

Effect of Motivation and Gender on Problem-solving in Student Mathematics

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Abstract—The purpose of this study was to determine the effect of motivation and gender on students' mathematical problem-solving abilities. This research is ex-post facto research. The population in this study were class VII students of SMP Negeri 5 Wonomulyo as many as 144 students with a sample of 44 students. The instrument used in this study is a test of mathematical solving abilities and student learning motivation questionnaire. The indicator of the ability to understand the problem is the ability to plan problem-solving, ability to solve problems, and the ability to re-examine the results obtained. Indicators of motivation are the desire and desire to succeed, the encouragement and need to learn, the hopes and aspirations of the future, the appreciation in learning, and the existence of interesting activities in learning. Analysis of the data used is a regression with dummy variables, simple regression, and multiple regression. The analysis was carried out at a significance level of 5%. The results obtained are: (1) there is no significant influence between gender on students' mathematical problem-solving abilities, (2) there is significant influence between learning motivation on students' mathematical problem-solving skills, (3) together there are influences significant between motivation and gender towards students' mathematical problem-solving abilities.

Keywords—learning motivation, gender, mathematical problem-solving skills

I. INTRODUCTION

Mathematics is one of the subjects that contribute to the development of science and technology. Then efforts should be made to improve the quality of mathematics education. But the reality is that when the grades of students' mathematics are still low. Based on data from the Education Assessment Center of the Ministry of Education and Culture shows that the average score of junior high school mathematics national examinations in Polewali Mandar over the past two years (2016 and 2015) ranks lowest when compared with the values of other subjects, as presented in Tables 1.

TABLE I. THE AVERAGE SCORE OF THE 2016 NATIONAL MIDDLE SCHOOL TEST FOR POLEWALI MANDAR REGENCY

Subject	Indonesian Language	English	Mathematics	IPA
Average value of UN (2016)	63.01	53.92	51.8	55.97
Average value of UN (2015)	64.88	54.74	53.5	57.56

The same thing happened in SMP Negeri 5 Wonomulyo, based on preliminary observations and information from one of the educators who taught mathematics at SMP Negeri 5 Wonomulyo stated that students' mathematics learning outcomes were still relatively low, most students had not achieved the Minimum Completeness Criteria (KKM) subjects. One of them is seen from students' mathematical problem-solving. The factor of the low student learning outcomes in SMP Negeri 5 Wonomulyo is the lack of appreciation of students to learn mathematics, students are negative towards mathematics and assume that mathematics is a difficult subject to understand, so they are not motivated to learn mathematics.

There are two factors that influence student learning outcomes, namely extrinsic (external) and intrinsic (internal) factors, where one intrinsic factor that influences is psychological factors which include intelligence (IQ), attention, interests, talents, motives, motivation, cognitive and the reasoning of students [1], [2]. Of these factors, one of the causes of the low ability of students to solve mathematical problems is learning motivation. Learning motivation comes from the word motive which means strength in an individual so that the individual acts or acts [3]. While Miller et al. [4] define motivation as a change in energy in a person's self that is characterized by the emergence of feelings and reactions to achieve goals. So learning motivation is a psychological condition of students that can lead to learning activities with pleasure and earnestly so that the goals they desire can be achieved.

Motivation has a positive impact if the motivation can provide support and direction of activity. Students who are more motivated usually need less guidance from teachers than students who have low motivation. Also, students with high motivation can solve complex problems independently, without help from others [5].

Gender differences not only affect the ability of mathematics but also affect the way men and women acquire mathematical knowledge. Male students are more interested in mathematics than female students, so that female students' anxiety levels are higher than male students regarding mathematics. This, of course, can harm female students. Therefore, gender aspects also need to be one of the considerations for teachers in choosing a suitable learning model to overcome female students' anxiety in mathematics [6].

Gender comes from the Latin, the genus, which means type or type. Gender refers to the biological differences between men and women; gender is a psychosocial aspect of men and women. In this case, the gender in question is a gender identity. Gender identity is the private face of gender, perception of the self as relatively masculine or feminine in characteristics." Gender identity is a person's self-perception as a person who has relatively masculine characteristics or feminine. So, each person has a perception of himself that can be measured by an instrument to find out whether it is masculine or feminine [7].

Based on several studies obtained through observations, it is said that gender influences mathematics because of the biological differences in the brains of boys and girls. In general boys are superior in the field of mathematics because of their good spatial abilities, besides boys are focused on things that are intellectual, abstract, and objective, while girls are superior in the field of language and writing and generally their attention, is focused on things that are concrete, practical, emotional, and personal [8], [9].

Problem-solving is one of the basic abilities that must be possessed by students who need experience, knowledge, understanding, and intuition in meeting the demands of a situation. Problem-solving is a process to overcome difficulties to achieve the desired goal. The process needs to understand the problem-solving process, organize the skills they have in choosing and identifying relevant conditions and concepts, looking for generalizations, formulating resolution plans and then solving problems [10].

II. RESEARCH METHOD

The research method used in this study is an ex post facto research method, to determine the influence of motivation and gender on students' mathematical problem-solving abilities. The design used in this study is in Fig. 1.

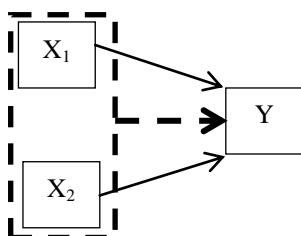


Fig. 1. Research Design

Information:

- X₁: Gender
- X₂: Motivation
- Y: Mathematical problem-solving ability

Fig. 1 shows the relationship between variables consisting of two independent variables and one dependent variable in this study, namely the influence of motivation on problem-solving abilities, gender influence on problem-solving abilities, and the influence of motivation and gender together on students' problem-solving abilities.

The population in this study were students of class VII SMP 5 Wonomulyo with 144 students consisting of 59 male students and 85 female students, with sampling using simple random sampling obtained samples of students of class VII B and VII C consisting of 18 students male and 26 female students.

The instruments used in this study were student learning motivation questionnaires and students' mathematical problem-solving skills. Motivation indicators referred to in this study are the desire and desire to succeed, the encouragement and need for learning, the hopes and aspirations of the future, the appreciation in learning, the existence of interesting activities in learning, and the existence of an environment that is conducive to learning. Indicators that are used to measure students' mathematical problem-solving abilities are the ability to understand problems, the ability to plan problem solving, the ability to solve problems, and the ability to re-examine the results obtained.

The data analysis technique used in this research is multiple linear regression test. However, prerequisite tests were first carried out namely normality test, multicollinearity test, and heteroscedasticity test. This analysis is used to determine the relationship between the independent variable and the dependent variable by using linear equations. The linear regression equation is as follows.

$$\hat{Y} = b_0 + b_1X_1 + b_2X_2 \quad (1)$$

\hat{Y} is the dependent variable predicted, b_0 is a constant, b_1 and b_2 are regression coefficients, while X_1 and X_2 are independent variables. The tests carried out on multiple linear regression analysis are F test and t-test. F test is used to test the effect of independent variables together on the dependent variable while the t-test is used to determine the effect of independent variables partially on the dependent variable.

III. RESULT

Based on the results of data collection given to 44 students, the percentage data on the tendency of student motivation variable scores are presented in Fig. 2.

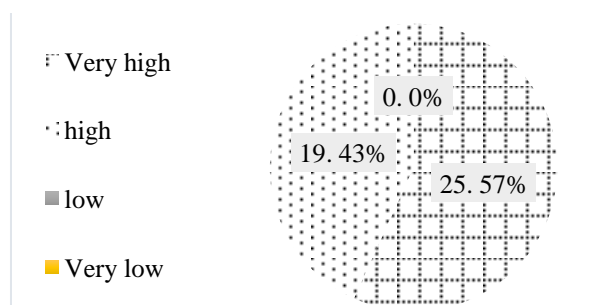


Fig. 2. Categorizing Student Motivation Scores

From Fig. 2 it is found that the number of students who have very high motivation is 56.82%, the number of students who have motivation in the high category is 43.18%, and the rest there are no students who have motivation in the low and very low categories. The tendency of variable scores on students' mathematical problem-solving skills is presented in Fig. 3.

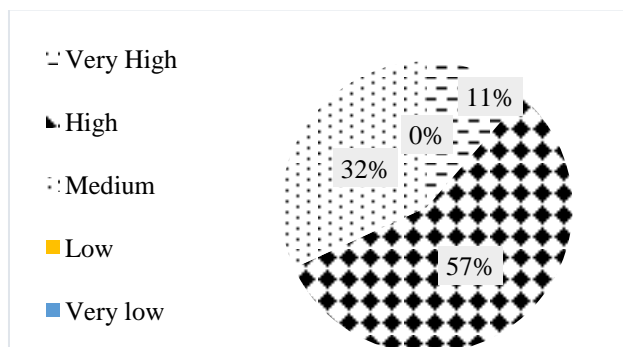


Fig. 3. Categorizing Student Mathematical Problem Solving Ability

From Fig. 3 above it is found that the number of students who have problem-solving abilities in the very high category is 11.36%, and the number of students in the high category is 56.82%, in the medium category is 31.82%, and the rest there are no students who have problem-solving abilities in the low and very low categories.

Description of mathematical problem-solving abilities regarding student gender is presented in Table 2.

TABLE II. DESCRIPTION OF STUDENTS' MATHEMATICAL PROBLEM SOLVING CAPABILITIES VIEWED FROM GENDER

Statistics	Gender		Total
	Man	Woman	
N	18	26	44
Mean	78.28	83.85	81.57
Deviation Standard	5.32	5.27	5.92

Based on Table 2, it was found that the average score of female students' mathematical problem solving (83.85) was higher than the average value of male students (78.28). To test the hypothesis in this study used multiple linear regression test, with a prerequisite test that must be carried out namely normality test, multicollinearity test, and heteroscedasticity test.

Test normality in the study using the help of SPSS 20.00 application. As for the results of the normality test in this study using the Kolmogorov-Smirnov test that is obtained sig 0.200 > 0.05 then H0 is accepted, so it can be concluded that the motivation data is normally distributed. Whereas for learning outcomes data obtained sig. 0.200 > 0.05 then H0 is accepted, or in other words, the data on students' mathematics learning outcomes are normally distributed.

Multicollinearity test is a situation where between two or more independent variables in the regression model there is a linear relationship. To find out whether there is a multicollinearity problem, the method is used by looking at the tolerance values and VIF. Decision-making method is if the smaller the tolerance value and the greater the VIF value, the closer the multicollinearity problem is and if the tolerance value = 0.909 > 0,1 and VIF = 1.100 < 10 then there is no multicollinearity problem.

Heteroscedasticity test is a condition where there is a variance inequality from the residual in the regression model. Regression models require the absence of heteroscedasticity problems. The method used is the Spearman's rho test, that is, if the significance value between the independent variable and the residual is > 0.05, there is no heteroscedasticity problem, but if the significance is < 0.05, there is a problem of heteroskedasticity. Based on the table, it is known that the significance value of motivation variables is obtained by sig. 0,191 and gender variables obtained by sig. 0.467. Because the significance value > 0.05, it can be concluded that in the regression model there is no heteroscedasticity problem.

Thus, because the prerequisite test for regression analysis has been fulfilled, a hypothesis test can be done using multiple regression analysis. Multiple regression hypothesis testing using SPSS 20.00 obtained the results in Table 3.

TABLE III. MULTIPLE REGRESSION ESTIMATES

Model	Unstandardized Coefficient (B)	T	Sig.
Constant	43.314	2.954	0.005
Gender	-4.089	-2.650	0.011
Motivation	0.445	3.180	0.003

Source: data analysis (2018)

Multiple regression tests are conducted to test whether between gender variables (X_1) and motivation (X_2) together influence the students' problem-solving ability (Y). Regression obtained $\hat{Y} = 43.314 + -4.089X_1 + 0.445X_2$. From the regression equation, obtained X_1 coefficient is negative; this means that there is a negative relationship between gender variables with variable problem-solving abilities, or in other words that female students have higher problem-solving abilities compared to male students. Whereas in the motivation variable, obtained X_2 coefficient positive, this means that there is a positive relationship between motivation variables with variable problem-solving ability, or in other words the higher the motivation of students, the higher the students' mathematical problem-solving skills. The F test results were obtained by sig. 0,000 so that H0 is rejected or in other words, motivation and gender together influence the students' problem-solving abilities.

R Square (R^2) analysis or the coefficient of determination is used to determine how much the percentage of the contribution of the influence of the independent variable together on the dependent variable. The following is the R square table. From the output, it can be seen that R^2 is 0.34. So the contribution of the influence of the independent variable is 34% while the remaining 66% is influenced by other factors not examined.

Correlation test of student gender variables (X_1) on students' mathematical problem-solving ability variable (Y) to determine the relationship between these two variables used product moment correlation formula. From the calculation, it is obtained $0.001 < 0, 05$ means that the problem-solving ability also influences students' motivation and the value of $r = 0.468$ means that the relationship between motivation and problem-solving ability is in the medium category. Testing the significance of the correlation of motivation variables and mathematical problem-solving abilities students were tested using a hypothesis test (t-test) with a significance of 5%. From the calculation results obtained sig. $0.001 < 0.05$. So it can be concluded that there

is an influence between gender on students' mathematical problem-solving abilities.

Correlation test of student motivation variable (X_2) on students' mathematical problem-solving ability variable (Y) to determine the second relationship of this variable used product moment correlation formula. From the calculation obtained $0.000 < 0.05$ means that it is assumed that motivation also influences students' mathematical problem-solving ability, and obtained the value of $r = 0.516$ which means that the relationship between motivation and problem-solving ability is in a strong category. Testing the significance of the correlation of motivation variables and mathematical problem-solving abilities students were tested using a hypothesis test (t_{test}) with a significance of 5%. From the calculation results obtained $sig. 0.001 > 0.05$. So it can be concluded that there is an influence between motivation on students' problem-solving abilities.

After conducting a series of studies, it can be concluded that there are motivational and gender influences together on students' mathematical problem-solving abilities. This is in line with the results of Ryan et al. [11] study which states that there is an influence between gender characteristics and motivation on students' mathematics learning outcomes. The same thing also happens to motivation and gender variables that have a partial effect on students' mathematical problem-solving abilities.

IV. CONCLUSION AND IMPLICATION

Based on the results of research on the influence of motivation and gender on students' mathematical problem solving abilities, it can be concluded that: there is a significant influence between gender on students' mathematical problem-solving abilities; there is a significant influence between motivation on students' mathematical problem-solving skills, and together there is a significant influence between motivation and gender on students' mathematical problem-solving abilities.

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