Mathematical representation ability using website for learning transformation geometry in a teacher education classroom

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Abstract. The importance of mathematical representation ability is help student to describes thinking processes that has be done by students in order to understand concept, operation, and student ideas. Seeing the importance of student’s mathematical representation abilities in learning transformation geometry, the use of websites is expected to help students to illustrate their ideas. The purpose of this research is to find out the difference between learning with using website and learning without website. The population of the study were all students of grade II of 2 classes. Sample taken with purposive sampling, one class is experiment class and one other is control class. Data were analyzed using descriptive statistical and t-test. The result showed that achievement of mathematical representation is difference between learning using and without website.

1. Introduction

In the era of millennia, human beings are closely attached to the use of technology and information in various lines of life ranging from social media, online shopping sites, transportation that can be ordered online, online learning institutions, to formal teaching and learning activities. ICT in the world of education such as, website, edmudo and learning sites developed by instructors or educational institutions are used as media to support learning activities.

The mastery and use of technology is one way to facilitate learning so as to reduce conceptual miss related to mathematical abilities. One form of presentation of lecture material, exercises, and quizzes is to be published on a website that can be accessed by all students anytime and anywhere. Presentation of lecture material like that allows students to repeat the material that has been learned by clicking on topics that students have not mastered. As for the appearance of an attractive website, it can increase students interest to study the material deeper, either independently or in groups.

The ability of mathematical representation needs to be paid attention to lectures on geometry of transformation and linear algebra. The ability of representation can describe the thinking process that is done by students in understanding the concepts, operations, and ideas of students. Seeing the importance of students mathematical representation ability in learning transformation geometry, the use of websites is expected to help students to illustrate their ideas. Representations constructed by students are the same as solving problems and investigating their mathematical ideas to help themselves understand concepts and arrange meaningful ways to construct systematic solutions and describe them. The series of student representation activities can be facilitated by website-assisted learning. From all of the series, students are encouraged to communicate their mathematical representation processes through pictures, algebraic forms, sentences, and arguments.
One form of presentation of lecture material, practices, and quizzes is to be published on a website that can be accessed by all students anytime and anywhere. Presentation of lecture material on the website allows students to repeat the material that has been learned by clicking on topics that students have not mastered. Meanwhile, if the appearance of an attractive website can increase the interest of students to learn more material either independently or in groups. The study of geometry is an important component because it allows students to analyze and interpret the environment around them[1,2,3]. The geometry courses in college contain definitions, axioms, and theorems [4]. In mathematics classroom context, several studies have shown that students feel difficult to visualize the concept of geometry. Consequently, they cannot analyze, define conjecture, justify the problem and moreover to compiling geometric proofs [5,6,7].

The importance of the ability of mathematical representation for the owned by the student really help students in understanding the mathematical concepts in the form of pictures, symbols, and the written word [8]. When students have access to mathematical representation and ideas that they show, then they have a bunch of tools that will significantly expand their capacities in thinking mathematically [9]. There is a need for some reason the ability of representation, namely: is the ability to build basic concepts and mathematical thinking, and to have a good understanding of the concepts that can be used in problem solving [10].

Mathematical representation is a mental activity that requires students to learn optimally so that website-based learning is expected to help students organize mental activities that are tailored to their abilities. In addition, website-assisted learning also provides opportunities for students to design learning progress both individually and in groups.

The purpose of this study is to address research question as does the using website affect the ability of mathematical representation in learning transformation geometry? The ability of mathematical representation referred to in this study is, to present data or information of representation from a diagram, graph, or table; use visual representation to solve problems; make an equation or mathematical expression from another given representation; and problems by involving mathematical expressions [11].

2. Method
The research was contained at one of university in Cirebon. The population is all students in a teacher education classroom at the Faculty of Teacher Training Education 4th Semester. The number of subjects in this study were 44 students. The researcher choose the fourth semester in a teacher education classroom, because mathematics courses in fourth semester can be used as objects, to examine students’ ability of mathematical representation about learning transformation geometry only in semester IV, in addition, students in this semester are also a group of students who are deemed ready to accept the treatment of research, with the aim of becoming their own experience in learning transformation geometry independently. The sample was chosen randomly from two classes as research samples, from these two classes then randomly selected one class that would be the experimental group, and one class that would be the control group.

The aim of this research is to describe and analyze the ability of mathematical representation based on the data obtained. To uncover the situation regarding the ability of mathematical representation, researchers use experimental method. The population in this research is all students of mathematics grade II of 2 classes that contracted courses transformation geometry. Purposive sampling is selected for choose experiment class dan control class. Research instrument is a pre- and post-test of mathematical representation.

The data about mathematical representation ability of students is obtained through tests of mathematical representation ability. The Kolmogov-Smirnov test, Levene test, and t test were used to analyze the data. The t test was used to determine differences students’ mathematical representation who got learning using and without website. Before using the t test, the prerequisite tests are the normality of the data distribution test using the Kolmogov-Smirnov test and the homogenity variance test of the data groups using the Levene test.
3. Result and Discussion
Before analyzing the post-test score, the pre-test score analysis was previously done. Mann Whitney test result pre-test scores ability of mathematical representation ability shows p-value that is, 0.397 (0.397 > α). It is indicated that there was same in ability of mathematical representation between the experimental and control class. The same ability in pre-test will give an overview of the different treatments in the two classes of research.

This research question is “does the using website affect the ability of mathematical representation in learning transformation geometry?” This question concerned whether using website in learning geometri (reflection dan rotation) affect their ability in order to present data or information from diagram, graph or table representation; using visual representation to solve problems; make equations or mathematical expressions from other representations given; and solve problems by involving mathematical expressions. To address the research question, the research hypotheses were developed as below,

H₀: There is no mean difference on the post-test between experimental and control class
H₁: There is a mean difference on the post-test between experimental and control class

Pre- and post-test were analysed statistically using t-test. Table 1 below present the statistical description of the data from the two classes and the t-test result of respectively.

| Class            | N  | Minimum | Maximum | Mean    | SD     |
|------------------|----|---------|---------|---------|--------|
| Experimental     | 22 | 33      | 2       | 19.23   | 1.605  |
| Control          | 22 | 41      | 3       | 18.14   | 2.367  |
| Valid N (listwise)| 22 |         |         |         |        |

To answer the research question, normality were tested. Table 2 below present the normality of the data from the two classes, and the result of homogeneity test present in table 3.

| Class            | Statistic | Df  | Sig.     | Criteria          |
|------------------|-----------|-----|----------|-------------------|
| Experimental     | 0.937     | 22  | 0.169    | Normal distribution|
| Control          | 0.947     | 22  | 0.279    | Normal distribution|

| Method                        | Levene Statistic | Df1 | Df2 | Sig.  |
|-------------------------------|------------------|-----|-----|-------|
| Based on Mean                 | 5.893            | 1   | 42  | 0.020 |
| Based on Median               | 4.122            | 1   | 42  | 0.049 |
| Based on Median and with      | 4.122            | 1   | 40 | 0.049 |
| adjusted df                   |                  |     |     |       |
| Based on trimmed mean         | 5.745            | 1   | 42  | 0.021 |

The result show that the value of Sig. 0.020 is smaller than 0.05. This means that the post-test data comes from a variance that is not homogeneous so, to find out the difference in the average post-test is done by t’-test. The result of the test are in table 4 bellow.

| Class            | N  | Mean    | Std. Deviation | Std. erro Mean | Criteria     |
|------------------|----|---------|----------------|---------------|--------------|
| Experiment       | 20 | 19.230  | 7.527          | 1.605         | H₀ Rejected  |
| Control          | 20 | 18.140  | 10.634         | 2.267         | H₀ Rejected  |
From table 4 $H_0$ is rejected. It is mean, there is a significant difference between the experimental and control class. The differences that occur illustrate the different learning effects between the experimental and control class. The difference between the experimental and control class is obtained from the result of the mathematical representation ability test of 4 practice with the details of one practice for each indicator of mathematical representation ability. The indicators of mathematical representation used in this research are, to present data or information of representation from a diagram, graph, or table; use visual representation to solve problems; make an equation or mathematical expression from another given representation; solve problems by involving mathematical expressions [11].

From observations, student spend a great deal of time outside of campus. If they want to use part of that time solidifying and extending the transformation geometry they learned in school, however, they will have difficulty finding effective learning activities. Website is a solution for students to learn geometry with more flexible time. In addition, the website also provides opportunities for students to get material while relaxing in a cafe, in the family room, or in a self-contained or group room. Site-based learning supports student learning independence and provides sophisticated learning guidance for students with a sequence of transformation geometry content from easy to complex. Researchers believe with the initial ability of mathematical representation of students before receiving treatment, having the same initial ability distribution, website-assisted learning has a positive impact on students. This is proof from the result of research that found that website-assisted learning provides better outcomes (post-test) compared to classes not given website assistance. The website assistance gives students the opportunity to repeat and read lecture material that is available on the website tailored to the learning needs of each student. This is what makes learning aided by a website have a good impact on achieving the student’s final grade.

The quantitative result of this research are in line with research that have been carried out in the previous century. Goldenberg found that the use of computer technology in learning mathematics has a positive effect on students so that it can provide better performance in learning mathematics compares to those who do not use [12]. Similar of other researchers found that the advantage of using a computer program because it provides a common context and language that student and teachers can use [13].

Website can be modeled to perform pedagogical or tutoring tasks. The interactions among these agents and students include instructing, evaluating feedback from students, mining the characteristics of students, solving problems and effectively tutoring with hint [14]. The Mathmtutor (website) offers detailed, interactive, step-by-step guidance with problem solving, individualized problem selection, detailed reports of student performance for teachers, parents, etc. on the basis of cognitive model [15]. Raines & Clark found from them research that appropriate use of technology will get more students thinking and reasoning mathematically; but, technology in and of itself is not a panacea that will resolve all students’ struggles [16].

From the explanation that has been stated it can be indicated that learning to use a website is good but in Indonesia it still has shortcomings such as, not all regions have a good internet network, not all students have computers, and other obstacles. From this situation, the possibility of students being able to access the website without a hitch is in campus. But, in this study the results show that the learning outcomes of transformation geometry using websites are better, especially in the ability of mathematical representation.

4. Conclusion
The resut of this study indicated that website-assisted learning provides better outcomes (post-test) compared to classes not given website assistance. Other than that, website-assisted learning helps students independently learn actively, the involment of students in the learning process by activating prior knowledge, and giving students the opportunity to explore and meet their personal achievement targets thus, can help the learning needs of each student of various levels of ability. The increasing ability of mathematical representation, begins with learning transformation geometry material which
available on the website then, repeat and practice solving related problems with mathematical representation. That is, treatment can be a cause of increased mathematical representation ability.

After knowing the mathematical abilities, the authors give suggestions for the next researcher: website-assisted learning transformation geometry can related in other mathematical ability as problem solving.

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