The ability of understanding mathematical concept and self-regulated learning using macromedia flash professional 8

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Abstract. Changes to the curriculum in Indonesia have also caused changes in the learning process. Students are required to play an active role in classroom learning, while teachers only act as facilitators. So that in this curriculum, students are expected to have self-regulated learning. But also, another aspect that must still be had by students is a good understanding of concepts, especially in a material that is considered difficult like mathematics. One alternative way that can be done to achieve both aspects is the use of instructional media, such as interactive multimedia. One interactive multimedia that can be used is the Macromedia Flash Professional 8 application. This study aims to compare two groups with different treatments on trigonometry material. This study uses a quasi-experimental method with the non-equivalent control group design. This study was divided into two groups; the first group was given learning using flash media as an experimental group and the second group as a control group using ordinary learning. The sample in this study was taken from two classes of thirteen classes with purposive sampling, namely class X RPL 2 and X AKKUL 1 in SMK Negeri 1 Cianjur. Data were analyzed using the Mann Whitney Test and the Independent Sample t/t'-test. The results showed that the achievements and increased ability to understand mathematical concepts from the experimental group were significantly better than the control group. Based on N-gain criteria, the increased is including the medium category. At the same time, the self-regulated learning of the experimental group is the same as the self-regulated learning of the control group.

1. Introduction

Education is the main pillar in the development of human resources and the community of a nation. So that the government in a nation is required to continuously make updates or innovations in order to achieve these educational goals. One of the efforts made by the government is to improve the curriculum. The latest curriculum introduced to the world of education in Indonesia after the Kurikulum Tingkat Satuan Pendidikan (KTSP) or Education Unit Level Curriculum is the 2013 Curriculum. This 2013 curriculum has also been updated through various revisions.

Changes to this curriculum also cause changes in the learning process. The learning process changes from what students are initially told to students find out. Students are required to play an active role in classroom learning, while teachers only act as facilitators. Each learning process, students are directed to become independent students because learning independence is part of self-regulation when facing learning situations [1]. Importantly, the students will succeed in their academic achievement if they have self-regulated learning or independent learning [2]. So that in this curriculum, students are expected to have self-regulated learning, to be in accordance with the program launched by the government.

Based on findings in the field, when researchers conducted PLP (Pengenalan Lapangan Persekolahan) or School Field Introduction, researchers found that most students still did not show self-
regulated learning. This is indicated by several problems that occur as in the case of task collection, students still have to be reminded by the teacher. When not reminded, they did not take the initiative to collect. In addition, most students are still unable to manage their own learning patterns at home and other problems. This is in line with the other research, which shows that students have not been embedded in self-regulated learning [3]. One of them, students ask teachers to be directed continuously in learning activities, and many other problems.

In addition to self-regulated learning, another aspect that students must have, of course, is a good understanding of concepts. Students' understanding of subject matter is the main thing in the learning process [4]. In learning mathematics, the ability to understanding the mathematical concept is the main thinking that can lead students to have other mathematical ability [5,6]. If likened, concepts are the stones of development in thinking [7]. The goal in mathematics teaching has shifted towards an emphasis on procedural and conceptual understanding [8]. Therefore, understanding concepts is one of the important goals of learning.

However, during the PLP the researchers also found that most students only memorized the formula without knowing the flow of the solution or the initial formula that is the basis of the given problem. This can be seen when students find it difficult if given a question with a different type. One of the reasons students fail to solve mathematical problems well is because students have difficulty in understanding concepts and lack of good reasoning in working on the questions or tests given [9]. The incident shows that students’ understanding of mathematical concepts is still low. So, educators should focus more on conceptual understanding [10].

One alternative way that can be done to achieve both aspects is the use of instructional media. A media is needed that is able to encourage the independence of student learning and is able to provide a good and correct understanding of concepts for students. It can not be denied that learning media were created to facilitate the learning process [11]. Especially on subjects that are considered difficult by students, one of them is mathematics.

Abstract mathematical characteristics really need seriousness and high concentration to understand it [12,13]. In addition, the abstract nature of mathematics also makes many students consider mathematics as a difficult subject. So, causing some students to have difficulty in understanding mathematical concepts and not even a few students who are not interested in learning it. Then the important role of the media is needed in the learning process so that the material delivered by the teacher is quick to arrive and easily maximally understood by students [14]. Teachers should be able to provide experiences to build or establish mathematical concepts [15,16]. So this learning media is really needed to overcome this.

However, conditions in the field indicate that the ability of teachers to use instructional media is still low [17]. However, this learning media is one of the supports of learning success. The selection of the right type of media will increase students’ interest, and interest in the subjects taught [18]. Technology that is rapidly developing now can be utilized properly as a means to support the learning process. We can use various kinds of technology as learning media. Interactive multimedia-based learning media is one of the learning media with a student-centred learning process. Interactive learning multimedia is learning by using various media which are equipped with a controller that can be operated by its users [19]. Users can choose what learning they want [20]. Based on these explanations, interactive multimedia is expected to foster student self-regulated learning and be able to provide a good and correct understanding of mathematical concepts for students. This is evident from the existence of a controller that can be operated by students directly in their learning.

One interactive multimedia that can be used is Macromedia Flash Professional 8 application. Besides being very interesting and can increase students’ interest and motivation to learn [21], this media can also stimulate students to manipulate the concepts and can find out the real form of abstract mathematical concepts [22]. This is in line with the results of other research that Macromedia flash can improve students’ self-regulated learning [23].

Based on the background, this research aims to; 1) determine the achievement of the ability to understand mathematical concepts of students who use Macromedia Flash Professional 8 and the achievement of the ability to understand mathematical concepts of students who use ordinary learning; 2) determine an increase in the ability to understand the mathematical concept of students who use
Macromedia Flash Professional 8 and an increase the ability to understand mathematical concepts of students who use ordinary learning; and 3) determine the self-regulated learning of students who use Macromedia Flash Professional 8 and the self-regulated learning of students who use ordinary learning.

2. Method
This study uses a quasi-experimental method with the design of The Nonequivalent Control Group, because this method doesn’t require a randomly selected sample. There are two groups in the design of this study, namely the experimental group and the control group. The research design of The Non Equivalent Control Group is as follows [24]:

\[
\begin{align*}
\text{Experimental Group} : & \quad O_1 \quad X \quad O_2 \\
\text{Control Group} : & \quad O_3 \quad O_4
\end{align*}
\]

O₁ and O₂ are the pre-test and post-test experimental classes, and O₃ and O₄ are the pre-test and post-test control classes, respectively. While X is the treatment received an experimental group that is learning by using flash media.

The population of this study is the X grade students of SMK Negeri 1 Cianjur. As for the sample in this study, two classes from thirteen classes were selected, namely class X RPL 2 as the experimental group and X AKKUL 1 as the control group. The sample selection uses a purposive sampling technique, namely the technique of determining the sample with certain considerations [24].

The instrument used in this study was in the form of a test instrument for the ability to understand mathematical concepts and a non-test instrument in the form of a self-regulated learning questionnaire. Furthermore, the data obtained were analyzed using the Independent Sample t / t' Test if the samples come from populations with normal distribution, and use the Mann Whitney test if the samples come from populations that are not distributed normally.

The indicators that show understanding of the concept include restating the concepts learned, classifying objects based on mathematical concepts, applying concepts in an algorithm, giving examples or counter examples of concepts learned, presenting concepts in various representations, and linking various mathematical concepts internally or externally [25].

While the indicators of self-regulated learning used are indicators of self-regulated learning namely the existence of a strong desire and desire to learn, being able to take decisions and initiatives to deal with problems, responsibility for what is done, and self-confidence and doing tasks work independently [26]. Table 1 shows scoring guidelines that researchers use to measure students’ understanding of mathematical concepts based on the answers given during the test:

| Answer Criteria                      | Score |
|--------------------------------------|-------|
| No answer                            | 0     |
| There are answer using the method but the wrong way | 1     |
| Give a correct answer but not accompanied by a reason | 2     |
| Give answer but not all are correct  | 3     |
| Give answer, the reason can be understood, and correct | 4     |

As for the score criteria on the self-regulated learning questionnaire, researchers used the Guttman scale response format with alternative responses being YES or NO. Determination of positive directed score is 1 for option YES and 0 for option NO. As for the negative-directed scale, then the score might be the opposite, which is 0 for the YES option and 1 for the NO option.

3. Result and Discussion
This study uses two groups as samples, namely one group as an experimental group and the other group as a control group. After the data is obtained, then the data is analyzed by a predetermined method. Following are the results of data analysis on the ability to understand mathematical concepts and the self-regulated learning of the two groups.
Table 2. Descriptive Statistics Achievement Data of Understanding Mathematical Concepts Ability

| Group   | N  | Ideal Score | The mean | Standard Deviation | Minimum score | Maximum score |
|---------|----|-------------|----------|--------------------|---------------|---------------|
| Experiment | 30 | 100         | 68.07    | 10.329             | 50            | 92            |
| Control  | 28 | 100         | 53.96    | 20.585             | 13            | 88            |

Based on Table 2, it can be seen that the average post-test score of the experimental group was 68.07, while the control group obtained an average of 53.96. From the descriptive data, it can be seen that the average score of the experimental group is greater than the average score of the control group, with an average difference of 14.11. However, to find out whether there is a significant difference, different tests will be performed on the two groups using the t-test.

Before the conduct of t-test up previously done testing the normality of both groups data by using a test for normality with the Kolmogorov-Smirnov, the results of the normality test show that the value of the achievements of the ability to understand the mathematical concept of experiment group student derived from a population that is distributed normally with the value of Sig. 0.131. But the achievement value of the ability to understand the mathematical concepts of the control group comes from populations that are not normally distributed with the Sig. 0.038. Further, to determine the significance of differences mean both group data, used Mann Whitney test because there is one of a group that is not distributed normally. Based on Mann Whitney test results, obtained that Asymp. Sig (2-tailed) = 0.016. The value of sig. (1-tailed) = ½ sig (2-tailed) then sig (1-tailed) = ½ (0.016) = 0.008. Furthermore, obtained the sig. (1-tailed) < 0.05. The achievement of the ability to understand the mathematical concept of the experiments group student is better than on the achievements of the ability to understand the mathematical concept of control group students.

Table 3. Descriptive Statistics of Gain Index Data Ability to Understand Mathematical Concepts

| Group   | N  | The mean | Standard Deviation | Minimum score | Maximum score |
|---------|----|----------|--------------------|---------------|---------------|
| Experiment | 30 | 0.5737   | 0.1287             | 0.25          | 0.86          |
| Control  | 28 | 0.4243   | 0.2320             | -0.05         | 0.79          |

Based on Table 3, it can be seen that the average gain index score of the experimental group was 0.5737, while the control group obtained an average of 0.4243. From the descriptive data, it can be seen that the average score of the experimental group is greater than the average score of the control group, with the average difference being 0.1494. Furthermore, the data were statistically tested with a test that is the same as testing the achievement of the ability to understand the mathematical concept, namely by using t-test.

Before doing the t-test up previously done testing the normality of data both groups by using the Kolmogorov-Smirnov. The results of the normality test is N-Gain of the ability to understand the mathematical concept of experiment group students and control group student each derived from a population that is distributed normally with the value of Sig. is 0.200 and 0.200. Furthermore, in the similarity test of variance with Levene obtained sig values = 0.000. The value of sig. no more substantial than 0.05 means stated that the variance of the population of the two classes is not homogeneous. Furthermore, to find out the significance of the mean difference between the two groups of data the statistical test is used, for non-homogeneous data pairs the t-test is used with the equal variances not assumed and obtained $t_{count} = 3.003$ with df = 41.548 and sig. (2-tailed) = 0.005. Value sig. (1-tailed) = ½ sig.(2-tailed) means sig. (1-tailed) = ½ (0.005) = 0, 0025. Furthermore, obtained sig.(1-tailed) < 0, 05. There is a difference in mean both groups. Means, an increase in the ability to understand mathematical
concepts of experiment group students is better than an increase the ability to understand mathematical concepts of control group students.

Next is an analysis of student self-regulated learning based on questionnaire data that has been received, the following results are obtained:

| Table 4. Statistics Descriptive Data Results of Self-Regulated Learning Questionnaire |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Group                           | N               | Ideal Score     | The mean        | Standard Deviation | Minimum score   | Maximum score   |
| Experiment                      | 30              | 100             | 55.33           | 11.740            | 30              | 85              |
| Control                         | 28              | 100             | 56.61           | 12.327            | 35              | 80              |

Based on Table 4, it can be seen that the average score of the experimental group's learning independence questionnaire was 55.33, while for the control group, an average of 56.61 was obtained. From the descriptive data, it can be seen that the average score of the experimental group is smaller than the average score of the control group, with an average difference of 1.28. Same as the testing earlier, before the conduct of t-test up previously done testing the normality of data, both groups by using a test of normality Kolmogorov Smirnov. The results of the normality test is the value of self-regulated learning of the experiment group students and control group students each derived from a population that is distributed normally with the value sig. respectively are 0.200 and 0.142. Furthermore, the test similarity variance by Levene obtained sig. = 0.452. The value of sig. are more substantial than 0.05 means stated that the variance of the two groups is homogeneous. To find out the significance of the mean difference between the two groups of data the statistical test is used, for homogeneous data pairs the t-test is used with the equal variances assumed and obtained t_{com} = -0.403 with df = 56 and sig. (2-tailed) = 0.688. Value sig. (1-tailed) = ½ sig.(2-tailed) means sig. (1-tailed) = ½ (0.688) = 0.344. Furthermore, obtained sig. (1-tailed) > 0.05. So, there is no difference in the mean of the two groups. Means, the self-regulated learning of experiment group students is not much better than the self-regulated learning of control group students.

As to the possibility of the factors that become the cause of a significant difference in achievement and increase the ability to understand mathematical concepts among students who use flash media with students who are only given ordinary learning is there is learning by using flash media, teachers provide a different learning experience to students. So there is a special interest from students to participate in learning. This interest makes the students try to follow the learning with pleasure and be able to understand mathematical concepts well. This is in line with some research which shows that the use of flash media significantly influences the ability to understand mathematical concepts [27,28].

While one of the causes that self-regulated learning of experimental group was the same with the control group were not any students in the experimental group has a laptop. So in the learning process, those who don't have laptops or don't even have to join with other friends who carry laptops. This more or less affects of their self-regulated learning, because there is one indicator that is not met, namely confidence and perform tasks independently. Such conditions lead to a sense of dependency from students who do not carry laptops to students who carry laptops. One other possible cause is that based on previous studies on difference in self-regulated learning between male and female student, it shows that the self-regulated learning of female students is better than the self-regulated learning of male students [29–31]. Because the experimental group is dominated by male students while the control group is dominated by female students, so that the self-regulated learning of the experimental group is not better than the control group.

4. Conclusion
Based on the results of research and discussion, the general conclusions are derived research that: 1) the achievement of the ability to understand mathematical concepts of students who use Macromedia Flash Professional 8 is better than the achievement of the ability to understand mathematical concepts of students who use the ordinary learning; 2) the increase of the understanding of mathematical concepts ability of students who use Macromedia Flash Professional 8 is better than the increase of the understanding of mathematical concepts ability of students who use the ordinary learning; and 3) Self-
regulated learning of students who use Macromedia Flash Professional 8 is the same as or not better than self-regulated learning of students who use ordinary learning.

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