Increased mathematical relational understanding ability and self regulated learning of high school students through Edmodo online learning

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Abstract. This study aims to analyze and improve the relational mathematical learning abilities and independent learning of students who obtain Edmodo and Google Classroom learning which is reviewed with mathematical initial ability. This type of research is a quasi-experimental design. The research sample is students of class X MIPA 1 and 2. Data collection techniques with purposive sampling technique. The instrument used consisted of tests and questionnaires. The results showed that 1) Overall, the achievement and improvement of the mathematical relational understanding ability (KPRM) of students who obtained the Edmodo learning were no higher than students who received Google Classroom learning, 2) a. Viewed from the high KAM category, accepted and improved, the KPRM of students who received the Edmodo learning was no higher than students who obtained Google Classroom learning, b. Judging from the moderate KAM category, the achievement and improvement of the KPRM of the students who received the Edmodo learning were not significantly higher than students who obtained Google Classroom learning, 3) Overall, independent learning achievement arranged by students who learned Edmodo learning was not significantly higher for students who received Google Classroom learning, and 4) A significant relationship is obtained between KPRM and students' SRL in Edmodo learning.

1. Introduction
According to the Law of the Republic of Indonesia No.20 of 2003 concerning National Education System Chapter I Article 1 states that: "Education is a conscious and planned effort to create an atmosphere of learning and learning process so that students actively develop their potential to have religious spiritual power, self-control, personality, intelligence, noble character, and the skills needed by themselves, society, nation and country" (Ministry of Education and Culture: 2003).[1] Education is needed so that the wider community can develop the science and technology they have. One of the needs in science and technology in education is about mathematics.

Mathematics is defined as the basis of science that is developing at this time, because mathematics plays an important role in the way of thinking of a student and the ability to solve a problem, especially in daily life basis. Mathematics can also develop the abilities needed by individuals in dealing with all aspects of life. The existence of mathematics at every level of education becomes a basic lesson that must be mastered, given the role of mathematics is needed in various aspects of life. However,
mathematics is used as one of the subjects that is not liked by most students, because students consider mathematics to be a boring, scary, even difficult subject.

The purpose of learning in mathematics is that students have the ability to: 1) understand mathematical concepts, explain the inter-concept interrelationships and use concepts and algorithms, flexibly, accurately, efficiently, and precisely in problem solving; 2) use the patterns to make guesses and be able to make generalizations; 3) use reasoning and doing mathematical manipulation; 4) communicating ideas, reasoning and being able to compile mathematical proofs; 5) has an attitude of appreciating the usefulness of mathematics in life; 6) have attitudes and behaviors that are in accordance with the values that exist in mathematics and learning; 7) conducting motor activities that use mathematical knowledge; 8) using simple teaching aids or technology results to carry out mathematical activities (Ministry of Education and Culture, 2014).[2]

Based on the objectives above, one of the abilities in mathematics is the ability to understand in understanding its mathematical concepts, explaining the interconnectedness of its concepts and using its concepts and algorithms, flexibly, accurately, efficiently, and precisely in problem solving. Skemp (1976) breaks down understanding into 2 types, namely: (1) instrumental understanding, which is memorized concepts / principles without relation to others, can apply formulas to simple calculations, and work on formulas algorithmically; and (2) relational understanding, namely linking one concept / principle with another concept / principle.[3]

The foundations of relational understanding are stronger when compared to instrumental understanding. Instrumental understanding only memorizes the formula without understanding the concept, whereas relational understanding can solve problems related to relevant concepts or procedures without memorizing the formulas (Marhami, 2016).[4] In addition, the existence of other abilities such as affective ability also influences student learning outcomes in mathematics. One of the affective abilities, namely regarding self-regulated learning. According to Lestari and Yudhanegara (2015) said that self-regulated learning as the ability to monitor, regulate, control aspects of cognition, motivate, and behave based on oneself in learning.[5]

In addition, various types of learning sites or commonly referred to as e-learning have begun to be developed and can be accessed quickly, easily and for free via mobile phones or laptops / computers. One of the learning media is learning by using Edmodo application. According to Pitoy (2012), Edmodo is a social network platform for teachers and students with the aim of sharing ideas, files, agenda of activities, and assignments.[6] Edmodo makes it easy for students and teachers to communicate outside the classroom. Meanwhile, the advantages of Edmodo (Wankel, 2016) are that it is easy to send pictures, files, videos and links, send individual messages to teachers, create groups for individual discussion according to class or topic, safe environment for students, messages designed to easier to understand and not limited by the number of characters.[7]

In addition to the existence of learning media in enhancing the ability of relational understanding and self-regulated learning, the teacher can see the ability of students by preparing material that will later be given to students in accordance with the actual situation of students. According to Long and Kerlin, there are several factors that influence students when learning (in Sumarmo, 2006).[8] One of the influencing factors is prior knowledge. The prior knowledge or commonly referred to as students' “initial mathematical ability (KAM)”. Students’ initial ability is one of the factors that play a role in encouraging the achievement and improvement of students mathematical abilities.

Based on the background of the problems that have been described, the formulation of the problems in this study, namely 1) Are the achievement and improvement of mathematical relational understanding abilities of students who obtained Edmodo online learning is higher than students who got Google Classroom learning in terms of a) as a whole, b) based on KAM category (high, medium, low); 2) Are self-regulated learning students who got Edmodo learning online better than students who got Google Classroom learning, 3) Is there a significant relationship between mathematical relational understanding ability and students' self regulated learning on Edmodo learning.

Based on the formulation of the problem, the purpose of this study is to assess 1) The achievement and improvement of the mathematical relational understanding ability of students who get Edmodo learning online is higher than students who get Google Classroom learning in terms of a) as a whole, b) by KAM category (high, medium, low); 2) Self regulated learning students who get Edmodo learning
online compared to students who get Google Classroom learning; 3) Significant relationship between mathematical relational understanding ability and students' self-regulated learning on Edmodo learning.

2. Methods
This type of research is included in experimental research. This study uses a quantitative approach with a quasi-experimental method (quasi experimental design). According to Creswell (2017), this quasi-experimental study uses two research groups namely the experimental group and the control group, but in selecting research subjects the two groups are not chosen randomly.[9] The design used in this study is the Nonequivalent Control Group for mathematical relational understanding abilities, while the design used for self-regulated learning is Posttest Control Group Design. The population in this study were class X students, while the study sample was MIPA 1 (34 students) and MIPA 2 (31 students). Data collection technique is a purposive sampling technique. The research instrument consisted of tests and questionnaires.

3. Result and Discussion

3.1. Research results and discussion
The research that has been done has obtained the results of the pretest and posttest mathematical problem solving abilities and the results of the posttest self regulated learning. The hypothesis of this study was used to determine the value of the posttest on the achievement and improvement of the mathematical relational understanding ability of students who obtained learning, either by using Edmodo or Google Classroom which were reviewed as a whole or in KAM. Based on these hypotheses, posttest results are calculated for normality test (Shapiro-Wilk) and homogeneity tests as well as t test data for achievement and improvement in mathematical relational understanding abilities and self-regulated learning as a whole and in KAM, if the data are normally distributed. Meanwhile, if the data are not normally distributed, then the test used is the Mann Whitney test (M-W). Meanwhile, the results of research conducted on the results of the posttest to measure the overall achievement of mathematical relational understanding capabilities, where the data is normally distributed and homogeneous. So, t test can be done with the following results:

Table 1. T test on Achievement of Mathematical Relational Understanding Ability based on Overall Media Learning

| Media Learning       | Mean  | t     | Sig.(1-tailed) | H_0   | Interpretation   |
|----------------------|-------|-------|----------------|-------|------------------|
| Edmodo               | 77.88 | -1.294| 0.100          | Accepted | Not Higher       |
| Google Classroom     | 81.03 |       |                |       |                  |

Table 1 shows that Sig. 0.100 is greater than the significant level that is 0.05, therefore H_0 is accepted. So, it can be concluded that overall, the achievement of mathematical relational understanding ability of students who obtained Edmodo learning was not significantly higher than students who obtained Google Classroom learning. Furthermore, calculations are performed to calculate the data to increase the overall mathematical relational understanding ability. However, the data that has been tested with normality test, then the data is not normally distributed. So, testing using the Mann Whitney test with the following results:

Table 2. Mann Whitney Test on Improvement of Mathematical Relational Understanding Ability by Overall Media Learning

| Media Learning       | Mean Rank | M-W   | Sig.(1-tailed) | H_0 | Interpretation   |
|----------------------|-----------|-------|----------------|-----|------------------|
| Edmodo               | 32.16     | 498.500| 0.353          | Accepted | Not Higher       |
| Google Classroom     | 33.92     |       |                |       |                  |
Table 2 shows that Sig. 0.353 is greater than the significant level that is 0.05, therefore $H_0$ is accepted. So, it was concluded that the data on improving students' mathematical relational understanding abilities that obtained Edmodo learning were not significantly higher than students who obtained Google Classroom learning as a whole. Then a calculation is performed to calculate the data achievement of KAM's mathematical relational understanding ability. However, the data that has been tested with normality test, then the data is not normally distributed. Thus, the test is carried out with the Mann Whitney test with the following results:

Table 3. Mann Whitney Test Data Achievement of Mathematical Relational Understanding Ability Based on KAM

| Category        | Media Learning       | N  | M-W       | Sig (1-tailed) | $H_0$ | Interpretation         |
|-----------------|----------------------|----|-----------|----------------|-------|------------------------|
| High KAM        | Edmodo               | 2  |           |                |       |                        |
|                 | Google Classroom     | 3  | 1.000     | 0.091          | Accepted | Not Higher             |
| Moderate KAM    | Edmodo               | 30 | 342.000   | 0.154          | Accepted | Not Higher             |
|                 | Google Classroom     | 27 |           |                |       |                        |

Table 3 shows that the high KAM and the moderate KAM are Sig. 0.091 and Sig.0.154 is greater than the significant level that is 0.05, therefore $H_0$ is accepted. So, it can be concluded that a. seen from the high KAM category, the achievement of the mathematical relational understanding ability of students who obtained Edmodo learning was not significantly higher than students who obtained Google Classroom learning, b. seen from the moderate KAM category, the achievement of the mathematical relational understanding ability of students who obtained Edmodo learning was not significantly higher than students who obtained Google Classroom learning. Next, a calculation is performed to calculate the data for increasing KAM's mathematical relational understanding ability. However, the data is not normally distributed data, then the next test is carried out with the Mann Whitney test with the following results:

Table 4. Mann Whitney Test Data Improvement of Mathematical Relational Understanding Ability Based on KAM

| Category        | Media Learning       | N  | (MW)      | Sig (1-tailed) | $H_0$ | Interpretation         |
|-----------------|----------------------|----|-----------|----------------|-------|------------------------|
| High KAM        | Edmodo               | 2  | 2.000     | 0.277          | Accepted | Not Higher             |
|                 | Google Classroom     | 3  |           |                |       |                        |
| Mediate KAM     | Edmodo               | 30 | 365.500   | 0.263          | Accepted | Not Higher             |
|                 | Google Classroom     | 27 |           |                |       |                        |

Table 4 shows that the high KAM and the mediate KAM are Sig. 0.227 and Sig. 0.263 greater than the significant level that is 0.05, therefore $H_0$ is accepted. So, it can be concluded that a. seen from the high KAM category, the increased mathematical relational understanding ability of students who received Edmodo learning was not significantly higher than students who obtained Google Classroom learning, b. seen from the moderate KAM category, the improvement in the mathematical relational understanding ability of students who received Edmodo learning was not significantly higher than students who obtained Google Classroom learning. Then, the calculation of self regulated learning achievement data is calculated, where the data is normally distributed and homogeneous. Meanwhile, the results of achieving self-regulated learning, namely:
Table 5. T test on Achievement of Self Regulated Learning as a whole

| Media Learning          | Mean   | t    | Sig.(1-tailed) | H₀     | Interpretation |
|-------------------------|--------|------|----------------|--------|----------------|
| Edmodo                  | 71.01198 | 0.107 | 0.457         | Accepted | Not better    |
| Google Classroom        | 71.0835 |      |               |        |                |

Table 5 shows that the Sig. 0.457 is greater than the significant level that is 0.05, therefore H₀ is accepted. So, it can be concluded that the data on the achievement of self-regulated learning of students who received Edmodo learning were not significantly better than students who obtained Google Classroom learning as a whole. Next, a calculation is made about the relationship between mathematical relational understanding ability and self regulated learning, where the data is normally distributed. Meanwhile, the results of the calculation:

Table 6. Correlation Tests for Relational Comprehension Ability and Self-Regulated Learning

|                      | Relational Understanding | Self Regulated Learning |
|----------------------|--------------------------|-------------------------|
| ρs                   | Correlation coefficient  | -0.360                  |
|                      | Sig.(2-tailed)           | 0.037                   |
|                      | N                        | 34                      |
|                      | Koefisien korelasi       | -0.360                  |
|                      | Sig.(2-tailed)           | 0.037                   |
|                      | N                        | 34                      |

Based on the above table, it is known that the results of the calculation of the correlation significance value of the relational understanding ability and self regulated learning Sig.=0.037 smaller than α = 0.05, therefore H₀ is declined. So, it can be concluded that there is a significant relationship between mathematical relational understanding ability and students' self-regulated learning in Edmodo learning.

Therefore, based on the results above, it can be concluded that the data is not in accordance with the results of a research conducted by Purwasih who said that increasing the mathematical understanding ability of the experimental class is better than the control class. [10] Meanwhile, problem-solving abilities and self-regulated learning are interrelated with one another. This is supported by the study of Hargis's findings (Sumarmo, 2004) that individuals who have high self-regulated learning, usually these students tend to be able to study well, are able to monitor the results they get, can evaluate and manage their learning effectively so that they can manage time in completing his job and get a high score.[11]

4. Conclusion

Based on the description above, the results of the study shows that 1) Overall, the achievement and improvement of the mathematical relational ability of students who obtained Edmodo learning were not significantly higher than students who obtained Google Classroom learning as a whole, 2) a. Judging from the moderate KAM category, the achievement and improvement of mathematical relational abilities of students who obtained Edmodo learning were not significantly higher than students who obtained Google Classroom learning, b. Judging from the low KAM category, the achievement and improvement of mathematical relational abilities of students who obtained Edmodo learning were not significantly higher than those of students who obtained Google Classroom learning. 3) Overall, the achievement of self-regulated learning of students who received Edmodo learning was not significantly better than students who obtained Google Classroom learning as a whole, and 4) There was a significant relationship between mathematical relational abilities and students' self-regulated learning in Edmodo learning.
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