



Students' Mathematical Reasoning Ability Viewed from Personality Type Rational and Idealist

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Abstract

This finds out about pursuits to (1) describe the mathematical reasoning ability of high school students as viewed from the rational and idealist personality types; (2) knowing the causes of students' errors in answering questions. This type of research is qualitative research. The subjects of this research were eleventh-grade students of high school 1 Wanasaba East Lombok. Determination of the concern using purposive sampling. Data collection methods used personality tests and mathematical reasoning exams on trigonometric material. The outcomes of this study indicate that both rational and idealist personality types are capable of substantiating and equally incapable of making logical conclusions. Students with rational and idealist personality types do not meet the indicators of making logical conclusions because the subject is wrong in giving argument formulation because they do not master the concept of arbitrary cosine triangle rule. Students with the rational personality type can perform calculations based on certain rules or formulas, while students with the idealist personality type are unable. This is because the idealist personality kind students use the wrong formula in the problem-solving process. After all, the situation does not understand the concept of arbitrary sine and cosine triangle rules. The idealist personality type student can predict the answer and the solution process, while the rational personality type is unable. This is because students with the rational personality type answer not to the desired answer to the question. After all, they do not understand the query from the question.

Keywords: *Mathematical Reasoning, Causative Factors, Rational Personality Type, Idealist Personality Type*

Introduction

Reasoning is a very essential element of mathematical capacity in instructing and mastering of mathematics (Sukirwan, Darhim, & Herman, 2018). The reasoning is also important in learning mathematics, apart from helping students understand difficult material, it also improves their abilities. Mathematical material is implemented through reasoning and reasoning which is used to understand mathematical material. Mathematical material is implemented via reasoning and reasoning making use of and studying mathematics material (Mariyam & Wahyuni, 2016). the reasoning is drawing conclusions or making new statements that are really based on statements that have been previously verified (Miswanto, Susanti, Hapizah, Meryansumayeka, & Nurzalena, 2019). (NCTM, 2000) states that mathematics

studying has to be oriented to five general studying poses, particularly problems, communication, connection, reasoning, and representation. In Indonesia, reasoning capabilities are the goal of gaining knowledge of mathematics. As referred to Permendiknas No. 22 in 2006 explains that the goal of mathematics learning is students must be able for using reasoning on patterns and properties, manipulate and generalize mathematics, collect evidence, or provide explanations of mathematical ideas and statements (Depdiknas, 2006).

Even though reasoning ability is very important, in fact, the mathematical reasoning abilities that students have so far have not developed properly. Students still have difficulty solving problems due to a lack of logical reasoning skills to solve problems (Mikrayanti, 2016). Research performed by means of (Agustyaningrum, Hanggara, Husna, Abadi, & Mahmudii, 2019) published that the average score of the mathematical learning indicators used only reached 42.12% and was in a low category. Also, research conducted by (Ayuningtyas, Mardiyana, & Pramudya, 2019) published that students' reasoning skills have been nevertheless low. Where college students have difficulty in providing mathematical arguments, making logical inferences from several ideas, and difficulties in finding evidence of arguments.

When viewed from the TIMMS results, Indonesia ranks 44th with an average of 397 out of the 49 countries surveyed. Indonesia's average score is far below the highest average score of 618 achieved by Singapore (OECD, 2015). From the TIMSS results, it was revealed that Indonesian students were still weak in solving none of the problems related to routine proof, problems that required mathematical reasoning, finding generalizations or conjectures, and finding relationships between the data or facts provided (Nahdi, 2015). This was obtained from the results of interviews by researchers with mathematics subject teachers at Wanasaba 1 Public Senior High School in East Lombok, saying that students still had many difficulties in utilizing the information on the questions to get to the problem-solving process and still had difficulty finding a proof.

Many factors affect students' abilities in learning mathematics, but one factor that needs to be considered is personality type (Setyadi, Mardiyana, & Triyanto, 2019). Personality is a dynamic organization of the individual psychophysical system that determines the thoughts, attitudes, and behavior of individuals in a typical manner (Sarjana & Khayati, 2016). David Keirseay classifies character into 4 types, particularly rational and idealistic personality types (Putra, 2017). The rational personality type has the characteristics of liking explanation based on logic, being able to capture abstractions and material that require high intellectuality, after being given material by the teacher, usually looking for additional material through reading books, teachers who give additional assignments after giving material. The idealist personality type is a personality type that has the characteristics of liking material about ideas and values, prefers to complete assignments privately rather than group discussions, can view problems from various perspectives, likes to read and write so that it is less suitable for objective test forms, creative (Yuwono, 2016).

Based on the above background, this finds out about pursuits to (1) describe the mathematical reasoning ability of high school students as viewed from the rational and idealist personality types; (2) knowing the causes of students' errors in answering questions.

Methodology

This research is qualitative research. Qualitative research is research that aims to understand what phenomena actually occur to research subjects (Rokhima, Kusmayadi, & Fitriana, 2019). The objectives of this research were (1) describe the mathematical reasoning ability of high school students as viewed from the rational and idealist personality types; (2) knowing the causes of students' errors in answering questions. This research was carried out in the eleventh grade of Wanasaba 1 Public Senior High School in East Lombok Regency.

The subjects of this study were six students, each with three students with rational personality types and three students with idealist personality types. The determination of the research subject was carried out by purposive sampling and with the consideration of the subject teacher. Subjects with the rational personality type are coded R and subjects with idealist personality types are coded I.

Data have accumulated the use of tests and interviews. The test is used to determine students' reasoning skills through answers. Meanwhile, interviews are used to find out more details about written answers and to find out the causes of mistakes made by students. Description of indicators in this research can be viewed in Table 1.

Table 1. Description of Indicators

No	Indicators of Mathematical Reasoning	Description of the Indicators
1	Make logical conclusions (Sulistiawati, Suryadi, & Fatimah, 2016) (Agustyaningrum et al., 2019) (Wahyuni, Susanto, & Hadi, 2019)	Able to make conclusions based on statements that have been verified
2	Estimating answers and solution processes (Fisher, Kusumah, & Dahlan, 2019)	Able to formulate solutions to problems in the problem
3	Doing proof (Hendriana, Rohaeti, & Sumarmo, 2017) (Ayuningtyas et al., 2019)	Able to prove based on the information on the questions
4	Perform calculations based on certain rules or formulas (Hendriana et al., 2017)	Be able to perform completion steps correctly by using certain rules or formulas

Data triangulation used to be carried out to decide the validity of the data. The data triangulation used was time triangulation. Data analysis in this research are data reducing, data presenting, verification, and conclusions drawing (Wulandari & Wutsqa, 2019). Data analysis procedures were: (1) all students were given a personality test; (2) categorizing students based on their respective personality types, namely rational personality types and idealistic personality types; (3) students are given a mathematical reasoning test; (4) analyzing students' answers; (5) students are interviewed based on answers; (6) analyzing the results of the interview.

Result and Discussion

The outcomes of student work are then corrected and grouped into 4 indicators of mathematical reasoning. Furthermore, a summary of indicators from the outcomes of students' mathematical reasoning skills and pupil work results viewed in the Table 2.

Table 2. Student Mastery of Indicators

No	Indicators	Description of the Indicators	
		Rational Personality Type	Idealist Personality Type
1	Make logical conclusions	Unqualified	Unqualified
2	Estimating answers and solution processes	Unqualified	Qualify
3	Doing proof	Qualify	Qualify
4	Perform calculations based on certain rules or formulas	Qualify	Unqualified

Table 2 above explains that students with rational personality types and idealistic personality types have the same and different abilities. Students with rational personality types and idealist personality types are both capable of substantiating and equally incapable of making logical conclusions. Meanwhile, the difference between the two personality types is that students with rational personality types can perform calculations based on certain rules or formulas, while students with idealist personality types are unable. Students with idealist personality types can predict answers and solution processes, while students with rational personality types are unable.

Students with Rational Personality Types

The results of working on subject R are as follows.

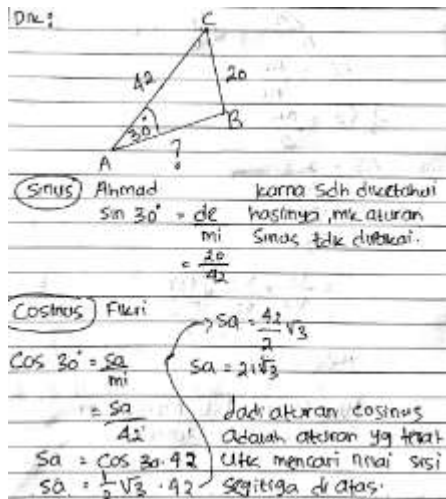


Figure 1. The Results of Working on Subject R in Number 1

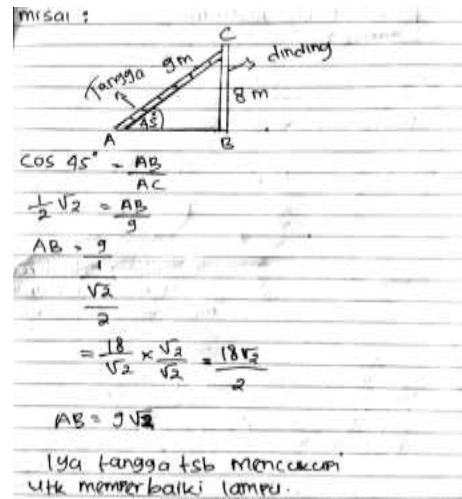


Figure 2. The Results of Working on Subject R in Number 2

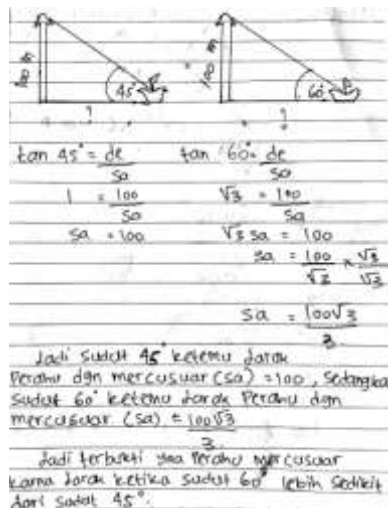


Figure 3. The Results of Working on Subject R in Number 3

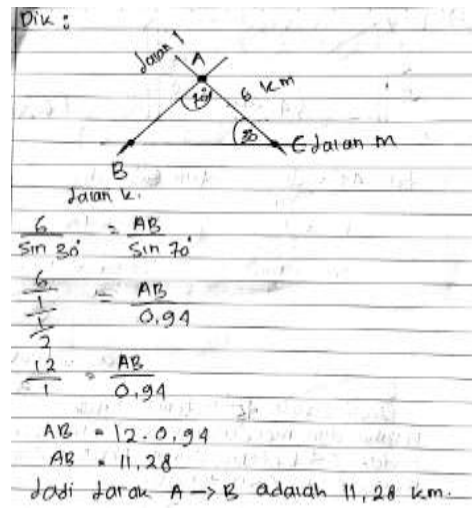


Figure 4. The Results of Working on Subject R in Number 4

Based on the outcomes of work number 1, subject R can conclude correctly. But the arguments written are incorrect. The sine and cosine rule formulas described also do not lead to correct arguments. To explore more deeply related to the conclusions made and the causes of subject R to write wrongly in writing the formula for the cosine rule, the researchers conducted an interview. The outcomes of the

interview with subject R confirmed that subject R used to be capable to explain that the cosine rule was more precise for determining the unknown side length. But subject R does not know whether the written formula is correct or not. This indicates that subject R does not understand the concept of the formula for the cosine rule.

Based on the results of work on number 2, it appears that subject R answered the question incorrectly and did not lead to the desired answer to the question. Besides, the estimates made are not in line with the calculation results. To explore more deeply related to the results of work on subject R, an interview was conducted. The result of the interview with subject R is that subject R says that the length of the stairs is sufficient because the calculation results obtained are $9\sqrt{2}$ while the length of the stairs is 9. Subject R is looking for AB length because the length of the ladder is known. This indicates that subject R does not understand questions from questions.

Based on the results of work on number 3, subject R can prove it correctly and with the correct formula and calculation results. To explore more deeply related to the results of work on subject R, an interview was conducted. The outcomes of the researcher interview with issue R are that subject R can explain the evidentiary steps taken.

Based on the outcomes of work on number 4, subject R can find the length of AB correctly and with the formula and with the correct calculation results as well. To explore more deeply related to the results of work on subject R, an interview was conducted. The results of the researcher interview with subject R are that subject R can explain the method or steps taken in finding the distance A to B in detail.

Students with Idealist Personality Types

The results of working on subject I are as follows.

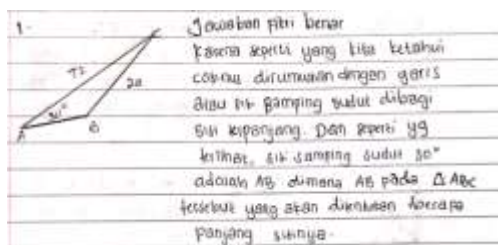


Figure 5. The Results of Working on Subject I in Number 1

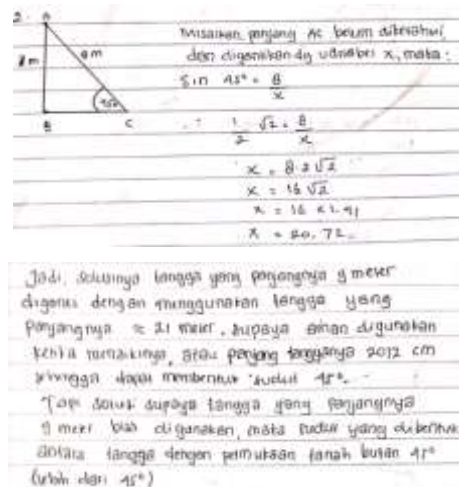


Figure 6. The Results of Working on Subject I in Number 2

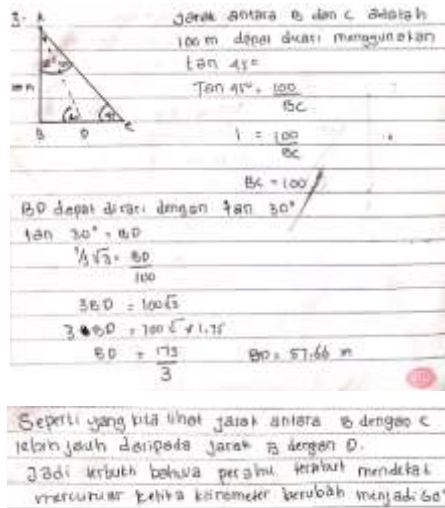


Figure 7. The Results of Working on Subject I in Number 3

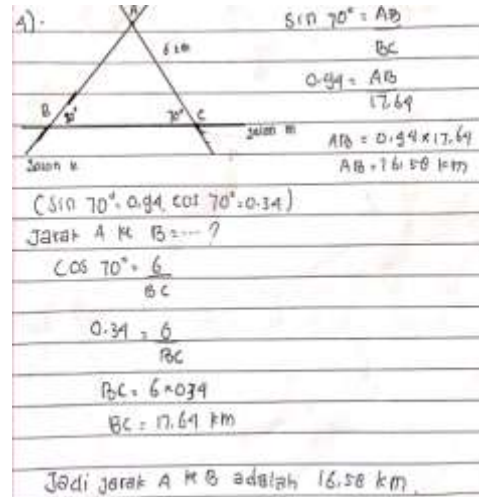


Figure 8. The Results of Working on Subject I in Number 4

Based on the results of work on number 1, the subject I was able to make correct conclusions but the arguments written were incorrect. Subject I wrote that the formula \cos is the side divided by the hypotenuse. To explore more deeply related to the conclusions and causes of the subject I to write the formula, the researcher interviewed the subject I. The outcomes of the interview with the subject I obtained information that subject I did not know that the formula $\cos \alpha = \frac{\text{side}}{\text{hypotenuse}}$ could or not used in any triangle. Subject I assumed that this formula could also be used in any triangle. From the results of the work and interviews, the subject I was wrong in answering the questions because he did not understand the cosine concept.

From the outcomes of work on number 2, the subject I was able to estimate the minimum length of the stairs that must be used and was able to provide solutions to existing problems. However, the calculation results to estimate the stairs are not accurate. To explore more deeply related to the estimates and solutions offered as well as the causes of the subject I to make incorrect calculations, the researchers interviewed the subject I. The results of the interview with the subject I obtained information that subject I was able to explain estimated answers and provide written solutions. Subject I made a mistake in doing calculations because he was confused about multiplying $\sqrt{2}$ by 8 or x .

Based on the results of work on number 3, subject I was able to prove that the boat was approaching the lighthouse when the clinometer showed 60° and with the correct calculations. To explore greater deeply related to the proof process carried out by subject I, the researcher conducted an interview. The outcomes of the researcher interview with the subject I confirmed that subject I used to be capable to explain the steps taken in making the evidence and was able to explain that the answers and results of the calculations were correct.

Based on the outcomes of work on number 4, the subject I made calculations with an incorrect formula. Subject I uses the formula $\sin = \frac{\text{front side}}{\text{hypotenuse}}$ and $\cos = \frac{\text{side}}{\text{hypotenuse}}$ so that the result obtained is wrong. To explore more deeply related to the formula used and the cause of subject I to incorrectly determine the AB distance, the researchers conducted an interview. The results of the researcher interview with the subject I showed that subject I considered that the \cos and \sin formulas could be used for all triangles because the most important thing was that there were sides of the angle and the longest side. Subject I used the trigonometric comparison formula for a right triangle because he did not understand the concept of the trigonometric formula for any triangle.

Conclusion

Based on the results and discussion, students with rational and idealistic personality types are both able to prove and equally unable to make logical conclusions. Students with rational personality types and idealistic personality types do not meet the indicators of logical conclusion because the subject is wrong in providing the argument formula, namely because they have not mastered the concept of arbitrary cosine triangle rules. Meanwhile, the difference between students who have rational personality types and idealistic personality types lies in the calculation based on certain rules and estimating the answers and the solving process. Students with rational personality types can perform calculations based on certain rules or formulas, while students with idealistic personality types are unable. This is because students with idealistic personality types use the wrong formula in the problem-solving process. However, the subject did not understand the concept of the random sine and cosine triangle rule. Students with idealistic personality types can predict the answer and completion process, while students with rational personality types are unable. This is because students with the rational personality type answered not the desired answer to the questions. After all, they did not understand the questions from the questions.

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