Vol. 10, No. 3, 2024, pp. 805-816
DOI: https://doi.org/10.29210/020244022

Contents lists available at Journal IICET

JPPI (Jurnal Penelitian Pendidikan Indonesia)
ISSN: 2502-8103 (Print) ISSN: 2477-8524 (Electronic)

Journal homepage: https://jurnal.iicet.org/index.php/jppi

The influence of the ability to understand mathematics concepts based on Van Hiele's level of thinking on the learning outcomes of mathematics education students

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Article Info

Article history:

Received May 18th, 2024
Revised Jul 13th, 2024
Accepted Aug 25th, 2024

Keyword:

Transformation geometry,
Van Hiele,
Level of thinking,
Learning outcomes

ABSTRACT

The aim of this research is to find out whether there is an influence on the ability to understand mathematical concepts based on Van Hiele theory on the learning outcomes of STKIP Muhammadiyah Sungai Penuh students. The research method that will be carried out is associative (correlational) research. Sample determination was carried out using random sampling technique or determining samples randomly after carrying out a normality test, test homogeneity and equality of means tests. The results of the calculations carried out obtained the calculated r value = 0.5 46 and r table = 0.444, apparently r count > r table , then it can be concluded that H 1 accepted , so it can be concluded that there is a significant relationship between learning interactions and results learn mathematics with interpretation Enough. Coefficient of determination $(r)^2$ = 0.2981 . So the magnitude of the relationship between variable X and variable Y is 29.81 %. This means that the relationship between the ability to understand mathematical concepts and the learning outcomes of transformation geometry is 29.81 %.

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Introduction

In studying mathematics, it is natural that when solving mathematics problems, students make mistakes. However, if errors that arise do not receive immediate attention and follow-up, it will have a negative impact on students. Remembering that in mathematics lessons, the material that has been given will be interrelated to support various subsequent materials such as transformation geometry courses. Many students do not understand mathematical concepts well, especially at university level. Many students do not master basic concepts before solving mathematics problems, especially in transformation geometry courses. Most students memorize without knowing what the correct concept is, so that if the question or language used is slightly changed, students will automatically be confused about finding the answer (Ni Wayan Sunita, N. Putri Sumaryani, 2023). In terms of understanding, it is defined as the process, method, act of comprehending or comprehending. Thus, understanding can be interpreted as the ability to understand something and translate from one form to another once that something is known (Hoiriyah, 2019) . Learning is said to be meaningful if students experience and discover for themselves the concepts of the material being taught. The inability to understand concepts results in students having difficulty in solving mathematical problems (Sarumaha et al., 2018).

Transformational geometry is part of the Mathematics Education curriculum which focuses on functions, geometric transformations, isometry, and various types of geometric transformations. This is a subject that requires deep understanding after studying basic and analytical geometry. Students are expected to have high visual and analytical thinking skills in this lesson (Maifa, 2019). Compared to other fields of mathematics, geometry is often considered one of the most difficult fields to understand (Susilawati, 2022). One of the reasons behind this is the difficulty of students in creating physical structures precisely and accurately, as well as the belief that creating geometric drawings requires precise measurements and takes quite a long time. Apart from that, students often experience difficulties in proving the concepts being taught (Sundawan et al., 2018). Application of transformation geometry can be done such as determining the slope of stairs and determining computer network topology (Nur'aini et al., 2017). However, learning transformation geometry in class is not optimal because many students find it difficult to understand concepts and solve problems (Sholihah et al., 2018).

The transformation geometry course is given in semester 6. The material studied in this course includes; (1) prerequisite material: function, (2) transformation, (3) transformation composition, (4) isometry, (5) reflection, (6) half-turn, (7) translation, (8) rotation, (9) shear reflection , and (10) dilation (Dinata, 2019) . Research from Mentaruk also shows that students face difficulties in understanding the topic of transformation geometry. They have difficulty recognizing information that is important to prove a concept and choosing the right strategy to prove the material (Mentaruk & Tentena, 2015). Then, according to Hanafi's research, the use of mathematical applications in the form of visualization is needed to help learn transformation geometry (M. Hanafi, KN Wulandari, 2017).

Several studies have shown the positive benefits of applying van Hiele's theory in learning geometry, which focuses on geometric concepts (Fona Fitry Burais, 2014). Van Hiele's theory emphasizes that mathematics teaching, especially geometry, must be adjusted to the level of development of students' geometric thinking abilities. Van Hiele's theory states that the quality of students' understanding depends not only on how much knowledge they have, but more on how they think and process information. (Mason, 2021). In effective geometry teaching, it is important to pay attention to the level of geometric thinking at each student's level of mathematical ability and choose learning methods that are appropriate to that level.

In learning geometry, students will go through five hierarchical levels. These five levels include level 1 (Visualization) where they recognize shapes without paying attention to geometric properties, level 2 (Analysis) where they recognize geometric properties, level 3 (Abstraction) where students can make deductive conclusions but are not yet fully mature, level 4 (Deductive) where they have good deductive abilities, and level 5 (Rigor) where they realize the importance of basic concepts in proof (William F. Burger, 1986). Each stage of geometric thinking describes how students process information in a geometric context. The level of geometric thinking explains how students think and what geometric concepts they think about, rather than how much knowledge they have mastered (Nopriana, 2017). Students must go through the various levels of geometric thinking sequentially and gain a solid understanding of each level before moving on to the next level. With proper guidance, students can complete the five levels of geometric thinking, but it is impossible to reach one level without passing the previous level (Salifu et al., 2018). Each level reflects the thinking skills applied in understanding geometric concepts. Progression from one level to the next is more influenced by learning materials, approaches and tools than by the student's age or maturity level .

Van Hiele's theory describes a series of levels of thinking that considers the speed at which students advance from one level to the next, which is greatly influenced by how learning occurs. The way the material is delivered, the content taught, and the role of the lecturer as a guide also influence the speed of development of students' thinking (Bragg et al., 2016). This theory considers a number of factors that influence the development of students' thinking, such as the way time is managed and the approach to teaching material, differences in levels of thinking between student groups, and the achievement targets set (Fitriati, 2015). Reaffirming the previous argument by referring to the perspective from the lecturer's point of view, (Susilawati, 2022) said " on campus students think that mathematics material is material a hard lesson to learn. Especially in completing material on the congruence of space and building structures flat in geometry ". Lecturers explain geometric concepts directly on the blackboard or using visual aids, while students are less active in participating during learning. In addition, in studying geometry, there are still many students who experience difficulties in formulating arguments, which results in their geometric thinking abilities being less developed (Prahmana, 2017).

According to Anisyah , "students are different in many ways, such as being different abilities, talents, interests they have different sharpness of seeing and hearing and different backgrounds behind his life. Therefore, lecturers should not generalize or assume that all children have the ability and speed to learn the same, so "In the same time, all students are considered to be able to complete the same lesson content " (Anisyah, 2023). The type of error most often made by research subjects is conceptual error (Sholihah et al., 2018). To assess the extent to which students have developed geometric thinking skills, they must meet the predetermined levels of geometric thinking . The following are the results of the exam scores for the transformation geometry course for STKIP Muhammadiyah Sungai Penuh students.

Table 1. Transformation Geometry Subject Exam Scores

Value Range	Class		Amount
	A	B	
A ≥ 85	1	0	1
80 ≤ A- < 85	2	1	3
65 ≤ B+ < 70	0	1	1
60 ≤ B- < 65	4	6	10
50 ≤ C < 60	8	4	12
50 ≤ D < 60	3	3	6
1 ≤ E < 50	0	0	0
Amount	18	15	33

Source: List of transformed geometry test scores at STKIP Muhammadiyah Sungai Penuh

Based on the table above, it can be seen that students in the Mathematics Education study program taking the Transformation Geometry Lecture have varying grades. The importance of understanding mathematical concepts for a prospective teacher makes researchers interested in conducting this research. This research is the result of an initial test of students' ability to understand the concept of transformation geometry based on the Van Hiele level of thinking. Each level reflects the thinking skills applied in understanding geometric concepts. Progression from one level to the next is more influenced by learning materials, approaches and tools than by the student's age or maturity level . This makes researchers interested in seeing the relationship between the ability to understand mathematical concepts and the learning outcomes of STKIP Muhammadiyah Sungai Penuh students. Based on the problems above, the formulation of the problem in this research is what There is a relationship between the ability to understand mathematical concepts and the learning outcomes of STKIP Muhammadiyah Sungai Penuh students on transform geometry questions based on Van Hiele theory.

Method

The type of research that will be carried out is associative (correlational) research, because it aims to explain the relationship between the ability to understand mathematical concepts and learning outcomes. According to (Iskandar, 2009) "Associative (correlational) research is often referred to as causal relationship research *(causal correlational)".* The instruments in this study used closed questionnaires and mathematics learning outcomes tests. According to (Sugiyono, 2009) "The questionnaire is technique collection data is carried out by giving a set of questions or written statements to respondents to answer. Closed questionnaires contain questions accompanied by a number of alternative answers provided. Respondents in answering just have to tick (√) in the appropriate column or place. Meanwhile, the questionnaire assessment uses a Likert scale of 1 to 4. After the questionnaire grid is created, the questionnaire questions are then prepared. The questionnaire statement consists of positive and negative statements. The score can be explained as follows: For statement positive: (1) Score 4 For answer always (SL), (2) Score 4 For answer often (SR), (3) Score 2 For answer sometimes (KK), (4) Score 1 For answer No Once (TP). For statement negative: (1) Score 1 For answer always (SL), (2) Score 2 For answer often (SR), (3) Score 4 For answer sometimes (KK), (4) Score 4 For answer No Once (TP)

Analysis of Results Test try questionnaire

Validity questionnaire

To determine the validity of each questionnaire item, the product moment correlation formula proposed by (Sugiyono, 2009) is used, namely:

$$r_{xy} = \frac{N\sum xi - (\sum x)(\sum y)}{\sqrt{\{N\sum x^2 - (\sum x)^2\}\{N\sum y^2 - (\sum y)^2\}}}$$

Table 2. Criteria Correlation Coefficient

$0.20 \leq r_{xy} < 0.40$	correlation low
$0.40 \leq r_{xy} < 0.70$	correlation Enough
$0.70 \leq r_{xy} < 0.90$	correlation tall
$0.90 \leq r_{xy} < 1.00$	correlation very tall

Reliability Questionnaire
For determine religiosity questionnaire used formula Kr-20 that is:

$$r_{11} = \frac{n}{n-1}\left[\frac{S^2 - pq}{S^2}\right]$$

Information :
r_{11} = reliability test in a way whole
n = number of questions
p = subject that answer Correct
S^2 = Variance

Table 3. Criteria reliability questionnaire

$0.20 \leq r_{xy} < 0.40$	Reliability low
$0.40 \leq r_{xy} < 0.70$	Reliability is sufficient
$0.70 \leq r_{xy} < 0.90$	High reliability
$0.90 \leq r_{xy} < 1.00$	Very high reliability

Results Test Study
Test Validity "A test *can* be said to be valid if the test can be measuring what should be measured" (Arikunto, 2006). For content validity seen from the suitability of the test to the subject matter, in other words, making the test grid well.

Compile test
Procedure writing test results study the author did as following : (1) Analyze principal discussion with subpoint discussion Which will tested. (2) Make grille test learning outcomes. (3) Write question For each sub principal discussion.

Test Try test
Use of truly accurate tests, with meaning have had High validity and reliability will provide reliable research results. The trial test will be carried out at IAIN Kerinci. Mathematics education students were selected because the students' backgrounds are almost similar.

Analysis item question
After the test trials have been held, the next action is to analyze the results of the test trials. The aim is to see the existence of the questions that were prepared. not too difficult and not very easy. In do analysis question items, the components that need to be considered are the level of difficulty, distinguishing power, and test reliability.

Level Difficulty (Kindergarten) Question
The difficulty level of a question is the opportunity to answer a question correctly at a certain level of ability which is usually expressed in the form of an index. To determine the level of difficulty of questions in objective form, the formula is used, namely:

$$P = \frac{B}{Js}$$

Information:
P = Number index difficulty question
B = Many students answered correctly
Js = Number of students taking the test

Power Differentiator (DP) Question
The discriminating power of a question is the ability of a question to distinguish between students who are clever (have mastered the material being asked), and students who are less clever (have not mastered the material being asked). To determine the differentiating power of One essay form question uses the formula:

$$Dk = \frac{Ba}{Ja} - \frac{Bb}{Jb}$$

Information:

$Dk =$ Power differentiating questions
Ba = Many participants in the upper group answered the questions correctly
BB = Lots participant group lower Which answer question Correct
Ja = Lots participant group on
Jb = Lots participant group lower

Table 4. Clarification Power differentiator question

$0.00 \leq D < 0.20$	Not enough
$0.20 \leq D < 0.40$	Enough
$0.40 \leq D < 0.70$	Good
$0.70 \leq D < 1.00$	Good very

Reliability Test

Test reliability is a measure of whether the test can be trusted. (Sugiyono, 2009) "A reliable instrument is an instrument that, when used several times to measure the same object, will produce the same data." To find the reliability of the questions, the formula proposed by (Arikunto, 2006) is used as follows:

$$r_{11} = \frac{n}{n-1}\left[1 - \frac{\sum \sigma_i^2}{\sigma^2}\right]$$

Information :

r_{11} : coefficient reliability
n : amount item items questionnaire
$\sum \sigma^2$: amount Variance each items
σ^2 : Variance total

Table 5. Criteria coefficient reliability test

0.80	< r 11	≤1.00	: reliability very high
0.60	< r 11	≤0.80	: reliability tall
0.40	< r 11	≤0.60	: reliability currently
0.20	< r 11	≤0.40	: reliability low
0.00	< r 11	≤0.20	: reliability very low

Use of truly accurate tests, with meaning have had High validity and reliability will provide reliable research results. The trial test will be carried out at IAIN Kerinci on mathematics education students. When analyzing test items, the components that need to be considered are the level of difficulty, distinguishing power and test reliability.

Technique Analysis Data

Test Normality

The hypothesis that has been formulated will be tested using *correlation and regression.* The use of correlation and regression requires that the data for each variable be analyzed must be distributed normal (Sugiyono, 2010). For That Before hypothesis testing is carried out, data normality testing will first be carried out using the *Lilliefors test.* In the normality test, the hypothesis will be tested that the data for each variable is normally distributed.

Analysis Linear Regression Simple

To see the ability to understand mathematical concepts (X) to results learn math (Y) is done *analysis regression linear simple* . Use *analysis regression* in accordance with the opinion of (Usman, 2011) which states that " *regression analysis* is useful for obtaining functional relationships between two or more variables or getting the influence between predictor variables on the criterion variable or predicting the influence of predictor variables on the criterion variable". The simple linear regression equation formula is as follows:

$$Y = a + bx$$

Price a and b obtained with formula:

$$a = \frac{(\sum Y_i)(\sum X_i^2) - (\sum X_i)(\sum X_i Y_i)}{n \sum X_i^2 - (\sum X_i)^2}$$

$$b = \frac{(\sum X_i Y_i) - (\sum X_i)(\sum Y_i)}{n \sum X_i^2 - (\sum X_i)^2}$$

Coefficient Correlation and Coefficient of Determination

Technique correlation This used to s e e the effect of student activity sheets based on *discovery-contextual learning* (X) with student learning outcomes (Y). With the following hypothesis:

$H_0 : \mu = 0$: No there is that influence significant between ability to understand mathematical concepts with student mathematics learning outcomes.

$H_1 : \mu \neq 0$: There are that influence significant between ability to understand mathematical concepts with students' mathematics learning outcomes .

To calculate the correlation coefficient (r) based on data that has been obtained with technique *Products Moments* Which stated by (Sugiyono , 2009) as follows :

$$r_{xy} = \frac{n(\sum X_i Y_i) - (\sum X_i)(\sum Y_i)}{\sqrt{\{n \sum x^2 - (\sum x)^2\}\{n \sum y^2 - (\sum y)^2\}}}$$

Information:

r_{xy} = Coefficient correlation
$\sum X$ = Amount score variable X
$\sum Y$ = Amount score variable Y
$\sum XY$ = Amount results time variable X And variable Y
$\sum X^2$ = Amount square score variable X
$\sum Y^2$ = Amount square score variable Y
n = large sample

To see whether the correlation between the calculation results is significant or not, it needs to be compared with the r table , with a certain level of error. According to (Sugiyono, 2009) states that "The condition is that if r counts more small from table, so H_0 accepted, And H_1 rejected. But on the contrary when r count greater than r table (rh > r table) then H_1 accepted". After carrying out the calculations, it is obtained r_{count} = 0, 0.5 46 and r_{table} = 0.444, apparently $r_{count} > r_{table}$, then it can be concluded that H_1 accepted.

Table 6. Interpretation Mark r

Coefficient interval	Relationship Level
0.00 – 0.199	Very Low
0.20 – 0.399	Low
0.40 – 0.599	Currently
0.60 – 0.799	Strong
0.80 – 1,000	Very Strong

After the value of r is obtained, the coefficient of determination can be obtained (r^2) expressed in % to see the magnitude of the influence significant between the ability to understand mathematical concepts on mathematics learning outcomes, the formula is used:

$$KD = r^2 \text{ X } 100\%.$$

The test questions are 5 questions in essay form according to the grid of ability to understand mathematical concepts (can be seen in Table 7. Research subjects were given questions about the ability to understand the mathematical concept of transformation geometry.

Table 7. Van Hiele Geometry thinking ability test grid

Levels	Indicators of Geometry Thinking Ability	Question Number
Visualization	Students can create shapes by constructing shapes and identifying shapes based on their appearance	1, 3
Analytical/Verbal	Students can describe a shape according to its properties and compare shapes based on their characteristic properties	2, 3, 4
Abstraction (sequencing)/Image	Students can recognize the relationship between one geometric shape and another geometric shape. At this stage, students understand the sequential relationships between various geometric shapes	2, 3, 4
Deduction/Logic	Deductive conclusion-making, namely drawing conclusions from specific matters. Students are able to identify the characteristics of shapes and are able to prove theorems deductively and state the relationships between these theorems.	2, 3, 4
Rigor (Accuracy)/Applied	At this stage, students already understand how important it is to be precise in the basic principles that underlie a proof.	2, 3, 5

Calculation Mark end :

$$Nilai\ Akhir = \frac{Perolehan\ Skor}{Total\ Skor\ Max}\ x\ 100\%$$

Results and Discussions

To obtain data regarding the ability to understand mathematical concepts and student mathematics learning outcomes. The author distributed questionnaires and tests on transformational geometry learning outcomes to 6th semester students of STKIP Sungai Penuh with a sample size of 18 people. Before being given to the sample class , the questionnaire and learning outcomes tests were tested first outside the sample, namely mathematics education students at IAIN Kerinci to determine the validity, reliability of the questionnaire and to determine the validity, level of difficulty, differentiation and reliability of the test questions.

From calculating the validity of the questionnaire with a total of 25 items, 20 items were obtained that meets the testing criteria . From calculating the reliability of the questionnaire, a reliability value of 0.7 8 was obtained , meaning that the learning interaction questionnaire used as a research instrument had high reliability. From the calculation of the reliability of the learning outcomes test, a reliability value of 0.5 30 was obtained, meaning that the learning outcomes test used had moderate reliability. From testing the level of difficulty of the questions, 1 question was difficult, 2 questions were medium and 2 questions were easy. Then data analysis was carried out. From distributing questionnaires obtained questionnaire data on the ability to understand mathematical concepts seen in the following table:

Table 7 . Tabulation Score Questionnaire ability to understand mathematical concepts in learning Transformation Geometry

Information	Mark
Amount student	18
Amount Items	20
Average	73.72
Standard Deviation	6,815
Variance	46,448
Max	91
Min	63

Data regarding student transformation geometry learning outcomes based on learning outcomes tests can be seen in the following table 8.

Table 8. List Tabulation Score Results Study Transformation Geometry

Information	Mark
Amount student	18
Amount Items	5
Average	76.17
Standard Deviation	10, 428
Variance	1 08,735
Max	9 5
Min	56

From the table above, it can be seen that in the test that the author gave to 18 samples, information was obtained that many students had not achieved complete learning in Reflection, Rotation, Translation and Dilation material for STKIP Muhammadiyah Sungai Penuh mathematics education students of 5 questions. The average student learning outcome is 76.17 with a standard deviation of 10.428 . To see more clearly the average between concept understanding ability and learning outcomes can be seen in Figure 1 below:

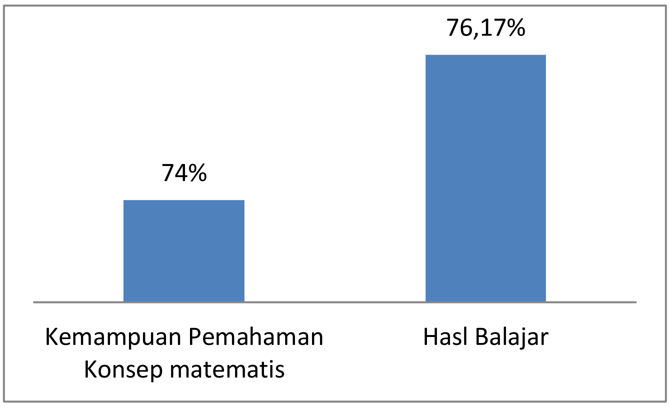

Figure 1. Average ability to understand concepts and learning outcomes

In Figure 1 above, it can be seen that the average value of the ability to understand mathematical concepts and learning outcomes of mathematics education students at STKIP Muhammadiayah Sungai Penuh is at 74% and 76.17% based on Van Hiele theory.

Analysis of student answers based on a test of understanding the concept of transformation geometry

From the questions given below, students' geometric thinking abilities will be seen based on the level of visualization, analysis, abstraction, deductive and rigor (proof). This can be seen in Figure 2 below.

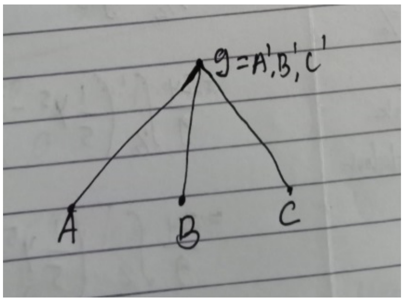

Figure 2. Student Wrong Understand Definition Shadow (problem 1)

In the initial situation or problem faced, of the 8 students who faced this question, 2 students did not give the answer "not fit", 2 students gave an answer that contained two errors (visualization) , and 4 students approached the correct answer (analysis), in Figure 2 students have an understanding of shadows as something that's in behind. This can be seen in Figure 2 where students put point g backwards using their knowledge when studying reflection in level school that A shadow is at in behind mirror . From One question This clear that ability beginning student Still very not enough,Where student only capable For put dot, dot, dot together shadow even though it is still wrong and does not proceed to the following solution at all about point middle And line Which load A point . Students are not able to analyze well in describing how point ABC is reflected at point g. They cannot provide reasons or arguments to support the answers they give. From this it can be seen that the ability to think geometrically at the level of visualization and mathematical analysis is still weak. Students' geometric thinking abilities are at levels 1 to 2 or the analysis to pre- formal deduction stages with the average being at the analysis and formal pre-deduction stages .

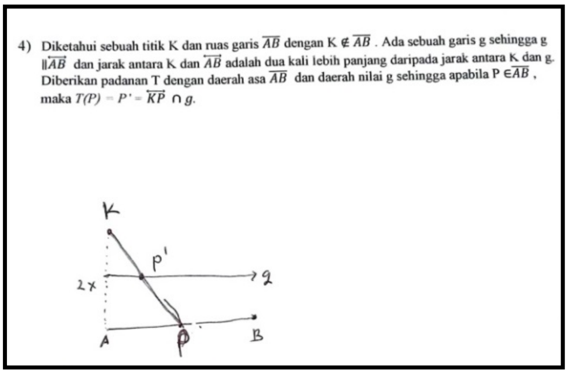

Figure 3. In interpreting the definition of a mapping (Problem 2)

In the second problem, of the 8 students who faced the previous question, there were 3 students who did not provide an answer, 3 students answered with two types of errors, and 2 students were almost close to the correct answer. The second drawback, In Figure 3, it can be seen that students are able to draw two parallel lines, but when placing point K, which has been mentioned in the mapping definition, the distance between K and $\overleftrightarrow{AB}$ is twice as long as the distance between K and line g , what they do is place point K on outside these two lines. When asked why point K was placed like that, the student explained that what he understood was the distance to point K, where the length of the distance from point K was 2 times the length starting from line g (as depicted) then he just placed point K outside the line $\overline{AB}$ and g. This indicates that students do not have an adequate understanding of the concepts that must be applied in solving the given problem, which also affects the procedural steps. If it is related to van Hiele's theory, it can be concluded that students' thinking abilities in mathematical abstraction are still underdeveloped However, he is already good at the visualization , analysis and abstraction stages but has not yet reached perfect deduction .

Two of the students who gave the correct answer knew the position of point K which was mentioned in the mapping definition. The distance between K and $\overleftrightarrow{AB}$ is twice as large length than the distance between K and line g , and successfully completes the calculation. From the students' answers, it can be seen that they are able to explain the position of point K. Students can draw two parallel lines $\overleftrightarrow{AB}$ and point K. Thus, it can be concluded that students have mastered the visualization , analysis and abstraction stages well but have not yet fully achieved perfect deduction . It can be concluded that students' geometric thinking abilities are on average at levels 1 to 3 or the abstraction to informal deduction and formal pre-deduction stages .

From the responses of two students, it appears that they have the ability to think geometrically at the visualization and analysis level, as evidenced by their skills in drawing two parallel lines g | | AB. Students have demonstrated the ability to think geometrically at the abstraction level by providing views on how to create two parallel lines and point k in the middle of line AB. However, in interviews regarding the characteristics of students at STKIP Muhammadiyah Sungai Penuh, it was seen that students did not have the ability to think mathematically at a deductive level because they were unable to explain the process of drawing line g and line AB, as well as point K with arguments. their informal.

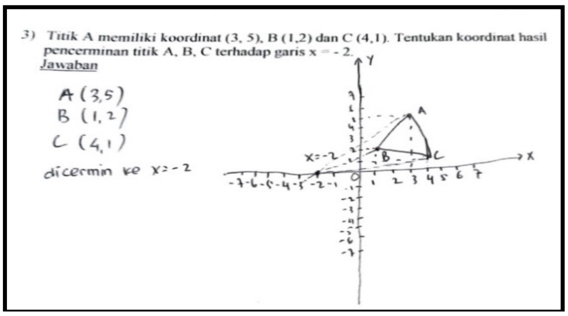

Figure 4 . Students' abilities towards Problem 3

From the 3rd problem, four were 2 students who did not give the answer "not fit", 3 students answered with one type of error (visualization level), from the 3 students' responses it was seen that they had the ability to think geometrically at the level of visualization, analysis and abstraction. with their ability to illustrate the shapes of the ABC triangle. Apart from that, they also showed their ability to think geometrically at the abstraction level by providing opinions about how to place point ABC in Cartesian coordinates, but students were still unable to complete the reflection of point ABC onto the line x = -2. However, from interview interactions with students at STKIP Muhammadiyah Sungai Penuh evel because they are unable to explain the ABC point reflection process using their informal arguments. It can be concluded that students' geometric thinking abilities are at levels 1 to 3 or the abstraction stage with the average being at the informal deduction (abstraction) and formal pre-deduction stages.

Results Data analysis

In this data analysis, the process for obtaining a simple linear regression equation, normality test, linearity and significance test will be discussed simple regression coefficient, correlation coefficient and coefficient of determination.

Equality Regression Simple Linear

Model equality regression linear simple is $\hat{Y} = a + bX$. From The research results showed that the values a = 7 2 , 3 3 and b = 0.85 so that the simple linear regression equation obtained was Ŷ = 7 2.3 3 + 0.85 X.

Test Normality

In the normality test, the hypothesis will be tested that the questionnaire data is the ability to understand mathematical concepts and learning outcomes are normally distributed or not. Test normality of results Study based on results calculation obtained price L_0 = 0.11 12 whereas L_{tabel} = 0, 2000 So, $L_0 < L_{tabel}$ that is 0.11 12 < 0, 2000 For level The randomness was 95%, so it was concluded that the questionnaire data on the ability to understand mathematical concepts and the learning outcomes data came from samples with a normal distribution.

Test Linearity And Meaningfulness Regression

Test Linearity

For regression linearity obtained calculated F value = 0.381 and price $F_{(0.05)(9.5)}$ = 3.61 Because $F_{count} < F_{table}$ then the regression is linear at a significance level of 95%, so it can be concluded that there is a linear relationship between the ability to understand mathematical concepts (variable X) and learning outcomes (variable Y).

Test Meaningfulness

For test meaningfulness regression obtained price F_{count} = 7 , 2256 And price F_{table} = 2.77, so $F_{calculated} > F_{table}$ then the regression means real for The 95% significance level or linear relationship between variable X and variable Y is meaningful, this shows that there is a meaningful relationship from the ability to understand mathematical concepts to the geometry learning outcomes of STKIP Muhammadiyah Sungai Penuh students.

Coefficient Correlation And Coefficient of Determination

The product moment correlation technique aims to see the extent of the relationship between one of the independent variables and the dependent variable. The independent variable in this research is the ability to understand mathematical concepts (X) while the dependent variable is the results of learning transformation geometry of mathematics education students at STKIP Muhammadiyah Sungai Penuh (Y). From the calculations carried out, the calculated r value is obtained = 0.5 46 and r_{table} = 0.444, apparently $r_{count} > r_{table}$, then it can be concluded that H_1 accepted , so it can be concluded that there is a significant relationship between learning interactions and results learn mathematics with interpretation Enough. Coefficient of determination $(r)^2$ = 0.2981 . So the magnitude of the relationship between variable X and variable Y is 29.81 %. This means that the relationship between the ability to understand mathematical concepts and the learning outcomes of transformation geometry is 29.81 %.

Conclusions

Based on results analysis And discussion data obtained equality regression linear $\hat{Y} = a + b$, Ŷ = 72.3 3 + 0.85 price $F_{(0.05)(9.5)}$ = 3.61 Because $F_{count} < F_{table}$ then the regression is linear at a significance level of 95%, so it can be concluded that there is a linear relationship between the ability to understand mathematical concepts (variable X) and learning outcomes (variable Y). Using the calculated r price correlation technique = 0.5 46 and r_{table} = 0.444, apparently $r_{count} > r_{table}$, then it can be concluded that H_1 accepted , so it can be concluded that there is a significant relationship between learning interactions and results learn mathematics with interpretation Enough. Coefficient of determination $(r)^2$ = 0.2981 . So the magnitude of the relationship between variable X and variable Y is 29.81%. This means that the relationship between the ability to understand mathematical concepts and the learning outcomes of transformation geometry is 29.81%. As has been explained, there are many factors or relationships that influence student learning outcomes, not only the ability to understand mathematical concepts but also other relationships or factors. The ability to understand mathematical concepts only contributes to student transformation geometry learning outcomes, namely 29.81%, and the remainder is equal to 70.19% is determined by other relationships, which in this case are not included in the author's observations. The author only reviews the ability to understand students' mathematical concepts, especially in studying reflection, rotation, translation and dilation

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