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THE PROFILE OF JUNIOR HIGH SCHOOL STUDENTS' REASONING IN SOLVING MATHEMATICS OPEN-ENDED PROBLEM ACCORDING TO REFLECTIVE-IMPULSIVE COGNITIVE STYLES

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Abstract

Several studies showed that students' reasoning in solving mathematical problems is low. There are several factors that led to lower students' mathematical reasoning. The goal of this literature is to describe the profile of junior high school students reasoning in open-ended mathematics problem solving according to reflective-impulsive cognitive styles. Several studies have shown that by looking at the students' cognitive styles, teachers be able to plan and provide the appropriate learning. In this literature a more deeply reviewed about student reasoning in open-ended mathematics problem solving according to reflective-impulsive cognitive style.

Keywords : reasoning, open-ended mathematics problem, reflective-impulsive cognitive styles.

INTRODUCTION

A. Background

In mathematics learning students do not only taught to memorize mathematical formulas but students also can use mathematics to solve problems in everyday life. Mathematics can be used to develop student ability in communicate the ideas through mathematical models that can be sentences and math equations, diagrams, graphs, or tables.

Mathematics formed due to the human minds which connected to the ideas, processes, and reasoning. Sa'adah (2010:10) said that the material of mathematics and mathematical reasoning cannot be separated, it is beacause mathematics can be understood through reasoning and reasoning can be understood and be trained through mathematics' material. So mathematical reasoning ability is important and needed in studying mathematics. This can be seen on kompetensi inti of SMP/MTs in curriculum of 2013 that process, present, and reasoning in the concrete domain (using, extract, compose, modify, and create) and in the abtract domain (writing, reading, counting, drawing, and composing) according to the learned in schools and other sources of the same in angle of view/theory (Notodiputro, 2013:48).

In addition, Badan Standar Nasional Pendidikan (BSNP) (2006:140) also stated that several learning objectives of mathematics, which is to students have the ability to (1) in the pattern and nature of reasoning, mathematical manipulation into generalizations, construct evidence, or explain ideas and mathematical statement, and (2) problems solving that include the ability to understand the problem, devised a mathematical model, solve the model and interpret the obtained solution. Based on several above opinion indicates that the reasoning and problem solving is an important aspect which need attention of the teacher.

Djamarah (2010:62) said the readiness of teachers to recognize the characteristics of students in learning is the main capital of delivery learning materials and an indicator of the success of the implementation of learning. Therefore, the first step to make improvements in developing students' reasoning in problems solving, teachers must be know in depth how the

actual profile students' reasoning in mathematical problems solving. Profile of students' reasoning in mathematical problems will a capital base in designing learning which develops reasoning ability.

In the activities of learning, mathematics activity is a means for students to be able to solve their problems through logical reasoning. Through the reasoning activities students are trained to draw conclusions or make a new statement based on some facts. Therefore, students will have difficulty if the teacher only saw the success of students in the final result regardless about logical thought process of students in understanding, resolve, and draw conclusions math problems which given by teacher. Suriasumantri (2010:42) stated that the reasoning is a process of thinking in drawing a conclusion in the form of knowledge and have certain characteristics, namely the pattern of logical and analytical thinking in finding the truth.

Giving an open-ended questions is one way that can be done by teachers in developing students' reasoning in solving mathematical problems. Becker and Shimada (1997) stated that the open-ended problem is a problem which has several or many correct completion, and several ways to get the correct answer. Therefore, by giving the open-ended questions to students, students might have opportunity to use his reasoning in solving problems in many ways and looking for many alternative solution.

The research of Swartz and Perkins (Hassoubah, 2004) suggests that humans tend to have four patterns of thinking are not effective or wrong. Fourth tendency to think one of the covers (1) haste, which is too early to make a decision, without considering other ideas or alternatives; (2) unkempt, namely the tendency for irregular thinking, jumping from one idea to another without exhaustively analyze one of these ideas; (3) not focus, which becomes blurred or vague and unclear thinking in giving opinions; (d) narrow, ie the tendency of not thinking deeply, thus ignoring other important information that may exist. Referring to these studies it appears that there is a relationship between reasoning with reflective-impulsive cognitive style.

Abdurrahman (1999:174) said children which impulsive cognitive style tended to answer the question quickly but made a lot of mistakes while the reflective cognitive style kid which tends to answer the question more slowly but just made a little mistake. In addition, Froehlich (2003:3) also said that one group of children made decisions after Briefly looking at the figures, they were cognitively impulsive Thus, while the other group deliberated the choices carefully before coming to a decision, Thus they were cognitively reflective. Abdurrahman also added which students have learning disabilities generally impulsive cognitive style. However, in general the students progressed from impulsive to reflective. It thus was said by Kenny (2007: 188) that actually reflective-impulsive cognitive style can be trained and reduced based on age, because of the speed of cognitive (cognitive tempo) is a characteristic which can be trained. So it would be better if a teacher knows their students possessed cognitive style in solving problems, especially reflective and impulsive cognitive style. This is done so that students gain practice to respond to an issue with sufficient time and careful manner so the resulting answer was correct.

The one of important characteristic which has a close relationship with the process of learning mathematics is reasoning and cognitive styles of students in solving mathematical open-ended problems. A teacher who knows the reasoning and cognitive styles of their students will know the cause of the error, difficulties, and parts that are not be understood by the students in solving the problem. It can also be used as information for teachers to be able to plan and deliver the appropriate learning and optimal learning outcomes.

Based on the above, it can be concluded that the students know the reasoning in solving problems is an important thing which should be known by the teacher. In addition, the reflective-impulsive cognitive style of the students also affects how students reasoning in solving problems. Therefore, researchers are interested to examine and describe how the **The Profile of Junior High School Students' Reasoning In Solving Mathematics Open-Ended**

Problem According To Reflective-Impulsive Cognitive Styles.

B. Formulation of The Problem

According to the background described above, it can be formulated problem is "how profiles reasoning junior high school students in solving open-ended mathematics problems according to reflective and impulsive cognitive style?".

C. Goal

The goal of this literature is to describe the profile of reasoning of junior high school students in solving open-ended mathematics problem according to reflective-implusive cognitive style.

D. Benefit of The Study

Based on the objectives to be achieved in this literature, the expected benefits of the research as follows.

1. To contribute knowledge to readers especially teachers about mathematical reasoning in solving open-ended problems based on reflective-impulsive cognitive style.
2. Provide information for teachers about differences in mathematical reasoning mathematics students in solving open-ended problems based on reflective and impulsive cognitive style.
3. As consideration for the teachers in designing learning by observing students' cognitive styles, especially reflective and impulsive cognitive style.

DISCUSSION

A. Reasoning

Mathematics formed due to the human minds associated with the ideas, processes, and reasoning. Sumpter (2008:4) said that reasoning is defined as the line of thought-adopted to produce assertions and reach conclusions in task solving. This means that the reasoning is defined as a way of thinking that was adopted to produce the statements and conclusions reached in problem solving.

Suriasumantri (2010:42) stated that the 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 are intended the mindset that be logical and analytical thought processes. Logical or consistent pattern of thinking, means the pattern of thinking in a certain pattern or a certain logic, while the analytical nature is the consequence of a certain mindset, because the analysis is essentially a thinking activity based on certain steps.

Mason (2010: 135) said that I began by introducing you to certain that underlie mathematical thinking, as follows specializing, generalizing, conjecturing, and justifying.

Table 1
The Description of Reasoning Activities in Solving Open-Ended Problems

No	Activity	Description
1	Specializing	Collects the fact, such as whatever known and asked of the question.
2	Generalizing	Makin the general mathematical pattern.
3	Conjecturing	Give a conjecture, check a conjecture, and test a conjecture.
4	Justifying	Provide arguments and make conclusion.

A student in performing mathematical reasoning must have the ability or knowledge in solving mathematical problems and the ability to explain or give a reason for the settlement is

done based on the pattern of logical and analytical thinking. Based on the above reasoning some sense, then mathematical reasoning in question in this research is a logical thought process in achieving the conclusion that contain activities with specializing, generalizing, conjecturing, and justifying.

In this literature, the profile of students reasoning in solving open-ended math problems is the description according to the actual state of the logical thought process of students in drawing conclusions on the open-ended problem solving math based on the stages of problem solving proposed by Polya.

Table 2
The Activities of Mathematical Reasoning in Solving Open-Ended Mathematics Problem Proposed By Polya

No	Polya's Phrase	Reasoning Activities
1.	Understanding the problem	a. Specializing b. Justifying
2.	Devising a plan	a. Conjecturing b. Generalizing c. Justifying
3.	Carrying out the plan	a. Conjecturing b. Generalizing c. Justifying
4.	Looking back	a. Conjecturing b. Justifying

B. Open-Ended Problem Solving

Open-ended problem tasks are often thought of as tasks for which more than a single correct solution is possible, and that they offer students multiple approaches to the problems by placing little constraints on the students' methods of solution. Furthermore, Shimada (Mahmudi, 2008) states that open-ended problem is a problem that has several or many correct answers, and several ways to the correct answers.

According Suherman (2003: 123), the problem which is formulated to have a many right answers is called the incomplete problem or also called open-ended problems. The main goal of open-ended problem which is given to student is not to get the solution, yet how the way to get the solution. Besides, Becker and Shimada (1997 : 1) said that open-ended approach, an 'Incomplete' problem is presented first. The lesson then proceeds by using many correct answers to the given problem to provide experience in finding something now in the process. This can be done through combining student own knowledge, skills, or ways of thinking that have previously been learned."

Based on several arguments above, open-ended problem is a problem that has several or many possible correct answers, and several ways to the correct answers. On the other words, open-ended problem can be stated as a problem with one way to find many possible correct answers, a problem with many ways to find one correct answer, or a problem with many ways to find many possible correct answers.

C. Reflective-Impulsive Cognitive Style

Each individual has a characteristic, so each individual has different characteristics from each other. The difference is caused by several factors and one of them is cognitive style. Cognitive style is characterized as a cognitive trait that is likely to declare a difference in the quality of the individual's ability solving the problem.

Liu & Ginther (1999) said that there are many definitions of cognitive style. For

example, Tennant defines cognitive style as an individual characteristic and consistent approach to organizing and processing information. Meanwhile Liu & Ginther itself suggests that cognitive style refers to the tendency of individual characteristics and consistency in feel, remember, organize, process, think, and solve problems. Based on the understanding of cognitive style proposed by experts, so that in this study it can be said that the style is the way a person's cognitive processing, thinking and problem solving to information from the outside that is consistent.

Froehlich (2003:3) said that that "One group of children made decisions after Briefly looking at the figures, they were cognitively impulsive Thus, while the other group deliberated the choices carefully before coming to a decision, Thus they were cognitively reflective". In addition, Abdurrahman (1999:174) also said that that impulsive children tended to answer the question quickly but makes many mistakes while reflective children tend to answer the question more slowly but just made a little mistake.

Based on the definition stated above, there are two important aspects that must be considered in measuring reflective-impulsive, namely: a) the time to make a decision to solve the problem (Rozencwajg & Corroyer, 2005:452), b) contain uncertainty which means that the child's response will provide answers hesitation or less carefully, so that measurements can be seen from the reflective impulsive frequency of students in providing answers to get the answer correct. If the aspect of time (the time variable can be divided into two, namely fast and slow, then the aspect of uncertainty (variable uncertainty) is divided into carefully / accurately (answer frequency slightly (and not accurate / not accurate (frequency answered a lot), then the students can be grouped into 4 (four) groups, namely: group of students quickly and carefully, slowly and carefully (reflective), fast and inaccurate (impulsive), and the slow and careful. (see Figure 1)

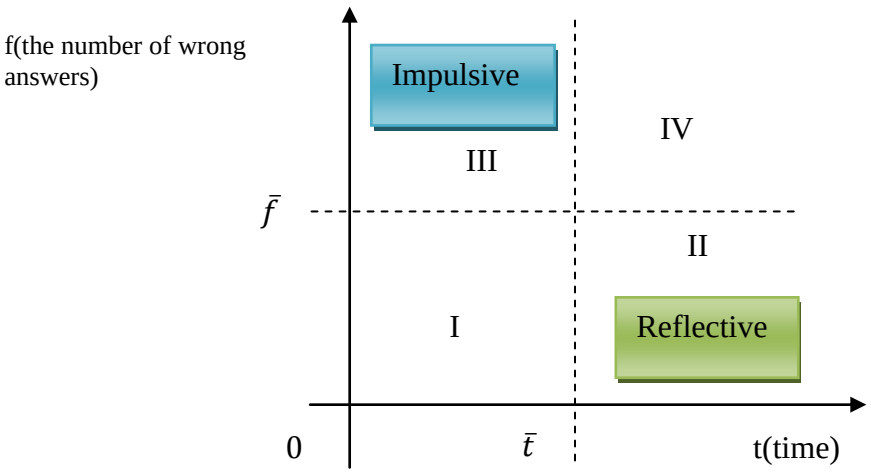

Figure 1. The Place of Reflective-Impulsive Child Based on *t* and *f*

The author's reason for restrict study's on reflective and impulsive students are a) the proportion of reflective and impulsive children is greater than the group of children quickly and carefully and slowly and carefully. This is supported by several studies, such as Reuchlin (Rozencwajg & Corroyer, 2005:453) found the proportion of reflective-impulsive children by 70%, Warli (2010) shows a group of students reflective and impulsive by 73%, and Faisal (2011) which shows the proportion of reflective and impulsive student group at 78.93%. b) support the findings Jerome Kagan, the first hypothesis that individuals who responded quickly (impulsive) to make more mistakes, c) limited number of researchers.

From the definition of reflective-impulsive cognitive style noted above, it is a reflective cognitive style in this literature is the cognitive style of individuals whose characteristics are slow in responding to the problem, but accurate so the answers tend to be correct. Meanwhile impulsive cognitive style is a cognitive style of individuals who have characteristics in responding to problems quickly but not accurately so that the answers tend to be wrong.

The instument of cognitive style used in this literature is an instrument that has been developed by Warli (2010) and consists of 13 items and each item consists of 1standard figure and 8 variation figures, which uesd for measuring the reflective-impulsive cognitive style of junior high school students. Because the range of age's students same with this literature so writer use Warli's instrument.The use of the speed limit and the number of errors in answering the ideal time to use limit and limit errors in the ideal answer. Therefore MFFT only choose images that are identical to the standard and does not require the application of a concept or formula to find the answer. Warli concluded in his research to select images that are identical to the standard picture of 13 items simply use the maximum ideal time 14.56 minutes. Based on it the ideal time limit set 7.28 minutes. While the ideal of the number of wrong answers is 7 from 13 errors that may occur. So that students have a reflective cognitive style ideal time > 7:28 minutes and the number of incorrect answers < 7 questions. While students are impulsive cognitive style have time to answer ≤ 7:28 minutes and the number of ≥ 7 answers one question.

D. Relevant Research

Warli (2010) dissertation entitled " The Profile of Creativity Student Who Have Reflective Cognitive Style and Impulsive Cognitive Style in Solve Geometry Problems ". The results showed that the profile reflective of student creativity in solving geometry problems tend to be high , otherwise it is said also that reflective students to be very careful in solving problems , considering various aspects , so that the answers obtained are likely a bit , but it is true . While the profile of impulsive student creativity in solving geometry problems are very low , students are less careful in solving the problem , a little trying , working directly answers obtained so much , but tend to go wrong . Based on research conducted by Warli , then lets also differences in reasoning between the student profile that reflective and impulsive cognitive style in this study . Subjects in the study Warli a junior high school students so that researchers used an instrument developed by the Warli to see the reflective - impulsive cognitive style of the students . This is because the subjects in this study is also the eighth grade students of junior high school age with the same level of research that has been done by the Warli .

Mujiono (2011) thesis entitled "The Profile of Students' Reasoning in Solving Mathematics Problems According to The Differences of Field-Dependent and Field Independent Cognitive Style and The Differences of Gender". The results showed that students in the FI group, both men and women in response to a task analytically, may associate the information known in the matter so as to construct appropriate mathematical models and mathematical models are completed correctly in order to obtain the correct solution. Students in the FD group of men can understand some of the information that is known in the matter but can not associate with other information on certain variables affected because he thinks must be known. While FD female students can not know the difference in value of a particular variable. This suggests that the FD students, both men and women are affected in the surrounding context which is not relevant to the important information contained in the task and look at the global task. Mujiono also said that there was no significant difference in students' reasoning of men and women in solving math problems for each group FD and FI cognitive styles. Based on research conducted by Mujiono, researchers want to examine and describe the cognitive styles that influence students' learning difficulties are reflective-impulsive cognitive style.

CONCLUSION

Based on the above it can be concluded that the profile of student reasoning in solving open-ended math problems based on reflective - impulsive cognitive style , namely (1) a reflective cognitive style of students who will be careful and slow in understanding the stages to re-examine the matter so that the answers tend to be true other than that students are able to use reasoning to solve problems in some alternate , while (2) impulsive cognitive style of students who will quickly rush in answering thus less able to understand the questions and the answers tend to be wrong , but students will be able to solve problems in several alternative although answers the resulting incorrect . It can be concluded that the reasoning of students in solving mathematical problems reflective cognitive style of students better than students whose impulsive cognitive style . This is because students are reflective cognitive style more cautious and careful in answering that answers tend to be true , while students who recklessly impulsive cognitive style that is less accurate and tend to produce incorrect answers

SUGGESTION

Based on the above, in general there is a difference between students which have a reflective-impulsive cognitive style. Therefore, the authors recommend that teachers pay attention to the cognitive style of reasoning students especially in developing reflective and impulsive cognitive style.

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