The Relationship Between Mathematical Ability And Physics Ability of Students At The High School Level

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ABSTRACT

To understand Physics lessons, certain mathematical abilities are needed as students' basic abilities to solve problems in Physics. This research aims to see the relationship between the Mathematics and Physics abilities of high school level students, especially in class xi.This research method is to analyze the relationship between mathematics and physics grades given by the teacher at the end of the semester report card using correlation analysis. The results of the research obtained a combined correlation coefficient value of r = 0.727, which means the correlation value is high. The conclusion of this research is that there is a positive correlation between abilities. mathematics with students' physics abilities in high school students.

Keywords:Correlation Analysis, math skills, physics skills

1. Introduction

Physics subjects are one of the science subjects that can develop inductive and deductive analytical thinking skills in studying natural behavior. This study can be a collection of knowledge consisting of facts, concepts, principles, laws, formulas, theories and models. However, the most important thing is how this can be developed into a solution to solve various surrounding problems, both qualitatively and quantitatively.

According to (Tzanakis, 2002) there is a close relationship between mathematics and physics, namely: (1) mathematical methods are used to explain the meaning of physics concepts and theories, (2) physics concepts and ways of thinking are used to help develop new mathematical concepts. Some experts also state that a physicist uses two ways to study natural phenomena, namely: (1) through experiments and observations, (2) through mathematical explanations. So, it could be said that mathematics plays a big role in understanding physics.

The problem that high school teachers often face is that the majority of students find it difficult to work on physics problems related to mathematics, whereas physics learning in high school almost entirely involves mathematical calculations. Another problem faced by high school physics teachers is that before providing physics material, the physics subject teacher must also provide the mathematical basis, because the mathematical material that will be used to solve physics problems has not been discussed in mathematics subjects.

Theme: The Relationship Between Mathematical Ability
And Physics Ability of Students At The High School Level

Based on this background, research was conducted which aimed to determine the relationship between mathematics ability and physics learning outcomes at high school level.

2. Methods

This research is research conducted in the field using quantitative research methods, namely using statistical calculations whose results are in the form of numbers. The population of this study were all students majoring in science at one of the schools in Langkat district. The sample of this study was 60 students in class XI Science, even semester 2023. The sampling technique used in this study was purposive sampling. Data collection in this research is done by searching for data, namely in the form of cognitive scores in mathematics subjects (as independent or manipulated variables) and cognitive scores in physics subjects (as dependent or response variables) in student learning outcomes reports or odd semester report card scores in 2023. The control variable in this research is the number of hours in mathematics and physics subjects. Data were analyzed using a correlation test. Correlation shows the magnitude of the relationship between the independent variable and the dependent variable. The magnitude of the relationship is expressed by the correlation coefficient. The correlation coefficient ranges from $\square 1$ to $+1$. A value of $+1$ indicates a perfect positive relationship and a value of -1 indicates a perfect negative relationship. The correlation coefficient is determined using the following formula:

$$r_{xy} = \frac{n \sum x_i y_i - (\sum x_i)(\sum y_i)}{\sqrt{\left(n \sum x_i^2 - (\sum x_i)^2\right)\left(n \sum y_i^2 - (\sum y_i)^2\right)}}$$

Explanation:

r_{xy} = correlation between x and y

x_i = value x to i

y_i = value y to i

n = many values

(Sudjana, 2005)

To facilitate interpretation of the level of correlation between the two variables, Table 1 is used (Hinkle DE, 2003)

Theme: The Relationship Between Mathematical Ability
And Physics Ability of Students At The High School Level

Table 1. Interpretation of Correlation Coefficients

Positif	Negatif	Penafsiran
$0.90 - 1.00$	$-0.90 - -1.00$	Korelasi sangat tinggi (Very high)
$0.70 - 0.90$	$-0.70 - -0.90$	Korelasi tinggi (high)
$0.50 - 0.70$	$-0.50 - -0.70$	Korelasi sedang (moderate)
$0.30 - 0.50$	$-0.30 - -0.50$	Korelasi rendah (low)
$0.00 - 0.30$	$-0.00 - -0.30$	Korelasi kecil (little if any)

3.   Results and Discussion

The following is a summary of the average scores and maximum and minimum scores for each class for physics and mathematics subjects:

Table 2. Summary of Average Scores and Maximum and Minimum Scores for Each Class for Physics and Mathematics Subjects

Kelas	Average Mathematics Score	Physics Grade Average	Maximum Value Mathematics	Minimum Value Mathematics	Maximum Value physics	Minimum Value physics
XI-1	82,475	84,154	90	78	90	77
XI-2	81,365	83,475	90	75	88	75
XI-3	80,425	81,239	89	75	88	75

Based on the data collected, it appears that the average mathematics score is lower than the average physics score. The correlation value of mathematics scores with physics scores can be seen in the following table after data processing.

Table 3. Correlation Coefficient Values for Each Class

No	Kelas	R count
1	XI-1	0,787
2	XI-2	0,735
3	XI-3	0,661
4	Combined	0,727

From the table above, the correlation coefficient (r) value is 0.787 for class XI-1. The coefficient value shows that the mathematics value as a manipulated variable has a positive relationship with the

Theme: The Relationship Between Mathematical Ability
And Physics Ability of Students At The High School Level

physics value as the response variable. Because if the correlation coefficient is close to 1, it means that the relationship between variables x and y is close and the changes are in the same direction. This means that if variable x increases, variable y will also increase. In other words, if students' math skills are good then their physics learning outcomes will also be good. For class XI-2, a value of 0.735 was obtained and for Class For the combined correlation value, a value of 0.727 was obtained. In accordance with table 1, it can be interpreted that the data obtained has a high correlation or it can be interpreted that the correlation of the two variables is said to be significant. The results of the research show that there is a significant influence between basic mathematics abilities on physics learning outcomes. Individually, basic mathematical abilities have a significant influence on physics learning outcomes. This is in accordance with the opinion of several studies which state that in learning physics, mathematics plays an important role. Mathematics is really needed in solving problems in physics. So basically someone who has basic mathematical skills will easily understand physics concepts and solve physics calculation problems.

4. Conlusion

The conclusion of this research is that there is a positive correlation between mathematical abilities and the learning outcomes of students in the classes conducted in the research. Positive correlation applies to all classes, both classes XI-1, XI-2, XI-3 and combined. From the results of this research, it is hoped that it can help teachers to provide solutions to students in studying physics so that there are no significant obstacles in understanding physics lessons.

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