Elementary School Student's Multiple Intelligence in Mathematical Problem Solving

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Abstract: The characteristics of the students is very diverse, one of which is intelligence. There are eight kinds of intelligence, namely 1) linguistic intelligence, 2) mathematical intelligence, 3) visual-spatial intelligence, 4) kinesthetic intelligence, 5) musical intelligence, 6) naturalist intelligence, 7) interpersonal intelligence, and 8) Intrapersonal intelligence. Based on the theory that Gardner has revealed, human intelligence is not single. So multiple intelligences of the students' needs to be analyzed through the way of problem solving done by students. The aim of this research was to describe the multiple intelligences of elementary school students in solving mathematical problems. The object of this research is the students of grade V MI Hasanuddin Gedangan-Sidoarjo. The research was a qualitative descriptive research because of the data obtained is data in the form of descriptive sentences and visual images. Implementation of this research is done in 5 stages, that is initial phase include literature study and empiric study, test preparation phase, main stage giving question to student, data analysis phase, and reporting stage. From the research that has been conducted, it is known that the dominant multiple intelligences in the students influence the way students think in solving math problems.

1 INTRODUCTION

Anita E. Woolfolk (in Joseph, 2006: 106) suggests that according to the previous theories, the intelligence includes three definitions, namely (1) the ability to learn; (2) the overall knowledge gained; and (3) the ability to adapt successfully to the situation or the environment in general. The intelligence of the students themselves is not only single but covers various fields. According to Gardner (2011), there are eight kinds of intelligence, 1) linguistic intelligence, 2) mathematical intelligence, 3) visual-spatial intelligence, 4) kinesthetic intelligence, 5) musical intelligence, 6) naturalist intelligence, 7) interpersonal intelligence, and 8) Intrapersonal intelligence. Schmidt (2003: 32) argues that intelligence is a collection of pieces of ability that exist in different parts of the brain. According to him, all these pieces are interconnected, but do not work independently. And most importantly this piece is not static or determined since someone was born. Intelligence can develop throughout origin is fostered and improved. This opinion is almost similar to the opinion of Armstrong (2003: 1) that the most important thing for us is to realize and develop all

kinds of human intelligence and combinations. Ariany, et. All (2017) said that the lecturer needs to know the dominant intelligence in the students, so that the lecturer can plan the learning which is relevant to the students' intelligence. Willis and Johnson (2001) stated that teachers' strategies may vary from establishing specific times of direct instruction using various methods to setting up multiple-intelligence centers or stations that students visit at flexible times throughout the day. Although all children will benefit from experiences with all intelligences, teachers can encourage students to "learn" on their strengths to achieve mathematical understanding.

The characteristics of multiple intelligences in mathematics will be explained in detail.

1. Verbal-Linguistic Intelligence: According to Munro (1994), students with verbal-linguistic intelligence will feel easy to convert numerical data into verbal data. they can think better through discussion, argument, and verbal explanation.
2. Logical-Mathematical Intelligence: Logical-mathematical intelligence is concerned with the ability to process numbers and/or skills using

logic such as: interested in manipulating the environment and tend to prefer a trial-and-error strategy, relatively fast in counting activities, likes to count, and likes strategy games like games Javanese chess, tends to easily accept and understand the explanation of cause and effect.

3. Visual-Spatial Intelligence: Visual-spatial intelligence is concerned with the ability to accurately capture color, direction, and space and to change its capture into other forms such as decoration, painting, painting, sculpture. A person with visual-spatial intelligence can imagine things, giving birth to ideas visually and spatially (in the form of images or visible forms of the eye) (Armstrong, 1996). According to Supit (2003: 39) people with visual-spatial intelligence can estimate the distance and existence of himself with an object.

4. Kinesthetic Intelligence: The student with this intelligence, can think easily through body movement, for example he can understand the graph by moving his finger through the graph, he will do some movement to understand something. (Munro, 1994)

5. Musical Intelligence: Musical intelligence deals with the ability to capture sounds, differentiate, compose, and express themselves through rhythmic, rhythmic sounds or voices, and tapping objects to the table at the time of writing or drawing. They tend to enjoy playing musical instruments or even playing music with unused objects.

6. Naturalist Intelligence: Naturalist intelligence relates to the proficiency in recognizing and classifying flora and fauna in their environment. This intelligence also relates to one's love of natural objects, animals, and plants. Naturalist intelligence also characterized by sensitivity to natural forms, such as leaves, clouds, rocks.

7. Interpersonal Intelligence: This intelligence involves many skills, namely the ability to empathize with others, the ability to organize a group of people toward a common goal, the ability to recognize and read other people's thoughts, the ability to make friends or establish contacts (Armstrong 1993: 11, 2002: 21-22). Interpersonal intelligence is built on the core ability to recognize differences, especially major differences in mood, temperament, motivation, and intention (Gardner 1993: 23).

8. Intrapersonal Intelligence: Intrapersonal intelligence deals with the internal aspects of a person, such as, the feelings of life, the range of emotions, the ability to distinguish emotions,

mark them, and use them to understand and guide their own behavior (Gardner 1993: 24-25).

According to Wardhani (2010: 39), mathematics problems can be distinguished in two types, namely: 1) Routine problems, it can be solved by following procedures that may have been studied. Routine problems are often referred to as the problem of translators because the description of the situation can be translated from words into symbols. 2) Non-routine problems lead to process problems, requiring more than simply translating problems into mathematical sentences and the use of known procedures. Non-routine issues require solving the problem by creating their own troubleshooting methods. Based on Aldover (2018), mathematical problem solving is a performance assessment test that requires judging a student's overall performance on a problem, making it more complex than simply marking an answer right or wrong.

In every type of the intelligences, students have their own way to solve the problem. Therefore, Cheng (2017) said that normal-school mathematics students should give the answers to mathematical problems through independent thinking and extensive reading of literature, improve the process of solution through team discussion, and turn MPSA internal force into mathematical literacy through the problem explaining. According Polya (1973: 222-224) step in solving the problem are: 1) Understanding the problem (understanding the problem) 2) Planning a plan (devising a plan) 3) Carry out the calculation (carry out a plan) 4) Re-examining the process and results (looking back at the completed solution).

The important of multiple intelligence in solving mathematics problems was known from the result of the research done by Eissa and Mostafa (2013). It was investigated the effect of using differentiated instruction by integrating multiple intelligences and learning styles on solving problems, achievement in and attitudes towards math in six graders with learning disabilities in cooperative groups. From this research, it is known that differentiated instruction by integrating multiple intelligences and learning styles on solving problems , achievement in, and attitudes towards math in the target students was effective. Another study aims to investigate the relationship between Gardner's theory about multiple intelligence and mathematics learning was done by Niroo, et. al. (2012). The result of the study was indicated that in the case of pre-test, there exists a significant relationship between the mathematical intelligence and students' mathematical functioning in general and in levels of application and reasoning; however, in the level of knowing there does not exit such

relation. The research done by Ariany, et. Al. (2017) reported that every student has a dominant intelligence, interpersonal intelligence is the dominant intelligence that most students have from the eight types of intelligence in multiple intelligences. The implications of this study are that students become aware of their dominant intelligence so that they are more confident. So, according to the result of recent study about multiple intelligence, it is important to identify student's multiple intelligence to determine the effective method of teaching that can facilitate student with diverse intelligence to learn in the class.

2 RESEARCH METHOD

The research was a qualitative descriptive research because of the data obtained were descriptive sentences. This research was conducted in 5th grade students of MI Hasanuddin Tebel-Gedangan-Sidoarjo in the academic year 2015/2016. The steps of this research were as follows:

2.1. The initial phase of the study was literature studies and empirical studies. The study of this literature was conducted to obtain various theories about multiple intelligences. While the empirical study is to get a description of the student's achievement of the students in grade 5 in MI Hasanuddin Tebel, as well as to get a general overview of the student's multiple intelligences. Empirical study was done by giving a questionnaire to find out the dominant multiple intelligence of students in grade 5.

2.2. Implementation Phase. The implementation phase was held in two phases that can be explained as follows:

    a. Compile the problems for mathematics problem solving test. The problem compiled has been adjusted to the characteristics of each intelligence. The next step was expert validation, this step was aimed to get advice for the appropriateness of the problems compiled.

    b. The implementation of the research. The problems that have been compiled will be given to the subjects to be solved individually. Then, they will be interviewed to know the steps to get the test results. During the students did the test, the researcher observe the attitude shown by students.

2.3. Data Analysis

    a. Analysis of the data, the researcher analyzed to know the multiple intelligences of students who are known from the steps of student work and it will be compared to the characteristics of multiple intelligences that have been obtained from the literature study and empirical study in the early stages of the research

    b. Make a conclusion.

3 RESULT AND DISCUSSION

At the beginning of the research, all grade 5 students in MI Hasanuddin were given a questionnaire to find out the dominant multiple intelligences of each student. From this test, researcher has known that the students in the class have not only one intelligence. But, from the result researcher would find out the student with dominant intelligence to do the mathematical problem-solving test. The researcher selected seven research subjects with different intelligence then given a mathematical problem-solving test. After being given a problem-solving test, the student was interviewed to get the validity of the test results.

The result and discussion of the research was explained as follows.

3.1 Verbal-Linguistic Intelligence

Polya Problem Solving Steps	Number of Problem				
	1	2	3	4	5
Understand the problem	Very Good	Very Good	Very Good	Very Good	Very Good
Devise a plan	Good	Not good	Good	Very Good	Good
Carry out the plan	Very Good	Not good	Very Good	Very Good	Good
Look back	Good	Not good	Good	Very Good	Good

Based on the Polya's steps, the work of students is follows:

Students with linguistic intelligence like activities related to Language. She loves reading or telling stories. She easier to understand the meaning of the story given by the researcher. As for the matter of geometry that contains the image of a plane combined, he found it difficult.

3.2 Logical-Mathematics

Based on the Polya's steps, the work of students is follows:

Polya Problem Solving Steps	Number of Problem				
	1	2	3	4	5
Understand the problem	Very Good	Very Good	Very Good	Very Good	Very Good
Devise a plan	Good	Good	Good	Very Good	Good
Carry out the plan	Very Good	Good	Very Good	Very Good	Good
Look back	Good	Good	Good	Very Good	Good

Students with logical-mathematical intelligence like calculating activity. This student loves mathematics subjects. Student with logical-mathematical intelligence, in formulating the problem, he wrote somethings that were known and asked from the story in the answer sheet and solve it well. This student did the test in order and every step of the answer detailed. Students with logical-mathematical intelligence cannot write a detailed explanation of his answer.

3.3 Visual-Spatial Intelligence

Based on the Polya's steps, the work of students is follows:

Polya Problem Solving Steps	Number of Problem				
	1	2	3	4	5
Understand the problem	Good	Very Good	Good	Good	Good
Devise a plan	Good	Very Good	Very Good	Not good	Very Good
Carry out the plan	Very Good	Very Good	Very Good	Not good	Very Good
Look back	Good	Very Good	Good	Not good	Very Good

Students with visual-spatial intelligence tend to get easier to solve the geometric problem. He likes to make some illustrations by drawing in the paper about the problem to understand the meaning of the problem. As in working on the story problem at number 1, he understood the purpose of the matter by drawing the shape of the wheels of the car and the bicycle wheel, then he finished it in mathematical form.

3.4 Kinesthetic Intelligence

Based on the Polya's steps, the work of students is follows:

Polya Problem Solving Steps	Number of Problem				
	1	2	3	4	5
Understand the problem	Not good	Good	Not good	Not good	Not good
Devise a plan	Not good	Good	Not good	Not good	Not good
Carry out the plan	Not good	Not good	Not good	Not good	Not good
Look back	Not good	Not good	Good	Good	Good

The favorite activities of kinesthetic students were physical activities. Students with kinesthetic intelligence tend to move around, such as moving their legs and arms, such as tapping their ballpoint pen on the table, shaking their legs, and like to move places when they feel bored. When thinking, he tends to make movements to describe his ideas.

3.5 Musical Intelligence

Based on the Polya's steps, the work of students is follows:

Polya Problem Solving Steps	Number of Problem				
	1	2	3	4	5
Understand the problem	Not good	Very Good	Good	Good	Good
Devise a plan	Not good	Good	Very Good	Very Good	Good
Carry out the plan	Not good	Not good	Very Good	Very Good	Not good
Look back	Not good	Not good	Good	Good	Not good

Musical intelligence tends to influence a person to play music. In reading the subject he tends to read it aloud so that he himself can hear his voice. Students with this intelligence, at the beginning of the test, he did not solve the problem well because the test is done in a quiet place. He can work well while working while singing. Of the five test questions he can only do two things well. As for the other three questions he can only understand the problem of the problem, only when he finds the results, he is not careful or not check back results.

3.6 Interpersonal Intelligence

Based on the Polya's steps, the work of students is follows:

Polya Problem Solving Steps	Number of Problem				
	1	2	3	4	5
Understand the problem	Good	Good	Good	Very Good	-
Devise a plan	Not good	Not good	Good	Very Good	-
Carry out the plan	Good	Not good	Very Good	Very Good	-
Look back	Not good	Not good	Good	Very Good	-

Students with interpersonal intelligence tend to be sociable. In solving mathematical problems, he prefers to work in groups. He likes to work in a discussion, and he leads the discussion. This student misinterpreted the number 1 problem as his friend did. So, the answer is written less true. For question number 2, he did not finish completely. Based on the

interview, the student said forgot the formula determines the plane area. At number 3, 4 and 5, can be done well.

3.7 Intrapersonal Intelligence

Based on the Polya's steps, the work of students is follows:

Polya Problem Solving Steps	Number of Problem				
	1	2	3	4	5
Understand the problem	Not good	Good	Good	Very Good	Good
Devise a plan	Not good	Good	Not good	Very Good	Not good
Carry out the plan	Not good	Not good	Not good	Very Good	Not good
Look back	Not good	Not good	Not good	Good	Not good

Unlike students with interpersonal intelligence, students with intrapersonal intelligence tend to be alone. This student can only solve the problem number 4. While the other problems are not done completely or the answers written are direct and incorrect answers. During the test, the student is also less active in asking questions, either to the researcher or to her friends. Researchers judge that he is an introvert person, so he cannot tell his feelings/thinking to others well.

4 CONCLUSIONS

Based on Gardner's Theory, there are eight multiple intelligences. On this research, the students not only have single intelligence, but also other intelligence as their inferior intelligence. Teacher need to identify student's intelligence to determine the effective method of teaching that can facilitate student with diverse intelligence to learn in the class. It is because of the intelligence of students influence their way to solve the problem. Students usually use their dominant intelligent to achieve their best way to learn.

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