JARME **Journal of Authentic Research on Mathematics Education**
Volume 6, No. 2, Juli 2024
https://doi.org/ 10.37058/jarme.v612.10563 **e-ISSN 2655-7762**

THE INFLUENCE OF SELF-EFFICACY ON STUDENTS' MATHEMATICAL REASONING ABILITIES REVIEWED FROM GENDER

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ARTICLE INFO

Article history
Received: 2024-03-28
Revised: 2024-06-20
Accepted: 2024-07-23

Keywords
Self-Efficacy, Mathematical Reasoning Abilities, Gender

ABSTRACT

To improve students' mathematical reasoning abilities, it is of course important to look at cognitive and affective aspects together, to see more broadly whether affective factors play an important role in mathematical reasoning abilities. This research aims to determine the differences in self-efficacy between male and female genders, differences in mathematical reasoning abilities between male and female genders, and the influence of self-efficacy on students' mathematical reasoning abilities in terms of gender. The research method used in this research is a correlational method with an ex post facto research design. The population of this study were all class VII students at SMP Negeri 20 Tasikmalaya. The sample in this research was obtained using non-probability sampling with a purposive sampling technique from the existing population. Classes VII-B, VII-C, VII-D, VII-E were selected as sample classes with a total of 102 students. The data collection technique is by giving a mathematical reasoning ability test and a self-efficacy questionnaire. The data analysis techniques used are descriptive statistical analysis, independent sample t-test, and two way ANOVA. Based on data processing, data analysis, and hypothesis testing, research results showed that (1) There are differences in self-efficacy between male and female genders, (2) There are no differences in students' mathematical reasoning abilities between male and female genders, (3) There is no influence of self-efficacy on students' mathematical reasoning abilities in terms of gender. These findings certainly show that affective aspects do have a role in determining students' abilities, but of course some affective aspects have a significant role, some only influence a small part.

Untuk meningkatkan kemampuan penalaran matematis siswa, tentu penting melihat aspek kognitif dan afektif secara bersama-sama, untuk melihat lebih luas apakah faktor afektif berperan penting dalam kemampuan penalaran matematis. Penelitian ini bertujuan untuk mengetahui perbedaan self-efficacy antara gender laki-laki dan perempuan, perbedaan kemampuan penalaran matematis antara gender laki-laki dan perempuan, dan pengaruh self-efficacy terhadap kemampuan penalaran matematis siswa ditinjau dari gender. Metode penelitian yang digunakan pada penelitian ini adalah metode korelasional dengan desain penelitian expost facto. Populasi penelitian ini seluruh siswa kelas VII di SMP Negeri 20 Tasikmalaya. Sampel dalam penelitian ini diperoleh dengan mengunakan non probability sampling dengan teknik purposive sampling dari populasi yang ada. Terpilih kelas VII-B, VII-C, VII-D, VII-E sebagai kelas sampel dengan jumlah 102 siswa. Teknik pengumpulan data yaitu dengan memberikan tes kemampuan penalaran matematis, dan angket self-efficacy. Teknik analisis data yang digunakan adalah analisis statistik deskriptif, Uji independent sample t-test, dan two way ANOVA. Berdasarkan

pengolahan data, analisis data, dan pengujian hipotesis diperoleh hasil penelitian (1) Terdapat perbedaan self-efficacy antara gender laki-laki dan perempuan, (2) Tidak terdapat perbedaan kemampuan penalaran matematis siswa antara gender laki-laki dan perempuan, (3) Tidak terdapat pengaruh self-efficacy terhadap kemampuan penalaran matematis siswa ditinjau dari gender. Temuan ini tentunya menunjukkan bahwa aspek afektif memang memiliki peran dalam menentukan kemampuan yang dimiliki siswa, namun tentu beberapa aspek afektif ada yang memiliki peran signifikan ada pula yang hanya mempengaruhi sebagian kecilnya saja.

How to Cite:

Nuraeni, S., Herawati, L., & Heryani, Y. (2024). Pengaruh *Self-Efficac*y Terhadap Kemampuan Penalaran Matematis Siswa Ditinjau dari Gender. *Journal of Authentic Research on Mathematics Education, 6*(2), 205-216. https://doi.org/10.37058/jarme.v612.10563

1. INTRODUCTION

Mathematics is a very important, vast and unlimited field of knowledge. According to (Tampubolon et al., 2019) mathematics is a discipline that not only dwells on formulas and numbers, but also includes abilities in it. But in reality, mathematics is still considered scary, especially when students are required to solve problems, therefore students need mathematical reasoning skills to make it easier to solve problems. According to (Hari et al., 2018) self-confidence (self-efficacy) greatly affects students' actions, such as the unwillingness to try. The impact is that many students tend to rely on cheating or the help of others in solving problems, because they are not confident in their own abilities. In line with (Taufik & Komar, 2022) students' self-efficacy and learning motivation are believed to play an important role in improving students' mathematics learning achievement in school.

According to (Hadiat & Karyati, 2019) mathematical reasoning ability is part of reasoning ability in general, and this is very important in solving various types of mathematical problems. This proficiency is an important aspect that students are expected to have, according to the PISA 2022 results report. Despite this, Indonesia is still ranked 70th out of 81 countries in terms of mathematical reasoning ability tests. Mathematical reasoning skills are also part of the mathematical thinking aspect, in which students are taught to think logically, be able to make argum saen, think more abstractly and draw conclusions well. This is of course because students who are indeed less thorough, easily forget the material, have no ideas, lack understanding and lack of confidence.

Mathematical reasoning skills are needed to achieve mathematical goals, such as understanding concepts, using ideas more flexibly, especially in reconstructing knowledge. According to (Rosyidah et al., 2021) Students' mathematical reasoning skills in Indonesia tend to be low, especially in dealing with problems in the form of Higher Order Thinking Skills (HOTS). Students still feel confused when presented with HOTS questions or questions in the form of stories and require high reasoning. According to (Kurnia Putri et al., 2019) a person with low reasoning skills will often face difficulties in dealing with

various problems, because it is difficult to connect facts so that they can reach conclusions. Therefore, it is important to develop reasoning skills in each individual. An interview with a mathematics teacher at SMP Negeri 20 Tasikmalaya stated that students at the school still face challenges in dealing with problems that require mathematical reasoning skills. So that the researcher feels that by conducting this research, it certainly opens up new knowledge for the researcher and of course for the school being researched. As well as research conducted by researchers related to self-efficacy, mathematical reasoning ability and gender is not considered to be much and even what the results are not known.

In addition to mathematical reasoning skills, students also need to have a good affective attitude so that it is useful to increase student success in solving problems, one of which is self-efficacy. According to (Hadiat & Karyati, 2019) self-efficacy and mathematical reasoning ability have an important role in achieving student success, so self-efficacy is needed by students in acquiring good mathematical reasoning skills. According to (Nurussalamah & Marlina, 2022) Students with low levels of self-efficacy in working on math problems tend to avoid the task because they find it difficult and doubt their ability to solve it. On the other hand, students who have high self-efficacy will still try to solve math problems no matter how difficult the task is. Self-efficacy is needed when students are going to solve problems. Self-efficacy is also very important in the process of working on math problems, because when working on problems, students also need confidence to be able to solve math problems well.

In the problem of self-efficacy to mathematical reasoning ability, gender is also often involved in the focus of self-efficacy research where in the study (Suryono, 2018) the results of data analysis obtained showed that there was a significant difference in the level of self-efficacy based on gender with a significance level of 0.000. According to Vogt, et al. (Wahyo & Effendi, 2022) have observed that the level of self-efficacy in mathematics in males is higher compared to the level of mathematical self-efficacy in females. But on the other hand, according to Bandura (Hanifah et al., 2020), research shows that the level of mathematical self-efficacy in women is higher than in men, because women have the ability to perform several tasks at once.

The purpose of this study is to (1) find out the difference in self-efficacy between male and female students, (2) find out the difference in mathematical reasoning ability between male and female students, and (3) find out the influence of self-efficacy on students' mathematical reasoning ability from a gender perspective.

2. METHODS

2.1. Research Subject

The population taken in this study was all grade VII students at SMP Negeri 20 Tasikmalaya. Then 102 students were selected based on the same number of students using purposive sampling. The goal is to see the self-efficacy and mathematical reasoning ability of students reviewed from the perspective of gender so as to see a balanced number of male and female students. This research was carried out from 6 to 7 February 2024.

2.2. Data Collection

The data collection method in this study includes the use of tests and questionnaires. The questionnaire is used to assess the level of self-efficacy of students, which can be classified into high, medium, or low categories. Meanwhile, the test is used to measure students' mathematical reasoning skills, which can also be grouped into high, medium, or low ability categories.

The instruments used include a mathematical reasoning ability test consisting of 2 descriptive questions that have been tested and carried out validity and reliability, not forgetting expert validation. With scoring guidelines adopted from (Putri et al., 2022). Furthermore, the self-efficacy questionnaire contains 23 statements, a likert scale with 4 answer choices (Riza et al., 2020) is used in the study. For positive statements, the assessment is given by giving a score of 4 for the answer strongly agree (SS), score 3 for the answer agree (S), score 2 for the answer disagree (TS), and score 1 for the answer strongly disagree (STS). The opposite applies to statements that are negative. After obtaining the categorization of self-efficacy and the results of the mathematical reasoning ability test, it was followed by data analysis.

2.3. Data Analysis

Quantitative data analysis is carried out in three stages, namely instrument making, research implementation, and data processing. At the stage of making the instrument, the researcher prepares a mathematical reasoning ability test, and a self-efficacy questionnaire, which is followed by testing the instrument until the instrument is ready for use. Then the research implementation stage the researcher carries out the distribution of tests and questionnaires to the samples that have been decided. As well as the data processing stage, the researcher conducted data analysis with the help of SPSS software and drew conclusions.

3. RESULT AND DISCUSSION

3.1. Result

The data collection that has been completed then the researcher conducts data processing that produces several things, including the results of the mathematical reasoning ability test and also the self-efficacy of students as follows.

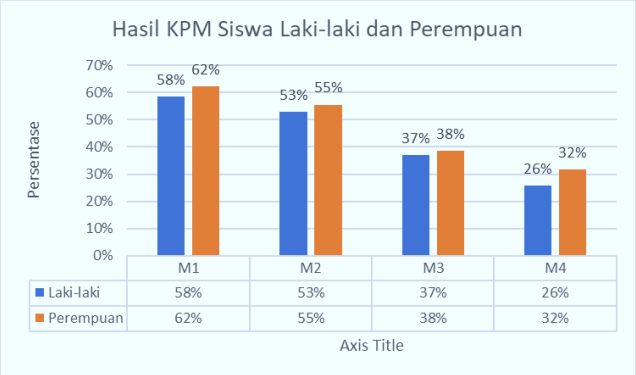

Figure 1. Mathematical Reasoning Ability Test Results

After obtaining the results of students' mathematical reasoning skills, then the researcher grouped them into several levels, namely high, medium and low, adopted from (Nugroho, 2022)

Table 1. Mathematical Reasoning Ability Category

Category	Value Interval Formula	Value Interval	Frec	Persentage
Tall	$Nilai \geq Mean + Sd$	$Nilai \geq 26{,}3$	14	13,7%
Currently	$Mean - Sd < Nilai < Mean + Sd$	$9{,}9 < Nilai < 26.3$	68	66,7%
Low	$Nilai < Mean - Sd$	$Nilai < 9{,}9$	20	19,6%

In addition to being categorized as a whole mathematical reasoning ability, it is categorized by gender with the following results:

Table 2. Categorization of Mathematical Reasoning Ability Based on Gender

Categorization of Mathematical Reasoning Ability	Men	Percentage of Men	Women	Percentage of Women
Tall	3	5,9%	12	24%
Currently	39	76,5%	29	57%
Low	9	17,6%	10	20%

After obtaining the results of the mathematical reasoning ability test, and the categorization of male and female students, the research continued with the provision of a self-efficacy questionnaire and obtained the following results:

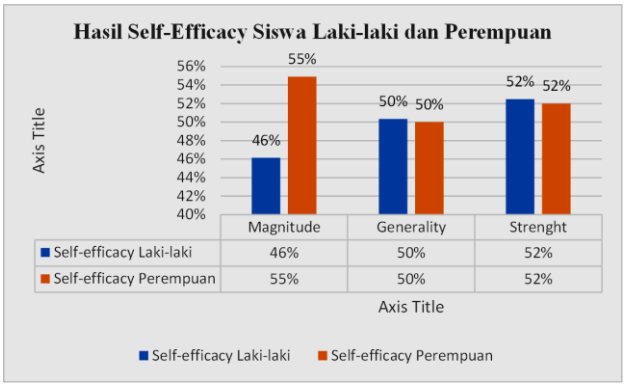

Figure 2. Self-Efficacy Questionnaire Results

Then it was found that students had a self-efficacy categorization, namely high, medium and low adopted from (Pratiwi & Imami, 2022).

Table 3. Self-Efficacy Categorization

Category	Value Interval Formula	Value interval	Frec	Persentage
Tall	$x > \bar{x} + SD$	$\bar{x} > 66{,}1$	11	10,8%
Currently	$\bar{x} - SD < X \leq \bar{x} + SD$	$52{,}6 < \bar{x} < 66{,}1$	82	80,4%
Low	$x < \bar{x} - SD$	$\bar{x} < 52{,}6$	9	8,8%

In addition to the results of the self-efficacy category, the researcher also categorized self-efficacy based on gender with the following results:

Table 4. Categorization of Self-Efficacy Based on Gender

Self-Efficacy Categorization	Men	Percentage of Men	Women	Percentage of Women
Tinggi	6	12%	9	18%
Sedang	40	78%	39	76%
Rendah	5	10%	3	6%

From the results of the mathematical reasoning ability test and self-efficacy questionnaire, the following hypothesis tests were carried out:

Differences in Self-Efficacy Between Male and Female Gender

Putting forward the first hypothesis, a prerequisite test is needed, namely normality and homogeneity must be met. In this case, the prerequisites have been met. This hypothesis uses an independent sample t-test with the following results:

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Self-Efficacy	Equal variances assumed	.052	.820	-2.376	100	.019	-3.098	1.304	-5.685	-.511
	Equal variances not assumed			-2.376	99.758	.019	-3.098	1.304	-5.685	-.511

Figure 3. Differences in Self-Efficacy Based on Gender

From these results, a sig value of 0.019 < 0.05 was obtained so that there was a difference in self-efficacy between male and female genders.

Differences in Mathematical Reasoning Ability between male and female gender

The second hypothesis also requires the fulfillment of prerequisite tests, namely normality and homogeneity. In this research hypothesis, the prerequisites have been met. This hypothesis also uses an independent sample t-test with the following results:

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Kemampuan Penalaran Matematis	Equal variances assumed	4.673	.033	-.845	100	.400	-1.373	1.624	-4.595	1.850
	Equal variances not assumed			-.845	96.003	.400	-1.373	1.624	-4.597	1.852

Figure 4. Mathematical Reasoning Ability Based on Gender

From these results, the value of Sig.(2-tailed) was obtained of 0.4 > 0.05 which means that there was no difference in mathematical reasoning ability between male and female genders.

The Influence of Self-Efficacy on Students' Mathematical Reasoning Ability in terms of Gender

Revealing the third hypothesis, the residual normality and homogeneity of variance must be fulfilled and have been met. In this hypothesis, two way ANOVA is used, with the following results:

Tests of Between-Subjects Effects

Dependent Variable: Kemampuan Penalaran Matematis

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.527[a]	5	.105	1.123	.353
Intercept	1.749	1	1.749	18.652	.000
VARX1	.476	2	.238	2.538	.084
VARX2	.017	1	.017	.186	.668
VARX1 * VARX2	.035	2	.017	.187	.830
Error	9.002	96	.094		
Total	11.474	102			
Corrected Total	9.528	101			

a. R Squared = ,055 (Adjusted R Squared = ,006)

Figure 5. Self-Efficacy on Mathematical Reasoning Ability Based on Gender

From these results, a sig value of 0.830 > 0.05 was obtained, meaning that there was no effect of self-efficacy on students' mathematical reasoning ability reviewed from the perspective of gender.

3.2. Discussion

From the results of the study, it was found that self-efficacy reviewed from gender had a significant difference, if viewed from the results of statistical tests this occurred because the significance value < 0.05, then it can be concluded that student self-efficacy has a difference when viewed from gender, in line with (Hanifah et al., 2020) that gender differences are one of the parts that can affect self-efficacy. In line with (Suryono, 2018) in his study, there was a significant difference in self-efficacy based on a sample with a significance value of 0.000. The findings of the study show that the level of self-efficacy of students can be seen from the indicators used both from strengths and weaknesses.

Female students tend to have better grades than men in the magnitude dimension. This dimension discusses students' confidence in completing tasks according to their level of difficulty. Then according to (Davita & Pujiastuti, 2020) women have more ability when expressing opinions. In line with (Hafidz, 2019) it is stated that girls are more involved in subjects, pay more attention to class, try harder, and participate in more classes than boys. The results of the research that have been carried out show that female students tend to have a sense of optimism so that they are able to solve the given problems, have the ability and interest in solving problems. Many female students are confident that if they work problems, they will get good grades, and improve their quality.

Male students have a deficiency in the magnitude dimension, male students are not sure that they are able to solve problems well, tend to want to see the work of their other friends because of this fear, Of course, contrary to research (Fitriani, 2017) states that in their culture, men show a higher level of self-confidence (self-efficacy) than women, men have high thoughts, and women have low thoughts. In other studies, it was found that men have better self-efficacy than women, one of which is in a study (Nurfauziah et al., 2018) based on the analysis of self-efficacy questionnaire data and interviews with people, the results were obtained that male students have better self-efficacy than female students when measured in percentage. But this study has a difference from previous research. The findings of this study indicate that female students have a higher level of self-efficacy than male students. In line with the opinion (Hanifah et al., 2020) the achievement of female students is better than that of men, where in theory women are better because in completing tasks, female students show higher motivation and a greater level of perseverance in completing tasks. Judging from the results of the category where high self-efficacy is more possessed by women than men, and low self-efficacy is dominated by men. Then the average results show that women have better self-efficacy of 60.90 compared to men. So based on this description, it is concluded that grade VII students at SMP Negeri 20 Tasikmalaya have differences in self-efficacy between male and female genders.

Then for the next hypothesis, it can be seen that the mathematical reasoning ability of each indicator has advantages and disadvantages of each gender, both male and female. However, the results of the statistical test show that the sig value is 0.4 > 0.05, which means that there is no difference in mathematical reasoning ability between male and female genders. From the results of the data tabulation, the students' mathematical reasoning skills were better than all the existing indicators, but the difference was not significant. But from the percentage, there is a difference, female students have a tendency to be able to solve math problems well, this can be based on the learning experience of students who

are used as a reference. In line with (Salmina, 2018) which stated that there is a difference in the mathematical reasoning ability of men and women with female students who are superior, where male students are less careful in analyzing problems, and do not like mathematics so that when given the test students are reluctant and experience difficulties and choose another way, namely cheating. However, according to research conducted by (Saputri et al., 2022), it is stated that male students tend to have superior reasoning skills than women. Of course, the difference in research is based on differences in research places, research times, so of course there are differences.

In this study, both male and female students have similar weaknesses, namely in the M3 and M4 indicators regarding manipulating mathematics and compiling evidence, as well as drawing conclusions. Male and female students tend not to be able to make inferences and make evidence so that they get the right results, then after students finish finishing, they always do not want to conclude or make a conclusion sentence with the excuse of being lazy. According to (Fatmahayati, 2019) students are still not able to compile evidence of an existing problem, stating mathematically based on what is already known. Therefore, it is necessary to improve students' abilities. Meanwhile, according to (Kusumaningtyas et al., 2021), students will have different levels of reasoning ability according to their respective abilities. This study has shown that gender stereotypes and social expectations of mathematical reasoning ability affect beliefs and motivations, If male and female students are treated fairly and have the same expectations to achieve success, then there is likely to be no difference in the mathematical reasoning ability of male and female students, so based on the discussion that has been explained, it can be concluded that grade VII students at SMP Negeri 20 Tasikmalaya There is no significant difference in mathematical reasoning ability between male and female students. If male and female students are treated fairly and have the same expectations to achieve success, then there is likely to be no difference in the mathematical reasoning ability of male and female students, so based on the discussion that has been explained, it can be concluded that grade VII students at SMP Negeri 20 Tasikmalaya There is no significant difference in mathematical reasoning ability between male and female students.

The next hypothesis shows that self-efficacy on students' mathematical reasoning ability reviewed from a gender perspective has no effect. The results of the statistical analysis showed that the sig was 0.830 > 0.05, which means that there was no relationship between the level of self-efficacy and students' mathematical reasoning ability from a gender perspective. However, it turns out that these results are contrary to research (Umaroh et al., 2020) that there is a significant influence between self-efficacy and students' mathematical reasoning skills. The results of the study show that not all students who have low ability always have low self-efficacy as well or vice versa. In this study, the data showed that students who had low mathematical reasoning skills, had moderate and even high self-efficacy. This is in line with (Agustiana et al., 2019) students with high self-efficacy have better mathematical reasoning skills than medium and low self-efficacy, but contrary to research (Nurussalamah & Marlina, 2022) that students with low self-efficacy have a tendency to stay away from the problem because they are not sure they are able to solve the problem well.

The researcher also found that each class sampled had different characteristics and different tendency to results. According to the opinion (Turhusna & Solatun, 2020) it is stated that each individual or group has different characteristics that can be caused by innate factors or environmental factors. If you look at it as a whole, male and female students have difficulties in solving math problems, complaining of forgetting the material that has been delivered by the previous teacher and if you pay attention to the teacher, they still forget when doing the problems so that they get low scores. This can happen because students who have limited memory, students do not understand the material presented. In addition, students with low memory are often hesitant and have no confidence in solving mathematical problems, resulting in stagnant mathematical reasoning skills and lack of self-efficacy. In line with (Nurussalamah & Marlina, 2022) self-efficacy is not always used as a benchmark in determining the category of students' mathematical reasoning ability. Therefore, the results of the data tabulation show that there is a difference in percentage only. However, if all the data are put together and tested statistically, it shows that there is no effect, so that the students of grade VII of SMP Negeri 20 Tasikmalaya do not have an effect of self-efficacy on the mathematical reasoning ability of students who are recruited from gender.

4. CONCLUSION

Based on the results of the research and discussion, it can be concluded that there is a difference in the level of self-efficacy between men and women, both the results of statistical tests and the results of tabulation that show the same answer. Then the difference in mathematical reasoning ability between male and female genders, the results of the statistical test show that there is no difference, it's just that when viewed from the data tabulation shows that female students have good mathematical reasoning skills, from the results of the percentage is certainly greater than female students. However, the researcher took the results of the statistical test used as a conclusion. The effect of self-efficacy on students' mathematical reasoning ability reviewed from the perspective of gender The results of the statistical test showed that there was no effect of self-efficacy on students' mathematical reasoning ability when viewed from a gender perspective. Thus, it is important to note that both male and female students do not always have a high level of self-efficacy when they have high mathematical reasoning skills, and vice versa. So in this study, students with low mathematical reasoning skills will have a high probability of having moderate or even high self-efficacy. From the results above, of course, there are many other factors and affective aspects that can certainly be used as material for discussion in the next.

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