow will be more motivated to explore mathematical concepts, such as asking questions and testing hypotheses. Exploratory behavior is also important in increasing mathematical curiosity (Anderson & Dean, 1963; Ulya & Hayati, 2020; Zetriuslita & Ariawan, 2021).

Curious students can demonstrate exploratory behaviors such as forming and testing hypotheses and connecting current questions to prior knowledge. This can help them understand mathematical concepts more deeply and broadly. In addition, the development of epistemic beliefs is also very important. Students with better beliefs about mathematics will be more motivated to explore and understand mathematical concepts. Strategic educational interventions can also increase mathematical curiosity. Teachers can use strategic learning strategies to increase students' curiosity. Mathematical curiosity can generally be identified by several indicators, including asking about the information or problems/questions given, wanting to know things in detail, being enthusiastic/passionate about learning, seeking information from various sources, and trying alternatives to solving problems or questions (Zetriuslita & Ariawan, 2021). Teachers can give challenging assignments that can be completed with the help of available learning resources. This can encourage students to explore and understand mathematical concepts more deeply. Research also shows that mathematical curiosity can be increased through teaching methods emphasizing exploration, discussion, and interesting and challenging problem solving, such as the use of technology in today's digital age (Torbeyns et al., 2015). Project-based learning is one of the learning methods that is considered to emphasize exploration, discussion, and problem-solving, one of which, in this digital era, is STEM learning (Rahmawati et al., 2020).

STEM learning, which encompasses science, technology, engineering, and mathematics, has become a major focus in modern education due to the importance of these skills in addressing global challenges and evolving technologies. The STEM concept emphasizes the interdisciplinary integration of these four areas to develop practical skills and complex

problem-solving. As proposed by Jean Piaget and Lev Vygotsky, constructivist theory suggests that STEM learning involves an active process in which students construct their understanding through practical experiences and social interactions (Miles et al., 2018). Effective approaches to STEM education often involve several key elements, including project-based learning, collaboration, technology integration, and hands-on experimentation. Project-based learning allows students to apply theory to real-world situations, enhancing their understanding and skills. Collaboration in groups develops communication and teamwork skills, while technology integration gives students access to sophisticated tools and data analysis. Hands-on experiments allow students to apply theory to real-world contexts and hone their technical skills (Cheng et al., 2022). Good STEM learning approaches also encourage the development of critical and creative thinking skills. Students are encouraged to evaluate multiple solutions, identify problems, and develop innovative solutions. STEM learning models often involve real-life problems, which can increase student motivation and engagement. In practice, mathematical curiosity can be enhanced through various teaching methods that involve exploration and problem-solving. For example, challenging mathematical projects can stimulate students' curiosity and encourage them to find creative solutions. Technology and digital tools in mathematics learning can also expand students' exploration and provide access to additional resources (A. Roberts & Cantu, 2012; Zayyinah et al., 2022).

At the high school level, instruction involving challenging tasks and relevant problem situations can foster mathematical curiosity. This approach helps students understand mathematical concepts more deeply and enhances critical and analytical thinking skills. Project-based learning, complex problem-solving, and independent exploration can create a supportive learning environment that stimulates students' curiosity. In STEM education, applying constructivist principles and interdisciplinary approaches is key. Problem-based projects involving science, technology, engineering, and mathematics allow students to apply theory in practical contexts. These projects often involve challenging tasks relevant to real life, increasing student engagement and motivation (Gómez-Chacón et al., 2021; Rahmawati et al., 2020; Sitorus, 2022).

Group collaboration is also an important element in STEM learning. Working together on STEM projects helps students develop communication, collaboration, and problem-solving skills. Integrating technology into STEM learning allows students to use sophisticated tools and analyze data more effectively, while hands-on experiments help students apply theory in real-world contexts. Constructive evaluation and feedback are also important in STEM learning practices. Continuous assessment and effective feedback help students identify areas for improvement and refine their approaches to completing STEM tasks. Understanding the relationship between mathematical curiosity and STEM learning is essential to designing effective learning experiences. By leveraging mathematical curiosity as a driver in STEM learning and implementing curiosity-inducing teaching approaches, educators can help students develop deeper understanding and the skills needed to succeed in STEM fields (Hariyanti & Lestari, 2023; Li & Schoenfeld, 2019; Ulya & Hayati, 2020). Therefore, further research in this area may provide insights valuable for the development of more effective curriculum and teaching strategies, preparing students to face future challenges in the STEM

field. So the researcher will conduct a study on the influence of high school students' mathematical curiosity on their interest in STEM learning.

B. Methods

This is quantitative research. Quantitative research, according to the guidelines provided by John W. Creswell, represents a systematic approach to compiling, collecting, and analyzing data in the form of numbers or statistics. Quantitative research begins by formulating the problem, identifying the phenomenon to be studied, and establishing research questions (Creswell, 2014). The next step is to determine the purpose of the research and choose an appropriate research design. The data collection process is carried out through validated instruments. The collected data is then analyzed using appropriate statistical methods. The results of the data analysis are interpreted by considering practical and theoretical implications. Finally, the research findings are organized in a research report according to a scientific structure, clearly explaining the methods, findings, and interpretations. The report contributes to knowledge in the relevant research field (Creswell, 2013).

This study will analyze the influence of high school students' mathematical curiosity on their interest in STEM learning. In this study, the researcher acts as a planner, implementer, data collector, data interpreter, and reporter of research results. Activities carried out by the researcher include creating instruments in the form of online forms, collecting data through online forms for students, analyzing data, making conclusions, and making research reports. The subjects used in this study were high school students in Indonesia. The subjects selected were 200 high school students.

Research Instruments are tools used by researchers to collect data (Creswell, 2013). The instrument used in this study was an online form of student interest in three-dimensional media and STEAM. The research instrument contains a choice of students' mathematical curiosity levels based on five criteria, namely never, rarely, sometimes, often, and always, which are described in 5 indicators of mathematical curiosity, namely asking about mathematical information or problems given, wanting to know mathematical things in detail, being enthusiastic about learning mathematics, seeking information from various mathematical sources, and trying alternatives to solving mathematical problems (Zetriuslita & Ariawan, 2021). Meanwhile, the level of interest in STEM learning includes those who are interested and those who are not. Furthermore, the research hypothesis will be tested using SPSS-assisted logistic regression analysis. This aims to answer the research question, namely the influence of two or more independent variables on the independent variable. Before conducting a hypothesis test, the prerequisite test must first be met, namely the overall model test (overall model fit) model feasibility test based on the Hosmer and Lemeshow Test results. Furthermore, in the hypothesis test, the Wald test (t) shows how far the influence of the independent variable is partially in explaining the dependent variable. To find out the Wald test value, the significance level is 5%. The decision-making criteria are as follows: If the $p\text{-value} > 0.05$, then H_0 is accepted, meaning that one of the independent variables does not affect the dependent variable, but if the $p\text{-value} < 0.05$, then H_0 is rejected, meaning that one of the independent variables affects the dependent variable (Andrade, 2019).

Five hypotheses can be formulated in this research, namely:

1. The influence of asking about mathematical information or problems on interest in STEM learning.
2. The influence of wanting to know mathematical matters in detail on interest in STEM learning.
3. The influence of enthusiasm in learning mathematics on interest in STEM learning.
4. The influence of seeking mathematical information from various sources on interest in STEM learning.
5. The effect of trying alternatives to solving mathematical problems on interest in STEM learning.

C. Results and Discussion

The data that has been successfully collected is 271 respondents consisting of high school students in Indonesia. The data contains the respondents' mathematical curiosity and their interest in STEM-based learning. The analysis presented is related to the influence of high school students' mathematical curiosity on their interest in STEM learning. The analysis was conducted using SPSS-assisted logistic regression tests, as follows:

1. Case Processing Summary

Tabel 1. Case Processing Summary

Case Processing Summary		N	Percent
Unweighted Cases^a			
Selected Cases	Included in Analysis	271	100.0
	Missing Cases	0	.0
	Total	271	100.0
Unselected Cases		0	.0
Total		271	100.0

a. If weight is in effect, see classification table for the total number of cases.

The case processing summary was used to assess the accuracy and integrity of the data. Referring to Table 1, the data obtained in this study was 271, and there were no missing cases or data, so all data could have been processed and used in this research.

2. Classification Table

Tabel 2. Classification Table
Classification Table^{a,b}

Observed		Predicted			
		STEAM		Percentage	
		Tidak Tertarik	Tertarik	Correct	
Step 0	STEAM	Tidak Tertarik	0	66	.0
	M	Tertarik	0	205	100.0
Overall Percentage					75.6

a. Constant is included in the model.

b. The cut value is ,500

Table 2 obtained the overall percentage before the *variable* independent was entered, namely 75.6%. Based on this, 75.6% of students are interested in STEM learning, amounting to 205 students, and 24.4% are not interested in STEM learning, amounting to 66 students.

3. Iteration History

Tabel 3. Iteration History Book

Iteration History^{a,b,c,d}

Iteration	Coefficients							
	-2 Log likelihood	Constant	Ask for Information	Want to Detail Information	Enthusiastic to Learn	Searching for information	Trying Alternatives Solution	
Step 1	1	278.139	-6.580	.059	.291	.291	-.049	.077
	2	274.263	-9.916	.072	.375	.428	-.062	.125
	3	274.187	-10.580	.072	.385	.455	-.062	.136
	4	274.187	-10.599	.072	.385	.456	-.062	.136
	5	274.187	-10.599	.072	.385	.456	-.062	.136

a. Method: Enter

b. Constant is included in the model.

c. Initial -2 Log Likelihood: 300.880

d. Estimation terminated at iteration number 6 because parameter estimates changed by less than ,001.

Referring to Table 3 above, which is a table of iteration history when the independent variables are not included (in block 1), the value of -2 Log Likelihood is obtained: 300.880. When compared with the Chi-Square value when the degrees of freedom $DF = N - \text{Number of Independent Variables} = 271 - 5 = 266$ and the probability is 0.05, then the value of -2 Log-Likelihood: $300.880 < \text{Chi-Square value: } 305.5$. This shows that after the independent variables are entered, the model fits the data.

4. Omnibus Test

Tabel 4. Omnibus Test

Omnibus Tests of Model Coefficients

		Chi- square	Df	Sig.
Step 1	Step	26.693	5	.000
	Block	26.693	5	.000
	Model	26.693	5	.000

Based on Table 4, a significance value of <0.05 was obtained, which means that the model can be said to be fit or in other words, the addition of independent variables has a real influence on the model.

5. Hosmer and Lemeshow Test

Tabel 5. Hosmer and Lemeshow Test

Hosmer and Lemeshow Test

Step	Chi-square	Df	Sig.
1	10.637	8	.223

Based on the data in Table 5, the Chi Square Hosmer and Lemeshow test value is obtained: $10.637 > \text{Chi-Square table value: } 15.507$ (when $df = 8$ and probability $P = 0.05$). This can also be seen from the significance value in the table: $0.223 > 0.05$, which means there is no significant difference between the model and its observations, so the hypothesis test can be carried out.

6. Classification Results

Tabel 6. Classification Results
Classification Table^a

Observed		Predicted		
		STEM_Interest Not interested	Intereste d	Percentage Correct
Step 1	STEM Not interested	8	58	12.1
	Interest Interested	2	203	99.0
Overall Percentage				77.9

a. The cut value is ,500

Based on Table 6, after the independent variables are entered, the results show that students are not interested in STEM learning are 66 students, with a classification of 8 students who are indeed not interested and 58 students who should not be interested but are interested. Then, students interested in STEM learning are 205 students with a classification of 203 students who are indeed interested and two people who should be interested but are not interested in STEM learning. Based on Table 6, the accuracy of the research model is also obtained at 77.9%.

7. Logistic Regression Model and Hypothesis Testing

The output in SPSS had produced the following coefficient output results:

Tabel 7. Output SPSS Variables in the Equation Logistic Regression
Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	Ask for Information	.072	.183	.156	1	.693	1.075
	Want to Detail Information	.385	.168	5.280	1	.022	1.470
	Enthusiastic to Learn	.456	.181	6.374	1	.012	1.578
	Searching for information	-.062	.165	.142	1	.706	.940
	Trying Alternatives Solution	.136	.182	.559		.455	1.146
	Constant	-	4.525	5.486	1	.019	.000

10.599

a. Variable(s) entered on step 1: Asking for Information, Wanting to Detail Information, Enthusiastic to Learn, Seeking Information, Trying Alternative Solutions.

a. The First Hypothesis on X1(Asking for Information)

H₀ : There is no effect of asking about information on interest in STEM learning.

H₁ : There is an influence of asking about information on interest in STEM learning.

Referring to Table 7, the p-value (0.693) > 0.05 is obtained so that H₀ is accepted, which means that there is no effect of asking for information on interest in STEM learning. Based on these results, asking for information does not always directly affect students' interest in STEM learning. Although asking for information is integral to the learning process, this activity focuses more on understanding the material than on triggering significant interest and interest in STEM learning. In addition, asking questions is a foundational skill for developing other skills (Waruwu et al., 2023).

b. The First Hypothesis on X2(Want to Detail Information)

H₀ : There is no influence of wanting to know mathematical things in detail on interest in STEM learning.

H₁ : There is an influence of wanting to know mathematical things in detail on interest in STEM learning.

Based on Table 7, the p-value (0.022) < 0.05 is obtained, so it is rejected, which means that wanting to know mathematical things in detail influences interest in STEM learning. Based on these results, it was found that when students have a deep curiosity about the details of mathematical concepts, they are actively involved in learning and have an interest in learning. In addition, students can explore mathematical concepts in depth and relate them to practical applications in learning, such as those found in STEM learning (Belecina & Ocampo, 2016; Torbeyns et al., 2015).

c. The First Hypothesis on X3(Enthusiastic to Learn)

H₀ : There is no influence of enthusiasm in learning mathematics on interest in STEM learning.

H₁ : There is an influence of enthusiasm in learning mathematics on interest in STEM learning.

Based on Table 7, the p-value (0.012) < 0.05 is obtained, so H₀ is rejected, which means that enthusiasm for learning mathematics influences interest in STEM learning. Based on these results, enthusiasm for learning significantly influences students' interest in STEM learning. Students showing enthusiasm for learning can encourage students to be more involved in STEM experiments and projects, which develop critical and collaborative skills. Thus, enthusiasm for learning can be a way to increase participation and interest in media learning, such as in STEM learning (Asria et al., 2021; Fitriyana et al., 2024; T. Roberts et al., 2018).

d. The First Hypothesis on X4(Searching for Information)

H₀ : There is no influence of seeking mathematical information from various sources on interest in STEM learning.

H₁ : There is an influence of seeking mathematical information from various sources on interest in STEM learning.

Referring to Table 7, the p-value (0.706) > 0.05 was obtained, so H₀ was accepted, which means that there is no influence of seeking mathematical information from various sources on interest in STEM learning. Based on these results, seeking mathematical information from various sources does not always significantly influence students' interest in STEM learning. Although access to external sources of information such as books, scientific articles, or websites can enrich students' understanding of mathematical concepts, this process does not necessarily lead to more significant mathematical curiosity or engagement in STEM learning. Without contextual learning experiences or clear relevance between mathematics and its real-world applications, information-seeking alone is insufficient to increase students' mathematical curiosity in learning as it does in STEM learning (Puspitasari et al., 2024). In addition, contextualised mathematics or realistic mathematics education will also make mathematics more representative and students' curiosity and confidence will improve (Hidayat & Novikasari, 2023; Najah, 2024).

e. The First Hypothesis on X₅(Trying Alternative Solutions)

H₀ : There is no effect of trying alternatives to solving mathematical problems on interest in STEM learning.

H₁ : There is an influence of trying alternatives to solving mathematical problems on interest in STEM learning.

Based on Table 7, the p-value (0.455) > 0.05 is obtained so that H₀ is accepted, which means there is no effect of trying alternatives to solving mathematical problems on interest in STEM learning. Based on these results, although alternative strategies in problem-solving can provide variation and support understanding of mathematical concepts, not many students have this ability, and not all students respond to it with interest in learning mathematics, including in STEM learning (Papilaya et al., 2023) Based on Table 7, a logistic regression model was also obtained in terms of the variables significant independent influence:

$$\text{Logit}\left(\frac{\pi}{1 - \pi}\right) = -10,599 + 0,385X_2 + 0,456X_3$$

From the findings obtained, it was found that the data successfully analyzed was mathematical curiosity data and interest data in STEM learning. The final results of the logistic regression test showed an accurate model of 77.9%. This shows that students' mathematical curiosity classified into specific mathematical curiosity indicators affects students' interest in STEM learning. This confirms that students' mathematical curiosity, classified into several specific indicators, has a significant effect on students' level of interest in the context of STEM learning. This is in line with several studies. It is stated that mathematical curiosity drives project learning, including STEM, which emphasizes many STEM projects (Belecina & Ocampo, 2016; Torbeyns et al., 2015; Wicaksana, 2018).

D. Conclusion

This study concluded that the study had shown the influence of mathematical curiosity, which focused on wanting to detail information and being enthusiastic about STEM learning. The final result of the accurate model regression test was 77.9%. This indicated that education should have focused on developing mathematical curiosity through an exciting and relevant approach to create a learning environment that supported and increased students' interest in

STEM learning. Thus, learning that had facilitated and stimulated this curiosity could have created a more exciting and in-depth learning experience and encouraged students to be more actively involved in the learning process. Therefore, integrating teaching methods that prioritized mathematical curiosity in the STEM curriculum had been essential to developing students' interest and motivation.

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The Analysis of Mathematical Literacy Skills Based on the Self-Efficacy of Junior High School Students

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Abstract: The purpose of this study is to explain student's mathematical literacy abilities based on their own self-efficacy. This study aims to examine and describe mathematical literacy abilities across three levels of self-efficacy: high, medium, and low. The study was conducted at PKBM Homeschooling HSPG Purwokerto, focusing on 9th-grade junior high school students. Purposive sampling was used to select participants, and data were collected through questionnaires, written tests, and interviews. The data analysis uses qualitative descriptive analysis to fully discuss the importance of mathematics ability generated from self-efficacy. According to the research findings, students with high self-efficacy have good mathematical literacy skills, as seen by their performance on systematic questions. Meanwhile, students with moderate self-efficacy have pretty strong mathematical ability; they are able to successfully complete several aspects of mathematical literacy, although some remain inadequate. Then, students with low self-efficacy have extremely weak mathematical literacy skills, as evidenced by poor performance on the criteria of the mathematical literacy evaluation. Based on the research findings, self-efficacy improves students' mathematical literacy abilities since it is crucial in establishing students' ability to solve mathematical questions.

Keywords: mathematics; mathematical literacy; self-efficacy

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A. Introduction

Determination curriculum independence in Elementary and Secondary Education units be one of effort in prepare participant educate become human being human beings who have quality tall and powerful competition high so that you can answer challenges in the future come. The learning process in the merdeka curriculum emphasizes independence and facilitates participant educate For can develop abilities and skills 21st century (Tuerah, 2023) Merdeka Curriculum offers freedom to the teacher for develop learningto be able to customized with abilities and needs participant educate in unit school.

Flexibility in learning expected give chance for development customized learning with need in the future front and the world. This is in accordance with runway (Tuerah, 2023)y sociological from implementation Independent curriculum (Noptario et al., 2024) which state that : (1) learning must designed in effort preparation Students as world citizens. (2) learning arranged with lift various topics and dynamics social, as well as lift global issues. (3) Students are honed sensitivity social on problems that occur in various other parts of the world,motivated

For Study diverse different cultures, and are encouraged For contribute for a better world life good. Referring from statement the can understood that learning No just focus on content material learning but also pay attention to the learning process as well as ability from participant educate for can develop its potential.

Structured learning as above is also applied to the learning process mathematics, which is one of the eye lessons to be learned supported by participants educate from Primary Education to with Secondary Education. Mathematics is a necessary part developed in the world of education. Mathematics own role important in breakdown problem life. Mathematics is eye lessons that have role important in effort solve various problem in life every day (Rahman Yulianto et al., 2020). While (Hendriana et al., 2014) is of the opinion that mathematics own role in former pattern think humans are needed in modern society, because can make manbecome more flexible mentally, open and easy adapt with various situation as well as condition in various problems. In addition, mathematics is underlying science field knowledgetheothers. Suyitno (Rahman Yulianto et al., 2020) said that *mathematics is a queen of sciences and mathematics is a servant of sciences*. That matter show that mathematics own role important in development knowledge knowledge. Mathematics is a science in which there is a collection of concepts in the form of operations, numbers, symbols and definite patterns (Najah, 2024).

Importance mathematics in development knowledge knowledge, so that need there is study deep for in development mathematics. One of them, in study mathematics that is development literacy mathematics. Literacy mathematics is one of necessary skills developed in understand mathematics. OECD through PISA said that literacy mathematics is ability design, use, interpret breakdown mathematics in life every day. People who have ability literacy good math can know role important mathematics in life every day. As opinion (Haara et al., 2021) Mathematical literate people are able to recognize the role of mathematics in decision making or problem solving. Apart from that, math in breakdown the problem need ability procedural. This is in accordance with ability literacy interrelated mathematics relate with procedural abilities (Nisa & Arliani, 2023). Referring to matter said, in the process of solving problem required ability literacy mathematics for participants educate can analyze problem until with the process of interpreting problem in settlement problem.

Ability literacy mathematics also has role important in development of education. Therefore that, literacy mathematics be one of indicator international education standards (Ghofur et al., 2022). In Indonesia, the focus of educational evaluation through a minimum competency assessment is mathematical literacy (Nizham et al., 2017). The Government of Indonesia has fixed the curriculum, learning achievement targets, and international-based evaluation (Nugraha, 2022). However, The development of student learning achievement in mathematics, especially in junior high schools (SMP) in Indonesia, still shows a low level of knowledge (Suherman, 2024) and in reality ability literacy mathematics participant educate Indonesia still in Category low. Based on PISA report in 2022 ability literacy mathematics participant educate occupy ranked 70th out of 81 countries (Nugraha, 2022). The results show still need attention special in development ability literacy mathematics. In addition, the conditions it is also necessary become runway in development learning customized

mathematics with needs and skills century to 21 involving ability thinking, analyzing, and creativity.

Condition low literacy Mathematics is also explained in research previously. Participants educate experience difficulty in solve question connected mathematics with life every day. It is marked with participant educate Not yet can to describe problem until with analyze results from questions, participants educate doubt in answer question so that often produce different interpretations (Alqusyairi & Suherman, 2021). The doubts that cause different interpretations show absence belief participant educate in finish question mathematics. This is be one of existing internal factors in self participant less educated certain in settlement question mathematics. Some study literature explain that difficulty in finish problem mathematics is also due to participant educate Already own view that mathematics that eye difficult and many lessons count, thing this cause participant educate the more no certain in finish question mathematics. In ability belief participant educate in finish math period impact on the participant process educate finish problem. The term of inconsistency belief often known as *self-efficacy*.

Efficacy self, or often called *self-efficacy*, is level belief somebody to ability self Alone in finish problem or the tasks given to him (Indraswara & Kusmaharti, D., & Yustita, 2023). *Self-efficacy* own role important in settlement problem mathematics, because belief self from participant educate become one of the initial capital for can with easy understand literacy mathematics. This is reinforced with results study previously conducted by (Drajat, WR & Dasari, 2023) who stated that *self-efficacy* participant educate own connection significant with literacy mathematical, meaning how much big or small level *self-efficacy* participant educate will influence literacy mathematical participant educate. This is in line with opinion this is in line with (Nizham et al., 2017) PISA stated that *self-efficacy* own role important in Study because can influences the level of effort and persistence applied by participants educate in finish tasks and challenges.

Referring to the analysis and study above, in this research this done analysis for give description in terms of and description related with ability participant educate in literacy mathematics under review from ability *self-efficacy* from participant educate. In the discussion article this will describe ability literacy mathematics based on indicator from ability literacy mathematics that yourself, in order to provide clear picture related with ability participant education in mathematics literacy.

B. Methods

Types of research this is study descriptive qualitative purposeful for analyze understanding draft mathematics Junior High School students in grade IX towards data content. Subject study this is student class IX, which has get material in determining the subject, researcher use *purposive sampling* which is the sampling member sample based on consideration certain (Sugiyono, 2013). Election subject started with give questionnaire self-efficacy and test instruments literacy mathematically, then from results answer questionnaire student grouped become three category that is high, medium, and low. Test results literacy mathematical students who have not fulfil indicator literacy mathematical in a way maximum for further analyzed in the interview.

Collection techniques in research this use test written and interview. Written test correlated to the indicator literacy mathematical on data content as well interview correlated on test written information provided. The data validity technique used in study this is triangulation technique. Data analysis conducted in the study this through three stages that is data reduction, data presentation, and extraction conclusion (Sugiyono, 2013). After the data was obtained through test written and interview, then done data reduction data reduction is done with choose things main, focus things important, and throw away what is not need. Then the result data reduction the served so that there is a clear and possible picture for interesting conclusion.

As for the indicators literacy mathematics used is according to (OECD, 2019)oncognitive processes student is able to: 1) *formulating mathematical situations*, 2) *Employing mathematical concepts, facts, procedures and reasoning*, 3) *Interpreting, applying and evaluating mathematical outcomes*. In research this, indicator the will loaded in 9 grains questions given as instruments and already validated by expert education Mathematics, the indicators are as following:

Table 1. Cognitive Process Components and Indicators Mathematical Literacy Student

Cognitive Process Components	Indic ator
<i>Formulating mathematical situations</i>	Identifying aspect mathematics in the problem Representation mathematical from the given problem
<i>Employing mathematical concepts, facts, procedures, and reasoning</i>	Explain identified representation from the given problem Design and implement internal strategies finish problem Connecting and using various representation Reflecting on mathematical arguments , explaining and justifying results mathematical.
<i>Interpreting Applying and Evaluating mathematical outcomes</i>	Finding the mathematical model used Interpret results mathematical to real world context Use thinking mathematics and thinking computing For make prediction solution mathematical from contextualized problems

C. Results and Discussion

Analysis cognitive process problems literacy mathematics on three subject study done based on results answer write student in finish it. After that, is done interview with students forconfirm suspicion results analysis test mathematical literacy. The test instruments used and the results the analysis as following.

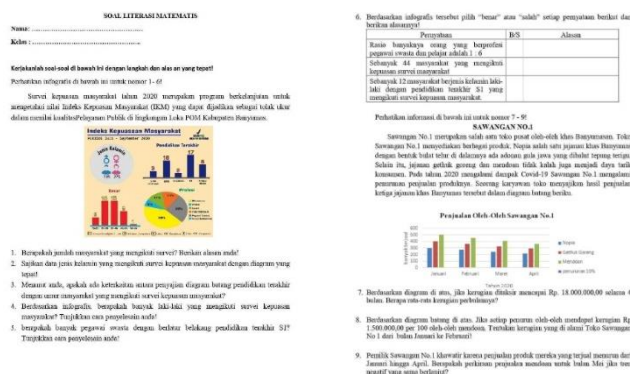


Figure 1. Instrument Test

1. Answer Written and Interview Subject Along With The Analysis

a. Analysis Answer Written and Interview First Subject (S1)

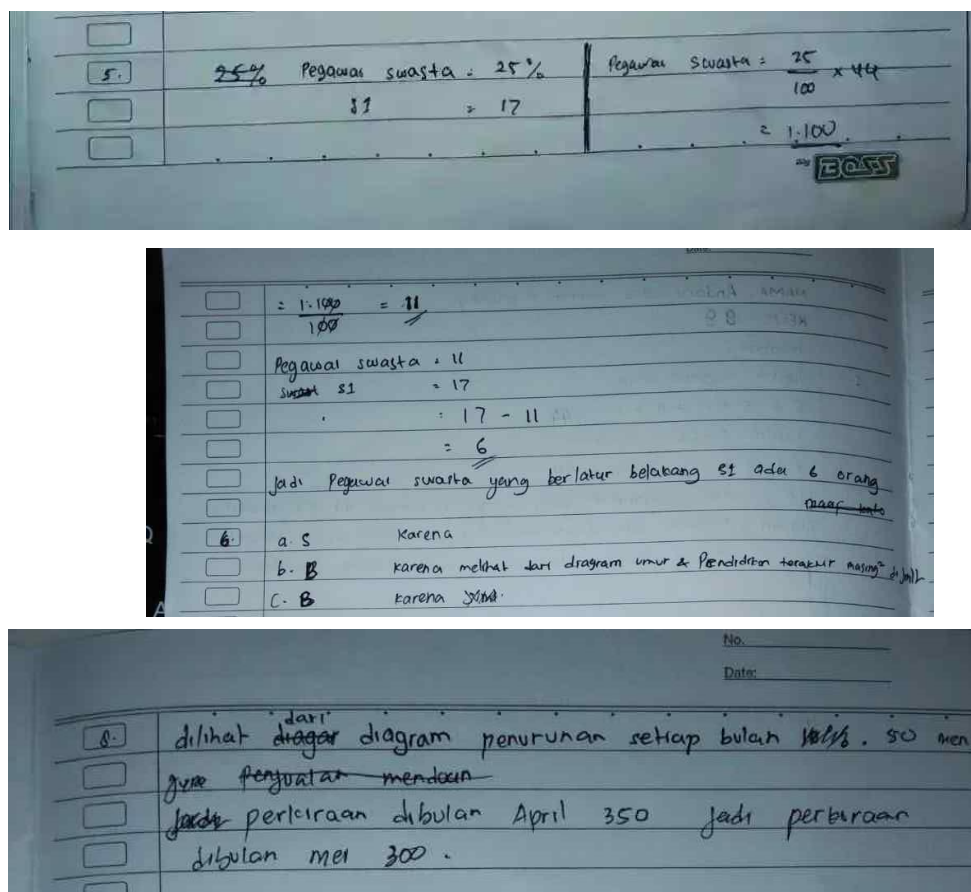


Figure 2. Results S1 Answer

Based on Figure 2, from (S1N5) suspected student experience difficulty in to mean questions asked that is the amount employee private with background behind S1 education. This is seen in the results settlement student where no can connect information public profession employee private as much as 25% with lots community with background behind S1 education as many as 17. From (S1N6a) and (S1N6c) it is suspected student not yet can explain reason why statement given is false or true. For (S1N9) it is suspected lack of information used from infographics provided so that No appropriate in predict decline sales in the month May.

On the question number 5 with indicator connect and use various representation. S1 can identify as much as 25% of employees private from pie charts and many public 17 people with bachelor's degrees, will but student No can connect second information the for determine lots employee private sector background S1 education. The following results interview researcher with first subject (S1):

- Q : Are you sure about your answer to number 5?
 S1 : I'm not really sure, because I don't know, that's all I know.
 Q : Why do you use the $25\% \times 44$ strategy?
 S1 : because we are looking for lots of private employees.
 Q : Do you understand the question given?

S1 : *Yes, looking for the difference between the number of private employees and the number of members of the public Bachelor's degree*

Q : *Have you ever heard of the profession of private employee with a Bachelor's degree background?*

S1 : *Yes, because when working you have to include your last education*

Q : *When working, do you have difficulty connecting two pieces of information?*

S1 : *Yes,*

From the interview excerpt, it can be seen that the subject does not understand the relationship between the two pieces of information, namely private employees and their last education. This makes students misinterpret the questions given. Therefore, students cannot complete the large number of private employees with a bachelor's degree.

On the question number 6a and 6c with indicator reflect mathematical arguments, explain, and justify results mathematical. S1 can give assessment of each question given with right. However no write the reason. Here results interview researcher with first subject (S1):

Q : *Did you have any difficulty completing number 6?*

S1 : *no.*

Q : *Why don't you write down the reasons for each statement?*

S1 : *because I forgot to write it down.*

Q : *From the statement 6a given, what reason should you give?*

S1 : *the ratio of the number of people working as private employees to students is 1:5?*

Q : *Whereas in question 6c, what reason should you give?*

S1 : *I don't know, I forgot.*

From the interview excerpt, it can be seen that the subject only wrote the assessment correctly. However, it is difficult to argue and explain the assessment given. This happens because students do not fully understand the information they get. It can be seen when the researcher asks for the reason that should be given in number 6a. Students make a mistake in stating the ratio of many people who work as private employees and students.

On the question number 9 with indicator use thinking mathematics and thinking computing for make prediction solution mathematical from contextualized issues. Subject write a prediction decline sale mendoan with see from the bar chart the stem is presented. Here results interview researcher with first subject (S1):

Q : *Did you have any difficulty completing number 8?*

S1 : *No.*

Q : *Why do you predict a 50% decline in mendoan sales?*

S1 : Because I looked at the bar chart from January to February sales decrease by 50, so every month there is a decrease of 50

Q : Did you not find any other information from the diagram?

S1 : No,

Q : If I ask you to observe again, would you find anything other information?

S1 : Oh yeah, it says there's a 10% decrease.

From the interview excerpt, it can be seen that the subject was not careful in reading and understanding the information provided. The subject only read the data presentation in January and February experienced a decrease of 50, so the subject generalized that the Sawangan No. 1 shop experienced a decrease in mendaan sales of 50 each month. This resulted in the subject not using his mathematical thinking and computational thinking to predict a given problem.

b. Analysis Answer Written and Interview Second Subject (S2)

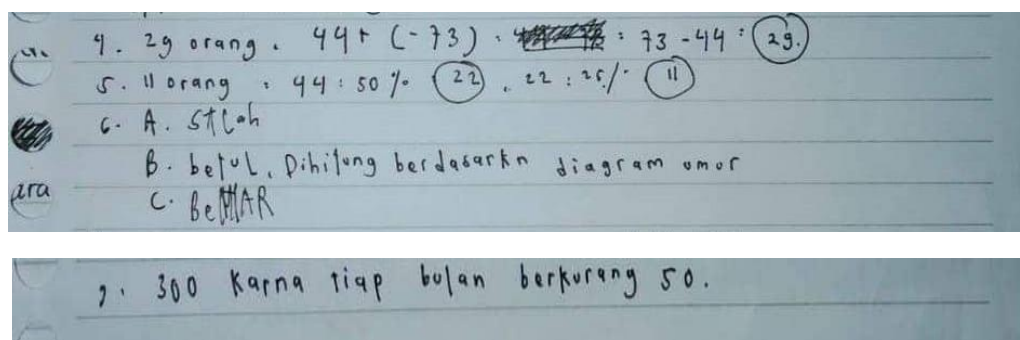


Figure 3. Results S2 Answer

Based on Figure 3. From (S2N4) it is suspected student experience difficulty in identify and design strategies from the information he obtained. This seen in the results settlement student where no can implement the right strategy. From (S2N5) it is suspected student experience difficulty in identify information must be obtained for finish problem. That thing seen in the results settlement student where no display identification information percentage employee private and many have a Bachelor's degree. From (S2N6a) and (S2N6c) it is suspected student not yet can explain reason why statement given is false or true. For (S2N9) it is suspected lack of information used from infographics provided so that No appropriate in predict decline sales in the month May.

On the question number 4 with indicator designing and implementing internal strategies finish problem. S2 does not show moreover formerly identification the necessary issues. However, the subject direct try for design and implement the strategy. Here's results interview researcher with second subject (S2):

Q : Are you sure about your answer to number 4?

S2 : Yes, I'm sure.

Q : Why did you write information 44?

S2 : *because of the number of people who took part in the survey.*

Q : *Why did you write information 73?*

S2 : *because the percentage of male gender*

Q : *In your opinion, is 73% of a society that follows survey?*

S2 : *eehmmm. yeah I think so*

Q : *If yes, what operation should be used to show the part?*

S2 : *don't know.*

From the interview excerpt, it can be seen that the subject designed a strategy from the two pieces of information obtained. This can be seen when the subject answered the researcher's question about what operation should be used to show 73% of a community that took the survey. However, the subject could not answer it. Therefore, the subject could not implement the strategy in finish problem with appropriate.

On the question number 5 with indicator connect and use various representation. S2 does not can identify information employee private from pie charts and many public Bachelor's degree from education diagram lastly. Next results interview researcher withsecond subject (S2):

Q : *Do you find it difficult to solve problem number 5?*

S2 : *Yes.*

Q : *Why did you write 44 x 50%?*

S2 : *because we are looking for lots of private employees.*

Q : *Why did you write 22 x 25%?*

S2 : *because we are looking for many people with a Bachelor's degree*

Q : *In your opinion, is there a relationship between private employees andlast education?*

S2 : *None, because I don't know who had the last education, S1, and became a private employees.*

Q : *When working, do you have difficulty connecting two pieces of information?*

S2 : *Yes,*

From the interview excerpt, it can be seen that the subject had difficultyidentifying the information that he/she had to obtain to solve the problem, and the subject also did not know the relationship between private employees and their last education. This caused students to make mistakes in using various representations. Therefore, students were unable to complete the large number of private employees with a bachelor's degree.

On the question number 6a and 6c with indicator reflect mathematical arguments, explain, and justify results mathematical. S2 can give assessment of each question given with right. However No write the reason. Here results interview researcher with second subject (S2):

Q : Did you have any difficulty completing number 6?

S2 : No.

Q : Why don't you write down the reasons for each statement?

S2 : because I don't know.

From the interview excerpt, it can be seen that the subject only wrote the assessment correctly. However, it was difficult to argue and explain the assessment given. This happened because the student did not fully understand the information obtained.

On the question number 9 with indicator use thinking mathematics and thinking computing for make prediction solution mathematical from contextualized issues. Subject write a prediction decline sale mendoan with see from the bar chart the stem is presented. Here results interview researcher with second subject (S2):

Q : Did you have any difficulty completing number 8?

S2 : No.

Q : Why did you write 300?

S2 : Because every month there is a decrease of 50 on the bar chart

Q : Did you not find any other information from the diagram?

S2 : No,

From the interview excerpt, it can be seen that the subject was not careful in reading and understanding the information provided. The subject only read the presentation of data in the bar chart which experienced a decrease of 50, so the subject generalized that the Sawangan No. 1 shop experienced a decrease in mendoan sales of 50 each month. This resulted in the subject not using his mathematical thinking and computational thinking to predict a given problem.

c. Analysis Answer Written and Interview Third Subject (S3)

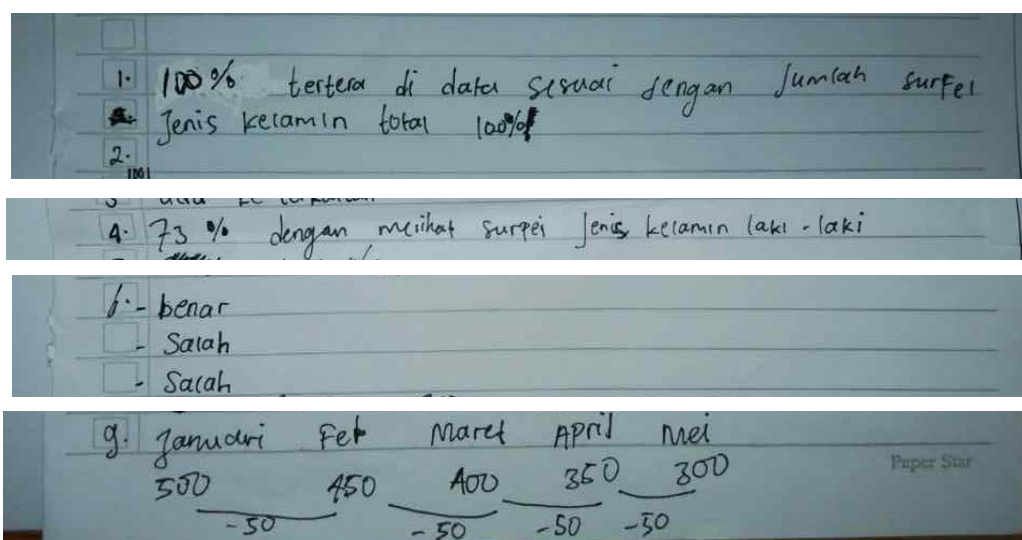


Figure 4. Results S3 Answer

Based on Figure 4, from (S3N1) suspected student experience difficulty in identify mathematical the amount the community that follows survey,. This is seen in the results settlement student where only write down 100% of what is obtained from the type diagram sex. From (S3N2) suspected student misconception about representation a percentage data to in the shape of a pie chart. This is seen in the results settlement student Where represent in bar chart form. From (S3N4) it is estimated student difficulty identify infographics provided. This is seen in the results settlement student only write 73% with see survey type sex male. From (S3N6) suspected student difficulty in understand the statement given. This is seen results settlement student when give assessment of each statement given not yet appropriate all and nothing write the reason. For (S3N9) allegedly lack of information used from infographics provided so that No appropriate in predict decline sales in the month May.

On the question number 1 with indicator identify aspect mathematics that is in the problem. Here results interview researcher with third subject (S3):

Q : *Are you sure about your answer to number 4?*

S3 : *Yes, I'm sure.*

Q : *Why did you write 100%?*

S3 : *because of the number of genders that participated in the survey.*

Q : *If I asked you to look at the infographic again, would you found other information?*

S3 : *No*

From the interview excerpt, it can be seen that the subject was less careful in reading the infographics provided. The difficulty in identifying infographics in a way mathematical so that No can give the right answer.

On the question number 2 with indicator representation mathematical from the given problem. The following results interview researcher with third subject (S3):

Q : *Are you sure about your answer to number 2?*

S3 : *yes.*

Q : *Why did you present it in a bar chart?*

S3 : *because it follows the presentation of other data.*

Q : *Why not choose a pie chart?*

S3 : *it's okay*

From the interview excerpt, it can be seen that the subject's lack of knowledge regarding the presentation of data in a diagram, the subject does not yet understand that percentage data should be presented with a pie chart. Lack of subject knowledge so that No can represent with appropriate.

On the question number 4 with indicator designing and implementing internal strategies finish problem. Here results interview researcher with third subject (S3):

Q : *Are you having difficulty solving problem number 4?*

S3 : *No*

Q : *Why did you write 73%?*

S3 : *Because it looks like a male gender.*

Q : *Do you understand the question given?*

S3 : *No*

From the interview excerpt, it can be seen that the subjects had difficulty in understanding the questions given. It can be seen from the subjects who only identified 73% of the male gender without writing down the number of people who took the survey. This resulted in students not designing and implementing a strategy to determine the number of male genders who took the survey.

On the question number 6 with indicator reflect mathematical arguments, explain, and justify results mathematically. Here results interview researcher with third subject (S3):

Q : *Are you sure about the assessment you gave?*

S3 : *yes*

Q : *Why did you write the assessment true, false, false?*

S3 : *ehhhmmm... because true, false, false.*

From the interview excerpt, it can be seen that the subject had difficulty in understanding the statements given. The subject only gave an assessment according to his opinion. It can be seen when the researcher asked for the reason, the subject could not explain each assessment in the statement given.

On the question number 8 with indicator interpret results mathematical to real world context. Here results interview researcher with third subject (S3):

Q : *Did you have any difficulty completing number 8?*

S3 : *No.*

Q : *Why did you write $1,500,000 = 1,425,000$?*

S3 : *Because I just answered randomly*

Q : *Do you understand the questions in the given problem?*

S3 : *just keep quiet*

From the interview excerpt, it is seen that the subject did not fully understand the questions given, so the subject just answered haphazardly. This resulted in the subject being unable to interpret the mathematical results of the decline in mendoan sales from January to February.

On the question number 9 with indicator use thinking mathematics and thinking computing for make prediction solution mathematical from contextualized issues. Subject

write a prediction decline sale mendoan with see from the bar chart the stem is presented. Here results interview researcher with third subject (S3):

Q : *Did you have any difficulty completing number 9?*

S3 : *No.*

Q : *Why did you write 300?*

S3 : *Because I see the result of $500-450 = 50$, so I conclude that each the month is reduced by 50*

Q : *Did you not find any other information from the diagram?*

S3 : *No,*

From the interview excerpt, it can be seen that the subject was not careful in reading and understanding the information provided. The subject only relied on the result of $500 - 450 = 50$ so that the subject predicted that every month there would be a decrease of 50. The subject estimated a decrease in mendoan sales in May of 300.

Based on the results of the analysis and interviews with 3 subjects, it was found that the subjects still faced several difficulties in completing mathematical literacy. *First*, the subjects had difficulty identifying aspect mathematical problems in the problem, because of the low literacy and accuracy in extracting information from the infographics provided. *Second*, the subject had difficulty representing mathematical from a problem, because lack of knowledge student about data presentation. *Third*, explain identified representation from problem, because subject experience difficulty in explain the relationship obtained from two representations namely bar chart education final with age the community that follows survey satisfaction society. *Fourth*, the subject difficulty designing and implementing internal strategies finish problem, because subject No understand questions and identify on a problem. *Fifth*, the subject experience difficulty connect and use various representation, because not yet understand the relationship between two representations in a given infographic. *Sixth*, subjects have difficulty reflecting on mathematical arguments, explaining, and justifying results mathematically, because lack of accuracy read infographics and tend to only origin just in justify results statement given. *Seventh*, subject experience difficulty interpret results mathematical to real world context, because the difficulty interpret the average of a mark certain so that subject No can interpreting the average of a other values. *Eighth*, the subject experience difficulty use thinking mathematics and thinking computing For make prediction solution mathematical from contextualized problems, because no be careful in reading and understanding infographics so that you immediately generalize the information you get without looking at it again.

Of the 3 subjects who were analyzed for answers and interviews, each had difficulty in achieving the given indicators. The first subject was able to complete 6 indicators of mathematical literacy, namely 3 indicators in the cognitive process of *Formulating situations mathematics*, 1 indicator in the cognitive process *Employing mathematical concepts, facts, procedures, and reasoning*, and 2 indicators in cognitive processes *Interpreting Applying and Evaluating mathematical outcomes*. Subject second capable complete 5 indicators literacy mathematical namely 3 indicators in the cognitive process of *Formulating situations*

mathematics, and 2 indicators in the cognitive process *Interpreting Applying and Evaluating mathematical outcomes*. Besides that subject third capable complete 2 indicators literacy mathematical namely 1 indicator in the cognitive process *Employing mathematical concepts, facts, procedures, and reasoning*, and 1 indicator on cognitive processes *Interpreting Applying and Evaluating mathematical outcomes*.

D. Conclusion

Based on from results analysis and discussion can taken conclusion that subject that has self efficacy tall can finish literacy mathematical more Good compared to others . Self efficacy is level belief somebody to ability self Alone in finish problem or the tasks given to him . Subjects who have self efficacy tall can complete 6 indicators literacy mathematical with fulfill 3 cognitive processes that is Formulating mathematical situations, Employing mathematical concepts, facts, procedures, and reasoning, and Interpreting Applying and Evaluating mathematical outcomes. Subjects who have self efficacy currently can complete 5 indicators literacy mathematical with fulfill 2 cognitive processes that is Formulating mathematical situations, and Interpreting Applying and Evaluating mathematical outcomes. Besides that subject that has self efficacy low only can complete 2 indicators literacy mathematical with fulfil 2 cognitive processes that is Employing mathematical concepts, facts, procedures, and reasoning, and Interpreting Applying and Evaluating mathematical outcomes.

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