

# THE THINKING PROCESS OF JUNIOR HIGH SCHOOL STUDENTS' IN SOLVING MATHEMATIC PROBLEM BASED ON GENDER

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## Abstract

The aim of this study is to find out the students thinking process in solving mathematical problems on the cubes and blocks material. This research is a qualitative descriptive study. The research subject is the eight grade students of SMP Muhammadiyah 1 Ponorogo, 4 students. Subject is taken based on gender and ability in mathematics. Data analysis was conducted based think aloud protocol. Then, time triangulation was conducted between the first and the second problems, and then method triangulation was done to obtain valid research subject data. This research finally provides the student's thinking process as follows. Female students, in understanding the problem, use the thought process in establishing the understanding, then in designing and planning solutions, they use the thought process and the formation of understanding, then formation of opinion. Female students in finding solutions use the thought process and the formation of the decision forming conclusions, and may address the issue based on the steps that have been prepared. Furthermore, they use the thought process and the formation of the decision forming conclusions in checking the solution of problems. Meanwhile, male students in understanding the problem use the thought process of understanding the formation, in designing and planning solutions they use the thought process and the formation of understanding and opinion. Furthermore, male students in finding solutions use the thought process and the formation of the decision forming conclusions. Then they use it in checking the results obtained.

**Keywords:** Thinking process, mathematics problem solving, gender

## INTRODUCTION

The problem solving in mathematics education becomes very important to build to the students. Problem-solving skills are the basic skills one that should have in order to lead a better life. The math problems which are given in school aimed to mature students' cognitive abilities to understand, plan, conduct and obtain the solution of any problems encountered. Therefore, the need in improving the ability of students to solve problems become being an important theme in the standards curriculum of mathematics education in Indonesia (Depdiknas, 2006).

NCTM (2000) states that the standard processes in mathematics are the problem solving, reasoning and proof, personal communication, connection, and presentation of mathematics. In solving mathematical problems, everyone has various ways and thinking styles because everyone has not the same ability to think. The thought process of each student is not always the same between one to another. The differences in the thought process can be caused by many things, one of them is because of their ability to receive and process the information that has been provided by the teacher when the learning process happened.

Hudojo (2005) stated that the problems solving is the essential form in the learning of mathematics. This is because through learning solutions: (1) students can skillfully selecting relevant information, then analyze it and finally re-examine the results, (2) the intellectual decision will come from within-a gift intrinsic to students, (3) the intellectual potential of students increased and (4) students learn how to perform the invention through the process of performing the discovery. Thus, it is reasonable if in mathematics learning at school is more focused on problem-solving activity.

In solving a math problem, there is a process of thinking in the students minds so that they can find the answers to math problems. Hudojo Herman (2005) stated that the students will practice the problem solving and process data or information. Processing of the data or information is called thinking. In order to stimulate and train the students' thinking skills in mathematics, it is necessary to use the right method or technique in learning to stimulate students to use all their potentials of thinking. Problem solving is the proper way to train students in learning to think

and it has been proven through a number of research experts. Pehkonen (2007) said that “problem solving has generally been accepted as means for advancing thinking skills”, which means that any solution has been generally accepted as a way to improve thinking skills. Furthermore, NCTM (2010) said that “problem solving plays an important role in mathematics and should have a prominent role in the mathematics education”. It means that the problem solving in mathematics plays an important role and should have a major role in mathematics education.

Based on interviews with the mathematics teachers, there are 40% more get test scores under KKM when taking the geometry material. Based on this reality, it needs to identify the difficulties experienced by the students in understanding the geometry material.

## **LITERATURE REVIEW**

### **Thinking Process**

According Yulaelawati (2004) one of the roles of educators in learning mathematics is to help students express how processes running in his mind when solving a problem, for example by asking students to tell the steps that they had in mind. According Suryabrata (2004) the thought process, in essence, there are three steps, namely the establishing of understanding, formatting opinion or conclusion, formatting decisions. The processes in thinking include: the formatting process of understanding, which eliminates the common traits so it will only the special traits; formatting opinion, combines (outlines) some sense, so that it becomes a sign of a problem; formatting a decision or forming conclusions, mind combining the opinions and taking decisions of other decisions.

Marpaung (1986: 6) explains that the thinking process is a process that consists of receiving information (from the outside or from within the students), processing, inference and retrieval of information from memory of the student. So by the time thinking, it does a Question & Answer with his own thoughts to be able to put the relationship between parts of a person's knowledge. From some of the questions that have been mentioned, it will give direction to one's mind.

According Tatag (in Abdul Aziz Saefudin, 2011) the thought process is a process that begins with receiving data, process and store it in memory and then take back from memory when needed for further processing. In the process of thinking occurs between the processing of incoming information by scheme (cognitive structures) that exists in the human brain. Experience or new information received will be treated with adaptation through the process of assimilation and accommodation.

Steiner and Cohors-Fresenberg (in Muh Rizzal, 2011: 19) says that the principal task of mathematics education is to explain the thinking of students in the study of mathematics with the goal of improving the teaching of mathematics in schools. While Marpaung (in Rizal, 2011: 19) states that the task of mathematics education is to clarify the thinking of students learn in mathematics and how it is interpreted in mind. By doing interpretation of information (data) collection through the observation of the behavior of students while studying mathematics (both in terms of concept formation in the atmosphere as well as problem-solving), it will be constructed in the student's thinking process.

In the process of learning activities in class, many students involved both boys and girls which every students, has an equal opportunity to obtain information about the training materials from the teacher. Biologically, men and women are different. The difference is clearly seen at their reproduction. Biological differences of men and women are caused by hormones that differ between men with women. By these differences, there is different treatment between men and women. Beside the biological factors, the other factor that affects student achievement is the psychological factor. Psychologically, men and women are also different. These psychological factors related to intelligence, attention, interest, aptitude, motivation, maturity and readiness.

## **Problem Solving**

In mathematics, students are often faced with the problem, so hopefully with the learning of mathematics; students were able to resolve the problems that exist. Existing competence in mathematics should lead to mastery of concepts and skills in solving problems with the ability to think critically, logically and systematically and structured. Problem-solving skill is an important thing that should be practiced to students. The problems associated with mathematics often encountered in everyday life, usually associated with real-life stories contained in the matter.

Hudoyo Herman (1988) stated that a question is an issue for someone when that person does not have any rules or specific laws that may be used to find answers to these questions. Krulik and Jesse Rudnick (in Carson, 2007) stated that problem is a situation, quantitative or otherwise, that confronts an individual or group of individuals, that requires resolution, and for which the individual sees no apparent or obvious means or path to obtaining a solution.

According Suherman (2003) the problem solving is part of the math curriculum which is very important because of the its learning process or completion, the students are possible to gain experience to use the knowledge and skills to solve problems that are not complicated. Problem solving regarding the level of processing information is higher. Based on the opinion above, the problems referred to in this study is a situation where the students do not know the answers and they need steps to complete.

If a problem is given to a student and the student to immediately know how to resolve it correctly, then the problem cannot be said to be a problem. Whereas solving mathematical problems is the best way to improve students' mastery of the material. Gagne (in Ketut Suma and friends, 2007) placed the problem solving as the highest ability from the hierarchy intellectual ability. According to him, the problem solving occurs more complex forms of learning that require simple rules to be known in advance. Then, Hembree (in Lazakidou, 2007) stated that problem solving is characterised as an essential and complex activity in mathematics. Other sources also mentioned that problem solving is the foundation of much mathematical activity. It is so important that the National Council of Teachers of Mathematics (NCTM) has identified it as one of the five fundamental mathematical process standards (NCTM in Zhu, 2007). Therefore, many efforts were made by the experts of mathematics education to improve students' skills in problem solving. So the problem solving can be a tool used to change of circumstances encountered into the desired state.

To solve the problem needed mental activity (thinking) which are more numerous and complex than the activities done during solving routine matter. Questions were given to students should be accepted by the students and arranged appropriate to students' cognitive structure. Polya (in Suherman, 2003: 91) reveals the solution in problem solving, there are four steps that must be done, namely: (1) understand the problem, (2) plan the processes, (3) solve the problem, (4) re-examine the results obtained.

## **METHOD**

This research is qualitative descriptive. The research was conducted at SMP Muhammadiyah 1 Ponorogo at Jalan Batoro Katong Ponorogo No. 6B. The subjects of this study was the eighth grade students of SMP Muhammadiyah 1 Ponorogo, consists of 4 students which is divided into two male and two female students. The instrument used in this study include: math tests results in the form of daily materials such as cube and blocks. From the issue are used to assess and describe the thinking of students problems solving based on gender.

## **RESULT AND DISCUSSION**

Based on the data analysis, it is found that women students of SMP Muhammadiyah 1 Ponorogo class VIII (students 1 and 2) are able to run the steps in problems solving by Polya, where

students with cognitive level is being fulfilled every step troubleshooting raised by Polya, namely (1) understand the problem, (2) plan the processes, (3) solve the problem, (4) re-examine the results obtained.

Female students in understanding the problem use the process of formation sense of thinking. It can be seen by students with high cognitive level can state what is known at the problem and say what is being asked easily and correctly. Then female students plan to use the thinking process and the formation of understanding in formatting opinion. It can be seen that female students can mention and describe supporting knowledge and linking knowledge used in solving the problem. Furthermore, female students in finding solutions use the thought of process and format of the decision in forming conclusions. It can be seen that female students may address the issue by using steps that have been prepared. The final step is to re-examine the results obtained, the female students use the thinking process and the formation of the decision forming conclusions in checking the solution, it is appropriate that the female students can check the results obtained.

Male students (student 3 and 4) in understanding the problem use the thought process the establishment of understanding. It can be seen that the male students can mention what is known at the problem and say what is being asked. Male students in designing and planning solutions use the thought process and the formation of understanding in formatting opinion. It can be seen that male student can name and describe knowledge of supporting and linking knowledge which is used in solving the problem. Male students in finding solutions from problems use the thought process of decision establishment. It can be seen male students may address the issue based on the steps that have been prepared even though the results are not perfect. Sexed male students use the thinking process in formatting of the decision and forming conclusions and it is appropriate that the male students can check the results obtained.

Based on the triangulation, it can be concluded that the students are female and male students gendered use the thinking process that consists of the formatting the understanding of thought process, the thought process in forming an opinion, the decision forming in the thought process, and thought processes in forming conclusions.

This research eventually resulted the thinking of students as follows: Female students can understand and analyze the problem by mentioning that unknown and being asked, the thought process used is the process of establishing understanding. Steps in designing and planning solutions use high-level cognitive thinking processes in forming the opinions. The process of thinking can be seen that the female students can make a connection between the known and questioned. Then, they can seek a solution of the problem-solving, in this step using the thought process and the formation of the decision forming conclusions. It is seen in calculating the area of cubes and blocks. Using the solution plan that has been collated, using all the data presented in trouble. The fourth step, female students in examining this case in accordance with the solutions students can inspect and examine the solutions that have been prepared. Female students use the thinking process in formatting of the decision and forming conclusions.

The thought process in this step is the formation of the thought process decisions. Male students can understand the problem by using the process of thinking in formatting sense, it can be seen by sexed male students in analyzing problems as a whole to understand, so they can mention what is known on the issue and said what was asked. It is also shown in the written form. Furthermore, it can design and plan solutions using the thought process, the formatting understanding and formatting of opinion. The formation of this opinion can be seen from the male students that can mention and explain the supporting knowledge of cubes and blocks later mentioned formulas used. Then students can associate between the known and the question, then male students mentioned knowledge used in solving the problem. The next step, male students can seek a solution of the problem using the thought process and the formation of the decision forming conclusions. It can be seen that male students may address the issue based on the steps that have been prepared. The next step, male students can check the solution, students

use mental arithmetic without having to write anything what they do, the students just examine and ascertain the accuracy of the steps that they had reconstructed. This thinking process is called as the forming the decision thinking process.

## CONCLUSIONS

Based on the result and discussion above, it can be conclude that:

1. Female students in understanding the problem use the process of formation sense of thinking. It can be seen by students with high cognitive level can state what is known at the problem and say what is being asked easily and correctly. Then female students plan to use the thinking process and the formation of understanding in formatting opinion. It can be seen that female students can mention and describe supporting knowledge and linking knowledge used in solving the problem. Furthermore, female students in finding solutions use the thought of process and format of the decision in forming conclusions. It can be seen that female students may address the issue by using steps that have been prepared. The final step is to re-examine the results obtained, the female students use the thinking process and the formation of the decision forming conclusions in checking the solution, it is appropriate that the female students can check the results obtained.
2. Male students in understanding the problem use the thought process the establishment of understanding. It can be seen that the male students can mention what is known at the problem and say what is being asked. Male students in designing and planning solutions use the thought process and the formation of understanding in formatting opinion. It can be seen that male student can name and describe knowledge of supporting and linking knowledge which is used in solving the problem. Male students in finding solutions from problems use the thought process of decision establishment. It can be seen male students may address the issue based on the steps that have been prepared even though the results are not perfect. Sexed male students use the thinking process in formatting of the decision and forming conclusions and it is appropriate that the male students can check the results obtained.

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