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DESCRIBE REASONING OF STUDENTS IN COMPLETING THREE-DIMENSIONAL PROBLEM-SOLVING

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Abstract

This study aims to describe reasoning by highly capable subjects (ST), medium-impacted subjects (SS), and low-ability subjects (SR) in completing three-dimensional problem-solving tasks. This research is a qualitative descriptive research. Instruments in this study are researchers as the main instrument guided by the task of solving problems Mathematics and interview guidelines are valid. The subjects of this study were students of class XI IPA C consisting of 3 people (high-ability subject (ST), medium-skilled subjects (SS), and low-ability subjects (SR)). The research process follows the steps of: (a) formulating the reasoning indicator in solving Mathematics problem, (b) formulating the supporting instrument (valid problem solving task of Mathematics and interviewing), (c) did research subject taking, (d) perform data retrieval to uncover students' reasoning in Mathematical problem solving, (e) do triangulation techniques to obtain valid data (f) perform analysis of student reasoning data in problem solving, (g) conduct discussion of result of analysis, (h) make a conclusion of research result. The results of a highly capable subject study show: 1) in understanding the problem using inductive reasoning type analogies, 2) planning completion using inductive reasoning, 3) carrying out the settlement plan using inductive and deductive reasoning, 4) re-examining using common procedures. While for the subject of moderate ability and low-ability subjects in solving problems only meet one reasoning indicator that is filed allegations (inductive type of analogy) is at the stage of understanding the problem. By looking at the students' abilities teachers need to provide non-routine questions so that students are better trained in reasoning and able to develop students' communication skills both in the learning process and in the community environment.

Keywords: reasoning, problem solving, dimension three, inductive, deductive

A. Introduction

If you look at the substance of the material, then one of the material that is considered difficult for students is the three dimensions. According to (Travers in Krismanto, 2008) it is also

important that geometry is a system, which by logical reasoning of facts or things accepted as truth discovered new traits that are growing. But the development of Mathematics education, especially the geometry curriculum applied in Indonesia in the last few decades, has not developed such logical reasoning. Ikram (2013: 5-6) describes that learning Mathematics must equip students with logical, analytical, systematic, critical and creative thinking skills and the ability to cooperate. If looking at the substance of the material, then one of the material that is considered difficult for students is the third dimension. According to (Travers in Krismanto, 2008) it is also important that geometry is a system, which by logical reasoning of facts or things accepted as truth discovered new traits that are growing. But the development of Mathematics education, especially the geometry curriculum applied in Indonesia in the last few decades, has not developed such logical reasoning. Ikram (2013: 5-6) describes that Mathematics learning should equip students with logical, analytical, systematic, critical, creative thinking skills and collaborative skills.

From the notion of mathematical reasoning it can be seen that the things that must be possessed by students in doing mathematical reasoning is the ability to run procedural problem solving mathematically and the ability to explain or provide reasons for the settlement. Polya (1985) defines problem solving as an attempt to find a way out of one difficulty to achieve a goal that is not so easy to achieve.

To lead to more analytical geometry, it is not easy. But in high school it needs to be attempted, so that the learning of Mathematics especially geometry, more specifically the geometry of space, also contributes in developing reasoning and communication ability, in addition to developing the responsiveness of students and spathe problem in space geometry. Hence the learning of this angle and distance though not wholly presented deductively, is endeavored to provide a direction for understanding through reasoning rather than merely technical-practical rote.

Dimension three is used as the focus of the problem because based on observations made by asking high school materials to some students of class XI and XII especially science majors in the city of Palopo, and alumni who are now sitting on the bench lectures and some even work to say that the three dimensions is materials that are somewhat elusive because as they learn they are like fantasizing, imagining dots, lines, planes and spacing between points to the field as well as large angles in three dimensions.

B. Literature Review

Penalaran Matematika

According to Suriasumantri (1999:42) reasoning is a process of thinking in drawing a conclusion in the form of knowledge and have certain characteristics in finding the truth. The characteristics of reasoning are: (1) the existence of a mindset called logic. In this case it can be said that reasoning activity is a logical process of thinking. This logical thinking is defined as thinking according to a certain pattern or according to certain logic; (2) the thought process is analytic.

The reasoning abilities include: (1) general reasoning related to the ability to find solutions or solving problems; (2) the ability to deal with conclusions, such as syllogism, and with regard to the ability to assess the implications of an argument; and (3) the ability to see relationships, not only the relationship between objects but also the relationships between ideas, and the necessity of using them to acquire other objects or ideas.

Seen from the process, reasoning consists of deductive reasoning and inductive reasoning. Deductive reasoning is a process of reasoning that is inherently derived according to its premises. While inductive reasoning is the process of reasoning in obtaining general conclusions based on empirical data. Deductive and inductive reasoning, both of which are arguments of a series of structured propositions, composed of several premises and conclusions, whereas the difference between the two is in the nature of the conclusion it derives.

Inductive reasoning is a thought process to draw conclusions about a common ground that stands for a particular thing. Arguments are inductively used to obtain strong conclusions. On inductive reasoning, the truth of a particular case can be inferred truth for all casesInductive reasoning is a thought process to draw conclusions about a common ground that stands for a particular thing. Arguments are inductively used to obtain strong conclusions. On inductive reasoning, the truth of a particular case can be inferred truth for all cases (Lehman in Marpiyanti, 2012).

Deductive reasoning is the process of thinking to draw conclusions about a particular thing that stands on the general or the truth has been proven. Marpiyanti (2012) explains that arguments deductively can be used to obtain a valid conclusion. On deductive reasoning is used the consistency of mind and logic. Deductive reasoning can be interpreted as a conclusion based on agreed rules. Activities that are classified as deductive reasoning (Sumarmo, 2010), namely: 1) carry out calculations based on certain rules or formulas; 2) draw logical conclusions based on rules, inferences, check the validity of arguments, prove and construct valid arguments; 3) establishing direct proof, indirect proof and verification by Mathematical induction.

C. Methodology

This research is a qualitative descriptive research. This research will be conducted in one of Senior High School, namely SMA Negeri 3 Palopo. Steps of taking the subject of research are: (a) Setting the class of research that is the class XI-IPA students who have studied the material Geometry especially Dimension Three. (b) Conduct tests which are then analyzed to establish the subject to be selected in the study. The number of research subjects to be selected is 3 people (1 person of high ability, 1 person of medium ability, 1 person of low ability In this study used other supporting instruments are: (a) Interview Guidance, and (b) Task Solving Mathematics Problem (TPMM) The data collection in this research will be done through interview based on the problem solving task of Mathematics, where the subjects are given paper and pen to do some tasks, then the subject is asked to tell in detail his understanding in solving the circle problem, interview and observation to explore the reason why performing such abuses and other possible solutions can be made.The ability of a research subject is learned through the interpretation or representation given by the subject in answering the interviewer's questions.

D. Finding and Discussion

1. Findings

Description of High Subject Subject reasoning (ST), Medium Capacity Subject (SS) and Low Subject (SR) in Problem Solving Dimension Three on Problem.

"Suppose there is a lighthouse that is $17\sqrt{3}$ m high, around it there are two boats. The distance between the two boats is 15 m. someone who is on a small boat looking to the top of the lighthouse, so as to form an angle of 600. The position of a large boat to the lighthouse perpendicular to the position of a large boat to the position of a small boat. From that situation,

a. Make a sketch!
b. If both boats headed to the lighthouse with the same time of departure and speed, then conclude which boat is fast to arrive! Prove it!"

Table 1. Differences in reasoning of Higher Subject (ST), Subjects Ability Medium (SS) and Low Subject (SR) in Troubleshooting Dimension Three

High Subject	Medium Subject	Low Subject
1. Understanding the Problem		
The high-ability subject (ST) explicitly understands the problem on the TPMM problem, but when viewed from the problem-solving result, the high-ability subject (ST) does not write down what is known and what is being asked on the given problem. Highly capable subjects know the steps that will be taken to solve the problem. High-ability subject (ST) uses long-term memory, ST tries to connect a concept that has been obtained and applied to the problem.	Medium-capable subjects (SS) use visual ability (reading) to recognize problems encountered. Medium-case subjects (SS) write down what is known and what is being asked on the answer-sheet of the troubleshooting tasks given in their own sentences.	Low-ability subjects (SR) use visual ability (reading) to recognize problems encountered. The low-ability subject (SR) writes what is known and what is asked on the answer-sheet of the troubleshooting task that is given by using his own sentence
2. Plan for Completion		

High-ability subjects (ST) in planning the settlement explicitly make the initial guess by sketching to make it easier in determining the steps to be taken. High-ability subject (ST) remembers mathematical concepts related to the problem.	Medium-minded subjects (SS) do not write or mention concepts, traits, or mathematical principles relating to problems encountered.	Low-ability subjects (SR) do not write or mention concepts, traits, or mathematical principles relating to problems encountered.
3. Carry out a Settlement Plan		
High-ability subjects (ST) use mathematical concepts that have previously been obtained. Subject berkemammpuan high manage or perform mathematical manipulation based on concepts that have been known both on the problem and based on experience in solving the problem.	Medium-trained subjects (SS) do not use their reasoning skills.	Low-impact subjects (SR) do not use their reasoning skills.
4. Looking Back		
The high-ability subject (ST) does not make any reasoning to re-examine what has been written, but uses only procedural abilities in imagining what has been written.	Medium-capable subjects (SS) do not make a reasoning.	A low-ability subject (SR) does not make a reason.

2. Discussion

Based on the results of a thoroughly obtained research, the reasoning of a highly capable object (ST) in understanding a three dimensional problem by providing different types of problems, either spatial or contextual, begins by using inductive reasoning. If it is associated with the initial stage in solving the problem, a high-performing Subject (ST) makes a preliminary observation in solving the problem, and then from that observation comes a conclusion related to the knowledge and experience stored in its long-term dime. The process in mind produces a number of meanings and propositions at once. The process called reasoning because based on a number of known or perceived propositions is then used to conclude a previously unknown new proposition. While deductive reasoning of high-ability subject (ST) is seen in the stage of completion plan by doing calculation activities based on certain rules or formulas, drawing logical conclusions based on the rules of the syllogism, and composing the proof. This is in line with opinion Sumarmo (2010) namely activities classified as deductive reasoning, namely 1) performing calculations based on certain rules or formulas; 2) draw logical conclusions based on rules, inferences, check the validity of arguments, prove and construct valid arguments; 3) establishing direct proof, indirect proof and verification by Mathematical induction. In re-examination, the subject of high-ability (ST) repeats each step through imagery. However, what the subject does is not classified as a reasoning activity but merely uses the procedural ability to reexamine the written steps.

E. Conclusion

Based on these descriptions, it can be concluded that the current student tendency in solving a problem especially on the question of the three dimensions given always begins with inductive reasoning which then uses deductive reasoning in solving the problem. Inductive reasoning for example learning activities can be started by presenting some observed examples or facts, listing the emerging traits, predicting possible outcomes, and then the student can be directed to construct a deductive generalization.

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