International Journal on Education Insight
Vol. 2, No. 2, October 2021, pp. 77-84
p-ISSN: 2722-2683, e-ISSN: 2722-2691, DOI: 10.12928/ijei.v2i2.4544

Relationship among mathematics representation skills, mathematics anxiety, and problem-solving ability of 8th graders

Dedy Krisnanto, Afit Istiandaru
Universitas AhTamanan, Banguntapan, Bantul DIY 55191 Indonesia
*Corresponding e-mail: afit.istiandaru@pmat.uad.ac.id

Abstract

The purpose of this research was to determine whether there was a positive and significant relationship between mathematical representation skills and mathematical anxiety with the problem-solving abilities of eighth grade students of SMP N 2 Sedayu Bantul Yogyakarta. This research is a quantitative research involving 63 grade VIII students of SMP Negeri 2 Sedayu. The data collection method is carried out through data collection techniques in the form of questionnaires and tests. The questionnaire instrument was used to determine student learning anxiety while the test instrument was used to determine mathematical representation and problem-solving skills. Data analysis used multiple linear regression analysis method. The results showed that there was a positive and significant relationship between mathematical representation ability and mathematical anxiety with solving ability by using the F-test which resulted in F = 3.882 > 3.33 = F table with a significance level of 5%. While the correlation coefficient obtained is R = 0.3666. The regression equation is $\hat{Y} = 48.84 + 0.25X_1 - 0.24X_2$. The relative contribution of X1 is 57.88% and X2 is 42.11%. While the effective contribution of X1 is 12.24% and X2 is 8.904%.

Keywords: mathematics anxiety, mathematics representation skills, problem-solving ability

How to cite: Krisnanto, D., & Istiandaru, A. (2021). Relationship among mathematics representation skills, mathematics anxiety, and problem-solving ability of 8th graders. *International Journal on Education Insight, 2*(2), 77-84. DOI: https://doi.org/10.12928/ijei.v2i2.4544

INTRODUCTION

Mathematics is a universal science. In addition, mathematics is the basis of science. This agrees with (Wahyudin, 2016), mathematics is one of the sciences that underlies the development of other sciences that are applied to everyday life. Therefore, mathematics is very important to learn so that humans can follow the development of science that is increasingly rapidly. But the reality is that today, there are still many students who view mathematics as a very boring and scary subject. This will result in the emergence of anxiety (anxiety) in learning mathematics.

Anxiety is an unpleasant feeling or emotional state, which is naturally accompanied by various psychological and behavioral phenomena. Mathematics anxiety can be defined as a feeling of tension and anxiety that interferes with the process of manipulating numbers and the process of solving mathematical problems in ordinary and academic life (Kurniawati, 2014).

Mathematics anxiety might also influence students' performance, by overloading working memory (Ashcraft & Kirk, 2001). Anxious students tend to have intrusive thoughts about how bad they did, which may distract attention from the task or problem at hand and overload working memory resources. It

Received July 26, 2021; Revised October 15, 2021; Accepted October 17, 2021

would also appear if anxiety affects the arithmetic performance, especially in tasks that involve multi-digit arithmetic (Dowker *et al.*, 2016). Thus, mathematics anxiety could be a plausible explanation for the low mathematics performance.

Problem-solving is a process to overcome difficulties encountered to achieve a desired goal. Through problem solving skills, students can be trained to get used to dealing with different problems. From the results of research conducted by Hoffman (2010), it shows that anxiety determines accuracy when solving mathematical problems. The results of Kurniawati's research (2014) show that the higher the level of anxiety, the lower the problem-solving ability of students.

Representation with problem solving has a close relationship. Mathematics representation skill is an important parameter in current mathematics education in Indonesia. It is an ability supporting other competences. If a student fails in doing representation in various realizations (visual, mathematics equation, and words), then there is high possibility if the student does not have proper understanding about mathematics (Risdianti & Kartono, 2021).

Representation is a result of students' thinking on a problem that is used as a tool to find a solution to the problem. Various kinds of students' thoughts on mathematics lessons can be in the form of symbols, shapes, pictures, tables, graphs and so on. This can be interpreted verbally or in writing. Therefore, students need mathematical representation skills to find and create a tool or way of thinking in communicating mathematical ideas from the abstract to the concrete so that they are easier to understand. Not only representation skills, problem solving skills are also important to develop because they are the heart of mathematics.

Based on the observation of interviews with the mathematics teacher of grade VIII SMP N 2 Sedayu, it was obtained information that the mathematical problem-solving ability of grade VIII students was still low. This is seen from the end year assessment scores of many students who have not met the passing grade. In addition, the teacher also explained that students generally have difficulty when making illustrative pictures of the problems or questions given and students cannot solve problems that involve mathematical expressions. From this information, it can be assumed that the ability and based on the researchers' initial interviews with students, the researchers obtained information that students still consider mathematics as a difficult subject, they are more comfortable if learning mathematics is short, even some students admit that they are afraid of being asked by the teacher to come to the front of the class to work on math problems representing class students. VIII still needs to be improved. These conditions are symptoms of math anxiety that generally occurs among students.

Based on the description above, researchers are interested in investigating whether there is a relationship between math anxiety and mathematical representation skills with problem solving abilities.

RESEARCH METHOD

This study uses a type of quantitative research. Meanwhile, the research design can be seen in Figure 1 (Sugiyono, 2017).

In Figure 1, X_1 is mathematics representation skills, X_2 is mathematics anxiety, and Y is mathematics problem-solving ability.

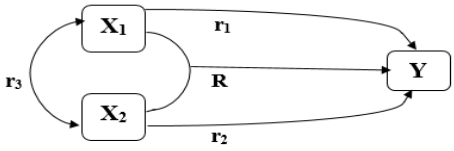

Figure 1. Correlation research design

This research activity took place at SMP Negeri 2 Sedayu, Bantul Regency, Yoyakarta for the 2019/2020 Academic Year. The activities carried out in the framework of this final research, took the research setting of class VIII A with a total of 32 students and class VIII C with a total of 31 students as a trial class. In this study there are 2 variables, namely two independent variables and one dependent variable. Mathematical representation skills (X1) and learning anxiety (X2) will be independent variables in this study. Meanwhile, mathematical problem-solving ability (Y) is the dependent variable.

Data collection techniques in this study are: (1) Questionnaire, (2) Test. The data collection instruments in this study were: (1) Mathematics Anxiety Questionnaire, (2) Mathematical Representation Skills Test, (3) Problem Solving Ability Test. The validity of the mathematical anxiety questionnaire, mathematical representation skill test and problem-solving ability will be validated by experts in their field. The data analysis techniques used in the research are: (1) Descriptive Data Analysis, (2) Prerequisite Testing (Normality Test, Linearity Test, Independence Test), (3) Hypothesis Testing (Simple Correlation Test, Multiple Correlation Test).

RESULTS AND DISCUSSION

In this study, it focuses on three variables consisting of two independent variables and one dependent variable. The independent variables are mathematical representation skills and learning anxiety, while the dependent variable is problem solving ability.

Description of research data

Mathematical representation ability

The mathematical representation ability test consists of 4 questions in the form of description questions with a maximum score of 20 then accumulated into a range of values between 0 to 100. Based on the test results given, the highest score is 95 and the lowest score is 70 (See Table 1).

Table 1. Frequency distribution data of mathematics representation skills

Interval	Frequency (f_i)	Mid value (x_i)	$f_i x_i$	$f_i(x_i - \bar{X})^2$
70 – 74	2	72	144	253.125
75 – 79	6	77	462	234.375
80 – 84	11	82	902	17.1875
85 – 89	10	87	870	140.625
90 – 94	1	92	92	76.5625
95 – 99	2	97	194	378.125

Then, we categorized the data based on high, moderate, and low category. We got Table 2.

Table 2. Data distribution of mathematics representation skills based on categories

Category	Criteria	F	%
High	X > 92.58	12	37.5
Moderate	$80.68 \leq X \leq 92.58$	8	25
Low	X < 80.68	12	37.5
Total		32	100

Through the results of the mathematical representation test, the average value of 32 students of class VIII A was 83.250 and the standard deviation was 5.95683397. Next is the interpretation of the values obtained by students into three categories, namely high, medium and low which are listed in table 2. Based on the results of this categorization, it can be concluded that the mathematical representation ability of class VIII A students of SMP Negeri 2 Sedayu in the 2019/ academic year 2020 is included in the high and low categories because the percentage between the high and low categories is the same as 37.5% and the medium category is not much different in percentage, which is 25%.

Mathematics anxiety

Mathematics learning anxiety scores were obtained through a questionnaire given by researchers to students. The learning anxiety questionnaire consists of 21 statements with negative values. The scale used in the questionnaire is a Likert scale with the following data in Table 3.

Table 3. Frequency distribution data of mathematics anxiety

Interval	Frequency (f_i)	Mid value (x_i)	$f_i x_i$	$f_i(x_i - \bar{X})^2$
45 – 50	5	47.5	237.5	886.1132813
51 – 56	3	53.5	160.5	160.4179688
57 – 62	9	59.5	535.5	15.50390625
63 – 68	11	65.5	720.5	241.6992188
69 – 74	3	71.5	214.5	342.6679688
75 – 80	1	77.5	77.5	278.4726563

Then, we categorized the data based on high, moderate, and low category. We got Table 4.

Table 4. Data distribution of mathematics anxiety based on categories

Category	Criteria	F	%
High	X > 68.692	3	9.375
Moderate	$52.933 \leq X \leq 68.692$	23	71.875
Low	X < 52.933	6	18.75
Total		32	100

Through the questionnaire data obtained, the average obtained is 60.813 and the standard deviation is 7.87989. And based on the categorization in Table 4, it can be concluded that the learning anxiety of class VIII A students of SMP Negeri 2 Sedayu in 2019/2020 is in the moderate category. This can be proven

by questionnaire data which shows that the percentage of students' learning anxiety is at a score of $52.933 \leq X \leq 68.692$ with an average of 71.875%.

Problem-solving ability

Students' problem-solving abilities were obtained by researchers with tests given to students. The test is in the form of a description question with 4 questions, each of which has a total score of 10 so that the overall score obtained by students is a maximum of 40. The scores obtained by students are then accumulated into scores with a range of 0 to 100. The results of the student's problem-solving ability test are listed in the Table 5.

Table 5. Frequency distribution data of problem-solving ability

Interval	Frequency (f_i)	Mid value (x_i)	$f_i x_i$	$f_i(x_i - \bar{X})^2$
72.5 – 76.4	1	74.45	74.45	99.40
76.5 – 80.4	10	78.45	784.5	356.41
80.5 – 84.4	6	82.45	494.7	23.29
85.5 – 89.4	8	87.45	699.6	73.45
89.5 – 93.4	5	91.45	457.25	247.11
93.5 – 97.5	2	95.45	190.9	243.32

Then, we categorized the data based on high, moderate, and low category. We got Table 6.

Table 6. Data distribution of problem-solving ability based on categories

Category	Criteria	F	%
High	X > 90,22	4	12,5
Moderate	$78{,}62 \leq X \leq 90{,}22$	27	84,375
Low	X < 78,62	1	3,125
Total		32	100

Based on the results of the problem-solving ability test, the average was 84.44 and the standard deviation was 5.8. And based on the data in table 6, it can be concluded that the problem-solving abilities of class VIII A students of SMP Negeri 2 Sedayu in the 2019/2020 school year are in the medium category. Based on the interpretation data, there are 84.375% of students in the medium category with a range of values between $78{,}62 \leq X \leq 90{,}22$.

Pre-requisite testing analysis

Normality test

The normality test is used to determine the distribution of data from each research variable that is normally or not normally distributed. In this study, the normality test used the chi-square formula (χ^2). Data from each research variable is said to be normal if $\chi^2_{hitung} \leq \chi^2_{tabel}$ with a significance level of = 5% and degrees of freedom k-1. The value of k that fulfills the operation is the number of class intervals on each research variable. Table 7 presents the results of the normality test of the three variables studied.

Based on the data in Table 7, namely the normality test, it can be seen that the value of χ^2 in each variable is smaller than the value of χ^2_{table} so it can be concluded that the distribution of data for each variable is normally distributed.

Table 7. Normality test

Variable	χ^2	χ^2_{table}	df	Conclusion
Mathematics representation skills (X_1)	3.911779	11.0705	5	Normal
Mathematics anxiety (X_2)	5.79182	11.0705	5	Normal
Problem-solving ability (Y)	6.546511	11.0705	5	Normal

Independency test

The independence test was conducted to test whether or not there was a relationship between the two independent variables, namely mathematical representation ability (X1) and learning anxiety (X2). Just like the normality test, the independence test uses the chi-square formula χ^2 with a significance level of = 5%. The degrees of freedom used are df=(b-1)(k-1) where b and k are the number of classes. Decision making refers to $\chi^2 \leq \chi^2_{tabel=(\alpha)(b-1)(k-1)}$concluded independently. Table 8 will present the results of the independence test between mathematical representation ability (X1) and learning anxiety (X2).

Table 8. Independency test

Variable	χ^2	χ^2_{table}	df	Conclusion
X_1 with X_2	23.538	37.65249	25	Independent

Based on Table 8, namely the independence test, it can be seen that $\chi^2 < \chi^2_{table}$ is 23.538 < 37.6529, so it can be concluded that the relationship between the variable of mathematical representation ability (X1) and learning anxiety (X2) is independent.

Linearity test

The linearity test was used to test the variables of mathematical representation ability (X1) with problem solving ability (Y) and learning anxiety (X2) with problem solving ability (Y) to determine whether there was a linear or non-linear relationship. In linearity testing, linear regression was used using the F test. The F test was carried out at a significance level of 5% or 0.05 with db of the numerator = k – 2 and db of the denominator = n – k. Research conducted by researchers has a value of db in the numerator = 4, and db in the denominator = 26 in the linearity test between the variables of mathematical representation ability (X1) and problem-solving ability (Y). while the learning anxiety variable (X2) with problem solving ability (Y) obtained the value of db in the numerator = 17, and db in the denominator = 13. The relationship between variables is said to be linear if $F \leq F_{table}$. The linearity test data is presented in Table 9.

Table 9. Linearity test

Variable	F	F_{table}	Conclusion
X_1 with Y	2,4544	2,74	Linier
X_2 with Y	1,13023	2,49867	Linier

Hypothesis test

In this study, there are 3 hypothesis tests carried out, namely the first is a hypothesis test to determine whether or not there is a positive and significant relationship between mathematical representation skills and problem-solving abilities, the second is a hypothesis test to determine whether or not there is a positive and significant relationship between learning anxiety. mathematics

with problem solving abilities, and the third is hypothesis testing to determine whether or not there is a positive and significant relationship between mathematical representation skills and learning anxiety with problem solving abilities.

First hypothesis: X1 to Y

$$H_{0,1}: \rho \leq 0$$
$$H_{1,1}: \rho > 0$$

In the first hypothesis test, the coefficient r value is 0.299439077. The next stage is to test the significance level of the correlation coefficient with the t test. The significance level used is 5% or 0.05 with v = n – 2 where n is the number of students. Decision making is based on t >t table then H0,1 is rejected. Based on the research, the value of t = 1.718922 and $t_{table} = t_{0,05;30} = 1.69726$ so that $t > t_{table}$therefore H0,1 is rejected so that the first hypothesis has a conclusion that there is a positive and significant relationship between representation skills mathematics with the problem-solving abilities of class VIII SMP Negeri 2 Sedayu Bantul students in mathematics learning for the 2019/2020 school year.

In addition to testing the hypothesis, based on the results of data analysis, a simple regression equation Y over X1 is obtained, namely $\hat{Y} = 62.2159 + 0.27273X_1$.

Second hypothesis: X2 to Y

$$H_{0,2}: \rho \geq 0$$
$$H_{1,2}: \rho < 0$$

In the second hypothesis test, the r coefficient value is 0.3666. The next stage is to test the significance level of the correlation coefficient with the t test. The significance level used is 5% or 0.05 with v = n – 2 where n is the number of students. Decision making is based on t >t table then H0.2 is rejected. Based on the research, the value of t = 2.158 and $t_{table} = t_{0,05;30} = 1.69726$ so that $t > t_{table}$therefore H0.2 is rejected so that the second hypothesis has a conclusion that there is a negative and significant relationship between learning anxiety and ability problem solving for class VIII students of SMP Negeri 2 Sedayu Bantul in learning mathematics for the 2019/2020 school year. In addition to testing the hypothesis, based on the results of data analysis, a simple regression equation Y over X2 is obtained, namely $\hat{Y} = 68.70 - 0.25617X_2$.

Third hypothesis: X1 and X2 to Y

$$H_{0,3}: \rho \leq 0$$
$$H_{1,3}: \rho > 0$$

In the third hypothesis test, the correlation coefficient value of multiple analysis R was 0.211454191. The next stage is to test the significance level of the correlation coefficient with the F test. The significance level used is 5% or 0.05 with v1 = k-1 and v2 = n-k where k = number of research variables, n = many respondents. Decision making is based on F > F table, then H0.3 is rejected. Based on the research, the value of F = 3.888278574 and F table = F(0.05; 2.29) = 3.33 so that F > F table or 3.888278574 > 3.33 then H0.3 is rejected so that the first hypothesis has a conclusion that there is a significant relationship positive and significant relationship between mathematical representation skills and learning anxiety with the problem solving abilities of class VIII students of SMP Negeri 2 Sedayu Bantul in learning mathematics for

the 2019/2020 school year. In addition to the above, based on the results of data analysis, it is found that the multiple linear regression equation for X1 and X2 is $\hat{Y} = 48.8461 + 0.25329X_1 - 0.2443X_2$.

Table 10. Contribution of mathematics representation skills and anxiety to the students' problem-solving ability

Variable	SR	SE
Mathematics representation skills (X_1)	57.88 %	12.24 %
Mathematics anxiety (X_2)	42.11 %	8.904 %
Total	100 %	21.14 %

Based on table 10, the Relative Contribution (SR) in the X1 variable is 57.887752%, while the X2 variable is the Relative Contribution (SR) of 42.1122478%. The Effective Contribution (SE) on the X1 variable is 12.2406078% while the Effective Contribution (SE) on the X2 variable is 8.9048113% with the total Effective Contribution of 21.1454191%.

CONCLUSION

There was a positive and significant relationship between mathematical representation ability and mathematical anxiety with solving ability by using the F-test which resulted in F = 3.882 > 3.33 = F table with a significance level of 5%. While the correlation coefficient obtained is R = 0.3666. The regression equation is $\hat{Y} = 48.84 + 0.25X_1 - 0.24X_2$. The relative contribution of X1 is 57.88% and X2 is 42.11%. While the effective contribution of X1 is 12.24% and X2 is 8.904%.

ACKNOWLEDGEMENT

We thank to the principal, teachers, and students of SMP Nehero 2 Sedayu Bantul for their involvement and support in this research.

REFERENCES

Ashcraft, M. H., & Kirk, E. P. (2001). The relationships among working memory, math anxiety, and performance. *Journal of experimental psychology: General*, *130*(2), 224.

Dowker, A., Sarkar, A., & Looi, C. Y. (2016). Mathematics anxiety: What have we learned in 60 years? *Frontiers in Psychology*, *7*, 508.

Hoffman, B. (2010). "I think I can, but I'm afraid to try": The role of self-efficacy beliefs and mathematics anxiety in mathematics problem-solving efficiency. *Learning and individual differences*, *20*(3), 276-283.

Kurniawati, A. D. (2014). Pengaruh Kecemasan dan Self Efficacy Siswa terhadap Kemampuan Pemecahan Masalah Materi Segiempat Siswa Kelas Viimts Negeri Ponorogo. *MATHEdunesa*, *3*(2), 36-41.

Risdianti, A., Kartono, K., & Masrukan, M. (2021). Mathematics Representation Skill Seen from Self-Efficacy in AIR Learning with Corrective Feedback. *Unnes Journal of Mathematics Education Research*, *10*(A), 1-8.

Sugiyono. (2017). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.

Wahyuddin, M. (2016). Pengaruh Metakognisi, Motivasi Belajar, dan Kreativitas Belajar Terhadap Kemampuan Pemecahan Masalah Siswa Kelas VIII SMP Negeri 2 Sabbangparu Kabupaten Wajo. *Daya Matematis: Jurnal Inovasi Pendidikan Matematika*, *4*(1), 72-82.