Mobile Learning to Improve Mathematical Communication Skills

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Abstract. The goal of this study is to find out if communication skills in math improve when mobile learning is used to help learn math. The approach used in this study is a quantitative approach with a Quasi-Experimental research design, and the design form taken is the Nonequivalent Control Group Design. The population in this study were class XI students, with a sample of 53 students at one of the senior high schools in Karawang. Data collection techniques were in the form of descriptive tests to measure student's mathematical communication abilities and questionnaires for students' independence in learning mathematics. The achievement and improvement of self-regulated learning of students who receive mobile learning is better than students who receive direct learning. The use of mobile learning is effective for improving communication skills, as well as being effective for use as a learning medium in an increasingly sophisticated technological era.

Keywords: Mobile Learning, Mathematical Communication Skills, Learning Medium.

1 Introduction

Learning mathematics is very meaningful in everyday life [1], [2] . Almost every social aspect requires knowledge of mathematics. In mathematics education, it is not limited to knowledge but in mathematics education, students are trained to be able to think logically, analytically, systematically, communicatively, and critically. Mathematical communication ability is a communication skill both delivering and receiving information conveyed verbally or in writing related to mathematical ideas. NCTM or the National Council of Teacher Mathematics, explains that mathematical communication is a fundamental mathematical skill for mathematics and mathematics education. Therefore, mathematical communication skills are very important for students to have [3], [4].

However, in reality, mathematical communication skills among high school students are still in the low category [5], [6]. Most students need help communicating their ideas and knowledge in the form of essay test answers. This was proven in the initial observations made by researchers to analyze students' mathematical communication skills. According to an analysis of the results of the students' answers based on their initial

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observations, it was discovered that in solving these problems, students made mistakes in communicating their ideas, which was due to their lack of understanding of the problems packaged into story problems. The students' inability to explain their understanding of the given transformation problem demonstrates this. In addition, students experience difficulties in connecting real events or the application of mathematics to everyday life in the form of mathematical ideas. Not only that, but some students had a hard time making assumptions and putting together answers to problems involving translation calculations. This error also occurs in drawing conclusions from the alleged results and also in presenting the right graphics.

Based on these problems, students' mathematical communication skills need to be improved. This is intended to increase mathematical abilities in Indonesia in accordance with national education goals. In line with that, the need for a learning media that can improve students' mathematical abilities both in the cognitive and affective domains. Teachers in the 21st century have to deal with different learning conditions than teachers did in the past[7]. Currently, teachers are faced with students whose lives are heavily influenced by technology. Every day students are familiar with television, computers, laptops, and smartphones in their hands, even students bring smartphones to school. It is proven that now communication technology has made high school students commonplace and it is not uncommon for students to become dependent on using smartphones/gadgets/gadgets. This also requires teachers to be able to operate the use of communication technology in the learning process, besides those teachers are required to increase their ability to apply technology in mathematics as a learning medium [8], [9]. Thus, learning media based on Mobile Learning was chosen.

Mobile Learning is a learning method that uses mobile devices. Mobile devices here can be in the form of cellphones, tablets, gadgets, or notebooks, which contain mathematics learning materials, quizzes, learning videos, and others. Android-based learning media can reduce a static environment, create an effective, engaging, and interactive learning process, and motivate students to learn [10], [11]. The use of gadgets as learning media provides several advantages, namely: 1) students can carry out independent learning so that they can increase and expand their knowledge, 2) students engage in more learning activities because they not only attend to the teacher's explanation but also carry out activities that others, such as observing and attempting, do not., and 3) Android-based learning media offers additional learning resources that can be used to enhance learning content. For this reason, there is a need for deeper research related to the use of mobile learning in improving mathematical communication skills.

2 Method

This study uses a quantitative approach. The design applied in this research is a Quasi-Experimental Design. Quasi-Experimental Design is an experimental research design that has an experimental group and a control group. The form taken from this Quasi-Experimental Design is the Nonequivalent Control Group Design, where this design form is the experimental group and the control group is not randomly selected (Table 1).

The research evaluation instrument consisted of pre- and post-test queries. A pretest is a test carried out before being given treatment. While the posttest is a test carried out after having received treatment, both in the experimental class and in the control class. for this implementation stage several steps were carried out, including 1) Carrying out activities according to the design, 2) Providing treatment to the experimental class and control class, 3) Giving pretests to both classes to find out students' mathematical communication abilities before being given treatment, 4) Applying the use of Mobile Learning in the experimental class, and not giving it to the control class, 5) Again giving the test in the form of a posttest to both classes to see the differences that occur.

Table 1. Quasi-Experimental Design

Group	Pretest	Treatment	Posttest
Experiment	O_1	X	O_2
Control	O_3		O_4

X : Treatment with mobile learning

O_1 dan O_3: Communication Mathematical Ability Test Before Giving Treatment

O_2 dan O_4: Communication Mathematical Ability Test After Giving Treatment

3 Result and Discussion

Data from the research on mathematical communication skills were obtained from the results of the pretest, which were used as a tool to measure the initial ability of mathematical communication in the experimental and control classes (Table 2). Furthermore, teaching is given to the two classes, in which the experimental class gets learning with the help of mobile learning while the control class does the learning directly. The final score or posttest is the final score after being given learning, both classes that receive mobile learning-assisted learning or control classes that receive direct learning.

Table 2. Pretest and posttest

	Experiment		Control	
	Pretest	Posttest	Pretest	Posttest
Mean	44,00	89,62	44,52	69,56
Std. Dev.	9,63	6,77	8,82	9,671

The pretest score for the experimental class was 44 as shown in the table 2, the pretest score for the control class was 44.52, which means that the average pretest score for the control class and the experimental class was not much different. This confirms that the average pretest scores of the experimental and control groups are similar. The first meeting in this study was the distribution of pretest questions to determine students' initial mathematical communication abilities, followed by providing mobile learning applications for students to download and install on their mobile devices. Next, the researcher demonstrated how to use mobile learning to experimental class students. The

researcher gave directions to students to prepare for the next meeting regarding transformation material so that students could first access mobile learning as a learning resource.

In the second meeting, students are given the freedom to express their findings regarding the material being taught. Students are directed to solve these problems according to their initial knowledge and are assisted by mobile learning. Students are welcome to express their ideas and ask questions. If there are students who ask questions, the teacher will create a discussion forum so that other students can explain through their knowledge to answer these questions, this is done by the teacher aiming to invite students to find out more information related to transformation material. In the third meeting, the teacher provides opportunities for students to practice the concept of transformation material or the skills of students in solving transformation problems independently by giving questions to work on individually. During the work on these questions, the teacher will check the answers of students, and correct any errors experienced when working on the questions given.

In the last meeting, the teacher concluded the material, and students were directed to complete assignments as exercises in mobile learning and students were directed to study the next material available in mobile learning and seek other information from various other sources. After all the meetings ended, a posttest was carried out to see the final results of mathematical communication skills after being given mobile learning-assisted learning. The posttest results indicate that the experimental group bettered the control group, the experimental class's posttest score was 89.62, whereas the control class's posttest score was 69.56, there was a difference of 20.96 between the experimental class and the control class. This is consistent with Nirfayanti's results those students who use mobile learning receive higher final grades than those who do not, because the use of mobile learning in learning will make students more active and understand the material provided compared to those without using mobile learning-based learning media [12].

The value of increasing students' mathematical communication abilities that have been achieved using normalized gain data or called the n-gain value, the n-gain value for the experimental class is 0.78 while the n-gain value for the control class is 0.37 as shown in the table 3. It can be seen that there is a much greater increase in the value of mathematical communication skills in students who use mobile learning compared to students who get direct learning. To compare the increase in communication skills between classes that use mobile learning and classes that use direct learning, an analysis of the statistical test of the difference between the two averages is needed. The test for the difference between two means requires a parametric test that includes normality and homogeneity tests, but if the data is not normally distributed or not homogeneous, then a non-parametric test is needed with the Mann-Whitney test.

Table 3. n gain

	Experiment	**Control**
	n- gain	**n-gain**
Mean	0,78	0,37
Std. Dev.	0,20	0,11

Test of Normality To determine if the sample data originates from a normally distributed population, a pretest on the experimental class and control class was conducted. The normality test used in this study was the Kolmogorov-Smirnov test, the experimental class obtained a P-Value significance of 0.104 because the value was more than $\alpha = 0.05$, so the pretest data for the experimental class were normally distributed. The significance value of the control class pretest data obtained a P-Value significance of 0.200 as shown in the table 4, meaning that the control class pretest data was normally distributed. Because both experimental class and control class pretest data were normally distributed, the next stage of statistical testing was the homogeneity test.

Table 4. Kolmogorov Smirnov Test

Class	Sig.
Experiment	0,104
Control	0,200

The purpose of this homogeneity test is to find out whether the variances of the two classes are the same, if the two variances are the same or are called homogeneous, the independent sample t-test is the following phase. The homogeneity test was carried out using the Levene test in SPSS software, the P value for the homogeneity test for the experimental class and control class was 0.397, this value is greater than the value $\alpha = 0.05$, so the data is homogeneous. After the data is normally distributed and homogeneous, it is continued with the independent sample t-test.

The P value for the independent sample t-test was 0.000 as shown in the table 5, this value was less than the value $\alpha = 0.05$, The increase in mathematical communication skills for classes using mobile learning was greater than the increase for classes using direct learning., the results of the research were in line with other studies that by using mobile learning students' mathematical abilities will increase [13], [14].

Table 5. Difference test using Independent Sample T test

	Sig.
Control-Experiment	0,000

4 Conclusion

According to the findings of a data analysis, findings, and discussion of the results of research conducted at SMA Negeri 1 Klari. Several conclusions can be drawn from the fact that the achievement and development of mathematical communication skills of students who receive Mobile Learning-assisted learning are superior to those of students who receive direct learning. Mobile learning is also effective for use as a learning medium in this increasingly sophisticated technological era, the effectiveness of mobile learning can be seen from its use as a learning tool to learn anywhere and anytime.

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