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The Ability of Mathematical Representation of Junior High School Students on Circle Material Based on Gender Differences

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Abstract

Mathematical representation is the ability to express ideas or definitions raised by the students when solving problems. At now, most students have difficulties in the ability of mathematical representation. The difficulty of this mathematical representation needs to be analyze the causes, including analysis based on gender differences. This type of research is a qualitative study which aims to systematically describe the ability of mathematical representation based on gender differences. The subjects of the study was grade IX students at SMP Negeri 4 in Natar, South Lampung. Research subjects numbered 31 people, consisti of 16 boys and 15 girls. Data was collected through tests and observations, and data were analyze descriptively based on 3 indicator levels, namely visual representations, mathematical expressions or similarity, and written words or texts. The results showed that there were differences in representation when viewed regarding gender, where girls make more representation than boys.

Keywords: ability of mathematical representation, gender differences

Introduction

Representation is a form of the interpretation of students' thoughts on a problem, which is used as a tool to find solutions of these problems (Sabirin, 2014). The ability of mathematical representation is a one of the general objectives of learning mathematics in schools. The general goal of learning mathematics in schools is to obtain an ability called mathematical power which includes: (a) learning to communicate (mathematical communication), (b) learning to reason (mathematical reasoning), (c) learning to solve problems (mathematical problem solving), (d) learning to associate ideas (mathematical connection), (e) learning to represent (NCTM, 2000).

This ability is very important for students and is closely related to communication skills and problem solving. Someone needs a representation in the form of pictures, graphs, diagrams, and other forms of representation to be able to communicate something (Sabirin, 2014). The representations raised by students are expressions of mathematical ideas or thought in their efforts to find a solution to a problem. Representation is also useful as a means of communicating students' mathematical ideas to other students as well as to the teacher (Sabirin, 2014). When students are dealing with a mathematical problem, students can present any information in the problem into a form or model that represents the problem so that solutions can be found (Nurhanurawati, 2019). However, although the use of varied representations is important for students, teachers usually remain in a type of representation in their class; i.e. symbol notation (mathematical representation) (Lie, et.al., 2011).

Representation is a something else in some manner (Goldin, 2001). As quoted Gagne (Hwang & Chen, 2007) that some studies emphasize the ability of good mathematical representation of students is the key to successful mathematical problem solving. Representation means the modeling of concrete things in the real world into concepts or

symbols of abstraks. (Hwang & Chen, 2007) Representations can be thought as externalizations of students mental models that can be manipulated, and used as shared information (Kalathil & Sherin, 2000).

The ability of mathematical representation can be measured by the achievement indicators of that ability. Mathematical representations can be grouped into three types of representations, namely 1) visual representations in the form of diagrams, graphs, or tables, and figures; 2) Equations or mathematical expressions; and 3) Words or written text (Armadan, et.al., 2017; Indri, et.al.; 2018; Kholiqowati, et.al., 2016; Nurhanurawati, 2019; Wijaya, 2018). (Safitri et.al., 2015) distinguishes between enactive, iconic and symbolic representations. At this research, the ability of mathematical representation regarding gender differences are rarely conducted.

While research on other mathematical abilities has been carried out by the researchers. Some researchers analyze the ability of mathematical representation in terms of learning styles (Sanjaya, et.al., 2018), kognitif style (Junita, 2016), and types of thinking (Kholiqowati, et.al., 2016). The results of the analysis generally show that the verbal representation of students is very lacking. The research results from (Hutagaol, 2013) support the improvement of students' mathematical representation abilities by using contextual learning.

Students' representation in mathematical word problem solving: exploring students' self-efficacy (Sahendra, 2018). Representation in mathematical learning and problem solving (Goldin, 2002). Process of mathematical representation translation from verbal into graphic (Rahmawati, 2017). Multiple representation skills and creativity effects on mathematical problem solving using multimedia white board system (Hwang & Chen, 2007). Role of students, representations in the mathematics classroom (Kalathil & Sherin, 2000).

Research Methods

This type of research is descriptive qualitative which aims to systematically describe the ability of mathematical representation in a circle material. The research was conducted in November semester one of the 2019/2020 school year, with the sample in the research activities being grade IX students at one SMP Negeri 4 in Natar, South Lampung. The selection of subjects in this study are based on recommendations from the school with consideration in one class that heterogeneous students have abilities with an even distribution of abilities between students with high, medium, and low abilities. Then obtained a class consisting of 31 students with details of 16 boys students and 15 girls students.

In this study there are 3 stages, namely (a) the preparatory stage, which is to make and study the problems contained in the field, make a background of theoretical studies, arrange instruments, prepare instruments, take care of licensing from the school by asking permission from the vice principal of Curriculum, then discuss with the chief of the MGMP mathematics subject to determine the schedule and class to be studied, (b) the implementation phase, i.e. conducting a test. This test is a question of the ability to represent as many as 3 items about the description in the circle material. The three items are to measure 3 indicators of mathematical representation ability, namely the representation of words or writing, mathematical expressions or equation, and visuals. To complete the research data, interviews were conducted with 3 students, consisting of high, medium and low representation ability students, and (c) the last stage was the evaluation stage. At this stage, data collection, data analysis, and making conclusions are carried out.

Problem description is (1) question number 1 to measure the indicator representation of words or writing, namely "Known two circles count the breadth of circle one and breadth of circle two with each radius of 2 cm and 4 cm. Do the two circles have a ratio of 1: 2? (explain)!", (2) problem number 2 to measure the indicator representation of equations or mathematical expressions, namely "A circular pool with a radius of 40 m. Around the edge of the pond a 5 m wide circular road was made. If the cost to make a road every 1m^2 is Rp.

15,000, calculate all costs to make the road!, and (3) question number 3 to measure the indicator of visual representation, namely "A circle with a radius of 3 cm is known. a). Inside the circle is made a square whose rectangular side alludes to the circle. Draw the position of the circle and the square, and calculate the area of the circle that is outside the square!. b) Outside the circle is made a square whose square edges allude to the circle. Draw the position of the square and circle, then calculate the area of the square outside the circle ".

Results and Discussion

When analyzing student answers, for question number 1 all students answer in the same way and most students have the correct answer. In answer number 1, there are some students who have not been able to write down how to complete the circle according to the correct rules. Boy students are still wrong in solving problems and messy arrangement and in solving problems by writing down the calculations used tend to write only final answers. While girl students write down problem solving and neatly arranged solutions and correct answers. Furthermore, in question number 2, most of the students were able to give explanations properly and correctly on the answers to problem solving. The boy students in writing the problem solving some then almost correct, while the girl students in the explanation well and correctly but there were stilled some students who were not able to give an exact explanation about the problem solving. Furthermore, in question number 3, most boy and girl students have not been able to present answers in the form of pictures correctly. In this answer, the researcher sees that students have not been able to draw along with an explanation in the picture for the next work process.

The results also showed there was differences in the ability of mathematical representation between boy and girl; and the difference is that girl students have higher capacity for representation than boy. The results of the analysis of the test answers show that girls are more systematic and detailed in the evidence than boys. Here is one example of student answers:

Jawaban diketahui

1. sari-sari 1 = 2 cm $A = \pi \times r^2 = 2 \text{ cm}$
 sari-sari 2 = 4 cm $= 3,14 \times 2^2 = 12,56$

$L_2 = \pi r^2 = 4^2 \times 3,14 = 50,24$ $L_1 = L_2$ 4
 $\frac{\pi r_1^2}{\pi r_2^2} = \frac{\pi r_1^2}{\pi r_2^2}$
 $r_2 = r_1 = 16:4$
 $= 4:1$


tidak ada perbandingan 1:2

diketahui

2. $\pi \times r_1^2 = 3,14 \times 40 \times 40 = 5024$
 sari-sari = 90 m seluruh biaya untuk membuat
 lebar = 5 m 256×2390.000

$\pi r_2^2 = 3,14 \times 45 \times 45 = 6357,850$
 $\pi r_2^2 - \pi r_1^2$ 3
 $(3,14 \times 40 \times 40) - (3,14 \times 45 \times 45)$
 $= 6307,826 \times \text{Rp} 15.000 = 133.450 \times \text{Rp} 15.000$
 $= 956,2390.000$ $= 20.2017.500,00$

3. a. diketahui
 sari-sari 3 cm
 a. $\pi \times r^2 = 3 \text{ cm}$
 $= 3,14 \times 2^2 = 12,56$

b. 

$B = \frac{8}{12} \times 100 =$


2. 

Figure 1. Example of student answers who meet the ability of representation

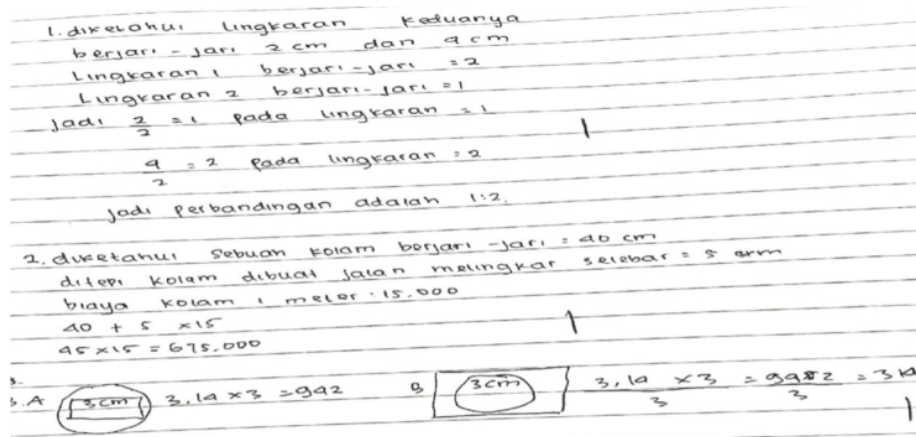


Figure 2. Examples of student answers who do not meet the ability of representation

Based on the analysis of the ability of mathematical representation of the indicators of word or written text in boy students can explain in a mathematically, reasonable but only some of them complete and correct, while for girl students the ability of mathematical representation of indicators of written words or text students write symbols and a formula that is consistent with the problem and in accordance with the indicator representation. Furthermore, the mathematical indicators or mathematical expressions, boy students can find mathematical models correctly, but wrong in getting a solution, while the mathematical indicators or mathematical expressions, boy students can find mathematical models correctly then do calculations or get solutions correctly and completely. Furthermore in, the visual representation indicator, boy students can paint a picture, but it is incomplete and incorrect, while for the ability of mathematical representation in visual indicators, girl students can also paint a picture, but it is in completing and incorrect.

One way to strengthen the results of the analysis, researchers also conducted interviews with 3 students with the highest, medium and low scores. Students with high scores say that the most difficult questions are numbers 3a and 3b, because of the difficulty in determining concepts. When presenting the results of the answers, the students seemed to understand the concept, Whereas students with medium scores said that the most difficult questions were 2, 3a, and 3b, when presenting the results of the answers they were less understanding the concept, lack of accuracy in calculating and reading questions, and students with low scores did not understand the concept, when presenting the results of the answers, they do not understand the difference in circumference and breadth of the circle, and do not understand the formula that must be used, so that students with low representation ability only do what students know. Students with low scores say that the most difficult questions are 1, 2, 3a and 3b.

The results of data analysis in this study indicate the existence of differences in representation. Based on mathematical abilities and gender of students, where those who have a high level of mathematical ability have a better representation power than students who have mathematical abilities are having bettered power of representation than students of low ability students. Indirectly from the results of this study stated that the level of girl mathematical influence ability students 'mathematical representation ability. The results of students' mathematical representation showed there were differences in representation if viewed regarding gender, where girls students gave more representation than boy students.

Conclusion And Suggestion

Conclusion

The results of data analysis in this study indicate the existence of differences in representation. Based on mathematical abilities and gender of students, where those who have a high level of mathematical ability have a better representation power than students who have mathematical abilities are having bettered power of representation than students of low ability students. Indirectly from the results of this study stated that the level of mathematical ability affects the mathematical representation ability of students.

The results of students' mathematical representation analysis shows there are differences in representation when viewed regarding gender, where girls students bring up more representations than boy students. Difficulties faced by dominant students are in questions number 3a and 3b with the type of questions that contain indicators of visual representation. The majority of students' mistakes in solving problems are not giving a mathematical explanation, in accurate when reading problems so that solving problems with incorrect perceptions, are not arranged logically, and in drawing pictures be less systematic, and calculation errors in getting solutions.

Suggestion

From the results and discussion, offered a suggestion in the from of approach and learning strategy that can improve the mathematical representation ability. The learning approach has the characteristics of learning focused on the learning process not the learning outcomes, in the steps of learning requires students to be able to analyze and present the results of writings, drawings, tables or other works, and communicate the results of the work.

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