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Multiple Mathematical Representation Profile of Grade VIII Based on Multiple Intelligences

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Multiple Abstract- *mathematical representation is important to be pondered Because It can enhance the student's ability to represent ideas in a variety of problem-solving solutions. When representing mathematical problems, each student will have a different profile Likely. The differences are possible due to different students have intelligence. This study Aimed to describe the multiple mathematical representations profile of the eight grade students based on multiple intelligences. This research is a descriptive qualitative research with three research subjects. The results Showed that the S1 outlined the process of working on each stage with the aim to explain and elaborate on her ideas to others. In working on this matter, S1 used equation by outlining every step of the process. This is in line with the student's character as the Linguistics Subject. S2 is incompatible with the possessed dominant intelligence. Because in children theory, those who have visual-spatial intelligence will be working in graphic. Consequently, S2 work using the equations were not thorough because she did not understand the meaning of the questions. S3 answered with a short way in accordance with the multiple intelligence theory that logical-mathematical subjects are in the high-speed counting. However in the ability of multi-representation, he can only express graphics and equations ideas but he has forgotten the graphic stage.*

Keywords: *profile, mathematic multiple representation, multiple intelligences*

I. INTRODUCTION

The transition from arithmetic to algebra is quite difficult for students because it requires students to make many adjustments even they are quite capable in arithmetic. Kieran (2004) suggested adjusting the algebra that focuses on relationships and not just counting numbers, focuses on representing and solving problems. Most of students, when given the algebra problem, they calculate it directly while abandoning an attempt to understand the meaning of the question, the relationship of each sentence so that they suffer from difficulties in solving problems and representing it. Dobrynina & Tsankova (Sukmawati, 2015) stated that to facilitate the transition from arithmetic thinking to algebraic thinking, the students should develop an understanding and possessing experience with the ideas from early algebra school.

Algebraic thinking skill is closely related to the mathematical representation because to be able to think well, algebra students should have good representation capabilities as well. The ability of a mathematical representation is one of the general purposes from mathematics learning at school. In thinking of algebra, students are able to do generalization ability, mathematical modeling and problem solving. To do all three skills in algebraic thinking, students need to be able to do multi-representation in the form of images, graphs, charts, and other forms of representation. With multi-representation, problems that are initially seem to be difficult and complicated can be seen more easily and simpler so that the presented issues can be solved more easily.

Based on Mudzakkir research (2006), the ability of junior high school students in Indonesia in representing ideas or mathematical concepts in the material of representing ideas or mathematical concepts in the division and numbers material, algebra, geometry, data representation, analysis and opportunities, are still regarded below the expectation. For instance, when students are asked to create a semblance of a table that represents the relationship between two variables, it turned out that representation ability of Indonesian students was 27%, while the ability of the international average is 45%. This is because Indonesian students are lack of ideas in expressing their opinion in solving mathematical problems.

In mathematical learning, when students are given a problem or question by the teacher, in resolving the issue, the students tend solve it in similar way as the examples that have been given by the teacher.

Consequently, students simply imitate and memorize the way the teacher resolves the issue. This is because they assume that the answers given by the teacher in the example is the only correct answer. Besides, the teacher does not attempt to provide answers about the possibility of more than one solutions, so that the students' ability to express ideas are low.

The ability of mathematical diverse representation is the ability to pour, state, translate, disclose or make a model of the ideas or mathematical concepts in new diverse mathematical forms. Some of diverse mathematical representation may be in form of charts, graphs, tables, expressions or mathematical notation and writing in their own language (Mudzakkir, 2006).

According to Pape & Tchoshanov (Luitel, 2001), there are four ideas that are used to understand the concept of representation, namely; 1) The representation can be seen as an internal abstraction of mathematical ideas or cognitive schemata built by students through experience, 2) as a reproduction of the mental from the mental state previously, 3) as a structured grain through images, symbols or emblems, 4) as the knowledge of something that represents something else. Based on the experts' opinion, it can be concluded that the ability of multi-representation is a student's ability to represent ideas in the form of charts, graphs, tables, mathematical expressions and words.

According to Ainsworth (Mehmet, et al, 2010), there are three main functions of multi representation, i.e., as a supplement in cognitive processes, helping to limit the possibility of misinterpretation, and building understanding of the concept in more depth. In addition to the above three main functions, multi representation also serves to explore the differences in the information declared by each interpretation. Multi representations tend to be used to complement each other where no single representation could not cover all delivered information. There are at least five important reasons of why multi representation is excellently useful for Mathematics learning, namely: 1) Learning multi representation helps learners who have different intelligence background. 2) The quantity and concepts of a physical nature can often be visualized and understood better by using representations. 3) Helping constructing other, more abstract representations. 4) Qualitative Reasoning is often aided by using a concrete representation. 5) an abstract mathematical representation can be used for quantitative reasoning which mathematical representations can be used to search for a quantitative answer to the question.

Chatib (2009: 12) stated that every person in the world has a basic character such as: different potential, interests and talents. This difference affects a person in perceiving and solving a problem. It means the student's ability to represent the problem depends on the individual ability relating to a person's intelligence. Because solving problems are important to be studied and in relation to the individual intelligence, researcher wants to know how the students' actual ability works in solving mathematical problems based on the dominant intelligence possessed by students.

II. RESEARCH METHOD

This study used a qualitative research with the descriptive qualitative as the method. This method is aimed to describe students' multi-mathematical representation ability based on their multiple intelligences. In the planning stage, the researcher compiles multiple intelligence tests to determine the subject of research, devises multi-representation test and interview. Phase of collecting data is using appropriate multi-representation test indicator and interviews. The main instrument is the researcher. In data analysis stage, the researcher uses reduction and conclusions, and also uses triangulation techniques.

III. RESULTS AND DISCUSSION

Result analysis for Representative Mathematical Ability Test

From the result of students' intelligence questionnaire, the researcher found three students based on the acquisition of three highest scores on the logical-mathematical, linguistic and visual-spatial. In this study, the researcher only limited on the three intelligence because the three intelligence that closely linked to mathematics is logical-mathematical, linguistic and visual-spatial. After getting the subjects, the

researcher conducted a written test and interview on the algebra material. The list of students selected in table 1.1, namely:

Table 1. List of Name of the Selected Students

No.	Student's code	Type of Intelligence
1	S1	Linguistic
2	S2	Spatial
3	S3	Mathematic Logic

The multi-representation ability in this study is related to the Two Variables of Linear Equations material. The expected answer maybe in form of words, diagrams/ pictures, and also can be deciphered in accordance with the formula.

A. Analysis on Student 1 (S1) with Linguistic Intelligence

1. The ability of the linguistic intelligence

   S1 represents students with intelligence Linguistics. Suparno (2003: 29) stated people with Linguistic intelligence has the ability to use language and words, both written and spoken in many different forms to express their ideas. They tend to be easier to learn by listening and verbalization. This ability is related to the use and development of language in general. People who have high linguistic intelligence will speak fluently, good and complete. It's easy to develop knowledge and language skills, it is easy to learn several languages. The person can easily understand the order and meaning of words in language learning, it is easy to explain and communicate ideas to others.

2. Result of the Student's Answer

   The following is an analysis of the answers to the student's multi-representation ability based on test,

   a. On the first question, S1 outlined using gradient formula to figure out the type of the equation slope 3 x + y = 4. Answer was disclosed properly.
   b. The second question, S1 also outlined the answers based on worth properties. However, the solution was not appropriate. In step 3, S1 added a second segment with (-4). But the results in step 4, S1 should have subtracted both sides by (y). However, the right-hand side had just been added to the y. As a result, the value of y that should have ridden down, has ridden up.
   c. S1 answer on this number was correct. With the same question a and b, S1 outlined answer according to the given equation to obtain the correct answer.

   In general, S1 solve the problem by means of equations

Analysis of the results of interviews with student
T = So, is the slope positive or negative?
S1 = Negative Ma'am, this is -3.
T = That's right, where did you get -3?
S1 = From the m value ma'am. Because before -3 is x, so the results of its m is -3. is it is not?
T = Yes, it's true
T = now go to the question b, why is y = 11?
S1 = here is the way ma'am.
T = Try repeat the way again carefully and see whether the steps are correct.
S1 = according to me, it is true ma'am. It's a 3 x 5 + y = 4, so 14-4 = y, then y = 11
T = Oh really?, let's see the step three, it is true, see the next step, why is y moved to the right side?
S1 = both are equally minus 4 ma'am.
T = The one you substracted is only 4 right?
S1 = the left one also, it's a y- 4.

T = OK, take a look at this, the right-hand side is added by y? why is the left side y is missing? If both are added, both should be right 2y.
S1 = oh yes yes ma'am .. it is my mistake..y should be omitted
T = the correct one is 15+ y - 4 = 4-4, so 15 + y - 4 = 0, so 15-4 = -y
S1 = -y?
T = it is because it has moved sections
S1 = I dont remember ma'am
T = Question c is easy right?
S1 = yes ma'am, I could do it. This is -5 and it is inserted to the value of y, so, the x = 9: 3 = 3.
T = Absolutely.

3. Conclusion
Eventhough S1 student still made mistake in calculating the problem due to carelesness, but in the process of working, S1 outlined the process of working on each stage with the aim to explain and elaborate on his ideas to others. in working on this matter, S1 used equation in outlining every step of the process. This is consistent with the character of the student as the subject of linguistics. But in a multi-representation point of view, the student only worked on one idea, namely to the equation.

B. Analysis of Students 2 (S2) with Visual Spatial Intelligence

1. The ability of visual-spatial intelligence
S2 represents student with visual-spatial intelligence. Suparno (2003: 29) stated that the visual-spatial intelligence covers a person's ability to understand the relationship more fully between objects and space. Students have the ability, for example, to create a form of imagination in his mind or the ability to create three-dimensional shapes. The ability to imagine a tangible form and then solve various problems in connection with prominent ability is the type of visual-spatial intelligence. People who have good visual-spatial intelligence can easily imagine three-dimensional objects in the room, it can describe the position with good space, has an active imagination, can express ideas in a graph more clearly and concisely.

2. Result of the Student's Answers
The following is student's answer analysis to the multi-representation ability based on test.
a. Question a was answered very briefly. S2 immediately applied a gradient formula. Using the equation of the gradient, S2 changed the early equation form 3x + y = 4 to y = -3x + 4. So, the value of m was automatically the next coefficient x.
b. In question b, S2 misinterpreted the problem. The initial equation was added to 2 while principally, only the value of x was added 2. Consequently, S2 answer in this question was incorrect.
c. Question c was answered correctly. S2 used equation ways.

Here is the analysis of the results of the interview
T = is question a difficult??
S2 = No Ma'am. This one I can do it.
T = Besides this way, do you have another way?
S2 = Emmmm, another way? Well, Ma'am, I only know working with this way.
T = Yes, it is alright
T = How about question b? Why is the result like this?
S2 = I can't do it ma'am. I do not know how.
T = Look carefully at the question, what is it that you need to add?
S2 = if the value of x is added by 2, the value of x-right ma'am?

T = your understanding is correct, let's give it a try, where is x?
S2 = this, (pointing to equation in question)
T = Is that so? Try doing it again, 3x + y = 4. Are all of the values x?
S2 = oh yes, this equation yes ma'am, no x and no y. But I do not know how to add it.
T = the value of x only, the last x value is 3, if x = 3, what was the value in part A?
S2 = part A? If x = 3 then y = 4.
T = Now change the value of x to 5, because it is added by 2. Well?
S2 = please give me a moment ma'am ...so if x = 5, y = - 11. Right ma'am?
T = True. So, does the Y value ride up or ride down?
S2 = from 4 to -11, rides down right ma'am?
T = True. Be more meticulous yes...
T = How about question c?
S2 = I could do this. It is easy Ma'am, the value of y is replaced by -5, so the result is 3.
T = true.

3. Conclusion
Although the S2 intelligence that stands out is the visual spatial, but when working on the problems, she did not do it in accordance with the possessed dominant intelligence. Because in children theory, those with visual-spatial intelligence will be working on the problem in the graphic. Then S2 work using the equations were not thorough because she did not understand the meaning of questions so that the answers are wrong though in interview, S2 has just realized it.

C. Analysis of Student 3 (S3) with Logical-Mathematical Intelligence

1. The ability of logical-mathematical intelligence
S3 represents student with mathematical logical intelligence. Suparno (2003: 29) states that logical mathematical intelligence includes a person's ability to think inductively and deductively, according to the rules of logic to think, understand and analyze the patterns of numbers, and solve problems by using the ability to think. Students who have high mathematical logical intelligence have high-speed in counting and solving mathematical problems.

2. Results of the Student's answers
The following analysis is the answers to the student's multi-representation ability to problems.
   a. S3 solved question a with the equation. S3 transformed the original equation into the general equation for the gradient, i.e. y = mx + c. From the initial equation, y = -3x + 4 was obtained. Thus, the value of m was -3, with a kind of negative slope.
   b. S3 misinterpreted the matter. The original equation was entirely written by 2. Thus the question b was answered wrong.
   c. In question c, S3 directly substituted value of -5 to y. The answer was true.

   In general, S3 has solved the problem using equations.

   Here is the analysis of the results of the interview
   T = is there a problem finding the slope?
   S3 = my answer is negative. Because m = -3. I said this is not difficult.
   T = Besides this way, do you have another way?
   S3 = yes ma'am, I have been taught to use the puzzle line. But I forgot.
   T = Yes, it is alright. Your answer is correct
   T = How about question b? Why this?
   S3 = I forgot ma'am.
   T = Look carefully to the question, what is added here?
   S3 = this one right Mom? This 3x is added by 2

T = your understanding is correct, try doing it again, but why do all the equations are added by 2?
S3 = I do not know how ma'am.
T = Yes very well then.
T = How about question c?
S3 = Yes, I know this one ma'am.

3. Conclusion
S3 as subject who has logical mathematical intelligence made a mistake in the second question because she misunderstood the meaning of the question. S3 used similarities and could use the graph but she has forgotten about the way. S3 answered with a short way in accordance with the multiple intelligence theory that logical-mathematical subject is very fast in counting. However, in multi-representation ability, she can only express ideas graphically and use equations but has forgotten the chart stage.

IV. CONCLUSION AND RECOMMENDATION

The importance of this study was to determine the student's multi-representation ability based on linguistic, visual spatial and logical-mathematical intelligence. By knowing these capabilities, the teacher can package the learning and teaching materials according to the ability and intelligence in expressing many ideas.

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