



THE INFLUENCE OF SPATIAL REASONING ABILITY OF STUDENTS OF METHODIST AEK NABARA PRIVATE MIDDLE SCHOOL ON GEOMETRY PROBLEMS THROUGH THE TGT LEARNING MODEL

Santi Nur Cahyani ^{1*}, Amin Harahap ², Nurlina Ariani Harahap ³

^{1,2,3} Mathematics Education Study Program, Faculty of Teacher Training and Education, Labuhanbatu University, North Sumatra, Indonesia.

e-mail: ^{1*} santinurcahyani2020@gmail.com, ² aminharahap19@gmail.com, ³ nurlinaariani561@gmail.com

*Correspondence Author

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Abstract: The majority of the mathematics curriculum in junior high school is devoted to geometry. The methods for solving mathematical problems using coordinates, diagrams, and drawings are covered in this topic. This study employs a descriptive quantitative research design. With 70 pupils split up into two classes, the population utilized class VIII at SMP SWASTA METHODIST AEKNABARA. Multiple linear regression tests were performed using the SPSS 24 application as part of the data processing technique. The T count > T table with a sig value of $0.000 < 0.05$ indicates that the Teams Games Tournament Learning Model (Tgt) variable was positively and significantly impacted by the T-Test of the Spatial Reasoning Ability variable, Geometry Material. The Teams Games Tournament Learning Model's F Test is concurrently.

Keywords: spatial reasoning ability; geometry material; teams games tournament (TGT) learning model

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INTRODUCTION

Mathematics is an integral component in the secondary education curriculum, which aims to develop students' cognitive abilities such as logical, critical, and systematic thinking. Mathematics is a core subject that is required in the formal education curriculum in Indonesia. The mathematics learning process can be identified through the interactions that occur between students, teachers, and learning media (Kunfiana et al., 2024).

Many students still consider mathematics a challenging subject, and it even causes anxiety because of the difficulty in solving math problems. (Novita Harahap, 2023a). Creative and interactive learning strategies are needed to overcome the challenge of students' lack of interest in mathematics (Kusumawati et al., 2023a). A mathematics learning approach that emphasizes the application of concepts in real life is expected to increase students' motivation and interest in learning (Rahmad, 2020).

To see the Influence of the Spatial Reasoning Ability of Students of Methodist Aek Nabara Private Middle School on Geometry Problems Through the Teams Games Tournament (TGT) Learning Model, an interesting and innovative approach is needed. Spatial reasoning is one of the most common inference methods used to construct new statements based on existing premises (Prayitno & Sarjana, 2021) stating



that spatial reasoning is the process of connecting several things to get a conclusion (Sari Nst et al., 2023) Mathematical reasoning is the main foundation in building an understanding of mathematical concepts. This ability contributes significantly to student learning success.

In reality, students' ability to visualize mathematical concepts is still limited. One of the causes is the lack of learning activities designed to develop students' spatial abilities, as well as the abstract nature of mathematics that makes it difficult for students to form mental representations (Sari Nst et al., 2023b). The limited research on imagination in mathematics makes it difficult for teachers to find ways to develop students' visual thinking skills. As a result, students' potential to solve mathematical problems creatively has not been maximized (Susilowati et al., 2020).

Three components make up spatial reasoning: mental rotation, spatial orientation, and spatial visualization (Novita Harahap, 2023b). Spatial visualization is the ability to change images in our minds, for example rotating or enlarging the image (Leni et al., 2021). (Febrianti et al., 2024) Mental rotation is like spinning a Rubik's cube in our heads without touching it (Spatial Rotation), Spatial Visualization, and Spatial Perception.

The ability to think spatially is one of the core competencies that must be mastered by students in studying geometry (CHOLILAH SMP Khadijah, 2023). Geometry has a significant portion of the junior high school mathematics curriculum. This study presents various strategies and visual approaches to solving geometry problems, with an emphasis on the use of images, diagrams, and coordinate systems (Simamora et al., 2024). The study of shape, size, relative position, and space characteristics is the focus of the mathematical field of geometry. The goal of the geometry curriculum is to help students become more adept in constructing, analyzing, and reasoning with geometric objects (Yuliany et al., 2024).

Geometry plays a central role in the mathematics curriculum. The objectives of learning geometry are to develop logical thinking skills, foster spatial intuition, build a strong foundation for advanced mathematics studies, and improve the ability to analyze and interpret mathematical arguments (Mathematics et al., 2019). Learning geometry requires students to have a strong conceptual understanding. The ability to visualize geometric objects, identify the characteristics of plane and spatial shapes, and make visual representations are essential skills in learning geometry (I. Fauzi & Arisetyawan, 2020).

The main objective of geometry learning is to develop students' logical thinking skills, equip students with problem-solving skills in the context of geometry, and build a strong foundation for learning more advanced mathematical concepts (Nurhaliza Ali et al., 2023). The level of success in mathematics learning can be measured by the mastery of material and concepts, as well as the ability to interpret mathematical representations such as symbols, diagrams, and tables to solve problems (Anwar, 2021).

Learning can be defined as a process of relatively permanent behavioral change as a result of experience and interaction with the environment. The learning process involves dynamic interactions between teachers, learning materials, and students. The teacher acts as a learning facilitator, so the quality of learning is greatly influenced by the teacher's competence in managing the teaching and learning process (Yudhi et al., 2022). Effective mathematics learning encourages active interaction between students in various aspects, including physical, cognitive, and affective (Nur Khodijah et al., 2020).

The TGT learning model involves several systematic stages to achieve learning objectives. The main difference between TGT and other cooperative learning models lies in the existence of tournaments or competitions between groups as a form of appreciation for group achievements (Setianingsih et al., n.d.). In this game, each team will compete to achieve the highest score. Each team member is required to make maximum contributions so that their team can win the competition (Sukenda Ekok, 2022). By using the game method, learning becomes more fun because students can learn while playing and interacting with various objects (A. Fauzi & Masrupah, 2022).

The application of the TGT model also provides an opportunity for students with low cognitive abilities to compete healthily with their peers who have higher abilities. This constructive competition can be a motivation for low-ability students to improve their learning achievement (Kusumawati et al., 2023b).

Therefore, the researcher tried to take the research title, namely "The Influence of Spatial Reasoning Ability of Students of Methodist AEK Nabara Private Middle School on Geometry Problems Through the TEAMS GAMES TOURNAMENT (TGT) Learning Model". With the research conducted by the researcher, it is hoped that it can help teachers in improving the spatial reasoning of students of Methodist AEK Nabara Private Middle School.

METHOD

This research methodology combines a quantitative approach with descriptive analysis. methods for descriptive analysis. Tables, curves, graphs, histograms, stem and leaf, and numerical metrics like arithmetic mean, median, skewness, and others are used to display data gathering methods that include tests and field observations (Alfatih, 2021). Students' spatial reasoning skills and responses to the multiple-choice tests are assessed by descriptive processing of data collection methods and multiple-choice assessments utilizing the Teams Games Tournament (TGT) learning paradigm. All 70 pupils in grade VIII at SMP Swasta Methodist Aeknabara during the odd semester of the 2024–2025 school year made up the study's population.

RESULT AND DISCUSSION

Validity and Reliability Test

1. Validity Test

Validity testing is a procedure to ensure that the data collection instruments used in research can accurately measure the construct or variable to be measured.

Table 1. Validity Test Results

Variabel	Item	R Count	R Table	Sig Value	Information
Spatial Reasoning Ability (X1)	X1.1	0,742	0,254	0,000	Valid
	X1.2	0,754	0,254	0,000	Valid
	X1.3	0,709	0,254	0,000	Valid
	X1.4	0,823	0,254	0,000	Valid
	X1.5	0,890	0,254	0,000	Valid
Geometry Material (X2)	X2.1	0,796	0,254	0,000	Valid
	X2.2	0,704	0,254	0,000	Valid
	X2.3	0,806	0,254	0,000	Valid
	X2.4	0,837	0,254	0,000	Valid
	X2.5	0,877	0,254	0,000	Valid

Teams Games Tournament (Tgt) Learning Model (Y)	X3.1	0,932	0,254	0,000	Valid
	X3.2	0,896	0,254	0,000	Valid
	X3.3	0,946	0,254	0,000	Valid
	X3.4	0,904	0,254	0,000	Valid
	X3.5	0,926	0,254	0,000	Valid

Source: SPSS 24 Data Processing

All of the statement items utilized in this study have excellent validity, it may be inferred. The validity test results, which demonstrate that the correlation coefficient value between each item and the overall variable score deviates significantly from zero, lend credence to this.

2. Reliability Test

Reliability testing is used to test the extent to which research instruments are free from random errors and can provide consistent measurement results.

Table 2. Reliability Test Results

Variabel	Cronbach's Alpha	Alpha Value	Information
Spatial Reasoning Ability (X1)	0,880	0,60	Reliabel
Geometry Material (X2)	0,866	0,60	Reliabel
Teams Games Tournament (Tgt) Learning Model (Y)	0,899	0,60	Reliabel

Source: SPSS 24 Data Processing

The reliability test results above demonstrate that the Cronch Bach alpha value is higher than the alpha value. As a result, the aforementioned statement items are deemed trustworthy.

Normality Test

The classical assumption test is the main requirement in multiple linear regression analysis. The goal is to ensure that the resulting regression model is the best, unbiased, and consistent model..

Table 3. Normality Test Results

One-Sample Kolmogorov-Smirnov Test

		Unstandardize d Residual
N		60
Normal Parameters ^{a,b}	Mean	.0000000
	Std. Deviation	2.74453360
Most Extreme Differences	Absolute	.103
	Positive	.103

	Negative	-.080
Test Statistic		.103
Asymp. Sig. (2-tailed)		.180 ^c

- a. Test distribution is Normal.
- b. Calculated from data.
- c. Lilliefors Significance Correction.

Source: SPSS 24 Data Processing

The data is deemed normally distributed according to the Kolmogorov-Smirnov test since the significance level (0.05) is less than the significance value (0.180).

Hypothesis Testing

1. Partial Hypothesis Testing (T-Test)

Partial hypothesis testing (T-test) is conducted to test the significance between two groups or populations. The T-test can also test the effect of independent variables individually on dependent variables.

Table 4. T-Test Results Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1.	(Constant)	12.408	2.820		4.401	.000
	Kemampuan Penalaran Siswa	.217	.084	.312	4.449	.000
	Materi Geometri	.265	.106	.303	4.775	.000

- a. Dependent Variable: Implementation of Independent Curriculum

Source: SPSS 24 Data Processing

The t-test results indicate that the following factors significantly affect hiring, work performance, and incentives:

- a. The Student Reasoning Ability variable (X1) has a significance value of $0.000 < 0.05$ and a T-value of $4.449 > 2.00$ Table. As a result, the Teams Games Tournament Learning Model (Tgt) variable (Y) is positively and significantly impacted by the Student Reasoning Ability variable.
- b. The Geometry Material variable (X2) has a significance value of $0.000 < 0.05$ and a T-value of $4.775 > 2.00$ Table. Consequently, the Teams Games Tournament Learning Model (Tgt) variable (Y) is positively and significantly impacted by the Geometry Material variable.

2. Simultaneous Hypothesis Testing (F Test)

The multiple linear regression model's appropriateness is tested via simultaneous hypothesis testing (F Test). In this study, the F value is utilized to assess whether the independent variables are appropriate and whether they have a beneficial impact on the research.

Table 5. F Test Results

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	87.888	3	29.296	7.907	.000 ^b
	Residual	242.445	56	4.329		
	Total	330.333	59			

a. Dependent Variable: Teams Games Tournament Learning Model (Tgt)

b. Predictors: (Constant), Spatial Reasoning Ability, Geometry Material

Source: SPSS 24 Data Processing.

The computed F value, as determined by the simultaneous test or F Test, is $6.767 > 2.77$ F table with a significant value of $0.000 < 0.05$. Therefore, the Teams Games Tournament (TGT) Learning Model variable is positively and significantly impacted by the F Test results on the variables of Spatial Reasoning Ability and Geometry Material taken combined.

Data analysis shows that TGT-type cooperative learning is an effective learning strategy in improving students' conceptual understanding, encouraging active participation, and forming positive attitudes towards mathematics, especially in flat geometry material.

Quantitative data analysis shows a significant increase in student's conceptual understanding after the implementation of the TGT-type cooperative learning model. This can be seen from the test results that reach the 'high' category and the level of student success in completing the learning unit which reaches 86.21%.

In terms of student cooperation in learning, this question has shown a picture of significant Science lessons through fun TGT learning where most of the students take part effectively in the midst of learning preparation progress (see tables 3, 4, and 5). It is widely accepted that learning preparation must be done by the teaching environment where students are effectively locked dynamically in learning rather than acting as separate collectors of ready-made goods. This introduction may be straight with the constructivism hypothesis where students are viewed as dynamic members, and Learning occurs through the process of Building information rather than taking understanding from adults.

In terms of Information Development, learning preparation occurs in a social and social environment, unlike in humans. In this way, exercises in geometry learning place a tremendous emphasis on students' interactions with their peers. The inclusion of entertainment in fun TGT learning can be a valuable meaning for students to create their talents. In this question, I create diversions and steps that

are adjusted to be used as educational diversions to arouse their curiosity and consideration of science, especially measurement. Students' reactions towards the use of TGT-type friendly learning are also important angles to be considered. In the last meeting of this project, students were asked about their confessions related to sentiments in the middle of learning; and connected learning components such as subjects, worksheets, competition diversions, tests, learning environments, and learning strategies. Based on the examination of reactions given by students, the normal level of students reacting positively to the TGT Level Construct fun learning strategy reached 92.10%. That inspiring reaction is what can bring us to the conclusion that TGT learning is fun and liked by students.

CONCLUSION

This study shows that a fun and competitive learning method such as Teams Games Tournament (TGT) is very helpful for junior high school students in understanding geometry concepts. When this learning method is applied, students become more knowledgeable about the material being taught. The results of this study are very credible because the measuring instruments used in the study have been proven to be valid and reliable. The two statements above show that both students' logical thinking skills and geometry materials have a very important role in the success of implementing the TGT learning model. In other words, to get optimal results from the TGT learning model, it is necessary to pay attention to students' initial abilities and the type of material being taught.

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