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The Influence of Gender and Learning Models on Students' Mathematical Reasoning Abilities at Students of Islamic Junior High School

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Abstrak

Penelitian ini merupakan penelitian kuantitatif yang bertujuan untuk mengetahui pengaruh gender dan model pembelajaran terhadap kemampuan penalaran matematis siswa. Penelitian dilaksanakan di MTsS Madinatussalam Percut Sei Tuan dengan menggunakan pendekatan quasi experiment. Penelitian ini melibatkan siswa kelas VIII sebagai peserta yang dipilih melalui teknik simple random sampling. Desain penelitian menggunakan faktorial 2×2 dengan dua variabel bebas, yaitu model pembelajaran discovery learning dan konvensional serta gender. Subjek penelitan adalah kelas VIII-1 berjumlah 32 siswa sebagai kelas eksperimen dan kelas VIII-2 berjumlah 32 siswa sebagai kelas kontrol. Instrumen yang digunakan berupa tes uraian kemampuan penalaran matematis yang telah divalidasi. Analisis data dilakukan menggunakan uji Two-Way ANOVA. Hasil analisis menunjukkan bahwa: terdapat pengaruh gender terhadap kemampuan penalaran matematis, terdapat pengaruh model pembelajaran terhadap kemampuan penalaran matematis, dan tidak terdapat interaksi yang signifikan antara model gender dan model pembelajaran terhadap kemampuan penalaran matematis siswa. Dengan demikian, baik gender maupun model pembelajaran secara masing-masing memengaruhi kemampuan penalaran matematis siswa, namun tidak terdapat pengaruh gabungan interaksi antara keduanya.

***Kata Kunci**: Gender, Kemampuan Penalaran Matematis, Model Pembelajaran.*

Abstract

This research is a quantitative research that aims to determine the effect of gender and learning models on students' mathematical reasoning abilities. The research was conducted at MTsS Madinatussalam Percut Sei Tuan using a quasi-experimental approach. This study involved students of grade VIII as participants selected through simple random sampling techniques. The research design used a 2×2 factorial with two independent variables, namely discovery learning and conventional learning models and gender. The subjects of the study were class VIII-1 totaling 32 students as the experimental class and class VIII-2 totaling 32 students as the control class. The instrument used was a validated mathematical reasoning ability essay test. Data analysis was carried out using the Two-Way ANOVA test. The results of the analysis showed that: there was an effect of gender on mathematical reasoning abilities, there was an effect of learning models on mathematical reasoning abilities, and there was no significant interaction between gender and learning models on students' mathematical reasoning

abilities. Thus, both gender and learning model individually influence students' mathematical reasoning abilities, but there is no combined interaction effect between the two.

Keywords: Gender, Mathematical Reasoning Ability, Learning Model.

A. Introduction

Students need mathematical reasoning abilities to comprehend, analyze, and solve issues. In this setting, the Independent Curriculum is flexible and student-centred (Hasibuan AM, 2018). This curriculum emphasizes critical and creative thinking, which is linked to mathematical reasoning. Students are required to actively identify, comprehend, and apply mathematical ideas contextually in the Independent Curriculum to meet complex and dynamic real-world issues (Hodiyanto, 2017).

The Independent Curriculum promotes analysis, assessment, and creativity as higher-order thinking skills (HOTS). This skill enables students not only to retain formulas and processes but also to grasp why and how mathematical ideas might be used. Students are taught to think critically, solve multi-way issues, and apply mathematical knowledge to other subjects and life (Dinni, 2018).

However, studies and field observations suggest that many pupils struggle with mathematical thinking. The disparity between procedural comprehension and using mathematical principles to solve conceptual issues is a major barrier for instructors and students (Sumartini, 2018). Students are frequently locked in a mechanical and algorithmic knowledge of mathematics, following the solution steps without comprehending why. This difficulty is exacerbated when pupils must analyze or apply abstract notions. In this circumstance, many students struggle to establish effective problem-solving skills or even recognize the first steps. Students' mathematical thinking skills may be lacking, which might hamper their learning (Marwazi.M, Masrukan., 2019).

The Independent Curriculum uses numerous methods to promote arithmetic learning by deepening students' thinking abilities. Project-based and exploration learning provide students real-world experiences (Kusumaningrum, S., & Djukri, 2016). This method lets students brainstorm ideas, make hypotheses, test them, and draw conclusions based on the data. Student mathematical thinking should improve greatly during this procedure (Khairani, D., Permana, D., Fauzan, A., & Musdi, 2024).

The following matches class VIII MTsS Madinatussalam Percut Sei Tuan researchers' early discoveries on arithmetic two-variable linear equation systems. When given reasoning and problem-solving issues, many students struggle to grasp the fundamentals of arithmetic two-variable linear equation systems. Students often memorize formulae without comprehending how and why they apply to different issues. Students can usually answer regular probability questions like estimating the likelihood of an even number on a dice roll or picking a red ball

from a bag because they understand the fundamental ideas taught in class (Wanahari, M., Amry, Z., Simamora, 2022).

Many students struggle when probability issues are linked to real-world situations that demand higher mathematical thinking. A school lottery involves 40 pupils, 25 of which are male and 15 female. What is the likelihood that two randomly picked students receiving rewards are female? Thus, students must comprehend probability, assess the issue, discover significant facts, and choose the best strategy to organize and solve the problem.

Probability becomes more difficult when applied to more complex everyday life situations, such as calculating a game strategy's probability of success, analyzing statistical data to predict an event's outcome, or assessing financial decision risk. Mathematical thinking is crucial in such circumstances (Sihotang, 2019). Students must be able to make diagrams or tables, manipulate numbers to uncover variable correlations, draw logical inferences from data, and build sound mathematical arguments to support their solutions (Hamidah, Kahirunnisa, 2018).

Students must not only comprehend probability but also use it in numerous contexts. Thus, instructors should push students to solve probability issues in actual circumstances to improve their mathematical reasoning abilities for daily problems. (Dwi Putra, 2018) Due to these issues, a learning approach that engages pupils is required. Students must actively uncover topics and solve challenges to have a greater comprehension of the content. This may be done using the discovery learning methodology.

Discovery learning enables students to actively investigate things they are studying. Students are allowed to investigate, discover issues, make hypotheses, and solve them via contextual learning. This method helps students not only learn formulae or follow processes, but also grasp why and how specific ideas are used (Abdul Basir, 2019).

Discovery learning may improve mathematical thinking in opportunity learning by applying mathematical principles to real life (Yuliani, K., & Saragih, 2015). Teachers might provide contextual issues like family financial budget planning and urge pupils to employ mathematical sequences. Students are given many ways to solve the issue to learn the formula and how to apply it in more difficult and realistic scenarios.

Discovery Learning is actively engaging with ideas and principles to gain knowledge (Adinia, A. F., & Simanjorang, 2024). This learning lets students explore, investigate, and solve problems to find new information. Discovery learning also promotes student cooperation. Students communicate, share, and learn from each other in many group activities in this approach. This enhances learning and promotes social and communication skills (Purwati Heni, 2018).

However, Discovery Learning implementation is difficult. It takes careful preparation and a teacher's knowledge of the content and students' requirements. Teachers must establish

exploration opportunities without abandoning learning goals (Simamora, R. E., Saragih, S., & Hasratuddin, 2018) . This technique may also be uncomfortable for those accustomed to more structured learning approaches. Mathematics is a key topic for critical, logical, and systematic thinking. The capacity to examine issues, formulate logical arguments, and draw generalizations based on evidence is crucial to mathematics. This skill helps with academic and daily issues. However, gender, learning approach, and environment affect math success. Three factors interact and impact each other (Khairani, D., Permana, D., Fauzan, A., & Musdi, 2024).

Math achievement is frequently influenced by gender. General cognitive disparities exist between male and female pupils. Male pupils do better in visual-spatial and abstract activities like non-verbal problem solving, according to research. In contrast, female pupils thrive at verbal and regular calculations. (Sariyasa, 2019) found that female students are less motivated to study arithmetic than male pupils. Also consistent with In Mathematical Ability Reviewed from Gender Differences, (Saniyyah, F., & Triyana, 2021) found that male students are generally less mathematically gifted than female students. (Saragih, S. & Habeahan, 2014) study, Students' Adaptive

Reasoning in Solving Mathematical Story Problems on the Material of Spatial Buildings at SMP Negeri 4 Surabaya, supports this view. Gendered differences. (Tunnajach.N.F & Gunawan, 2021) adds that male students had worse adaptable thinking than female pupils. Male students' problem-solving accuracy and precision are lower than female students', hence their outcomes are less than optimum(Cooney, 1985).

Gender, mathematical reasoning, and learning models affect mathematics learning. The correct learning strategy may assist male and female students in overcoming gender-related arithmetic problems (Sugarti, T., Salam, M., dan Wijaya, 2017). By using discovery learning and other approaches, educators may create an atmosphere that encourages mathematical thinking for all children. Thus, educators must evaluate student characteristics and adopt the right learning approach to enhance mathematical reasoning and eliminate gender inequalities in math learning. Thus, male and female pupils may grow and excel in mathematics equally. This is why academics are interested in tackling this issue, thus "The Influence of Gender and Learning Models on the Mathematical Reasoning Abilities of Students at MTsS Madinatussalam Percut Sei Tuan" study is conceivable.

A. Research Method

This study uses a quantitative approach, namely to test certain theories by examining the relationship between variables (Sugiyono, 2018). This research was conducted at MTsS Madinatussalam with an estimated research time to be carried out in the even semester of the 2024/2025 academic year. Sampling in this study used a lottery technique, by making a roll of paper containing all the populations from all classes VIII. The population in this study were all

students of class VIII MTsS Madinatusalam Percut Sei Tuan consisting of 6 classes. Then the first roll of paper was taken as the experimental class, namely class VIII-1, totaling 32 students, while the other roll of paper was the control class, namely class VIII-2, totaling 32 students. The research instrument was a Mathematical Reasoning ability test. The instrument consists of a collection of test questions to measure Mathematical Reasoning ability. This study will analyze the influence of each variable (gender and learning model) and its interaction on students' mathematical reasoning ability. If a significant interaction is found between the two variables, then a conclusion can be drawn regarding the role of gender in moderating the effect of learning models on mathematical reasoning ability.

Table 1. 2x2 Factorial Experimental Design

Variables A	Variables B		
		M_1	M_2
	G_1	M_1 G_1	M_2G_1
	G_2	M_1 G_2	M_2 G_2

Information :
M_1 : Learning model *discovery learning*
M_2 : Conventional learning model
G_1 : Male gender
G_2 : Female gender

B. Result and Discussion

To compare male and female mathematical reasoning skills following a learning model, gender-specific posttest data must be processed and analyzed. By segregating data by gender, researchers may observe more detailed and objective learning result patterns and determine whether gender variables affect them. For the Two-Way ANOVA test, which examines the effect of two variables (in this instance the learning model and gender) and their interaction on the dependent variable, this analysis is crucial. Thus, gender-based data processing enhances study validity and gives more detail.

Table 2. Description of Posttest Results of Mathematical Reasoning Ability Based on Gender

Group	N	Xmin	Xmax	Mean	s
Discovery_Male	16	71	91	81.94	5.446
Discovery_Female	16	73	98	87.63	6.946
Conventional_Male	16	66	87	74.75	5.183
Conventional_Female	16	71	89	80.19	5.822

Table 1 shows posttest math reasoning scores by gender and learning approach. Both boys and girls who were taught using Discovery Learning performed better than those who were taught conventionally. Female Discovery students had the highest average of 87.63 with a

standard deviation of 6.946, while male students had 81.94 and 5.446. In the typical group, female students averaged 80.19 with a standard deviation of 5.822, while male students averaged 74.75 with 5.183. This proves that women are better at arithmetic than males and that Discovery Learning works better.

Posttest Data Normality Test Based on Gender

Normality testing was used to examine whether gender-based posttest mathematical reasoning data were normally distributed. This test is crucial before parametric statistical analysis. Posttest data from male and female students was normal according to the normality test. Each group has a normality test p-value larger than 0.05. Thus, posttest data of male and female students' mathematical reasoning skills match the assumption of normalcy, making parametric statistical analysis possible. Table 2 shows SPSS 27 normalcy test results:

Table 3 Results of the Posttest Data Normality Test Based on Gender

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelompok	Statistic	df	Sig.	Statistic	df	Sig.
Hasil	Discovery_Laki-laki	.193	16	.112	.945	16	.415
	Discovery_Perempuan	.124	16	.200*	.966	16	.764
	Konvensional_Laki-laki	.140	16	.200*	.953	16	.531
	Konvensional_Perempuan	.185	16	.147	.924	16	.199

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on the results of the Kolmogorov-Smirnov normality test, it is known that all groups of posttest data on mathematical reasoning ability based on gender have a significance value (Sig.) greater than 0.05. The Discovery_Male group has a Sig. value of 0.112, Discovery_Female of 0.200, Conventional_Male of 0.200, and Conventional_Female of 0.147. Because all of these significance values are > 0.05, it can be concluded that the data in each group is normally distributed. Thus, the assumption of normality is met and the data is suitable for analysis using parametric statistical tests.

Hypothesis testing was done to examine whether learning modalities, gender, and their interplay affected students' mathematical thinking. The Two Way ANOVA test was utilized since the data was normal and homogeneous. This test may assess the role of each component (learning model and gender) and their interaction. We'll base our hypothesis conclusions on test outcomes. Table 4. shows SPSS hypothesis test analysis results:

Table 4 Two Way Analysis of Variance Table

Tests of Between-Subjects Effects

Dependent Variable: Hasil

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1350.875[a]	3	450.292	12.988	<,001
Intercept	421201.000	1	421201.000	12149.299	<,001
Model	855.563	1	855.563	24.678	<,001
Kelamin	495.063	1	495.063	14.280	<,001
Model * Kelamin	.250	1	.250	.007	.933
Error	2080.125	60	34.669		
Total	424632.000	64			
Corrected Total	3431.000	63			

a. R Squared = .394 (Adjusted R Squared = .363)

The statistical hypothesis of the third hypothesis of the research above is as follows:

Hypothesis 1: To test the effect of gender on students' mathematical reasoning abilities statistically, the hypothesis can be formulated

Statistical hypothesis:

$H_0 : \alpha_1 = \alpha_2 = 0$

Ha: At least one, $\alpha_i \neq 0$

Hypothesis 2: To test the effect of learning models on mathematical reasoning abilities.

Statistical hypothesis:

$H_0 : \beta_1 = \beta_2 = 0$

H_a : There is at least one $\beta_j \neq 0$

Hypothesis 3: To test the interaction between gender and learning model on mathematical reasoning ability.

Statistical hypothesis:

$H_0 : (\alpha\beta)_{ij} = 0, \quad i = 1,2; j = 1,2$

H_a : There is at least one $(\alpha\beta)_{ij} \neq 0, \quad i = 1,2; j = 1,2$

According to the table above, H0 is approved since model*gender's sig value is 0.933, which is larger than 0.05. Thus, gender and learning methodology do not affect class VIII MTsS Madinatussalam Percut Sei Tuan students' mathematical reasoning. The following illustration shows how gender and learning model affect mathematical reasoning: Hypothesis testing was done to examine whether learning modalities, gender, and their interplay affected students' mathematical thinking. The Two Way ANOVA test was utilized since the data was normal and homogeneous. This test may assess the role of each component (learning model and gender) and their interaction. We'll base our hypothesis conclusions on test outcomes. Table 4.14 shows the results of the SPSS hypothesis test analysis:

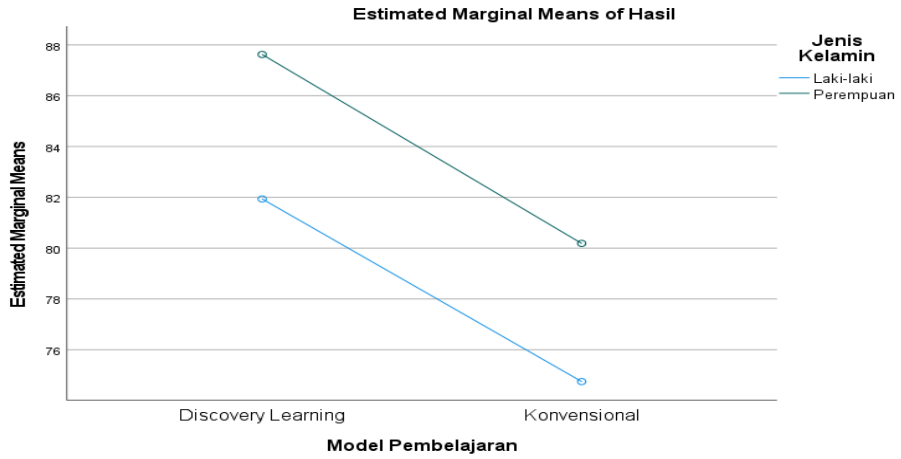

Figure 1 Interaction between gender model and learning model on mathematical reasoning ability

Figure 1 shows that Discovery Learning students in both male and female groups had a greater average mathematical reasoning ability than traditional learners. Male and female groups fall similarly from Discovery Learning to Conventional. Although men and females have different values, the learning model has a consistent impact on both genders. The learning model and gender do not interact much.

Discussion

The research found that Discovery Learning students performed better in mathematical reasoning than traditional pupils. Bruner's thesis claims that learning via discovery helps pupils actively construct their knowledge, enhancing high-level cognitive abilities like reasoning. Math thinking skills vary significantly between male and female pupils. Average scores are higher for boys. Different learning styles, motivation, or self-confidence in reasoning issues may explain this. This result must be contextualized based on student and learning environment factors.

The evidence suggests that the discovery learning paradigm is beneficial for all students regardless of gender. Teachers may concentrate on active learning practices that stimulate idea discovery without having to consider gender inequalities in outcomes. The gender component has a significance value of <0.001 in the two-way ANOVA test, which is below the significance threshold of 0.05. This reveals that male and female pupils vary significantly in mathematical thinking. F = 14.280 indicates a statistically significant difference. Thus, H_0 is rejected while H_1 is approved, indicating that gender affects pupils' mathematical thinking. This research found that gender affects math learning outcomes, particularly mathematical thinking. (Septriani, Nicke, Irwan, 2019) states that gender may alter pupils' learning, thinking, and communication styles. Male students think logically and methodically, whereas female students are more meticulous and thorough in arithmetic.

This study supports (M, Sherly, Tri Atmojo, 2019), which found that male students were better at logistical reasoning and female students at accuracy and presentation. Two-way ANOVA analysis yielded a significance value (Sig.) of <0.001 for the learning model factor. Since this number is below 0.05, H_0 is rejected and H_1 is approved. This suggests that the learning paradigm significantly impacts students' mathematical thinking. The F value of 24.678 suggests a high statistical effect. These findings suggest that the mathematics teaching and learning approach might alter students' mathematical thinking. This research compares discovery learning with standard learning approaches. Discovery Learning students outperformed traditional learners in mathematical thinking. Discovery learning promotes student discovery of topics via experiments, conversations, and exploration. Discovery learning helps pupils actively acquire and organize information, which improves high-level thinking abilities like mathematical reasoning, according to Bruner (Trianto., 2017).

C. Consclusion

Based on the results of the analysis and discussion in this study, several conclusions are put forward as follows: There is an influence of gender on the mathematical reasoning ability of class VIII students of MTsS Madinatussalam. There is an influence of the learning model on the mathematical reasoning ability of class VIII students of MTsS Madinatussalam. There is no interaction between gender and learning model on the mathematical reasoning ability of class VIII students of MTsS Madinatussalam Percut Sei Tuan.

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