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Mathematical Problem-Solving Ability of Rational Personality Students

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Abstract. This study aims to describe the ability of students who have personality tendencies in solving mathematical problems. This research is an exploratory study with a qualitative approach. Data was collected by giving problem solving ability tests and interviews to two subjects with rational personalities. Students' personalities were categorized based on David Keirsey's personality classification test, namely Artisan, Guardian, Idealist, and Rational. The results showed that (1) understanding the problem, in understanding the problem the subject visualized the information, this was in accordance with the characteristics of Rational who always needed something to help him in concretizing his ideas or thoughts through something, for example through pictures. (2) develop a strategy/completion plan, a) in formulating a strategy, the subject uses all the information and assumptions obtained from the problem and uses it to plan problem solving, b) in compiling a problem-solving plan, the subject does not write down the solution plan clearly, he only writes things that he deems necessary, according to his personality which has less intrapersonal ability so that they always do things as they please not based on generally agreed rules. (3) carry out the plan of completion, the subject always solves the problem according to the plan he has drawn up, this is indeed a characteristic of Rational who always does everything based on the goals he has set. (4) re-check, the subject checks the results of his work. This is in accordance with SR's personality which does not tolerate the slightest error.

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INTRODUCTION

In everyday life, humans are never free from problems. This makes problem solving skills an important skill to master. This is also in line with the goal of learning mathematics, namely so that students can have the ability to solve problems. (Gumilang, 2019). This goal places problem solving as an important part of the mathematics curriculum. Given the importance of mathematical problem solving skills in the world of education, educators must certainly strive so that students can achieve optimal results in mastering problem solving skills.

Problems can occur if a person does not have certain rules that can be used to overcome the gap between the current situation and the goals to be achieved. To achieve this goal, one needs to seek problem solving that involves optimal thinking processes. To solve a problem, one needs to find a rule to solve the problem. If someone has been able to overcome the gap between the current situation and the goals to be achieved (through self-created rules), then that person can be said to have solved the problem (Widodo, 2013).

At this time the development of technology is very rapid and sophisticated, so it requires strong experts in managing new ideas, responsive to change, able to handle uncertainty, able to handle orderliness, and able to solve problems (NCTM in Maulyda, 2019). Mathematics education in Indonesia is currently experiencing a paradigm, the goal is that mathematics learning will be more meaningful for students and provide adequate competence for both further study and entry into the world of work. Generally, today's world of work demands more analytical skills than doing procedural work. Realizing the importance of mathematics, all nations should understand and master

mathematics, both at the elementary school to university level. However, negative perceptions about mathematics cannot be ignored because mathematics in schools is a scourge for students.

Problem solving skills are one of the important skills that are expected to be obtained from the educational aspect. So that formal education in schools is expected to maximally improve students' ability to solve problems in mathematics. But problem solving is still considered the most difficult part of mathematics both for students who study it and teachers who teach about it (Setyadi, 2020).

The ability to solve problems needs to be continuously honed and improved. Before students are faced with very complex real-life problems, it is highly recommended that students have the ability and problem-solving skills to get used to dealing with problems in the future. Mathematics as a universal science, plays an important role in terms of students' problem solving abilities. Almost all aspects of mathematics can be modeled so that mathematical problem solving skills need to be improved. This is in line with the expression of Holmes which essentially states that in the twenty-first century, someone who learns to solve their mathematical problems is one who is able to solve life's problems productively.

According to Holmes, people who are skilled at solving problems will be able to keep pace with the needs of their lives, become more productive workers, and understand complex issues related to global society. Walk & Lassak states that basically every assignment to students in learning mathematics can be grouped into two things, namely as: (1) drill (drill exercise), and (2) problems (problems) to be solved. Exercise is a task whose completion method or steps or procedures have been studied or known to students. In general, exercises can be completed by applying one or more steps that have been previously learned by students. While the problem is more complex

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Polya (Gumilang, 2019) explains that there are four steps to solving problems, including: (1) understanding the problem, (2) planning for completion (devising a plan), (3) carrying out the plan (carrying out the plan), and (4) re-examination of processes and results (looking back).

Problem solving itself is defined as a real effort in order to find a way out or an idea related to the goals to be achieved by applying concepts or rules that have been obtained previously. To solve a problem, of course, data is needed so that logical decisions can be made. Decision making is one thing that is closely related to a person's character or personality.

Personality is a person's distinctive thoughts, emotions, and behaviors in adapting to their environment (Santrock, 2004:158). Although each person has his own personality, some experts try to see the similarities and formulate them into personality types. The interesting grouping of personality types is the Keirsey categorization. Keirsey and Bates (1985: 45) classify personality into 4 types, namely Guardian, Artisan, Rational and Idealist. This classification is based on how a person gains energy (extrovert or introvert), how a person takes in information (sensing or intuitive), how a person makes decisions (thinking or feeling) and what his basic lifestyle is (judging or perceiving).

One of the personality types of students who are known to have problem solving abilities is the Rational personality type. Keirsey (2009) said “Rational are the problem solving temperament. They are rigorously logical and value competence and ingenuity above all”.

METHODS

This study is a descriptive study, which describes the problem-solving abilities of students who have Rational personality tendencies. The data collected in this study is qualitative-explorative, which contains an explanation of the problem-solving abilities of students who have Rational personality tendencies. This research was carried out from April to May in the even semester 2020/2021 at SMA Negeri 11 Unggulan Pinrang.

The subjects of this study were students of class XI-IPA SMAN 11 Unggulan Pinrang, the class XI-IPA was chosen with the following considerations:

1. Class XI-IPA students have followed a series of math materials in the previous class that have been given by the teacher at school.
2. The character of class XI-IPA students is well known by the teacher.
3. Class XI-IPA is not in preparation for the National Exam like class XII.
4. The activities of class XI XI-IPA students are not too crowded, making it easier to conduct interviews.

Subject selection is carried out in stages, while the steps for selecting research subjects are:

1. Prepare an instrument for classifying personality types.
2. Define the criteria for selecting the subject. The criteria for selecting subjects in this study are as follows:
    a. Has a tendency Rational personality type.
    b. Have the ability to communicate / express his thoughts. In this case, the researcher asks the teacher for consideration to choose students who are considered quite capable of expressing their thoughts based on the teacher's observations during the learning process in class.
    c. Willing to participate in research data collection.
3. Carry out a written test of personality type classification.
4. Analyzing the results of the written test for the classification of personality types. The number of research subjects to be selected is two people.
5. If there are more than two prospective subjects who meet the criteria, then they are selected based on the consideration of the teacher.
6. Select two research subjects who meet the criteria.

The focus in this research is how to profile the problem solving ability of students who have a tendency of Rational personality type in solving mathematical problems. The main instrument in this research is the researcher himself. This is because the researcher is a planner, implementer, data collector, analyzer and interpreter of data as well as reporting research results. The other supporting instruments are:

1. Personality type classification test
   The personality type classification test used in this study uses a personality classification test from David Keirsey, namely the modified Keirsey four types Sorter.
2. Problem Solving Ability Test
   Problem Solving Ability Test in the form of mathematical problems analyzed using Polya problem solving steps
3. Interview guide
   Interviews were used in this study to further examine the problem-solving abilities that cannot be revealed only through written tests.

The data analysis process starts from data collection until the researcher finishes making research reports. There are two data obtained, namely the results of the problem-solving ability test and the interview data which are still in the form of recordings, then transformed into the form of interview scripts. Interview results and problem-solving ability test results were analyzed using the Miles and Huberman model (Afrizal, 2016). The data analysis process is carried out with the following steps:

1. Examine all available data from various sources, namely from interviews, observations that have been written down in field notes, and results of critical thinking skills tests.
2. Data reduction is an activity that refers to the process of selecting, focusing, abstracting, and transforming raw data. Subject statements that are not in accordance with the research objectives are omitted. Data validation is carried out at the time of data collection, namely by means of verification. In this study, the verification of the data used was source triangulation, namely comparing and checking data from two different subjects.
3. Presentation of data which includes classification and identification of data, namely writing organized and categorized data sets so that it is possible to draw conclusions from the data. In this study, data from interviews and data from problem solving ability tests that have been reduced are further categorized based on the observed problem solving ability indicators. It is intended that the information obtained can be easily concluded.
4. Create coding that aims to facilitate data exposure. Coding is carried out on excerpts of the research subject's answers during interviews.
5. Check the validity of the problem solving ability data. To assess the validity of qualitative data, several tests were carried out as follows:
    a. Credibility Test

        Testing the credibility of the data is focused on triangulation of sources and is equipped with an extension of the interview. The extension of the interview was carried out by asking questions to the same subject about the same problem-solving ability test that had been given previously. Triangulation of sources is done by: problem solving ability tests are given to different subjects, namely Subject 1 and Subject 2. When the subject is doing the problem solving ability test, interviews are conducted to explore more about problem solving abilities and recorded. The data from the interviews were made into an interview script which was equipped with a code. Furthermore, the results of the problem-solving ability test of Subject 1 and Subject 2 were compared. The data from the comparison of the problem-solving ability tests of Subject 1 and Subject 2 were consistent, considered valid data, and used as a reference in analyzing data to answer research questions.

    b. Transferability Test

        Transferability testing is carried out by compiling a detailed, clear, systematic, and reliable research report and describing in detail the problem solving abilities of high school students in solving mathematical problems, including: (1) selecting research subjects that are in accordance

with the theory and research objectives, (2) development of supporting instruments that are valid in terms of constructs and content, (3) collecting data according to theory, (4) seeking validity of data according to theory, (5) analyzing data and reporting research results systematically.

c. Dependability test

The dependability test was carried out by conducting an audit of the entire research process.

d. Conformability test

The conformability test reports the research process as it is, equipped with evidence in the form of interview recordings, critical thinking ability test results, and field notes.

6. Expose data
7. Interpreting data / Drawing research conclusions from the data that has been collected and verifying these conclusions. The interpretation of the data is directed to be able to build a formal theory about the problem solving abilities of high school students who have Rational personality tendencies. The conclusion in this study was obtained by digging up detailed information about the problem-solving abilities of high school students who have a rational personality tendency in solving math problems.
8. Analysis of interesting things, namely the analysis of behavior shown by research subjects that are not planned and are not related to the research objectives.

RESULT

This chapter discusses in detail the research data on the mathematical problem-solving abilities of high school students who have a tendency for the Rational personality type. As explained in the previous chapter that this research is a qualitative descriptive study, which describes what is about the selected research subject in this case the students of class XI-IPA SMA Negeri 11 Pinrang. Based on the results of the personality type classification test, two students with Rational personality were selected as research subjects. The choice of subjects in this study was not only based on the results of the personality classification test, the researchers also asked for consideration from the mathematics teacher. The two selected research subjects were then given math problems which were used to reveal their mathematical problem solving abilities, then interviewed to reveal their ability to solve mathematical problems. While the results of the interviews are used as data triangulation which serves to verify the research data.

Students' mathematical problem solving abilities are revealed by using problem solving steps from polya (Annizar, 2020), namely:

a. Understanding the problem

SR understands the problem by making a picture of the shape of the space referred to in this case the cube. After obtaining the edge length of the large cube, SR made possible the size of the small cardboard boxes that could fill the large cardboard completely by dividing the edges of the large cardboard

according to the desired size of the small cardboard ribs. From this it is known that SR estimates the size of the small cardboard through the drawing.

Based on the results of the analysis above, it is obtained that several personality characteristics are displayed by SR in understanding the problem, namely SR always needs something to help him in concretizing his ideas, for example in the form of pictures. This is proven by SR drawing the cube shape referred to in the problem.

b. Develop a plan/completion strategy

SR determines the solution plan by using all the information he gets from the problem. The first thing SR did was to observe the effect of a provision by first drawing conclusions about the relationship between the volume of a large cube and the number of small boxes that could fill a large cube completely. The conclusions made by SR are too general/too broad and not detailed. However, even though his conclusions are too general, SR can solve problems that require assumptions and relationships between the volume of a large cube and the number of small boxes that can fill a small cube completely. This means that SR is actually able to understand the assumptions and relationships that exist between a large cube and the number of small boxes that can fill a large cube completely, but is unable to explain/explain the relationship in detail. The subject does not write down the plan of completion clearly, he only writes down the things he deems necessary, according to his personality which has less intrapersonal ability so that they always do things as they please not based on generally agreed rules.

The personality characteristics that appear based on the results of the data analysis above show that SR has poor interpersonal intelligence, namely SR is not able to explain in detail about something even though SR actually understands it clearly.

Based on the valid data, it is known that SR reveals the facts/data needed in solving the problem by first representing the information in the form of pictures to make it easier to understand the information. Even though he did not write down the things that were known and asked clearly because he had visualized them in the form of pictures, it was very clear that SR understood and knew these things. After understanding the problem and what he wants to address in the problem, SR prepares a problem-solving plan by paying attention to the information contained in the problem. So it can be said that SR always has a logical reason in choosing problem solving steps, this can be seen from the way SR chooses problem solving steps which are always based on the goals to be achieved. SR also performs mathematical manipulations.

Based on the results of the data analysis above, there are several personality characteristics that emerge from SR's behavior when revealing data/facts/theorems, including: first, to more easily understand the available information, SR represents the information in the form of images. This is in accordance with the character of SR because SR always needs something to concretize the ideas/contents of his mind, for example in the form of images. So in this second question, he poured everything he understood in the form of pictures.

Second, in solving the problem SR did not write down the things that were asked clearly but it was certain that SR understood the existing problem, it was proven that SR was able to visualize it in the form of images. SR assumes that what is clear to them will be clear to others, so that since it is clear to everyone what to write again, it will only be a waste of time and effort. This is in accordance with SR's personality who always pays attention to the efficiency of everything he does.

Third, in preparing a plan for solving problems, SR always pays attention to the available information so that the solution to the problem he chooses is always based on certain reasons, not just based on intuition. This is in accordance with the character of SR which is known to be very logical, so that everything he does must have or be based on certain reasons.

The next personality character that appears in SR's behavior when solving problems is when determining the steps for solving problems as well as when performing mathematical manipulations, SR always pays attention to the goals to be achieved. This is in accordance with SR's personality who always prioritizes the achievement of goals.

The last personality character that appears is SR checking the results of his work. This is in accordance with SR's personality who does not tolerate the slightest error/mistake, so they always check their work.

c. Carry out the plan

The subject always solves the problem according to the plan he has compiled, this is indeed the characteristic of Rational who always does everything based on the goals that have been set.

d. Re-Check

The first thing that SR does to analyze information is to describe the information in detail and then look for the relationship between each information and describe it in the form of a venn diagram. After getting the relationship of each information SR rearrange the information to solve the problem.

From the results of the data analysis above, it is known that SR performs all stages in analyzing information, starting from describing, connecting to rearranging the information. This is in accordance with the personality characteristics of SR, namely having good analytical skills.

CONCLUSION

Based on the results of the study it can be concluded that:

1. Understand the problem,

The subject visualizes the available information to make it easier for him to understand the problem, this is in accordance with the characteristics of Rational who always need something to help him in concretizing his ideas or thoughts through something, for example through pictures.

2. Develop a strategy/plan for completion,

When formulating a strategy/completion plan, a) the subject uses all the information and assumptions obtained from the problem and uses it to plan problem solving, b) the subject does not write down the solution plan clearly, he only writes down the things he deems necessary, according to his personality. who have less intrapersonal abilities so they always do things as they please rather than according to generally agreed rules.

3. Carry out the plan,

   The subject always solves the problem according to the plan he has drawn up, this is indeed the characteristic of Rational who always does everything based on the goals he has set.

4. Re-Check,

   The subject checks the results of his work. This is in accordance with SR's personality which does not tolerate the slightest error.

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