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Mathematical Representation Ability Based on Self-Efficacy on Online Learning Through Flipped Classroom

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Abstract

This research aims to describe the mathematical representation ability of students grade XI in online learning through a flipped classroom which was assisted by learning videos. It employed the mixed method specifically the concurrent embedded design. The subject of the research was determined based on the self-efficacy score from a self-efficacy questionnaire of the students grade XI at SMA N 1 Selomerto, Wonosobo. The tests, questionnaires and interviews were employed to collect the data. The effect of self-efficacy on mathematical representation ability was analyzed based on a simple linear regression test. The results showed that (1) students with high self-efficacy were able to master all indicators of mathematical representation well compared to students with moderate and low self-efficacy; (2) self-efficacy has a positive effect on the mathematical representation ability in online learning through flipped classroom.

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INTRODUCTION

One of abilities needed by students to solve the mathematical problems is mathematical representation ability. According to Nadia, Waluya, & Isnarto (2017), mathematical representation always appears when students learn mathematics at any education level. Representation is defined as a form or arrangement that can illustrate, represent, or symbolize something in certain way (Hwang, 2007).

Rochmad, & Kartono (2014) argued that to solve the mathematical problems, students require to write what kind of information that they know and what questions being asked. therefore, the mathematical representation ability is necessary here.

Zhe (2012) mentioned some kinds of mathematical representation that can be implemented to find the solution in a mathematical task, such as (1) visual representation; representing the data or information in diagram, graphic, or table (2) verbal representation; writing the steps of solving the mathematical task by using words; (3) symbolic representation; making the equation or mathematical model from one given mathematical task.

Based on the interviews with one of the teachers in SMA N 1 Selomerto, Wonosobo, the students are still lacking on representing their mathematical ideas in form of picture, symbol, or words, whereas it makes the mathematical questions easier to be understood and solved.

Bandura (2006) stated that self-efficacy is defined as the belief of someone to understand his/her ability to make the achievement that influences the real events in real life. It can control on how people feel, think, motivate and behave. He mentioned that there are three dimensions of self-efficacy; magnitude, strength and generality. Magnitude dimension emphasizes the difficulty level believed by someone that it can be solved, strength dimension is related to the strength level of weakness believed by someone about the ability that they are aware of, and generality dimension is related to the confidence to be able to handle the task in certain condition or in some activities and situations.

Novalia & Rochmad (2017) stated that generally the mathematics learning at school is still centered on teacher, so that the position of teacher is very dominant. As a result, the learning-teaching activity more emphasizes on teaching rather than learning. The process of learning-teaching is just transferring knowledge from teacher to students, so that learning mathematic is only understood as memorizing and recalling formula.

One of the teaching-learning models that can involve students actively and improve mathematical representation so that it can improve self-efficacy is the flipped classroom. Damayanti & Sutama (2016) mentioned that flipped classroom is one of learning-teaching models that focuses on students to improve the learning-teaching effectiveness. This kind of model uses media that supports the learning-teaching material for students outside the class, such as learning material, learning video, power point, and others, so that students can learn them in their own houses. In contrast, learning session in the class is used to group discussion and do the tasks. On this learning process, teachers play role as the facilitator to motivate, supervise, and give feedback about student's worksheet.

Distance learning (PJJ) is an education system that has a broad reach across space, time, and socioeconomics. It opens access of education for anyone, anywhere and anytime. It also allows learning to be done anytime and anywhere.

One of the application media used in online learning is Whatsapp. According to Bouhnik & Deshen (2014) Whatsapp is one of the social media functioned as a means of sending messages to and from individuals or groups (groups) which includes various functions such as text messages, documents, images, photos, audio, and video. The results of Winardi & Wardono's (2017) research on the use of Whatsapp in learning state that group learning discussion on Whatsapp can help students to complete the tasks given by the teacher. Teachers can assist students in learning outside school hours. This has an impact on the quality of learning so as to improve mathematical representation, achieve completeness, and respond well to learning.

Based on the description above, the purpose of this study is to describe the mathematical representation ability of students grade XI in online learning through a flipped classroom assisted by learning videos.

METHOD

This research is a combination (mixed method) type of concurrent embedded; a method that combines the use of quantitative and qualitative research methods simultaneously, however the weight of the method is different (Sugiyono, 2010).

This research emphasizes more on qualitative research methods as primary method, and quantitative method as secondary method. Quantitative research is purposed as the supporting data to analyze the ability of mathematical representation in terms of self-efficacy categorization.

The research design employed in this quantitative research is the Pre-Experimental Design, type One-Group Pretest-Posttest Design. This was conducted at SMA N 1 Selomerto, Wonosobo Regency in grade XI 2019/2020 with linear programming material. The research subject is class XI MIPA.

Quantitative data collection techniques are carried out by testing the ability of mathematical representation. While the qualitative data collection techniques employed here is by using questionnaires, interviews and documentation techniques.

Quantitative data analysis is divided into two categories, namely initial data analysis and final data analysis. Initial data analysis is tested by using normality test. While the final data analysis uses data analysis that includes prerequisite tests, namely normality test and hypothesis testing, which includes hypothesis testing 1 (completeness proportion), hypothesis testing 2 (average completeness), hypothesis testing 3 (average comparison test), and test hypothesis 4 (influence of self-efficacy on mathematical representation ability).

Qualitative data analysis follows the concept proposed by Sugiyono (2010) with the following steps, namely data reduction, data display (data presentation), and conclusions.

RESULTS AND DISCUSSIONS

The first objective of this study is to test and analyze the quality of online learning through a flipped classroom based on video learning on linear programming material on self-efficacy.

At the implementation stage, it is measured by observing the implementation of learning, with the recapitulation as presented in Table 1.

Table 1. Learning Observation Recapitulation

Meeting	Average score	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 1, it is concluded that the average score of the researchers' skills in managing learning is in the good category. This shows that the learning carried out in the research is in accordance with the lesson plan.

The grouping of students based on the self-efficacy questionnaire was carried out after the implementation of the online learning process through the flipped classroom. Self-Efficacy is grouped into three categories, namely high Self-efficacy, Independent Self-efficacy, and Low Self-efficacy. Based on the results of the Self-efficacy questionnaire analysis, it was found the result of students' grouping as presented in Table 2.

Table 2. Grouping of students' self-efficacy siswa

Self-Efficacy	Percentage	Subject Choice
High	19.2%	SE01, SE02
Independent	73.1%	SE14, SE15
Low	7.7%	SE25, SE26

The selected students were analyzed more deeply about their mathematical representation ability by interview.

At the assessment stage of the learning implementation, several tests were carried out, which include testing hypothesis 1 (completeness proportion), hypothesis testing 2 (average completeness), hypothesis testing 3 (average comparison test).

Hypothesis testing 1 uses the right-hand side hypothesis test which is used to determine whether the mathematical representation ability in the

experimental class achieves completeness of 75%. From the test calculations, the obtained value is 0.22647 and the value of z(0,45) is 1.96. Because 0.22647< 1.64 then the value of $z_{count} < z_{(0,45)}$, which means the H_0 is accepted. Because the proportion of experimental class students have achieved completeness of 75%, so that the further tests are needed to determine the two possibilities for π which is π = 75% or π < 75%. Since $-1{,}96 < 0.22647 < 1{,}96$ then $-z_{\frac{1}{2}(1-\alpha)} < z_{count} < z_{\frac{1}{2}(1-\alpha)}$ which means that H_0 is accepted. As a result, the proportion of students who have achieved completeness is equal to 75%. It means that the experimental class has achieved completeness to 75%, or that 75% of the students in the class scored ≥ 70.

Hypothesis testing 2 was conducted to determine whether the average of mathematical representation ability of students who received online learning materials through flipped classrooms was more than 70 (the average initial ability test). The test used is the average test with the student t distribution. From the test calculation, the tcount value is 2.4399. For α= 5% and dk 25, then the result of the t(0,95)25 is 1.708. Because 2.4399 > 1.708, it means that H0 is rejected and H1 is accepted. So, the average of mathematical representation ability of students from classes that receive online learning materials through flipped classrooms is more than 70.

Hypothesis testing 3 was conducted to determine the average of mathematical representation ability of students before receiving online learning through the flipped classroom compared to students after receiving online learning through the flipped classroom. The statistical test t was employed. Based on the table, it is found that the average of mathematical representation ability of students before online learning through the flipped classroom is 82.85, while the average of mathematical representation ability of students after online learning through the flipped classroom is 93.87. This shows that the average difference in students' mathematical representation abilities before and after online learning through flipped classrooms is quite high. It was also obtained in table 4.11 that the value of sig (2-tailed) < 0.05, so H0 is rejected, then it showed that there are differences in students' mathematical representation abilities before online learning through flipped classrooms.

From the three results above, it can be concluded that the quality of online learning through the flipped classroom on mathematical representation abilities is in the good category. This is in accordance with research from Pratiwi (2013) which states that the mathematical representation ability of students who receive learning other than conventional shows increased results.

The second research objective is to analyze the mathematical representation ability in terms of students' self-efficacy.

From the three aspects of mathematical representation, students who have high self-efficacy can solve mathematical representation problems well. Students who have high self-efficacy can master visual representation, symbolic representation, and verbal representation well, although there are few errors in making mathematical models or in symbolic representation aspects. In the verbal representation aspect, students who have high self-efficacy are correct in answering and finding solutions, but they are less thorough in determining the result of the answer in accordance with the question, however the error is not too fatal because the mastery level is still 80%. Therefore, students who have high self-efficacy have mathematical representation abilities in the good category. This is in line with the results of research from Rakes and Dunn (2010), that students who have high self-efficacy will have an impact on good learning outcomes.

Students who have moderate self-efficacy can solve visual representation problems in a good category, but in the symbolic representation aspect, they are in the sufficient category. This can be seen from the fact that there are still errors in the symbolic representation aspect where students who have moderate self-efficacy are inaccurate in generating mathematical ideas, so that the equations used are inaccurate, too. In the aspect of verbal representation, students are correct in answering and finding the solutions, however they do not pay attention to detail in determining the result of the answer in accordance with the question.

The mathematical representation ability shown by students with moderate self-efficacy is based on students' beliefs to master mathematics well. They

tried to communicate with friends to find the best solution to the math problems they faced, although sometimes they avoided doing schoolwork. They were quite enthusiastic about taking mathematics lessons at school, able to motivate themselves to learn mathematics, especially if they previously obtained unsatisfactory grades, and tried to get better grades in the next math assessments. However, students with moderate self-efficacy often feel doubtful when solving difficult mathematical question that they have never encountered before.

Students who have low self-efficacy can solve problems of visual representation and symbolic representation in less-category. In the aspect of verbal representation, they were in good category. During the learning process, students with low self-efficacy were not too enthusiastic to participate in the class. When they were faced with math problems, sometimes they communicated with friends to find solutions, and sometimes they also ignored it, especially when the math problem is classified as difficult questions, also they will give up more easily. In terms of the schoolwork, sometimes they did it, on the other times they avoided it, and felt hopeless. In addition, students with low self-efficacy are less able to make mathematical completion plans.

The third research objective is to determine the effect of self-efficacy on students' mathematical representation ability in online learning through flipped classrooms. The test used was a simple linear regression test. From the test calculations, the regression equation is $\hat{y} = 32{,}773 + 0{,}551x$ After testing the value of b, the sig = 0.006 = 0.6% < 5%. By other means, H0 is rejected and H1 is accepted. So, there was a linear relationship between self-efficacy and mathematical representation ability, or it can be concluded that self-efficacy has a positive effect on mathematical representation ability.

The effect of it can be seen from the value of R square. The obtained value of R square is 0.274 or 27.4%. This result indicates that self-efficacy affects students' mathematical representation abilities by 27.4%, and there are still 72.6% of students' mathematical representation abilities influenced by other factors.

CONCLUSION

Based on the results of previous research and discussion, the conclusion of this study is that the quality of online learning through flipped classroom on mathematical representation ability is in the good category, as it was indicated in the planning and implementation stages learning which of included in the good category. At the learning assessment stage, students who received online learning through flipped classrooms achieved completeness of 75%, while the average of mathematical representation ability is more than 70 (initial ability test); the proportion of students' mastery after receiving learning is higher than before receiving it, the average of students' mathematical representation ability after learning is higher than before receiving it; Students who have high self-efficacy are more able to master all three aspects of mathematical representation well than students with moderate and low self-efficacy; Self-efficacy has a positive effect on the mathematical representation ability of the students grade XI of SMA N 1 Selomerto in online learning through flipped classroom. Students with low self-efficacy are not too enthusiastic and give up easily in the learning process, therefore, it is expected that teachers can provide more guidance and motivate students not to give up in completing school assignments, to recognize their own potential, and to increase their learning independence.

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