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THE EFFECT OF METACOGNITION, SELF-CONCEPT AND LEARNING INDEPENDENCE ON THE MATHEMATICAL PROBLEM-SOLVING ABILITY OF GRADE XI IPA STUDENTS OF SMAN 1 GOWA

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ABSTRACT

This type of research was ex-post facto research. The population in this study were all students of class XI of SMAN 1 Gowa while the sample in this study were XI IPA 5 and XI IPA 6, totaling 65 students. The sampling technique used cluster random sampling. Data analysis techniques using questionnaires and tests. Data analysis techniques used descriptive statistical analysis and inferential statistical analysis techniques.

The results of this study indicate that (1) Partially, the metacognition variable significantly influences the problem solving mathematics of students of class XI IPA SMAN 1 Gowa of 81.2%. (2) Partially self-concept variables significantly influence the problem solving mathematics of students of class XI IPA SMAN 1 Gowa of 89.6%. (3) Partially the learning independence variable has a significant effect on the problem solving mathematics of students of class XI IPA SMAN 1 Gowa of 74.4%. (4) Simultaneously the variables of metacognition, self-concept and learning independence significantly influence problem solving mathematics of students of class XI IPA SMAN 1 Gowa with a coefficient of determination R2 = 0.924 which means that the metacognition, self-concept and learning independence gave an effect of 92.4% on the problem solving mathematics of students of class

Keywords: Learning Independence and mathematical problem solving, Metacognition, Self-Concept

INTRODUCTION

Education is an effort or activity carried out in an orderly and planned manner with the aim of changing or developing desired behaviors in order to develop students so they can cope with any changes that occur. Schools, as formal institutions, are a means to achieve this educational goal. Through school, students learn a variety of things.

Schools are educational institutions and places where various activities take place, especially teaching and learning activities which not only involve teachers and students, but also several other components, namely the curriculum, facilities and infrastructure, environment and other components which influence each other.One of the subjects that is the basis of the compulsory curriculum in every school is mathematics.

Mathematics is a universal subject taught at every level of education and underpins the development of modern technology. It plays a vital role in various fields and advances human thought. The rapid development of information and communication technology is underpinned by the development of mathematics. Therefore, mathematics is a mandatory subject for students at every level of education, particularly elementary and secondary education.

Mathematics is a basic science that must be taught to students at every level of education, from elementary school, middle school, high school, and college. Schools are educational institutions and venues for various activities, especially teaching and learning activities that involve not only teachers and students but also several other components, including the curriculum, facilities and infrastructure, and other interrelated components. If any of these

components is not functioning properly, the teaching and learning process will be disrupted and the desired problem-solving results will not be achieved (Ningsih and Nurrohmah, 2016: 73-84).

One of the goals of mathematics is to provide a tool for solving problems, both within the subject itself, in other subjects, and in everyday life. Problem-solving is crucial in mathematics learning because it involves students themselves solving the problems, which leads to improved understanding.

In relation to the process of solving mathematical problems in schools, students are said to be able to learn independently if they are able to complete learning tasks without relying on others. This independence from others is referred to as independence. Independence in learning can be defined as learning activities and their progress driven more by the student's own will, choice, and responsibility. According to Hidayat (2009):28-29) revealed that in the learning process, students do not simply accept what the teacher gives but must be able to build relationships from the concepts and principles they learn. This condition can give rise to learning independence so that students are able to actualize their needs according to their potential. Students who have learning independence will not continuously depend on the material provided by the teacher in class.

This is because most students consider that every subject is relatively difficult, so that every assignment given by the teacher is not done by themselves first, but most of them only copy the work of their friends. This shows that the self-concept of students in doing assignments at school is less than optimal due to a lack of knowledge about themselves which includes beliefs, views and physical assessments, personal characteristics, motivations, weaknesses or abilities, failures and so on.

Metacognition is a form of cognition, or a two- or more-level thinking process involving control over cognitive activity. Therefore, metacognition can be defined as a person's thinking about their own thinking or their cognition about their own cognition. Furthermore, metacognition involves a person's knowledge and awareness of their own cognitive activity or anything related to their cognitive activity. Thus, cognitive activities such as planning, monitoring, and evaluating the completion of a particular task are inherently metacognitive. Metacognition, or "thinking about thinking," is the knowledge and understanding we have of our own cognitive processes and the ability to examine our thinking and monitor what is happening.

One of the important factors that significantly influences learning success, particularly in solving mathematical problems, is metacognition, self-concept, and student learning independence. Contemporary psychological research shows that, in addition to IQ factors, mathematical problem-solving is largely determined by metacognitive knowledge, self-concept, and learning independence.

Furthermore, research conducted by Ihsan (2016) shows that metacognition has a positive and significant effect on mathematical problem solving. Furthermore, research conducted by Hidayah (2015) shows a positive and significant effect between self-concept and mathematical problem solving. Furthermore, research conducted by Ayudhaningrum (2017) shows a positive and significant effect between learning independence and mathematical problem solving.

Based on the results of observations at SMAN 1 Gowa, namely when providing material, especially matrix material, students' abilities in matrix arithmetic operations such as addition, subtraction, and matrix multiplication are still lacking so that when given problem-solving exercises, it turns out that only some students can do it well, most do not know what to do in this case is usually related to each student's lack of metacognition. Then the students still feel lazy to study mathematics, according to them mathematics is a difficult subject to understand/comprehend so that students often have difficulty in achieving maximum mathematics learning outcomes. One of the reasons is because they often feel unsure that they will be able to complete the tasks assigned to them, or in other words, the student's lack of confidence in their ability to complete the task successfully. This belief is usually called self-concept. In fact, it has been known that self-concept greatly influences the results of students' mathematical problem solving. Therefore, the lack of self-concept of students in doing the tasks given, they tend to cheat rather than doing their own work. This proves that student learning independence is still lacking even though at school students are required to be independent in doing the tasks given.

Besides thatThe results of an interview with one of the mathematics subject teachers also said that the results of students' mathematical problem solving were still low because there were still many students who had not achieved the completeness given by the teacher, namely 75. This lesson that could be absorbed by students was still lacking, of course there were many factors that caused the incompleteness of the mathematics subject score. From the observations made, it can be seen from several factors that can cause students' problem solving results to be lacking, such as less conducive metacognitive knowledge, less self-concept and less awareness of learning independence. The purpose of this study was to determine the influence of metacognition, self-concept and learning independence on solving mathematical problems of class XI IPA students at SMAN 1 Gowa.

RESEARCH METHODS

This type of research is ex-post facto with causality. This research was conducted at SMAN 1 Gowa. The population in this study were all students of class XI IPA SMAN 1 Gowa. The sampling technique in this study was cluster random sampling by selecting two classes randomly from the six existing classes to determine the research class. The classes in this study were XI IPA 5 and XI IPA 6 consisting of 65 students. The data analysis techniques used in this study were questionnaires and tests.

RESEARCH RESULT

Data Description

Here is hThe results of the descriptive analysis show a description of the characteristics of the distribution of values from each research class.

Table 1. Descriptive Statistics of Metacognition

Statistics	Statistical Value
Mean	69.26
Median	70.00
Mode	62.00
Standard Deviation	7.68
Variance	59.10
Minimum	54.00
Maximum	85.00
Skewness	0.11
Kurtosis	-0.58

Table 2. StatisticsDescriptive Self-Concept

Statistics	Statistical Value
Mean	68.51
Median	68.00
Mode	68.00
Standard Deviation	6.93
Variance	49.97
Minimum	56.00
Maximum	82.00
Skewness	0.18
Kurtosis	-0.86

Table 3. StatisticsDescriptive Learning Independence

Statistics	Statistical Value
Mean	67.83
Median	68.00
Mode	72.00
Standard Deviation	7.15
Variance	51.17
Minimum	53.00
Maximum	83.00
Skewness	-0.06
Kurtosis	0.52

Table 4. StatisticsDescriptive Mathematical Problem Solving

Statistics	Statistical Value
Mean	75.35
Median	80.00
Mode	84.00
Standard Deviation	15.95
Variance	254.63
Minimum	16.00
Maximum	92.00
Skewness	-2.02
Kurtosis	4.42

Prerequisite test

Table 5. Distribution Table of Normality Test Using Kolmogorov Smirnov
One-sample Kolmogrov-Smirnov Test

	X1	X2	X3	Y
Asymp. Sig. (2-tailed)	200	200	200	127

Based on Table 5, it can be concluded that the data from the four research variables, namely metacognition, self-concept, learning independence, and mathematical problem solving, show that all samples are greater than 0.05, so H1 is accepted. Thus, the data from all research samples are normally distributed.

Table 6. Multicollinearity Test Results

Variables	*Tolerance*	VIF
Metacognition	0.175	5,718
Self-Concept	0.173	5,783
Learning Independence	0.947	1,057

Based on table 6, the VIF values of the three variables are <10, so it can be concluded that there is no multicollinearity problem in the three independent variables.

Table 7. Linearity Test

Correlation	F	Sig.	Information
X1,Y	0.789	0.728	Linear
X2,Y	0.984	0.504	Linear
X3,Y	0.965	0.516	Linear

Based on Table 7, it can be concluded that the data from the three regression line models tested show a sig. < 0.005, thus H1 is accepted. In other words, all regression models tested have a linear pattern.

Hypothesis testing

Hypothesis 1:

Table 8. Linear Regression Test Coefficient of X1 against Y

Model	Unstandardized Coefficients		Sig
	B	Std. Error	
(Constant)	-.615	4.133	0.882
Metacognition	1,011	0.061	0,000

Based on the output of the simple regression analysis in table 7 coefficients, it can be seen that the value with a sig value = 0.000 at the significant level.$\beta_1 = 1{,}011\alpha = 0{,}05$Because the sig value is smaller than the value αThis means that H0 is rejected and H1 is accepted, so it can be concluded that there is a significant influence of metacognition on mathematical problem solving of class XI IPA students at SMAN 1 Gowa of 81.2%. From this data, the regression equation can be constructed as follows:$0{,}000 < 0{,}05, Y = -0{,}615 + 1{,}011\, X_1$.

Hypothesis 2:

Table 9. Linear Regression Test Coefficient of X2 against Y

Model	Unstandardized Coefficients		sig
	B	Std. Error	
(Constant)	-6,250	3,167	0.053
Self-Concept	1,090	0.047	0,000

Based on the output of the simple regression analysis in table 9 coefficients, it can be seen that the value with a sig value = 0.000 at the significance level.$\beta_2 = 1.090\alpha = 0{,}05$Because the sig value is smaller than the value αThis means that H0 is rejected and H1 is accepted, so it can be concluded that there is a significant influence of self-concept on the mathematical problem solving of class XI IPA students at SMAN 1 Gowa of 89.6%. From this data, a regression equation can be constructed.$0{,}000 < 0{,}05$, as follows: $Y = -6{,}250 + 1{,}090X_2$.

Hypothesis 3:

Table 10. Linear Regression Test Coefficient of X3 against Y

Model	Unstandardized Coefficients		sig
	B	Std. Error	
(Constant)	5,677	4,562	0.218
Learning independence	0.905	0.067	0,000

Based on the multiple regression analysis output in Table 10, the coefficients show a value with a sig value of 0.000 at a significant level. This means that H0 is rejected and H1 is accepted. Therefore, it can be concluded that there is a significant influence of learning independence on mathematical problem solving among class XI IPA students at SMAN 1 Gowa of 74.4%. From this data, the regression equation can be constructed.$\beta_3 = 0{,}905a = 0{,}05sig < 0{,}05$as follows: $Y = 5{,}677 + 0{,}905X_3$.

Hypothesis 3:

Table 11. Linear Regression Test Coefficients X1, X2, X3 against Y

Model	Unstandardized Coefficients		sig
	B	Std. Error	
(Constant)	10,160	3,297	0.003
metacognition	0.226	0.092	0.017
Self-concept	0.871	0.095	0.000
Learning independence	0.050	0.025	0.048

Based on the output of the multiple regression analysis in table 11 coefficients, the value with the P value can be seen.$\beta_1 = 0{,}226$*Value*= 0.017 at a significant level, which means , with a value at a significant level, which means sig < 0.05, with a value at a significant level, which means sig < 0.05. This means that H0 is rejected and H1 is

accepted.$a = 0{,}05 sig < 0{,}05 \beta_2 = 0{,}871 sig = 0{,}000 a = 0{,}05 \beta_3 = 0{,}050\ sig = 0{,}048 a = 0{,}05$

From the ANOVA table, the value obtained isF count = 247.931. For F table with a significance level of 5%, F table = 2.75 is obtained. And the sig value is 0.000.< 0.05,So it can be concluded that H0 is rejected. So there is a significant influence of metacognition., self-concept and learning independence towards solving mathematical problemsby 92.4%.The multiple regression equation obtained is as follows:

$$Y = 10.160 + 0{,}226 X_1 + 0{,}871 X_2 + 0{,}050\ X_3$$

DISCUSSION

Metacognition

The results of the descriptive analysis showthat23 students with a percentage of 35.38% have metacognition in the high category and 42 students with a percentage of 64.62% have metacognition in the very high category and there are no students in the medium, low and very low categories.

Self-Concept

Descriptive analysis resultsshow thatThere are 20 students with a percentage of 30.77% who have a self-concept in the high category and 45 students with a percentage of 69.23% who have a self-concept in the very high category and there are no students in the medium, low and very low categories.

Learning Independence

The results of the descriptive analysis shown thatThere are 2 students with a percentage of 3.08% who have learning independence in the medium category, 23 students with a percentage of 35.38% who have learning independence in the high category and 40 students with a percentage of 61.54% who have learning independence in the very high category.

Mathematical Problem Solving

Descriptive analysis resultsshows that the ability to solve mathematical problems is atgood category of 65 respondents studied, there were 35.38% of students who had good mathematical problem solving abilities, 33.85% of students who had sufficient mathematical problem solving abilities and 30.77% of students who had poor mathematical problem solving abilities. So students' mathematical problem solving was classified as good based on the categorization of mathematical problem solving with a minimum value of 75.

The influence of metacognition on the mathematical problem-solving abilities of class XI IPA students at SMAN 1 Gowa.

Based on the results of the analysis, there is a positive influence between metacognition variables on mathematical problem solving of class XI IPA students of SMAN 1 Gowa. This is based on the Model Summary table with R2 (R square) of 0.812, which means the relationship between metacognition variables and mathematical problem solving shows a relationship of 81.2%. In the coefficients table, it can be seen that the value of β1 = 1.011 with a sig value = 0.000 at a significance level of α = 0.05, which means sig <0.05. This means that H0 is rejected and H1 is accepted, so it can be concluded that metacognition of class XI IPA

students of SMAN 1 Gowa has a positive influence on students' mathematical problem solving.

The influence of self-concept on the mathematical problem-solving abilities of XI IPA students at SMAN 1 Gowa.

Based on the results of the analysis, there is a positive influence between the self-concept variable on the mathematical problem solving of class XI IPA students of SMAN 1 Gowa. This is based on the Model Summary table with R2 (R square) of 0.896 which means the relationship between the self-concept variable and mathematical problem solving shows a relationship of 89.6%. In the coefficients table, it can be seen the value of β2 = 1.090 with a sig value = 0.000 at a significance level of α = 0.05 which means sig <0.05. This means that H0 is rejected and H1 is accepted, so it can be concluded that the self-concept of class XI IPA students of SMAN 1 Gowa has a positive influence on students' mathematical problem solving.

The influence of learning independence on the mathematical problem-solving abilities of class XI IPA students at SMAN 1 Gowa.

Based on the results of the analysis, there is a positive influence between the learning independence variable on the mathematical problem solving of class XI IPA students of SMAN 1 Gowa. This is based on the Model Summary table with R2 (R square) of 0.744, which means the relationship between the learning independence variable and mathematical problem solving shows a relationship of 74.4%. In the coefficients table, it can be seen that the value of β3 = 0.905 with a sig value = 0.000 at a significant level of α = 0.05, which means sig <0.05. This means that H0 is rejected and H1 is accepted, so it can be concluded that the learning independence of class XI IPA students of SMAN 1 Gowa has a positive effect on students' mathematical problem solving.

The influence of metacognition, self-concept and learning independence on the mathematical problem-solving abilities of class XI IPA students at SMAN 1 Gowa.

Based on the results of the analysis, there is a positive influence between the variables of metacognition, self-concept, and learning independence on solving mathematical problems of class XI IPA students of SMAN 1 Gowa. This is based on the Model Summary table with R2 (R square) of 0.924 which means the relationship between the variables of metacognition, self-concept and learning independence on solving mathematical problems shows a relationship of 92.4%. Then in the coefficients table above, it can be seen the value with a sig value = 0.017 at a significant level which means , with a value at a significant level, which means sig <0.05, with a value at a significant level, which means sig <0.05. This means that H0 is rejected and H1 is accepted, so it can be concluded that metacognition, self-concept and learning independence of class XI IPA students of SMAN 1 Gowa have a positive effect on solving mathematical problems of students.$\beta_1 = 0.226a = 0{,}05sig < 0{,}05\beta_2 = 0{,}871\ sig = 0{,}000a = 0{,}05\beta_3 = 0{,}050\ sig = 0{,}048a = 0{,}05$

Conclusion

Based on the results of descriptive and inferential statistical analysis, the following conclusions can be drawn:

1. The description of metacognition of class XI IPA students at SMAN 1 Gowa is in the very high category with a percentage of64.62%. Likewise, self-concept is in the very high category with a percentage of 69.23% and learning independence is in the very high category with a percentage of 61.54%. Meanwhile, mathematical problem-solving ability is in the good category with a percentage of 61.54%.35.38%.
2. There is a positive and significant influence of metacognition on mathematical problem solving of class XI IPA students at SMAN 1 Gowa of 81.2%.
3. There is a positive and significant influence of self-concept on the mathematical problem solving of class XI IPA students at SMAN 1 Gowa of 89.6%.
4. There is a positive and significant influence of learning independence on solving mathematical problems of class XI IPA students at SMAN 1 Gowa of 74.4%.
5. There is a positive and significant influence of metacognition, learning motivation, self-concept and learning independence together on students' mathematical problem solving of92.4%.

Apart from metacognition, self-concept and learning independence, there are still other factors that influence students' mathematical problem solving. Therefore, for future researchers, it is hoped that they will develop research models using other variables to determine the influence of students' mathematical problem solving. In mathematics learning activities, teachers should try to createa learning atmosphere that can foster students' self-confidence and mathematical communication skills to help students understand and work on mathematical problems.Students should be taught that learning is enjoyable and a necessity, not a burden. This can be achieved by making learning activities more enjoyable, such as by discussing and solving problems related to the lesson with friends.

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