# PROFILE OF MATHEMATICAL PROBLEM SOLVING ABILITY OF GRADE VII STUDENTS REVIEWED FROM STUDENTS' COGNITIVE STYLE

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**Abstract:** The objectives of this study are: (1) to describe the cognitive style of Grade VIII Students of SMPN 3 Bonegunu; (2) to describe the mathematical problem solving ability of Grade VIII students of SMPN 3 Bonegunu; (3) to know the factors causing the low level of mathematical problem solving ability of Grade VIII students of SMPN 3 Bonegunu. This research is an explorative research using quantitative descriptive approach. The conclusions of this study are: (1) the Grade VIII students of SMPN 3 Bonegunu who were subjected in this study consisted of 20 students had reflective cognitive style and 23 students had impulsive cognitive style; (2) mathematical problem solving ability of SMPN 3 Bonegunu students who have reflective cognitive style gain: maximum score is 58.45; minimum score is 32.68; average score is 45.28; standard deviation is 3.26 and students who have impulsive cognitive style gain: maximum score is 39.84; minimum score is 28.42; average score is 39.85 and standard deviation is 3.68; (3) factors causing the low ability of mathematical problem solving of students in SMPN 3 Bonegunu is the lack of practicing matters related to mathematical problem solving ability and teachers have not used strategies and learning models yet that can improve students' mathematical problem solving ability.

**Keywords:** *Mathematical problem solving ability, Reflective cognitive style and Impulsive cognitive style.*

## INTRODUCTION

Graduate Competency Standards that must be mastered by students as stated in Education Unit Level Curriculum (*Kurikulum Tingkat Satuan Pendidikan)* for mathematics subject is the ability to solve mathematical problems, (MoNE, 2006). Therefore, it is determined that the focus of mathematics learning in schools ranging from Elementary School to High School is a problem-solving approach. The problem-solving approach is implemented to provide sufficient supplies to students in order to have the ability to solve various forms of mathematical problems. It will also be useful for acquiring knowledge and the formation of thinking ways and attitude in solving problems encountered.

In solving the problem requires a complete and systematic thinking process by students, namely in raising the correct answer. This point is very likely to be achieved, because students are stimulated to develop all their psychological potential, especially those related to thinking processes (Sudia, 2013).

Students' thinking process in solving the problem is important that need attention of teacher that is, to assist students in raising correct answer from problem given (Sudia, 2013). Solving problems is a high level mental activity, so the development of problem solving ability in learning mathematics is not easy. Suherman (2001) mentions that problem solving is still considered as the most difficult thing for students to learn it and for teachers to teach it. For example non-routine issues that the presentation relates to real situations or daily life.

One of the factors causing the difficulty of students learning mathematical problem solving is that students are less or even never practiced by problems associated with problem-solving ability. Another factor

is the lack of understanding of the mathematical concepts of students, so when the concept is willing to be applied in problem solving, it becomes difficult (Sudia, 2013).

Understanding concepts in mathematics is something that is absolutely essential to master when a student follows the learning process of mathematics (Brooks & Brooks, 1993). To deal with the problem of understanding the concept in learning mathematics needs to be applied the right strategy. This is because basically the students have brought the initial knowledge gained in the previous education level (Suparno, 2005). The initial knowledge brought by the students is in the form of a scientific conception and some are still misconceptions.

One's interpretation of a concept is often different from the intended concept. The error of one's interpretation of a concept which is called misconception and if the students' misconception increases, the students will have difficulty in understanding the next concepts, especially those related to problem solving (Rahim, et al., 2015). This is because the concept in mathematics is hierarchical. One of the implications of misconceptions in the teaching and learning process is that if misconceptions are not detected and uncorrected, they can lead to a misconception of the students to the concept and this will result in the difficulty of the concept being applied in solving mathematical problems (Ulthayakumari, 2005).

Students' misconceptions are the main facing problem in the world of mathematics education today. Misconception in mathematics occurs universally. Students' conceptions and misconceptions allegedly form during childhood in brain interaction with nature (Berg, 1991). Studies of misconceptions show that misconceptions are resistant (Sadia et al, 2004) and this occurs because each individual builds his knowledge precisely with his experience. Therefore, a teacher needs to understand the nature and characteristics of students' misconceptions so that teachers can prepare appropriate learning strategies to change students' misconceptions and after which there will be conceptual changes or in other words, students must replace or improve most of the knowledge about conceptual change in perspective cognitive (Kabaca at al, 2011; Limo'n 2001 and Rahim, et al, 2015).

Younger builds new knowledge rather than building misconceptions of knowledge. This is as stated by Suparno (2005) that it is easier to build new knowledge from scratch when compared with changing misconception knowledge. Zimrot & Ashkenzi (2007) states that one will be able to change the alternative concept if they begin to doubt their own concepts so that the proposed new concept becomes useful. Suparno (2005) also added that conceptual change is very important in the learning process of mathematics. Only with conceptual alterations, either expanding concepts or aligning improper concepts, a student actually develops in understanding the concepts of math.

The inherent characteristics of each child may be different from each other. One of the variables that distinguish the characteristics of children in learning mathematics, including in problem solving is the cognitive style. Cognitive style determines a person's way of thinking when accessing information, managing information and making decisions. Each student has their own cognitive style. Differences in cognitive style attract the attention of researchers because researchers want to know the students' mathematical problem solving ability of different cognitive styles.

Experts who have defined the notion of cognitive style, for example: Heineman (in Sudia, 2013) suggests some notions of cognitive style as follows: (1) cognitive style refers to the preferred way of individuals in organizing and processing information; (2) cognitive style is usually described as a personality dimension affecting attitudes, values and social interactions; (3) cognitive styles include patterns of individual consistency behavior in terms of ways of thinking, remembering and solving problems. The same is also mentioned by Riding, et. al (in Sudia, 2013) that cognitive style refers to individual tendencies and consistency in understanding, remembering, organizing, thinking and solving problem.

From some sense of cognitive style mentioned above, basically the cognitive style focuses on the characteristics of individual consistency (does not mean individual characteristics can not be changed) in terms of ways of thinking, remembering, processing information and solving problems. From the sense of cognitive style it is also seen that between the cognitive style and problem solving have relevance, because the success of a person in solving the problem will be determined by how the person thinks, considering the previous concepts related to the given problem and how to process information to get the right solution. Therefore, in problem solving learning it is needed to consider the cognitive style of students.

A person's cognitive style can explain the individual's success differences in learning. This is consistent with the opinion of Ausubel (1968) Theo Van Els, and Brown, (1994) (in Mukhid, 2009) that cognitive style is one of the individual characteristics that can help explain individual success differences in learning, including mathematical problem-solving ability. This understanding shows that when a person undertakes a learning activity, his learning outcomes will be determined on how the individual thinks, how to manage, process, organize and remember the information obtained from the teacher or from other sources.

In relation to cognitive style, Acharya (2002) says that if the cognitive style of students can be accommodated in learning, it will result in learning attitudes and thinking skills improvements, academic achievement and creativity. Information about cognitive styles can help teachers in schools become more sensitive to students' differences in class (Sudia, 2013). Therefore, by knowing the cognitive style of the individual learning, it is possible to know the exact way teachers do when teaching mathematical concepts to individuals who have certain cognitive styles, primarily in teaching mathematics that uses problem-solving approach.

A number of cognitive styles have been identified in several literatures, for example Abdurrahman (1999) says that one of dimensions of cognitive style that gained the greatest attention in the study of disabled children is reflective-impulsive cognitive style (answering problems slower but fewer errors and answering problems quickly but many errors).

The reflective cognitive style and impulsive cognitive style was first proposed by Jerome Kagan in 1965. Kagan categorizes children's cognitive styles into 2 groups: children with reflective cognitive style and impulsive cognitive style. Children who have slow characteristics in answering the problem but are careful, so the answer to the problem tends to be true, called reflective cognitive style. Children who have fast characteristics in answering problems, but not so carefully that the answer to the problem tends to be wrong, called impulsive cognitive style (Kagan, in Sudia, 2013).

It has also been previously expressed that Impulsive-Reflective cognitive styles will be closely related or meticulous or not meticulous in solving problems. To solve a mathematical problem is needed accuracy and high accuracy in choosing the right concepts, principles and ways to obtain the right solution as well (Sudia, 2013). Practicing the accuracy of students in the implementation of learning is important enough for students to solve mathematical problems. This description also according to the researchers' opinion which is strong enough to be one of the reasons for choosing reflective-impulse cognitive style to be studied further related to students' mathematical problem solving abilities.

This study is a preliminary study that the results can be used to find out the problems and factors causing the occurrence of problems that exist in school during the thesis research. From the problems and factors that cause the known problems, can be found solutions to improve students' mathematical problem solving abilities, according to the causes of the problem. Therefore need to do preliminary study to know the problems and factors causing the problem based on cognitive style.

The objectives of this study are: (1) to describe the cognitive style of Grade VIII Students of SMPN 3 Bonegunu; (2) to describe the mathematical problem solving ability of Grade VIII students of SMPN 3

Bonegunu; (3) to know the factors causing the low level of mathematical problem solving ability of Grade VIII students of SMPN 3 Bonegunu.

## METHOD

This study is an explorative research using quantitative descriptive approach. The subjects of this study are students of class VIII-A and class VIII-B SMPN 3 Bonegunu each consisting of 22 students and 20 students, so the number of subjects in this study was 42 people.

Instrument used in this study there are 2 (two) kinds, that is cognitive style questionnaire and math problem solving test. The cognitive style questionnaire consists of 13 items. The mathematical problem solving test consists of 3 items representing a particular topic, namely a two-variable linear equation system.

To analyze the data in this study used quantitative descriptive analysis techniques, namely to know the students who have a certain cognitive style, namely reflective cognitive style and impulsive cognitive style. In addition, descriptive analysis is used to determine the maximum score, minimum score, average score and standard deviation of students' mathematical problem solving ability.

## RESEARCH RESULT AND DISCUSSION

### Research Result

After the data is collected, further analysis of students' cognitive style is done. After analyzing, obtained 20 students who had reflective cognitive style, 23 students had impulsive cognitive style and 7 students who had slow and inadequate cognitive style. Students who are the subject of this study are only students who have reflective cognitive styles and students who have impulsive cognitive style.

After analyzing the data, obtained mathematical problem solving ability of Grade VIII students of SMPN 3 Bonegunu from each cognitive style can be seen in Table 1 below.

**Table 1. Scores of Mathematical Problems Solving of Grade VIII Students of SMPN 3 Bonegunu Reviewed from Cognitive Style**

| Score | Cognitive Style | |
|---|---|---|
| | Reflective | Impulsive |
| **Maximum** | 58,46 | 39.84 |
| **Minimum** | 32,68 | 28,42 |
| **Average** | 45,28 | 39,35 |
| **Standard Deviation** | 3,26 | 3,68 |

The achievement of students' mathematical problem solving abilities of the two observed cognitive styles listed in Table 1 above has differences, in terms of maximum scores, minimum scores and average scores, but the score of the mathematical problem solving ability of the two groups cognitive style is still low. From the results of preliminary observations obtained information that the cause of the low ability of mathematical creative thinking is because they are not used to be practiced with problems related to mathematical problem solving ability. Another reason is that teachers have not used a strategy and learning model yet that can improve students' mathematical problem solving ability.

**Discussion**

The results of this study showed that the results of cognitive-style tests, namely: 20 students have reflective cognitive style and 23 students have impulsive cognitive style. Of the two cognitive styles derived from the cognitive-style test results, there is a difference in mathematical problem solving ability, although not too much different.

It has been mentioned in the results of the above research that one of the causal factors that resulted in the low ability of students' mathematical problem solving is that students are not often or even never trained on issues related to mathematical problem solving ability. In addition, the low ability to solve mathematical problems caused by strategies and learning models used by teachers have not been able to improve students' mathematical problem solving ability.

Students' mathematical problem solving ability need to be improved, because the ability to solve mathematical problems is one part of the high-level mathematical thinking skills that students need to have. Therefore it is necessary to apply appropriate strategies and learning models to improve students' mathematical problem solving ability. One of the strategies and learning models that can be used to improve the problem solving ability of mathematics is cognitive conflict strategy of cooperative setting. This is supported by research results by Ponamon et.al. (2015) and the results of Santi et.al. (2015) show that cognitive conflict strategy of cooperative setting can improve students' mathematical problem solving ability. Another learning model that can be used to improve the problem solving ability of mathematics is cooperative learning model. This is supported by the opinion of Lie (2004) that cooperative learning can improve students' mathematical problem solving ability.

In addition, cooperative learning according to Nur and Ibrahim (2012) is groups are used in discovery and discussion learning. With heterogeneous group activities, as well as rewarding group success can improve learning motivation, which in turn can improve students' positive attitudes toward the lessons, including math. Thus it can improve students' mathematical problem solving abilities.

**CONCLUSION**

Based on the results of research and discussion can be summarized as follows: the Grade VIII students of SMPN 3 Bonegunu who were subjected in this study consisted of 20 students had reflective cognitive style and 23 students had impulsive cognitive style; (2) mathematical problem solving ability of SMPN 3 Bonegunu students who have reflective cognitive style gain: maximum score is 58.45; minimum score is 32.68; average score is 45.28; standard deviation is 3.26 and students who have impulsive cognitive style gain: maximum score is 39.84; minimum score is 28.42; average score is 39.85 and standard deviation is 3.68; (3) factors causing the low ability of mathematical problem solving of students in SMPN 3 Bonegunu is the lack of practicing matters related to mathematical problem solving ability and teachers have not used strategies and learning models yet that can improve students' mathematical problem solving ability.

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