UJME 8 (2) 2019: 105-110
UNNES JOURNAL OF MATHEMATICS EDUCATION
https://journal.unnes.ac.id/sju/index.php/ujme/
ISSN: 2252-6927 (print); 2460-5840 (online)

The mathematical representation ability based on student's learning independence on problem based learning with scaffolding approach

Salma Mauludyah Rosayanti *, Mulyono

Department of Mathematics, Mathematics and Natural Sciences Faculty, Universitas Negeri Semarang, Indonesia

* *E-mail address:* salmamauludyah@students.unnes.ac.id

RETRACTED

ARTICLE INFO

Article history:
Received 15 April 2019
Received in revised form 14 July 2019
Accepted 16 August 2019

Keywords:
Mathematical Representation Ability;
Learning Independence;
Problem Based Learning;
Scaffolding

Abstract

Based on the initial mathematical representation ability test at Semarang State Junior High School 23, it shows that the mathematical representation ability is still low. Therefore, to improve students' mathematical representation ability, learning independence and supporting learning models are needed. Problem Based Learning with scaffolding approach as an effort to support learning activities. The method used for this research is a mix method with sequential explanatory design. The research population was class VII Semarang State Junior High School 23. The sampling technique uses simple random sampling. The results showed (1) Problem Based Learning with effective scaffolding approach to the achievement of mathematical representation capabilities; (2) The ability of mathematical representation on the subject of high learning independence is very good in fulfilling the three indicators of mathematical representation ability, subjects with moderate learning independence are good at meeting indicators of mathematical representation ability, subjects with low learning independence are not good enough in fulfilling mathematical representation abilities.

1. Introduction

National Council of Teachers of Mathematics (2000) states that in implementing mathematics learning in schools, educators must pay attention to the five main competency standards, namely problem solving skills, communication skills, connection skills, reasoning abilities, and representation. The ability to represent initially is still seen as part of mathematical communication skills. This can be seen in the National Council of Teachers of Mathematics 1989 which initially only recommended four basic competencies namely problem solving, communication, connection, and reasoning. However, after realizing that the ability of mathematical representation is something that always arises when someone learns mathematics at all levels / levels of education, the representation is seen as a component that needs attention. So that mathematical representation deserves to be emphasized and raised in the process of teaching mathematics in schools.

Based on the Program for International Students Assessment (PISA) it is known that the mathematical ability of Indonesian students is still low where Indonesia ranks 69 out of 76 countries with a math ability score of 355 from an overall average of 490 in 2015 (OECD, 2015). This shows that the mathematical abilities of Indonesian students are below the average among countries participating in PISA.

According to Daryono (2011), one of the factors influencing the low ability of representation is the learning process. Less effective learning results in low mathematical representation ability of students. Therefore, learning that should be implemented is student-centered learning. If students are accustomed to solving mathematical problems through an activity, then students will more easily develop mindsets and be able to improve the ability of mathematical representation. Problem Based Learning is one of learning that matches these criteria.

In Problem Based Learning students are required to learn independently. Independence is

To cite this article:
Rosayati, S. M. & Mulyono. (2019). The mathematical representation ability based on student's learning independence on problem based learning with scaffolding approach. *Unnes Journal of Mathematics Education*, *8*(2), 105-110. doi: 10.15294/ujme.v8i2.32210

one aspect of personality that is very important for individuals. Individuals who have high independence are relatively able to face all problems because independent individuals are not dependent on others.

Learning independence is one of the factors that influence student learning outcomes in mathematics that come from within students. Learning independence is the ability of a student to work independently in exploring learning information from learning sources other than the teacher. This is in accordance with Basir in Suhendri and Mardalena (2015) that "learning independence is defined as a learning process that occurs in a person, and in his efforts to achieve the learning objectives of that person is required to be active individually or not dependent on others, including not depends on the teacher. "

The most important part of the concept of independent learning is that each student must be able to identify sources of information, because identification of sources of information is needed to facilitate the learning activities of a student when the student needs help or support. One strategy that can be applied in mathematics learning is the scaffolding strategy. According to Mamin in Alfian et al., (2017) scaffolding is a practice based on Vygotsky's concept of zone of proximal development (the closest development zone). Implementing a scaffolding strategy means giving individuals a large amount of assistance during the initial stages of learning and then reducing that assistance.

Based on the initial explanation, there are several problem formulations in this study, which are as follows (1) Is the student's mathematical representation ability in Problem Based Learning with an effective scaffolding approach? (2) How is the ability of mathematical representation in terms of class VII students' learning independence in Problem Based Learning with the scaffolding approach?

The purpose of this study are as follows (1) knowing the ability of students' mathematical representation in Problem Based Learning with an effective scaffolding approach (2) describing the ability of mathematical representation in terms of the independence of learning of class VII students on Problem Based Learning with a scaffolding approach.

The hypotheses proposed in this study are as follows (1) students 'mathematical representation ability in Problem Based Learning with scaffolding approach reaches more than the minimum completeness criteria (2) students' mathematical representation ability in Problem Based Learning with scaffolding approach reaches more than classical completeness (3) the average mathematical representation ability of students in Problem Based Learning with scaffolding approach is higher than the average mathematical representation ability of students in Problem Based Learning (4) the proportion of students' mathematical representation ability in Problem Based Learning with scaffolding approach is more than the proportion of mathematical representation abilities students on Problem Based Learning (5) increasing students 'mathematical representation ability on Problem Based Learning with scaffolding approach is better than students' mathematical representation abilities on Problem Based Learning.

2. Methods

This type of research used in this study is a combination research method. As for the research design used in this study is a sequential explanatory design, which is collecting and analyzing quantitative data then collecting and analyzing qualitative data. Quantitative methods are used to determine the effectiveness of Problem Based Learning model learning with scaffolding approach to the achievement of mathematical representation abilities of class VII students of Semarang State Junior High School 23. While the qualitative method is used to determine the description of the ability of mathematical representation in terms of the independence of student learning in Problem Based Learning with the scaffolding approach.

The population used in this study were all class VII students of Semarang State Junior High School in the even semester of 2018/2019, namely class VII A-VII H. The technique used in sampling in this study was simple random sampling. Simple random sampling is done by randomly selecting two classes from the population without strata differences between each class. In this study, class VII H was taken as a control class by being given treatment in the form of learning through the Problem Based Learning model and class VII F as an experimental class to be given treatment in the form of mathematics learning through the Problem Based Learning model with a scaffolding approach. Determination of the subjects in this study using purposive sampling techniques, namely by selecting two research subjects from each student with high, medium, and low learning independence.

Data collection methods used in this study are (1) test delivery methods used to obtain mathematical representation capabilities data; (2) students scaling methods in this study are used to obtain data on student learning independence; (3) the interview method used to obtain in-depth information about the mathematical representation ability in terms of student learning independence based on the tests provided; (4) and the documentation method used to obtain data related to research.

Quantitative data analysis techniques are used to test whether learning in Problem Based Learning with the scaffolding approach is effective in achieving mathematical representation abilities. While qualitative data analysis techniques are used to obtain a description of mathematical representation ability in terms of the independence of student learning in Problem Based Learning with scaffolding approach. This qualitative data was obtained through interviews with six research subjects in the experimental class. Of the six subjects, two subjects were students with high learning independence, two subjects with moderate learning independence, and two subjects with low learning independence.

3. Results & Discussions

Based on the results of the analysis of students' learning independence given to the students of the experimental class, it is obtained the fact that each student has a different learning independence. From the results of the analysis of the scale of learning independence in class VII F as many as 10 students with high learning independence, 17 students with moderate learning independence, and 5 students with low learning independence. The selection of subjects was chosen by 2 students from the category of high learning independence, 2 students from the category of moderate learning independence, and 2 students from the category of low learning independence.

3.1. The Effectiveness of the Problem Based Learning Model with Scaffolding Approach to Achieving Mathematical Representation Ability

The results of this mathematical representation ability test are used for the final data analysis. Data on the mathematical representation ability of students from the two research classes is presented as follows.

Table 1. Data on the Value of Maths Problem Solving Ability

Class	N	Mean	Max	Min
Eksperimen	32	79,73958	95	60
Kontrol	33	704,8989	88,33	60

Before testing the hypothesis, a normality test and a homogeneity test are performed first. Based on calculations using SPSS 16.0 software, it is obtained $Sig. = 0.122$. Clearly $Sig. = 0.122 > 0.05$ so H_0 is accepted. This means that the data of the mathematical representation ability test values come from normally distributed populations. Based on this, for further analysis and calculation in this study using parametric statistics. This is in line with the opinion of Sugiyono (2016: 210) which states that the use of parametric statistics requires the fulfillment of many assumptions, and the main assumption is that the data to be analyzed must be normally distributed.

After the normality test, then proceed with the homogeneity test Based on calculations with the help of SPSS 16.0 software, Sig. Homogeneity test is $Sig. = 0.408$. Obviously $Sig. = 0.408 > 0.05$, so H_0 is accepted, which means that the data on the mathematical representation ability test has the same or homogeneous variance. Based on the homogeneity test, the results show that the mathematical representation ability of the experimental class and the control class have the same variance.

Then the hypothesis test is performed which includes a mean test, a one-party proportion test, a difference test of two averages, a proportion test and a gain test. The average test is used to determine whether the average mathematical representation ability of students in the experimental class reaches more than the minimum completeness criteria. Based on the results of calculations with ms.excel, obtained that t_{count}= 3.286 and t_table with a probability of 0.95 and dk = 32, obtained $t_{table} = 1.695$. Because t_{count}= $3.286 > t_{table} = 1.695$, H_0 is rejected. In conclusion, the average test of students' mathematical representation ability has reached more than the minimum completeness criteria of 71.

Furthermore, the one-party proportion test is used to determine whether the average mathematical representation ability of students in the experimental class reaches a minimum completeness criterion of 71 and reaches a 75% classical completeness. Based on the results of calculations using ms.excel, it was found that z_{count}= 2.449 and z_{table} with a significance level of 0.05 and probability = (0.5-0.05) = 0.45, z_{table}= 1.645 was obtained. Because z_{count}= 2.449> z_{table} = 1.645, H_0 is rejected. In conclusion, the test results of students' mathematical representation ability on Problem Based Learning with scaffolding approach achieve classical completeness.

Furthermore, to test the difference in two means is used to test the average mathematical representation ability in the experimental class is higher than the average mathematical representation ability in the control class. Based on the results of calculations using ms.excel, it was found that t_{count}= 2.333 and t_{table} with the degree of confidence (α) = 0.05 and dk = 32 + 33-2 = 63, obtained t_{table} = 1.669. Because t_{count} = 2.333> t_{table} = 1.669, H_0 is rejected. In conclusion, students mathematical representation ability in Problem Based Learning with scaffolding approach is more than students' mathematical representation ability in Problem Based Learning.

Furthermore, the proportion test is used to test the proportion of students who complete Minimum Completeness Criteria on the mathematical representation ability of students with Problem Based Learning with scaffolding approach more than the proportion of students on Problem Based Learning. Based on the calculation of ms.excel, we get z_{count}= 2.259 and z_{table}= 1.645. These results indicate $z_{hitung} \geq z_{table}$ means reject H_0. In conclusion the proportion of students who completed Minimum Completeness Criteria on the mathematical representation ability of students with Problem Based Learning with scaffolding approach is more than the proportion of students who completed Minimum Completeness Criteria on the mathematical representation ability of students on Problem Based Learning.

While the gain test used to calculate the increase in mathematical representation ability in the experimental class is better than the increase in mathematical representation ability in the control class. After calculating the ms.excel, t_{count} = 3.229 andt_{table} = 1.669 are obtained. The results show that $t_{hitung} \geq t_{table}$ means that H_0 is rejected. In conclusion, the average increase in mathematical representation ability in the experimental class is better than the average mathematical representation ability in the control class.

Based on this it can be said that the Problem Based Learning model with an effective scaffolding approach to the achievement of mathematical representation capabilities. The results of this study are in line with Zaini (2016) who revealed that learning with the help of scaffolding is effective, fulfilling aspects including learning outcomes with the help of scaffolding reaching the specified Minimum Completeness Criteria and can improve students' problem solving abilities.

3.2. Mathematical Representation Ability of Students in terms of Higher Learning Independence

Based on the results of the analysis of mathematical representation ability, subjects with high learning independence can almost do all the items about mathematical representation ability well. For indicators to make pictures to clarify the problem and facilitate resolution in one of the numbers, it has not been able to make a complete, correct picture and has not given information to clarify the picture.

For indicators to make equations or mathematical models of representations given to one of the numbers have not been able to make a representation model that is given completely and correctly. For indicators writing steps to solve mathematical problems with words on one of the numbers have not been able to draw conclusions correctly.

Overall, subjects with high learning independence are very good at completing test questions according to 3 indicators of mathematical representation. It's just that, in a number of numbers have not solved the problem in accordance with indicators of mathematical representation ability due to lack of accuracy in workmanship and lack of time.

3.3. Mathematical Representation Ability of Students in terms of Medium Learning Independence

Based on the results of the analysis of the mathematical representation ability of the subject with learning independence is almost able to do all the items about the mathematical ability of representation well. For indicators to make pictures to clarify the problem and facilitate the resolution of some numbers have not made a picture completely and correctly, and have not given information to clarify the picture.

For indicators to make mathematical equations or models of representations given to some numbers, they have not been able to make mathematical models of representations that are given completely and correctly. For indicators to write steps to solve mathematical problems with words are able to write well.

Overall, it can be concluded that subjects with moderate learning independence are already good at completing test questions in accordance with 3 indicators of mathematical representation. However, the indicators make drawings to clarify the problem and facilitate resolution and make equations or mathematical models of the representations that are given incomplete in working on several numbers because they are not thorough in their work.

3.4. Mathematical Representation Ability in terms of Low Learning Independence

Based on the results of the analysis of mathematical representation ability tests with low learning independence are less able to work on mathematical representation ability items. For indicators to make pictures to clarify the problem and facilitate its resolution, it is able to make a picture even though it is not complete and not given information in the picture.

For indicators to make mathematical equations or models of a given representation tend to be less able to solve due to difficulties in understanding the problem. For indicators to write steps to solve mathematical problems with words tend not to be able to write complete steps of completion so that in writing the final result is wrong. Overall, it can be concluded that subjects with low learning independence are not good at meeting indicators of mathematical representation ability.

4. Conclusion

Based on the results of the analysis and discussion, conclusions (1) The ability of mathematical representation of students in Problem Based Learning with scaffolding approach reaches more than the minimum completeness criteria (2) The ability of mathematical representation of students in Problem Based Learning with scaffolding approach reaches more than classical completeness (3) The average mathematical representation ability of students in Problem Based Learning with scaffolding approach is higher than the average mathematical representation ability of students in Problem Based Learning (4) The proportion of students' mathematical representation ability in Problem Based Learning with scaffolding approach is more than the proportion of mathematical representation abilities students on Problem Based Learning (5) Improving students 'mathematical representation ability on Problem Based Learning with scaffolding approach is better than increasing students' mathematical representation ability on Problem Based Learning (6) Description of student's ability to learn Mathematical representation in terms of the independence of student learning in Problem Based Learning with the scaffolding approach as follows: (a) Students with high learning independence are very good at fulfilling the three indicators of mathematical representation ability, namely the ability to draw pictures to clarify problems and facilitate their resolution, ability to make equations or mathematical models. from the representation given and the ability to write steps to solve mathematical problems with words (b) Students with learning independence are doing well in completing test questions in accordance with 3 indicators of mathematical representation. However, the indicators make drawings to clarify the problem and facilitate resolution and make mathematical equations or models of the given representations incomplete in working on several numbers because of inaccurate workmanship (c) Students with low learning independence are not good enough in capturing indicators of representation ability mathematical.

References

Alfian, M.H., Dwijanto, & Sunarmi. (2017). Effectiveness of Probing-Prompting Learning Models with Scaffolding Strategy to Mathematic Creative thinking Ability and Enthusiasm. *Unnes Journal of Mathematics Education* , 6(2): 249-257.

Creswell, J. W. (2016). *RESEARCH DESIGN: Pendekatan Metode Kualitatif, Kuantitatif, dan campuran.* Yogyakarta: PUSTAKA PELAJAR.

Daryono. (2011). Metode Think Talk Write Sebagai Upaya untuk Meningkatkan Kemampuan Representasi Matematik Beragam Siswa Mts Negeri Karangampel. Tersedia di *http://ejournal.unwir.ac.id/file.php?file-preview_jurnal&id=621&cd=0b2173ff6aa6fb0*

9c95f6d50001dfb&name=Daryono_vol1_no6_januari_2011.pdf. [diakses 20-12-2018]

Ghazali, M., Ayminsyadora, A., & Othman, A. R. (2013). Preschool Children''s Representation of Number on a Linear Number Line: Implications to Teaching and Learning of Number Concepts. *IOSR Journal of Humanities And Social Sciences (IOSR_JHSS).*, 14(6): 87-92.

Kholiqowati, H., Sugiarto, & Hidayah, I. (2016). Analisis Kemampuan Representasi Matematis ditinjau dari Karakteristik Cara Berpikir Peserta Didik dalam Pembelajaran dengan Pendekatan Saintifik. *Unnes Journal of Mathematics EducationI*, 5(3).

Murniati, S., Mulyono, & Kharis, M. (2017). Pembelajaran PBL Strategi *Working Backward* untuk Meningkatkan Kemampuan Pemecahan Masalah Matematik Siswa. *Unnes Journal of Mathematics Education*, 6 (1): 27-36.

NCTM. (2000). *Principles and Standars for School Mathematics.* United States of America: Key Curiculum Press.

OECD. (2016). *PISA 2015 results in Focus.* OECD Publishing.

Sudjana. (2005). *Metode statistika.* Bandung: Tarsito.

Sugiyono. (2016). *Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif, dan R&D).* Bandung: Alfabeta.

Suhendri, H. & Mardalena, T. (2015). Pengaruh Metode Pembelajaran *Problem Solving* Terhadap Hasil Belajar Matematika Ditinjau Dari Kemandirian Belajar. *Jurnal Formatif* 3, 2 (1): 105-114.

Suhendri, H. (2012). Pengaruh Kecerdasan Matematis-Logis, Rasa Percaya Diri, dan Kemandirian Belajar Terhadap Hasil Belajar Matematika. *Prosiding dalam Seminar Nasional Matematika dan Pendidikan Matematika.* Yogyakarta: Universitas Negeri Yogyakarta.

Sukestiyarno, Y. l. (2016). *Olah Data Penelitian Berbantuan SPSS.* Semarang: Universitas Negeri Semarang.

Tandiliing, E. (2015). Effectivity of Problem Based Learning (PBL) in Improving Students' Mathematical Representation. *Proceedingof International Conference On Research, Implementation And Education of Mathematics And Sciences*, 147-152.

Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 Tentang Sistem Pendidikan Nasional (Act of The Republic of Indonesia Number 20, 2003)

Wijayanti, K., Aizzatun, N., & Pujiastuti, E. (2018). Problem Solving Ability of Seventh Grade Students Viewed from Geometric Thinking Levels in Search Solve Create Share Learning Model. *Unnes Journal of Mathematics Education*, 7 (1): 8-16.

Zaini, N. K., Wuryanto, & Sutarto, H. (2016). Peningkatan Kemampuan Pemecahan Masalah dan Pengembangan Karakter Siswa Kelas VII Melalui Model PBL Berbantuan *Scaffolding*. *Unnes Journal of Mathematics Education Research*, 5 (1): 62-68.

Zhe, L. (2012). Survey of Primary Student's Mathematical Representation Status and Study on the Teaching Model of Mathematical Representation . *Mathematics Education.* 1: 63-76. Tersedia di [http://educationforatoz.-com/images/5_Liu_Zhe.pdf](http://educationforatoz.com/images/5_Liu_Zhe.pdf) [diakses 03-02-2019]