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An Ability of Mathematical Representation And Independence of Student Learning in Reciprocal Teaching With Resitation and Self Assesement

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Abstract

This study aims to: (1) find out the quality of reciprocal teaching with recitation and self assessment on the achievement of mathematical representation abilities, (2) describe the ability of mathematical representation in terms of student learning independence, and (3) determine the effect of learning independence on students' mathematical representation abilities in reciprocal teaching with recitation and self assessment. This research is a mixed method type of concurrent embedded design type. The subject of this study was determined based on the learning independence score using a learning independence questionnaire in the eighth grade students of MTs Urwatil Wutsqo Jepara. Data collection techniques are using tests, questionnaires, and interviews. The quality of learning is analyzed based on three quality categories, namely planning, implementation and assessment. The effect of learning independence on mathematical representation ability was analyzed based on simple linear regression test. The results showed that (1) the three domain qualities of learning were categorized as good, so it was concluded that the quality of reciprocal teaching with recitation and self-assessment of mathematical representation abilities was good. (2) students with high learning independence are able to master all mathematical representation indicators well compared to students with moderate and low learning independence; (3) learning independence has a positive effect on the ability of mathematical representation on reciprocal teaching with recitation and self assessment.

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INTRODUCTION

One of the abilities that students need to master in solving a mathematical problem is the ability of mathematical representation. According to Nadia, Waluya, & Isnarto (2017) mathematical representation is something that always arises when someone studies mathematics at all levels of education. Representation can be interpreted as a form or arrangement that can describe, represent, or symbolize something in a way (Hwang, 2007).

Aristyo, Rochmad, & Kartono (2014) said that to do math problems, students are required to write down what information they know and what is asked by the problem to work on. This process requires mathematical representation capabilities.

Zhe (2012) reveals several forms of mathematical representation that can be done to find a solution in a mathematical task, namely (1) visual representation, which is to present data or information in the form of diagrams, graphs, or tables; (2) verbal representation, which is to write down the steps to complete a mathematical task with words; (3) symbolic representation, which is to make mathematical equations or models of a given task.

Based on the results of an interview with one of the MTs teachers Urwatil Wutsqo Jepara, students are still not able to represent mathematical ideas in a mathematical problem in the form of pictures, symbols, and words to be more easily understood to find a solution to a problem.

In addition to having mathematical representation skills, student learning independence is also needed. Zimmerman (2000) states that learning independence is thought, feeling, and action that is produced by itself and planned cyclically according to the achievement of personal goals.

The need for learning independence, especially for individuals who study mathematics are supported by the results of studies such as those presented by Wongsri, et al (2002) that individuals who have high learning independence tend to learn better, are able to monitor, evaluate, and manage their learning effectively, saving time in completing assignment, manage learning time efficiently, and get a high score. The importance of learning independence arises as an answer to how a student can be responsible for his own learning process.

Purnamasari (2014) added that learning must be able to condition students to get new information and knowledge that is not taken for granted from the teacher's explanation but must be able to build their own concepts and principles learned. These conditions require learning independence that can be formed from the usual learning.

According to Novalia & Rochmad (2017) the learning of mathematics in schools is still centered on the teacher, so the teacher's position is very dominant. As a result, teaching and learning activities emphasize teaching rather than learning. The existing teaching and learning process is only a transfer of knowledge from teacher to student so that learning mathematics is interpreted by memorizing and remembering formulas.

Hasanah, Rochmad, & Hidayah (2012) stated that reciprocal teaching prioritizes the active role of students in learning activities, so students are given the freedom to communicate to explain their ideas and listen to their friends' ideas. This is in line with the basic principle of constructivism that students actively build their own knowledge based on their cognitive maturity.

According to Agoestanto (2012), the application of reciprocal teaching in learning can increase learning independence. This is in line with Choo, et al. (2011) which states that, reciprocal teaching encourages students to be more active in the dialogue group and helps students personally and cognitively in understanding the subject matter. This is based on the assumption that knowledge and understanding are the result of creative socialization that is compiled through the negotiation process between students and teachers or vice versa.

Forming new knowledge is not enough if it is only sourced from the teacher; students need to find other relevant sources so that their knowledge and understanding can be formed well. The reciprocal teaching application is integrated with recitation. According to Aditya (2016) recitation is a method of teaching where the teacher imposes a task, then the student must account for the results of the task.

According to Prasetyo, Rosana, & Wilujeng (2013) with the recitation method, it is expected that the learning process can take place in accordance with the objectives to be achieved. This is due to the assignment of assignments to students, students can

actively search for learning resources and will learn more, besides that, recitation demands accountability from students for the tasks they are doing

The ability of each student in a discussion group must be different; the discussion in reciprocal teaching with recitation is expected to be able to complement knowledge among members of the discussion group, where students who have mastered the material help other friends who experience difficulties. For this reason honesty is needed from students who feel that they lack control and understand the subject matter to acknowledge the shortcomings. To be able to assess and evaluate these deficiencies, self assessment is needed. Self assessment is a valuation technique in which students are asked to judge themselves relating to the status, process and level of achievement of competency that they learn in certain subjects (Suwandi, 2010)

Some research results show that self assessment influences student learning, for example the results of Topping's (2003) study conclude that there is evidence that self assessment can produce improvements in the quality of learning. Kartono (2011) states that self assessment can be used to shape and develop students' ability to examine and think critically about the learning process they are going through. Self assessment can also foster students 'confidence because they are given the confidence to judge themselves and increase students' understanding of their strengths and weaknesses (Shofiyah & Wasis, 2013)

Based on the description above, the purpose of this study includes: (1) knowing the quality of reciprocal teaching with recitation and self assessment on the achievement of mathematical representation abilities, (2) describing the ability of mathematical representation in terms of student learning independence, and (3) knowing the effect of learning independence on ability Mathematical representation of students in reciprocal teaching with recitation and self assessment.

METHOD

This research is a type of mixed method type concurrent embedded research that is a method that combines the use of quantitative and qualitative research methods simultaneously, but the weight of the method is different (Sugiyono, 2016: 412).

This research emphasizes more on qualitative research methods as the primary method, and quantitative methods as secondary methods, Quantitative research in research, as supporting data to analyze mathematical representation capabilities in terms of three categories of learning independence.

The research is used quantitative research design, a quasi-experimental design involving two groups (experiment and control). This research was carried out in MTs. Urwatil Wutsqo, Jepara Regency in class VIII of the 2017/2018 school year, with the material building up a flat side space (*bangun ruang sisi datar)*. Research subjects were class VIII B as an experimental class, and class VIII A as a control class.

Quantitative data collection techniques carried out by testing mathematical representation abilities. While qualitative data collection techniques use questionnaire techniques, interviews and documentation.

Quantitative data analysis is divided into two, namely initial data analysis and final data analysis. Preliminary data analysis (taken from the results of the initial mathematical representation capabilities with the aim to determine the similarity of the average of the experimental and control classes) using the normality test, homogeneity test, and two average equality tests. Whereas the final data analysis uses data analysis which includes prerequisite tests, namely normality test and homogeneity test, as well as hypothesis testing, which includes testing hypothesis 1 (proportion completeness), testing hypothesis 2 (average completeness), testing hypothesis 3 (proportion comparison test), testing hypothesis 4 (average comparative test), and testing hypothesis 5 (the effect of learning independence on the ability of mathematical representation).

Qualitative data analysis follows the concept of Miles and Hubermen (2007) with the following steps, namely data reduction, data display, and conclusions.

RESULTS AND DISCUSSION

The first objective in this research is to know the quality of reciprocal teaching with recitation and

self assessment of the student's mathematical representation ability. Reciprocal teaching quality with recitation and self assessment measured using three stages, which are planning for learning processes, implementation of learning processes, and assessment of learning results.

In the learning planning stage, the results of the assessment of learning devices are obtained as in Table 1.

Table 1. Validation result of learning devices

Learning Devices	Validate code	Average score	Category
Syllabus	V1,V2,V3	4.17	Good
Learning plan	V1,V2,V3	4.08	Good
Students handout	V1,V2,V3	4.13	Good
KRM exercise	V1,V2,V3	4.17	Good

From Table 1, it can be concluded that the average score on learning devices is in a good category, so that the learning devices that have been prepared are suitable to use in the study.

At the implementation stage is measured by observations of learning implementation, with recapitulation in Table 2.

Table 2. The result of learning implementation

Meeting	Score average	Criteria
1	3.19	Good
2	3.35	Good
3	3.54	Good
4	3.69	Good
5	3.73	Good
Average	3.5	Good

Based on Table 2, it was concluded that the average score of researchers' skills in managing learning was in the good category. This shows that the learning carried out in the study is in accordance with the Learning Plan.

The grouping of students based on the learning independence questionnaire was conducted after the implementation of the reciprocal teaching learning process with recitation and self assessment. Learning independence is grouped into three categories: high learning independence, moderate learning independence, and low learning independence. Based on the results of the learning independence questionnaire analysis, students were grouped in Table 3.

Table 3. Grouped students based on learning independence

Self-Effcaty	Percentace	Subjek
High	19,2	KB01, KB02
Middle	73.1	KB14, KB15
Low	7.7	KB25, KB26

The selected students will be analyzed more deeply about the ability of their mathematical representation by interview.

At the assessment stage the implementation of learning will be carried out several tests, which include testing hypothesis 1 (completeness of proportion), testing hypothesis 2 (average completeness), testing hypothesis 3 (comparative proportional test), and testing hypothesis 4 (average comparative test).

Testing Hypothesis 1 uses the right-hand hypothesis test that is used to determine whether the mathematical representation ability in the experimental class reaches completeness of ≥ 75%. From the calculation of the test, the value z_{hitung} is 0.22647 and the value of $z_{(0,45)}$ is 1.96. Because 0.22647 <1.64 meaning $z_{hitung} < z_{(0,45)}$ is accepted. Therefore, the proportion of students in the experimental class who have achieved completeness is 75%. Further testing needs to be done to find out two possibilities for π that $\pi = 75\%$ or $\pi < 75\%$. Because -1.96 <0.22647 <1.96 then $-z_{\frac{1}{2}(1-\alpha)} <$

$z_{\text{hitung}} < z_{\frac{1}{2}(1-\alpha)}$ meaning that H_0 is accepted. Therefore, the proportion of students who have achieved completeness is 75%. That means the experimental class has achieved completeness equal to 75%, meaning that there are 75% of the number of students in the class getting a score of ≥ 70.

Testing Hypothesis 2 is conducted to determine whether the average mathematical representation ability of the experimental class students is more than 70 (average initial ability test). The test used is the average test with Student distribution t. From the calculation of the test, the value of t_{hitung} is 2.4399. For α = 5% and dk 25, the value of $t_{(0,95)25}$ is 1,708. Because 2.4399> 1.708, that $t_{hitung} \geq t_{(1-\alpha),dk}$ means H_0 is rejected and H_1 is accepted. So, the average mathematical representation ability of students from the experimental class is more than 70.

Testing Hypothesis 3 was conducted to determine the proportion of students' completeness of mathematical representation ability of experimental class compared to control class students. The test used to test the similarity of the two proportions of the right. From the calculation of the test, the z_{hitung} is 7.31178. For the significant level (α) 5% obtained the value of $z_{(0,5-\alpha)}$ is 1.64. Because 7.31178 ≥ 1.64, then $z_{\text{hitung}} \geq z_{(0,5-\alpha)}$, meaning that $H_0$is rejected or $H_1$is accepted. Thus, the proportion of completeness of the experimental class students is more than the proportion of the completeness of the control class students.

Testing Hypothesis 4 was conducted to determine the average mathematical representation ability of the experimental class students compared to the control class students. Test used statistical test t. From the calculation, the value of t_{hitung} is 1.6886. For α 5% and dk 52, the value of $t_{(0,95)52}$ is 1.6759. Because 1.6886> 1.6759, then $t_{\text{hitung}} > t_{(1-\alpha),dk}$, means that H_0 is rejected and H_1 is accepted. Thus, the average mathematical representation ability of the experimental class students is more than the control class.

From those three results, namely in the planning, implementation, and assessment stages it can be concluded that the quality of learning uses the reciprocal teaching method with recitation and self-assessment of mathematical representation abilities in both categories. This is consistent with the research of Pratiwi (2013) which states that the mathematical representation ability of students who obtain learning other than conventional shows improved results.

The second research objective is to analyze mathematical representation ability in terms of student learning independence in reciprocal teaching with recitation and self assessment.

From three aspects of mathematical representation, students who have high learning independence are able to solve mathematical representation problems well. Students who have high learning independence are able to master visual representation, symbolic representation, and verbal representation well, even though there are few errors in making mathematical models or on symbolic representation aspects. In the aspect of verbal representation students who have high learning independence are right in answering and finding solutions to solutions, it's just less thorough in determining the final answer results that are in accordance with the request for the problem, but the error is not too fatal because the level of mastery is still 80%. Therefore students who have high learning independence have mathematical representation abilities in good categories. This is in line with the results of research from Rakes and Dunn (2010), that student who has high learning independence will have an impact on good learning outcomes.

Students who have moderate learning independence are able to solve visual representation problems in good categories, but on the symbolic representation aspect, they fall into enough categories. This can be seen from the fact that there are still errors in the symbolic representation aspect, students who have learning independence are not yet right in generating mathematical ideas, so that the equations used are less precise. In the aspect of verbal representation students are right in answering and finding solutions to solutions, it's just less accurate in determining the final answer results that are in accordance with the request for questions.

The ability of mathematical representation shown by students with the independence of moderate learning is based on students' beliefs to master mathematics subjects well. They try to communicate with friends to find the best solution to the mathematical problems they face, although

sometimes they avoid doing schoolwork. They were enthusiastic enough to take mathematics lessons at school, enough to be able to motivate themselves to learn mathematics, especially if they had previously received less satisfactory grades, and tried to get better grades in future mathematical assessments. It's just that students with moderate learning independence often feel hesitant when completing difficult math, or that they have never met before.

Students who have low learning independence are able to solve visual representation and symbolic representation problems in low categories. In the aspect of verbal representation with good categories, during the reciprocal teaching with self assessment recitation, students with low learning independence were not very enthusiastic about following it. When faced with math problems, they sometimes communicate with friends to find a solution, and sometimes also ignore it, especially if the problem is difficult, they will give up more easily. In carrying out schoolwork, sometimes they do it, sometimes avoiding it, and feel hopeless. In addition, students with low learning independence are less able to make math completion plans.

The third research objective is to determine the effect of learning independence on students' mathematical representation abilities in reciprocal teaching with recitation and self assessment. The test used is a simple linear regression test. From the calculation, the regression equation is $\hat{y} = 32{,}773 + 0{,}551x$. After testing the value of b, obtain sig = 0.006 = 0.6% <5%. That means, H_0 is rejected and H_1 is accepted. Thus, there is a linear relationship between learning independence and mathematical representation ability, or it can be said that learning independence has a positive effect on the ability of mathematical representation.

The magnitude of the effect can be seen from the R square value. R square value was 0.274 or 27.4%. This value shows that learning independence influences students 'mathematical representation ability by 27.4%, and there are still 72.6% of students' mathematical representation abilities influenced by other factors.

CONCLUSIONS

Based on the results of the previous study and discussion, the conclusions of this study are the quality of reciprocal teaching with recitation and self-assessment of mathematical representation abilities included in the good category, this is indicated by assessment in three stages of learning, namely the planning and implementation stages of learning included in the good category , at the learning assessment stage, the experimental class students achieved completeness by 75%, the average mathematical representation ability of the experimental class students was more than 70 (initial ability test), the proportion of students completing the experimental class was higher than the control class, the average mathematical representation ability experimental class students are higher than control class; Students who have high learning independence are able to master the three aspects of mathematical representation well, compared with students with moderate and low learning independence; Learning independence has a positive effect on the mathematical representation ability of the eighth grade students of MTs Urwatil Wutsqo Jepara on reciprocal teaching with recitation and self assessment. Students with low learning independence are not too enthusiastic and easily give up in participating in learning, so that the teacher is expected to provide more guidance and motivate students so that they do not despair in completing school assignments, better recognize their potential, and further improve their learning independence.

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