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Mathematical representation ability of class VII students on ARIAS learning model viewed from self-renewal capacity

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Abstract

This study aims to describe: 1) The effectiveness of the ARIAS learning for mathematical representation ability; 2) The ability of mathematical representation viewed from Self-Renewal Capacity (SRC). The method used is mixed methods with a population of class VII students of SMP N 40 Semarang 2019/2020 school year. Samples were taken by random class technique, obtained VII C as an experimental class and VII B as a control class. Subjects were taken using the purposive sampling technique, and 9 subjects were selected based on the student's SRC category. The methods of data collection using tests, questionnaires and interviews. The results showed that (1) ARIAS learning was effective against MRA; (2) Subjects with high SRC tend to meet all indicators of MRA; subjects with moderate SRC, S-04 and S-05 tend to meet all indicators of MRA, S-06 were less able to write down the steps for solving mathematical problems in words; Subjects with low SRC, S-07 was less able to create mathematical equations or models from the representations given and write down the steps for solving mathematical problems in words, S-08 and S-09 were unable to create mathematical equations or models from the representations given and write down the steps for solving mathematical problems in words.

1. Introduction

Mathematics is one of the subjects that always exist from elementary school to college level. It can be said that mathematics learning has an important role in education. According to NCTM (2000), there are five standard processes that students must have in mathematics learning. Representation becomes the fifth standard process after problem solving, reasoning and proof, communication and connection.

A representation is defined as any configuration of characters, images, concrete objects etc., that can symbolize or "represent" something else (Goldin, 1998). Sabirin (2014) also emphasized that the representation itself is a form of interpretation of students' thoughts on a problem, which is used as a tool to find solutions to the problem. The form of students interpretation can be words, writings, pictures, tables, graphics, concrete objects, mathematical symbols and others.

According to Effendi (2012), students need a mathematical representation ability to find and make a tool or way of thinking that facilitates students' understanding in communicating mathematical ideas that are abstract to concrete. Problems that students considered it was complex will be easier to solve if the strategy and the use of representations are appropriate to the problem. Good student's representation ability will make it easier when creating model problems in the environment and find the right problem solving. So it can be said that mathematical representation ability is a way for students to convey their thoughts or ideas in the form of mathematical models as a solution to solving a mathematical problem.

Based on the results of PISA 2018, it is known that the mathematical ability of Indonesian students is still low, where Indonesia was ranked 72 out of 78 countries. In addition, based on the archive of 7th grade final semester assessment scores for odd semesters in the 2019/2020 school year at SMP Negeri 40 Semarang, obtained an average was less than the Minimum Completeness Criteria, which is 70.

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Then based on the results of an interview with one of the mathematics teacher of at SMP N 40 Semarang, can be known that the student's mathematical representation ability was still low. Student's answer of the final semester assessment shows that the students did not write down the steps for solving mathematical problems in words. In addition, students still made mistakes in solving equations and inequalities. The question and student's work result in the final semester assessment that show that their mathematical representation ability is still low can be seen in Figure 1.

37. Dari 80 orang siswa didata. Hasilnya 45 orang gemar bermain sepak bola, 40 orang gemar bermain voli dan 15 orang gemar bermain selain sepak bola dan bola voli.
    a. Gambarlah diagram Venn dari peristiwa diatas.
    b. Tentukan banyaknya siswa yang gemar sepak bola dan voli

37. From 80 students were recorded. The result are 45 people like to play football, 40 people like to play volleyball and 15 people like to play other than football and volleyball.
    a. Draw a venn diagram from the situation above.
    b. Determine the number of students who like to play football and volleyball.

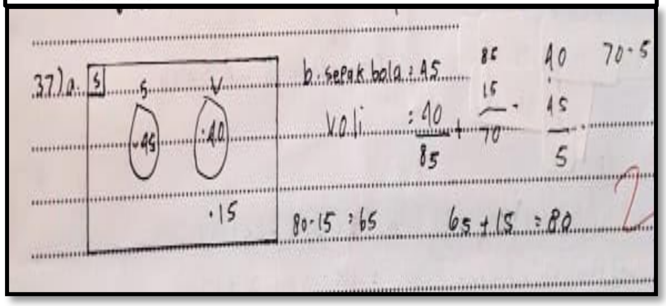

Figure 1. Student Work Results

Based on Figure 1, students have not been able to represent the questions well. This shows that students have not been able to make venn diagrams to clarify the problems in the given questions, as a result students have difficulty finding solutions for these problems. Students also did not write down the steps for solving mathematical problems in words.

In addition to the importance of mathematical representation ability in mathematics learning, students also need supporting skills to improve their mathematical representation ability. One of the skill is the ability to improve student performance. They must try to explore and develop their capacity to renew themselves or Self-Renewal Capacity (Suryana, 2016). Ståhle (1998) states Self-Renewal Capacity as the overall capacity of the organization to master change in strategy, operations, and knowledge. In line with this opinion, Bustanul in (Suryana, 2016) revealed that Self-Renewal Capacity is a person's capacity to always improve their performance through a process of learning and empirical reflection. Saarivirta (2007) states that the entire process in Self-Renewal which is carried out through exploitation, exploration, absorption, integration, and leadership is useful for increasing self-potential in learning.

Students who have a high Self-Renewal Capacity will be encouraged to always take advantage of the information and potential on their self. This information will help students achieve their learning goals. Suryana (2016) has conducted research and it was found that students' Self-Renewal Capacity is still low. This can be seen from the lack of enthusiasm of students in participating in learning activities, lack of interest in learning materials and the tendency to give up when they meet difficulty questions. Therefore, it is necessary to develop Self-Renewal Capacity in learning so that learning can be better.

A learning model that encourages students 'enthusiasm and interest in learning is needed to increase Self-Renewal Capacity in order to increase students' mathematical representation. ARIAS learning model (Assurance, Relevance, Interest, Assessment, and Satisfaction) is an alternative learning model that allows it to attract students' interest or attention during learning activities. According to a case study conducted by Susilawati (2015), the result was the increase in the mathematical representation ability of students with ARIAS learning model were better than students with conventional learning models.

Based on this description, the level of Self-Renewal Capacity is thought to have an influence on students' mathematical representation abilities. Thus, in terms of the importance of developing students 'Self-Renewal Capacity, which is closely related to mathematical abilities in the learning process, the ARIAS learning model can be applied to develop students' mathematical representation abilities. Therefore, the title of this research is "Mathematical Representation Ability of Class VII Students on ARIAS Learning Model Viewed from Self-Renewal Capacity" with the aim of research to determine the effectiveness of the ARIAS learning model for mathematical representation ability, and to describe students' mathematical representation abilities viewed from Self. -Renewal Capacity.

2. Methods

The type of research used in this research is mix method research with sequential explanatory design, where the first step are collecting and analyzing quantitative data, then in the second step is analyzed qualitative data. The quantitative method is used to analyze learning outcomes with ARIAS learning, while qualitative method is used to analyze mathematical representation ability viewed from Self-Renewal Capacity. Quantitative data were obtained from tests of mathematical representation ability and a Self-Renewal Capacity scale, while qualitative data were obtained from interviews with students.

The population of this research is all students of grade VII at SMP N 40 Semarang. The sampling technique was carried out by randomly selecting class Dewi (2017) and obtained class VII C as the experiment class and class VII B as the control class. The experiment class gain ARIAS learning and the control class gain PBL learning. Subjects are taken by purposive / purposeful sampling technique. Research subjects are taken based on the level of Self-Renewal Capacity of students categorized into low, moderate and high. Each of these categories was taken 3 subjects. The distribution of these categories can be seen in Table 1.

Table 1. Categories of Self-Renewal Capacity

Self-Renewal Capacity Scale Score (X)	**Category**
$X \geq \bar{x} + Sd$	High
$\bar{x} - Sd \leq X < \bar{x} + Sd$	Moderate
$X < \bar{x} - Sd$	Low

Source: Azwar (2019)
Information:
X : Subject SRC score
$\bar{x}$: Average SRC scale score
Sd : Standard SRC scale score deviation

The data collection method used the test method, the questionnaire method and the interview method. This test method is carried out to determine students' mathematical representation abilities, the questionnaire method is used to obtain data on the student's Self-Renewal Capacity category, and the interview method is used to obtain information about the mathematical representation ability in viewed from Self-Renewal Capacity of the research subject. The research instrument used was the mathematical representation ability test, the Self-Renewal Capacity scale, and the interview guide. The mathematical representation ability test instrument consisted of 4 items each containing 3 indicators in this study, that is (1) draw geometric shapes to clarify problems and facilitate resolution, (2) create mathematical equations or models from other representations given, and (3)) write down the steps for solving mathematical problems in words.. The test results were then analysed quantitatively, beginning with normality test and homogeneity test, then testing hypothesis. Meanwhile, the results of interviews and student tests were analyzed qualitatively to describe students 'mathematical representation abilities based on the students' level of Self-Renewal Capacity.

3. Results & Discussions

3.1. The Effectiveness of ARIAS Learning on Mathematical Representation Ability

The effectiveness of the ARIAS learning model on the ability of mathematical representation can be seen from the results of the mathematical representation ability test using several quantitative analyzes, including (1) one sample average completeness test, (2) one sample proportion test, (3) two average similarity test , and (4) two proportions similarity test. Before the four tests were carried out, the data on the results of the mathematical representation ability test in the experiment class and control class were tested for normality test and homogeneity tests. Then the results show that the data from the mathematical representation ability test results are normally distributed and have homogeneous variances. A summary of the results of the mathematical representation ability test of the two classes is presented in Table 2.

Table 2. Mathematical Representation Ability Test Results

Class	n	$\bar{x}$	s	Max	Min
Experiment	31	77.42	8.82	95	55
Control	30	71.33	9.37	93	53

The first quantitative test is the one-sample average completeness test which is carried out to find the individual completeness whether it that reached the Minimum Completeness Criteria that is 70. Based on the results of the mathematical representation ability test of students in ARIAS learning, there were 28 out of 31 students who completed it. In one sample average completeness test was obtained that $t_{count} = 4{,}68632 > 1{,}697 = t_{table}$. The test results show that the average mathematical representation ability in ARIAS learning more than 70 or can be called complete individually. This finding in line with research conducted by Lestari (2017) which shows that the ARIAS model learning was complete individually.

The one-sample proportion test became the second quantitative test carried out to test 75% of students complete the Minimum Completeness Criteria. Based on the results of the mathematical representation ability test of students in ARIAS learning, there were 28 out of 31 students who had completed the Minimum Completeness Criteria. On the one sample proportion test obtained. $z_{count} = 1{,}97021 > 1{,}64 = z_{table}$. The test results show that the proportion of students that reached completeness in ARIAS learning more than 75%. This finding is in line with the findings of Raharjo (2013) which shows that learning with the ARIAS model achieved classical completeness where 90% of students, that were 27 out of 30 students have passed the Minimum Completeness Criteria.

The third test is the two average similarity test to determine whether the average mathematical representation ability of students in ARIAS learning is more than the average mathematical representation ability of students in PBL. In two average similarity test was obtained that $t_{count} = 2{,}6135 > 2{,}002 = t_{table}$. This shows that the average mathematical representation ability of students in ARIAS learning more than the average mathematical representation ability of students in PBL. This finding in line with the findings of Dewanty (2017) which shows that the average mathematical representation ability of students with the ARIAS learning model more than the conventional model.

The fourth test is the two proportions similarity test to determine whether the proportion of completeness in ARIAS learning is more than the proportion of completeness in PBL. The test was obtained that $z_{count} = 2{,}749 > 1{,}64 = z_{table}$. This shows that the proportion of completeness in ARIAS learning more than the proportion of completeness in PBL.

Based on the analysis of mathematical representation ability test results, obtained that, (1) the average mathematical representation ability of the ARIAS model more than 70 or can be called completed individually, (2) the proportion of completeness in ARIAS learning more than 75%, or can be called completed classically, (3) the average of mathematical representation ability in ARIAS learning model more than the average of mathematical representation ability in PBL, (4) the proportion of completeness in ARIAS learning more than the proportion of completeness in PBL.

These results indicate that the ARIAS model is effective to improve mathematical representation ability. This is in accordance with research conducted by Susilawati (2015) that ARIAS learning model is effective in improving students' mathematical representation abilities. Other research conducted by Ifanda and Septian (2019) also shows that the increase in students' mathematical representation abilities by applying the ARIAS model is better than students who do ordinary learning. Therefore, the ARIAS learning model can be applied in learning to improve students' mathematical representation abilities.

3.2. Description of Mathematical Representation Ability in terms of Self-Renewal Capacity

The filling of the SRC scale was followed by 31 students of the ARIAS model class .Based on the results of the SRC scale analysis, three subjects were selected for each category of the student's SRC level. The subjects of this research can be seen in Table 3.

Table 3. The Subjects of Research

SRC level	Student Code	Subject Code
High SRC	E-01	S-01
	E-07	S-02
	E-02	S-03

Medium SRC	E-19 E-10 E-31	S-04 S-05 S-06
Low SRC	E-29 E-30 E-27	S-07 S-08 S-09

The research subjects were interviewed to determine the mathematical representation ability viewed Self-Renewal Capacity. From the result of the analysis of mathematical representation ability test and interviews, triangulation was carried out to obtain description of mathematical representation ability viewed from Self-Renewal Capacity

3.3.1 Description of Subjects with High Self-Renewal Capacity

Subjects with high Self-Renewal Capacity based on research results, subjects S-01, S-02, and S-03 tend to be able to draw geometric shapes to clarify problems and facilitate problem solving. Subjects S-02 and S-03 are able to draw geometric shapes completely and accurately on all question items, while subject S-01 is incomplete in giving information on the images of item 4. For indicators to create equations or mathematical model from the other representations given, the subjects S-01, S-02, and S-03 tend to be capable of this. Subject S-01 is able to create mathematical equations or models from other representations given on all items, while the subjects S-02 and S-03 are incomplete in writing mathematical equations or models from other representations given on one of the items. For indicators to write down mathematical problem solving steps in words, subjects S-01, S-02 and, S-03 tend to be capable of this. It's just that in one of the items, that is number 3, the subjects S-01, S-02 and S-03 are incomplete in writing down the steps for solving mathematical problems in words.

Based on the pattern of the subject with high *self-renewal capacity* on the three indicators of mathematical representation ability, in general the subjects S-01, S-02, and S-03 tend to be able to meet these three indicators well.

3.3.2 Description of Subject with Moderate Self-Renewal Capacity

Subjects with moderate Self-Renewal Capacity based on research results, subjects S-04, S-05, and S-06 tend to be able to draw geometric shapes to clarify problems and facilitate problem solving. Subjects S-04 and S-05 are able to draw geometric shapes completely and accurately on all question items, while the S-06 subject is incomplete in giving information on the images of item 2. For indicators to create equations or mathematics models from the other representations given, the subjects S-04, S-05, and S-06 tend to be capable of it. Subjects S-04, S-05 and S-06 are able to write equations or mathematical models from other representations completely and correctly on three items, while on one other item subject S-04, S-05, and S-06 is less complete and precise in writing equations or mathematical models from other representations given. For indicators of write down mathematical problem solving steps in words, subjects S-04 and S-05 tend to be capable of this, but S-06 subjects tend to be less capable because on three items they are not precise in solving mathematical problems.

Based on the pattern of the subject with moderate *self-renewal capacity* on the three indicators of mathematical representation ability, in general the subjects S-04 and S-05 tend to be able to meet these three indicators well. S-06 subjects tend to be able to draw geometric shapes to clarify problems and facilitate their solutions and tend to be able to create equations or mathematical models from other representations given, but tend to be less able to write down the steps to solve mathematical problems in words.

3.3.3 Description of Subject with Low Self-Renewal Capacity

Subjects with low Self-Renewal Capacity based on research results, subjects S-07, S-08, and S-09 tend to be able to draw geometric shapes to clarify problems and facilitate problem solving. Subjects S-08 and S-09 are able to draw geometric shapes completely and accurately on all question items, while subject S-07 is incomplete in giving information on the images of item number 2.For indicators to create equations or mathematics models from the other representations given, the S-07 subject tends to be less capable in this case because on 3 items S-07 writes mathematical equations or models incompletely and inaccurately, and for the subjects S-08 and S-09 tend to be unable to create mathematical equations or models from other representations given because on 2 items they are not able to create mathematical equations or models while for the other 2 items they are incomplete and precise in creating mathematical equation or model. For indicators of write down mathematical problem solving steps in words, the S-07 subject tends to be less capable in this case because he is not precise in solving mathematical problems, and subjects S-08 and S-

09 tend to be unable to write down the steps for solving mathematical problems because they do not write down the steps and solve mathematical problems according to the problems

Based on the pattern of the subject with low *self-renewal capacity* on the three indicators of mathematical representation ability, in general the subjects S-07, S-08 and S-09 tend to be able to meet the indicators of draw geometric shapes to clarify problems and facilitate resolution. S-07 subjects tend to be less able to create mathematical equations or models from other representations given and tend to be less able to write down the steps for solving mathematical problems in words. Subjects S-08 and S-09 tend to be unable to create mathematical equations or models from other representations given and tend not to be able to write down the steps for solve mathematical problems.

4. Conclusion

Based on the results of the study, it can be concluded that (1) the ARIAS learning is effective against students' mathematical representation abilities. (2) Subjects with high self-renewal capacity on the three indicators of mathematical representation ability, in general the subjects S-01, S-02, and S-03 tend to be able to meet these three indicators well (3) Subjects with moderate self-renewal capacity on the three indicators of mathematical representation ability, in general the subjects S-04 and S-05 tend to be able to meet these three indicators well. S-06 subjects tend to be less able to write down the steps for mathematical problem solving in words. (4) Subjects with low self-renewal capacity on the three indicators of mathematical representation ability, in general the subjects S-07, S-08 and S-09 tend to be able to meet the indicators of draw geometric shapes to clarify problems and facilitate resolution. S-07 subjects tend to be less able to create mathematical equations or models from other representations given and tend to be less able to write down the steps for solving mathematical problems in words. Subjects S-08 and S-09 tend to be unable to create mathematical equations or models from other representations given and tend not to be able to write down the steps for solve mathematical problems.

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