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The Relationship Between Students' *Curiosity* and Mathematical Conceptual Understanding Ability in Theorem Pythagorean

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Abstract

The aim of the research is to determine the relationship between students' *curiosity* and their ability to understand mathematics. The research was carried out using a quantitative descriptive method. The sample was 35 students in class VIII of SMP Negeri in Jakarta, selected using cluster random sampling technique. The instruments used were tests in the form of multiple choice questions and questionnaires, each with 30 items. The results of the prerequisite test with the normality test produce an L count value of 0.073 and an L table value of 0.150 for N = 35, a significance level of 0.05, meaning the data shows a normal distribution. The results of the prerequisite test with the linearity test are F count = 0.469 and F table = 2.63, meaning the relationship between variable X and variable Y is linear. The results of the Product Moment correlation test are rxy=0.662 with sufficient correlation coefficient information, this shows that there is a positive relationship between Variable X and Y. From the research results, it can be concluded that there is a positive relationship between students' *curiosity* and their ability to understand mathematics in Pythagorean Theorem for class VIII at SMP Negeri in Jakarta.

Keywords: *Curiosity*, Pythagorean theorem, the ability to understand mathematical.

1 INTRODUCTION

Human curiosity is very large and has existed since childhood. Whatever people see, feel, hear and think encourages them to continue searching for and knowing new things. This enriches knowledge and experience in learning activities. In the learning process, motivation is very important to help students develop interest in learning and foster curiosity during learning.

In the learning process, the presence of curiosity in students will make them have a tendency to determine and analyze new things to solve problems or reduce certainty in the learning activities being carried out. So the attitude of curiosity plays an important role during learning activities to find out how enthusiastic the students are and to what extent the students can grasp the material (Rahayu, & Dewi, 2022).

Curiosity is defined as a strong urge that arises within a person to understand the material or problem being faced. Curiosity (*curiosity*) makes students motivated to continue digging, finding answers to the problems given. How to train *Curiosity* is by providing challenging and confusing problems so that various questions arise in the student. One way to get answers is to ask educators. Questioning activities help students to demonstrate understanding abilities independently. *Curiosity* can be identified from the desire to learn, find out, investigate and know students in studying mathematics (Zetriuslita, Z, 2016). Curiosity encourages students to ask questions, seek answers, and not be satisfied with superficial understanding. It is the driving force that keeps students learning, despite difficulties or challenges. In the context of learning mathematics, curiosity can help students overcome confusion and boredom, because they are encouraged to discover the logic and beauty behind every mathematical concept. Apart from that,

curiosity also plays an important role in building critical thinking skills and mathematical problem solving (Mareti, J. W., & Hadiyanti, A. H. D., 2021).

Mathematics is one of the basic sciences that every human being must master, especially school students. In the context of mathematics education, for example, understanding learning is meant not only in the aspect of the ability to understand mathematics as a natural or cognitive science, but also in the attitude aspect towards mathematics. Mathematics education as an active, dynamic and generative process through mathematical activities (doing mathematics) makes an important contribution to students in developing reasoning, logical, systematic, critical and careful thinking, as well as being objective and open in dealing with various problems (Apiati, V ., & Hermanto, R., 2020). The meaning of mathematics cannot be defined absolutely, because mathematics has a role and relationship with other fields of study. However, the word mathematics itself comes from the Latin mathanein which means thinking or learning, while mathema means knowledge (Mutiarani, A., & Sofyan, D., 2022).

According to Ruseffendi, concepts arise because of human thoughts which are related to ideas, processes and reasoning (Ruseffendi, E.T., 2006). So ideas, processes and reasoning in mathematics are a unity that is difficult to separate to understand a mathematical concept. Meanwhile, according to Rahmawati, N. D., & Roesdiana, L. (2022), understanding concepts is a continuation of learning from concept cultivation, which aims to make students understand a mathematical concept better.

Every student is expected to have conceptual understanding abilities in mathematics subjects. Efforts to foster and increase students' curiosity, especially in mathematics subjects. Thus, it is important to develop students' curious attitude in schools, which are places where students learn new knowledge. Based on the description above, the author is interested in conducting research on the relationship between students' curiosity and their ability to conceptually understand mathematics by measuring student learning outcomes at one of the State Middle Schools in East Jakarta.

2 RESEARCH METHODS

The aim of the research is to find out whether there is a relationship between students' curiosity and their ability to understand mathematics regarding the Pythagorean theorem. This research was carried out at one of the state junior high schools in Jakarta. The research sample was class VIII students who were active in the odd semester of the 2023/2024 academic year.

The method used is a quantitative approach survey method, using correlation techniques. Correlation research or correlational research is a general approach to research that focuses on interpreting the relationship between two or more variables, without making additional changes or manipulation to existing data. The correlation technique in research focuses on solving problems that determine the relationship between variables X and Y. The variable in this research is curiosity (*curiosity*) students as the independent variable (X) and the ability to understand mathematical concepts is the dependent variable (Y). The research design can be described as follows:

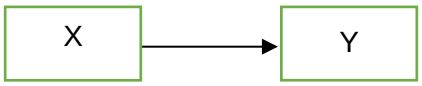

Figure 1. Correlation Research Design

The research sample is a portion of the population taken as a data source and represents the entire population. If the population is large, and it is impossible for researchers to study everything in the population, for example due to limited funds, personnel and time, then researchers use samples taken from that population. Samples are very important because they are part of the research. The sample size for this research

was 70 students consisting of 35 students in class VIII A and 35 students in class VIII D. The sampling technique used in the research was cluster random sampling. The research instrument uses a questionnaire with a student curiosity scale or variable X whose indicators are adopted from the research indicators of Daryanto & Darmiatun (2013), and Kurniawan (2014).

To collect data on mathematical conceptual understanding abilities (variable Y) using test instruments prepared in the form of multiple choice questions. The number of questions prepared is 30 questions on the Pythagorean Theorem. The questions are created based on indicators for class VIII mathematics subjects and by looking at students' conceptual understanding of mathematics abilities. Before questionnaires and tests were used as instruments in research, they were first tested to determine their validity and reliability of 56.18%. Validity itself is a measure that shows the level of validity or validity of an instrument. Meanwhile, reliability means a measuring tool/instrument that can be trusted and reliable to use because its measurements do not change after repeated use to get similar results. Apart from meeting validity and reliability, specifically for test instruments it is also necessary to meet the requirements for the level of difficulty and distinguishing ability of the questions. Difficulty level to determine the level of difficulty in reading and understanding the concept of formulas and symbol notation in the questions. Data analysis in this study was used to determine the existence of a significant relationship between curiosity (*curiosity*) students with the ability to understand mathematics in the Pythagorean theorem material. The steps taken in data analysis include prerequisite tests using the Liliefors test and linearity test, hypothesis testing using the correlation test and reinforced with significance tests using the t test and coefficient of determination test.

3 RESULT AND DISCUSSION

Curiosity data processing (*curiosity*) students and their ability to understand mathematics in class VIII of State Middle Schools in Jakarta were obtained through questionnaires and tests carried out to determine the level of correlation between students' curiosity and their ability to understand mathematics in the Pythagorean theorem material in class VIII of State Middle Schools in Jakarta.

3.1. Description of Student Curiosity Data (Variable X)

Based on data obtained from the results of distributing questionnaires, the minimum score for the curiosity variable was 49, and the maximum score was 84 with range = 35, number of interval classes = 6, and interval class length = 6. After calculating the frequency distribution, the average value was obtained. -mean = 66.071 median = 66.8 mode = 68.216, variance = 79.045, and standard deviation = 8.891. The following is a frequency distribution table for making histogram graphs and polygons for the variable X (student curiosity).

Table 1. Frequency Distribution of Variable

Mark	***f***	X_i	$f.X_i$	$X_i - \underline{X}$	$(X - \underline{X})^2$	$f(X_i - \underline{X})^2$	**Real Limits**
49-54	5	51,5	257,5	-14,571	212,314	1061,57	48,5 – 54,5
55-60	4	57,5	230	-8,571	74,201	296,804	54,5 – 60,5
61-66	8	63,5	508	-2,571	6,610	52,88	60,5 – 66,5
67-72	10	69,5	695	3,429	11,758	117,58	66,5 – 72,5
73-78	5	75,5	377,5	9,429	88,906	444,53	72,5 – 78,5
79-84	3	81,5	244,5	15,429	238,054	714,162	78,5 – 84,5
Amount	35	-	2312,5	-	-	2687,526	-

The research data presented in Table 2 are grouped based on average scores, the group of students who got scores below the average were 17 students, the group of students who got scores above the average were 18 students. The highest frequency is in the fourth class, and the lowest frequency is in the sixth class. From this information, it can be depicted in a histogram and polygon graph as follows:

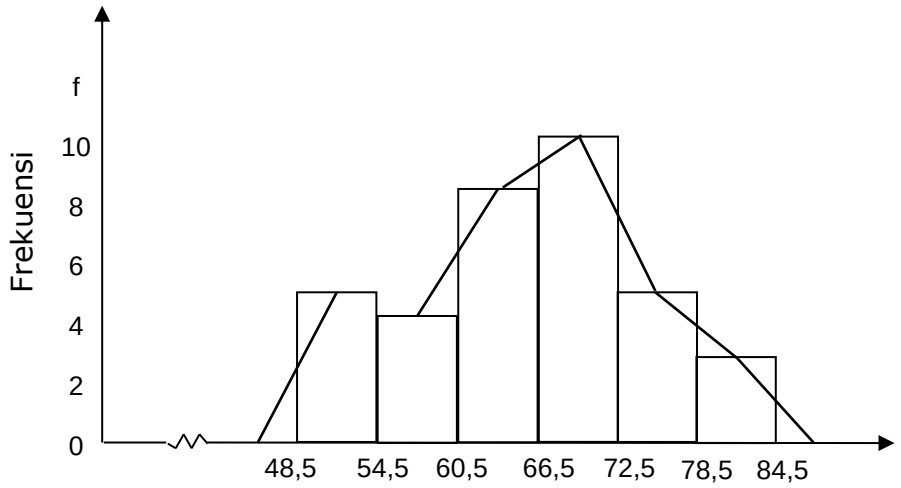

Figure 1. Histogram and Polygon Graph of Variable X

3.2 Data Description Mathematical Understanding Ability (Y)

From the results of research using test questions, the lowest score was 8 and the highest score was 96 with a range of 88, the number of interval classes was 6, and the interval class length was 15. After calculating the frequency distribution, the average value was 62.57, the median was 81.57, mode 73.50, variance 509.371, and standard deviation 22.569. Table 3 below is a frequency distribution table as a guide for making histogram and polygon graphs for variable Y (Mathematics Conceptual Understanding Ability).

Table 2. Frequency Distribution of Variable Y

Mark	f	X_i	$f.X_i$	X_i - $\underline{X}$	$(X - \underline{X})^2$	$f(X_i - \underline{X})^2$	Real Limits
8 – 22	3	15	45	-47,6	2265,76	6797,28	7,5 - 22,5
23 - 37	2	50	60	-32,6	1062,76	2125,52	22,5 - 37,5
38 - 52	5	45	225	-17,6	309,76	1548,8	37,5 - 52,5
53 - 67	8	60	480	-2,6	6,76	54,08	52,5 - 67,5
68 - 82	10	75	750	12,4	153,76	1537,6	67,5 - 82,5
83 - 97	7	90	630	27,4	750,76	5255,32	82,5 - 97,5
Amount	35	315	2190	-	-	17318,6	-

From Table 3, it can be grouped based on the average score, namely the group of students who got scores below the average were 16 students and the group who got scores above the average were 19 students.

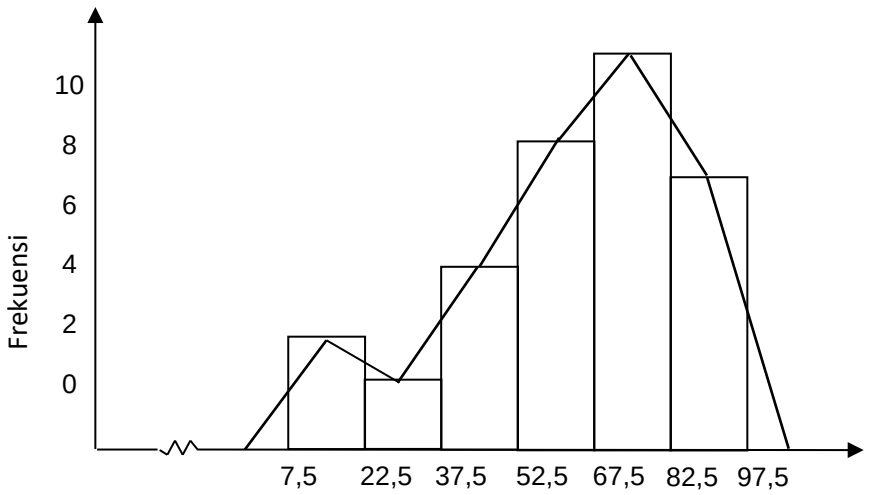

Figure 2. Histogram and Polygon Graph of Variable Y

3.3 Data Analysis Requirements Testing

The process of testing the data analysis requirements in this research is an important step that must be fulfilled before testing the hypothesis. This test is necessary because if the research data is not normally distributed, further analysis cannot be carried out using the parametric methods commonly used. Therefore, analysis requirements were tested, namely the data normality test. This research was carried out by testing the normality of the data used, namely the Lilliefors normality test, with the following results:

Table 3. Normality Test Results using the Liliefors test formula

No	Variable	Calculation Statistics		Conclusion
		L_{count}	L_{table} (a = 0.05 and n=35)	
1	X	0,064	0,150	Normal
2	AND	0,073	0,150	Normal

Based on the results of Lilliefors' calculations produced in Table 4.3, the calculated L value for the curiosity variable (*curiosity*) students (X) is 0.064, while L calculated for the variable ability to understand mathematical concepts (Y) is 0.073. Both values are less than L table (0.150). So it can be stated that the research data for the two variables comes from a normally distributed population.

Followed by the Linearity test. This test is carried out to find out whether the two existing variables, namely variable X and variable Y, have a linear relationship or not. The simple linear regression equation is: Y = a + bX. With Y = dependent variable (predicted value), X = independent variable, a = constant (Y value when X = 0), b = regression coefficient (increasing or decreasing value). From the results of the linearity calculations carried out, the price a = 0.730, the price b = 1.701. This value is substituted in the regression equation to become Y = 0.730 + (1.701)

Next, the F value was calculated and the calculated F value was obtained (F obs) = 0.469. Meanwhile, the F table value is at a significance level of 0.05 with dk (22;11) = 2.63. If you look at the calculated F value <F table, it can be seen that there is a linear

relationship between curiosity (*Curiosity*) Students with the ability to understand mathematical concepts regarding the Pythagorean Theorem. The following is a summary of the results of the linearity test between variable X and variable Y which is presented in Table 4.

Table 4. Linearity Test

Test	α	**Dk**	F_{count}	F_{table}	**Decision**
Linearity	0,05	22;11	0,469	2,63	H_0 accepted

Once it is known that there is a linear relationship between the two existing variables, then carry out further calculations, namely a regression significance test to test whether the linear relationship between X and Y is meaningful or not. Based on the calculations carried out, a value is obtained $F_{count}(F_{obs}) = 39{,}89$ and to F_{table} at a significance level of 0.05 with dk (1;33) = 4.14. Because F_{obs} more than $F_{table}(F_{obs} > F_{table})$ for H_0 is rejected, thereby indicating that the regression equation between X and Y is meaningful (significant). The following is a summary of the regression significance test.

Table 5. Regression Significance Test

Test	α	Dk	F_{count}	F_{table}	Decision
Significance of Regression	0,05	1;33	39,89	4,14	H_0 rejected

3.4 Hypothesis Testing

After entering the required values of variable So r count > r table which means there is a positive relationship between the curiosity variable (*curiosity*) students with the ability to understand mathematical concepts in the Pythagorean theorem material.

To determine the level of significance, test the correlation coefficient using the t test. Based on the test results, the value of t-count = 5.071, and t-table for a significance level of 0.05 with dk = 33, namely t-table = 1.692. From the results obtained, it is known that t-count > t-table thus shows that students' curiosity (variable

Once it is known that variable X has a significant contribution to variable Y, the next step is to calculate the contribution test using the coefficient of determination. The coefficient of determination test aims to determine the extent to which variable X contributes or influences variable Y. The process of calculating the coefficient of determination begins by calculating the correlation coefficient between the two variables. This correlation coefficient provides an overview of the strength and direction of the relationship between variable X and variable Y. Once the correlation coefficient is known, this value is then squared to get the coefficient of determination.

Based on the calculations carried out, the coefficient of determination value was 43.82%. This figure shows that 43.82% of the variation that occurs in variable Y can be explained by variable X. In other words, variable -other factors not included in this study. The following is a summary of the results of the correlation coefficient and determination tests that have been carried out:

Table 6. Curiosity Correlation Coefficient (*Curiosity*) Students with the ability to understand mathematics on Pythagorean theorem material

N	Coefficient		Significance Test	
	r	r^2	t_{count}	t_{table}
35	0,662	0,4382	5,071	1,692

Correlation Coefficient: 0.662 and Determination Coefficient: 43.82%. The correlation coefficient value obtained indicates that there is a significant relationship between variable X and variable Y. The correlation coefficient of 0.662 indicates that there is a fairly strong and positive relationship between these two variables. In the context of research, this value provides very important initial information, because it shows that an increase in variable X tends to be followed by an increase in variable Y. Meanwhile, the coefficient of determination provides a clearer picture of how big the influence of variable is 43.82%. This information is very important for understanding the dynamics of the relationship between these two variables and can be the basis for decision making or next steps in research.

3.5 Discussion of Research Results

Based on the results of the calculations carried out, 24 valid questionnaire items were obtained for the variable high so it is suitable to be used as a research instrument. The calculation is continued by carrying out a test of the level of difficulty of the questions and the distinguishing power of the questions on the test question instrument (variable Y). After the prerequisite tests are carried out and the questionnaire items and test questions are obtained which are used as instruments as data collection tools.

The next step is to collect data for research and process and analyze the data. Starting with conducting analysis prerequisite tests, namely normality and linearity tests. The normality test in this study was carried out using the Lilliefors normality test formula. After carrying out a normality test for variable the normality test calculation was continued for variable Y, after carrying out the calculation process, the L-obs value was obtained, namely 0.073 with L-table, namely 0.0.150 as in attachment 31. From these results it is known that L-obs<L-table, because it meets the test criteria, the data for variable Y is confirmed to be data originating from normal distribution.

After carrying out the normality test for the two variables, continue with carrying out the linearity test. This test is carried out to find out whether two variables have a linear relationship or not. The first step begins by looking for the regression equation with detailed calculations as in Appendix 32. The regression equation obtained from the calculation continues until an F-obs value of 0.469 is obtained and for F-table it is found to be 2.63. The relationship between variables X and Y is stated to be linear because the value of F-obs<F-table. Once it is known that the two variables have a linear relationship, then continue by carrying out a regression significance test. Briefly, the result is that the linear regression between variables X and Y is meaningful/significant.

Once the research data is known to be normally distributed and has a meaningful linear regression, the research hypothesis is then tested with detailed calculations in Appendix 33. The hypothesis test is carried out to find out whether there is a positive relationship between variable X (student curiosity) and variable Y (comprehension ability). mathematics Pythagorean theorem material). The hypothesis test used is the Product Moment correlation test proposed by Pearson. Based on the results of the hypothesis testing carried out, the value r-count > r-table was obtained (0.662 > 0.334), this shows that there is a positive relationship between variable In general, students' greater curiosity will be followed by an increase in their comprehension ability.

Next, a test was carried out to see the level of significance that existed between the two variables as attached in attachment 34 and after carrying out calculations the value t-

obs>t-tabel was obtained (5.071 > 1.692). Based on the presentation of these results, it can be concluded that students' curiosity plays a significant role/contribution to their ability to understand mathematics regarding the Pythagorean theorem. Once it is known that variable Calculating the coefficient of determination value as attached in attachment 35, the resulting value is 43.82%. This means that 43.82% of the ability to understand mathematics in the Pythagorean theorem material is influenced by students' curiosity and 56.18% is influenced by other factors.

This is in line with the results of research conducted by Zetriuslita. The results of the research show that problem-based learning that is implemented is more influential in developing critical thinking skills than communication skills and curiosity. Furthermore, (Zetriuslita, Z., 2018). Explain that curiosity has a greater influence on students' critical thinking abilities. According to him, critical thinking is a complex process that can only be carried out by students who truly understand the material being studied. When students have high curiosity, they tend to be more motivated to dig deeper and seek a deeper understanding of the topics they are studying. This, in turn, improves their ability to think critically, analyze information, and make better decisions based on solid understanding. In this study, no interaction was found between curiosity and learning models for the ability to understand mathematical concepts. Lusi Anggraini's research shows that although curiosity is an important factor, in the context of certain learning models, curiosity alone is not enough to significantly increase students' ability to understand mathematical concepts.

The importance of considering different contexts and variables in educational research. Although curiosity is an important factor in encouraging critical thinking skills, its effectiveness in improving conceptual understanding may be influenced by how curiosity is facilitated by the learning model used. Therefore, further research is needed to explore how these various factors interact with each other and influence student learning outcomes. Thus, insights from these two studies can be used to develop more effective learning strategies. For example, teachers can strive to not only increase students' curiosity but also choose and implement learning models that are able to support and strengthen that curiosity, so that overall they can improve students' critical thinking abilities and understanding of concepts. (Handayani, Y., & Aini, I. N, 2020) analyzed students' understanding of mathematical concepts into three categories, namely high, medium and low. Meanwhile, in this study, comprehension ability did not differentiate between these three things. However, this research succeeded in proving that there is a positive relationship between curiosity students with mathematical understanding abilities.

Thus, increasing students' curiosity can be an effective strategy for improving their mathematical understanding abilities. Teachers and educators can take advantage of these findings by creating learning environments that stimulate curiosity, such as using interactive teaching methods, presenting interesting intellectual challenges, and providing opportunities for students to explore topics that interest them. The positive relationship between curiosity and mathematical understanding ability shows that developing curiosity is an important key in supporting students' academic success in mathematics lessons.

4 CONCLUSION

Based on the results of processing the hypothesis test, the researcher drew the following conclusions about the results of this research: There is a significant positive relationship between students' curiosity and their ability to understand mathematics on the Pythagorean theorem material in class VIII of SMPN 50 Jakarta in the 2023/2024 academic year. The strength of this relationship can be proven by the results of the correlation test. From the obtained value, conclusions can be drawn from the results of data calculations, the value of r-xy = 0.662, so this shows that there is a positive relationship between students' curiosity in understanding mathematical concepts regarding the Pythagorean theorem. The magnitude of the correlation value (r-xy = 0.662) with the t test for

significance results in the calculated t value > t table or (5.071 > 1.692) at the 0.05% level. This means the correlation is significant. If the correlation value (rxy = 0.662) is followed up with the KD (Coefficient of Determination) test, the Coefficient of Determination = 43.82% is obtained. This means that students' curiosity can contribute 43.82% to their ability to understand mathematical concepts regarding the Pythagorean theorem. And the remaining 56.18% was contributed by other factors not studied.

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