

The use of wingeom software in geometry subject, how is the learning outcomes of junior high school students?

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Abstract. The Eight grade students' learning outcomes in geometry subject are less good. One of factors that influences it is the lack of learning media used by the teacher. Winggeom becomes one of computer softwares in dynamic mathematics for geometry topic. This study aims to compare the students' learning outcomes that are taught using wingeom software and without using it. This study is quasi experimental with the post-test only control design. The research populations are all eight grade students of SMP Islam Kedungbondo Bojonegoro, and saturated sampling is used to take the sample. The data are collected using test results. Technique in analyzing data uses t-test with significance level of 5%. The result shows that $3,85 > 1,7$, H_0 is rejected. It means that the learning outcomes of students who are taught using wingeom software are higher than those who are taught without using it.

1. Introduction

The development of science and technology encourages human to have better skill and competences in various field of profession. So do the lecturers and educators. Therefore, human have to compete in order to fulfill their needs. In this modern time, technology may have a very close relationship with the education world. [1] Technology is as a product of scientific thinking. [2] Educational technology and learning activities in the classroom cannot be separated and are always closely related.

Education has a very important role in human resources development. Technology is needed to make human resources to be measured, systematic, and sustainable. Many kinds of technologies have been developed by expert in this era, it can be utilized to improve the education quality through the use of applications. [3] Screencast-O-Matic application in flipped classroom teaching is a new innovation in learning reading. [4] Bamboomedia BMGames Apps can improve students' motivation and skills in each indicator in cycle I and II, while the student's skill in initial reading is improved and has reached the minimum learning criterion.

The importance of improving the education quality continues to be discussed by the government both in quality and quantity aspects. The quality aspect has been carried out continuously by the schools or education agencies in involving teachers or educators to attend trainings related to education fields. It has to be discussed to create smarter society that can solve their life problems well. In quantity aspect, various learning facilities, financial support, and infrastructures have been developed to create educated



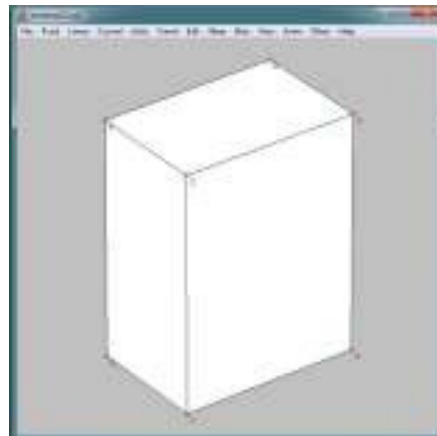
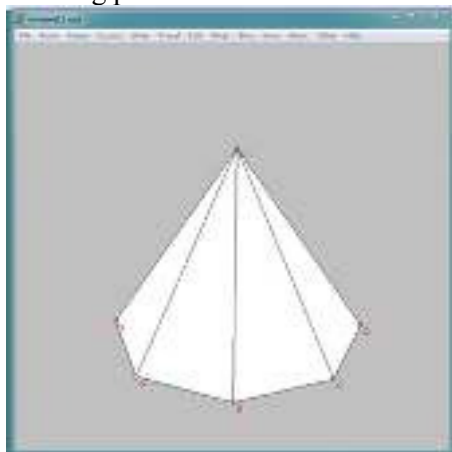
community. The government concern on education is realized by improving the quality of it. One of the concerned subjects is mathematics. This is a common problem that maths is not easy to be understood by most Indonesian students. [5] The results of National Examination for Junior High School students have been decreased in 2018. Based on the interview results with one of mathematics teachers, it is revealed that 75% of students' mathematics scores were still under the minimum standard and 25% of them got good scores. [6] Mathematics is a compulsory subject in every education field. [7] It is defined that mathematics is a structural, sequence, numerology, space and quantity science. [8] Mathematics is really needed in the study of science, humanities, and technology.

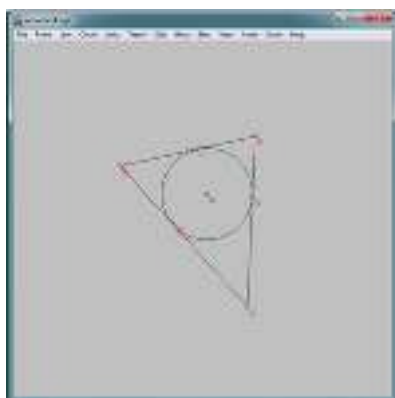
One of the materials tested in National Examination is geometry. It is a branch of mathematics which is very useful for living. Therefore, it is taught at schools. [9] Geometry is also mathematics aspect that is important to be taught in every level of education. [10] School geometry presented in an axiomatic fashion assumes that students think on a formal deductive level. However, this is usually not the case, and they lack prerequisite understandings about geometry. [11] Geometry is a branch of mathematics which deals with the study of different shapes or figures and their properties.

The geometry learning aims to enable students to achieve confidence in solving mathematics problems, and thinking mathematically. The purpose of geometry learning [12] is visualization that includes the introduction of shapes in surrounding environments, the construction of two-dimensional and three-dimensional objects, the ability to draw many kinds of shapes. [13] The geometry learning also aims to develop logical thinking skill, spatial intuition, embed knowledge to support other materials, and be able to read and interpret mathematical arguments. [14] The reasons of geometry learning are to improve spatial intuitions, develop logical thinking skill, and acquire more knowledge. [15] It is stated that there will be four geometrical skills that students must have, namely (1) being able to analyse the characters and properties of geometric shapes in both two and three dimensions, (2) being able to determine a point to be more specific and describe spatial relation using geometric coordinates and connecting them to other systems. (3) applying transformation and using it symmetrically to analyse mathematical situations, (4) using visualization, spatial reasoning, and geometry models to solve problems.

One of geometry models that is used to solve problems is winggeom media. [16] Media is anything that can be used to send the messages from the sender to the recipient in order to stimulate students' thoughts, feelings, concerns, and interest, so the learning process occurs. Winggeom stands for window geometry. [17] It is one of dynamic mathematics softwares for geometry topic. [18] The advantage of winggeom is the dynamic presentation of two-dimensional and three-dimensional geometric shapes that provide students with a more complete and real understanding of geometry. According to Purnomo [19], the winggeom program can be used as a mindtools for students, so they can construct their own knowledge.

The geometric shapes that were created through the Winggeom application can be seen in the following pictures.





Picture 1. Geometric shapes created through Wingeom application

In order to increase geometry understanding, [20] the field analytic geometry modules were used with Wingeom software. [21] The teacher who used Wingeom Application could develop students' skills in solving the problems so their achievements increased. A research [22] reveals that the effectiveness of students learning outcomes after using the constructivist module and web on circle and the sphere material with software wingeom indicates that the module is effective. In addition, [23] ICT-based project based learning student worksheet has fulfilled validity requirement. It can be said that Wingeom application is suitable for learning process. [24] There is an influence of discovery learning model using wingeom software on the student's ability to understand mathematical concepts. Based on the previous researchs, the researchers are eager to find out how is the learning outcome of Junior High School students using Wingeom software in geometry subject.

2. Research Method

This study used quantitative approach, a quasi-experimental research method with posttest only control design. The population were all eight grade students in academic year of 2017/2018, there were two classes with a sample size of 40 students. The sampling technique was saturated sampling. This study used two classes, namely the experimental class and the control class. The experimental class was taught using wingeom software, and the control class was taught without using it. Before the treatment was given, both classes have to meet normality, homogeneity, and balance tests.

The normality test used Lilliefors method for the students' initial skills with a significant level of 5%. The result showed that both classes came from normal distributed populations. It could be seen in table 1.

Table 1. The Normality Test for the Initial Skill

Class	L_{obs}	L_{table}	Conclusion	Data distribution
Experimental	0.1194738	0,1900	H_0 diterima	Normal
Control	0.175623406	0,1900	H_0 diterima	Normal

The homogeneity test used F test, it was concluded that both classes had homogeneous variances ($F_{calculate} = 0,7283 < 2,12 = F_{table}$). The balance test of initial skill used t-test, it got $t_{obs} = 0.0621 < 1,725 = t_{table}$. It showed that both populations had equal initial skills. Based on those test results, VIII A and VIII B acted as experimental and control classes with normal distribution, homogeneous, and balanced. It was concluded that it was feasible to conduct research using wingeom software in experimental class.

The dependent variable of this study was the students' learning outcomes on spatial material, while the independent variable was the use of winggeom software in experimental class and without using winggeom software in control class. The data collection techniques were documentation and test. Documentation technique was used a) to collect students' scores as preliminary data and, b) to find out the balance of initial skill in both classes. Test was used to determine students' learning outcomes after giving treatments.

The instrument trials were conducted at SMP ISLAM Kedung Bondo on IX grade students. The data collections consisted of students' test result sheets. This sheets contained 10 questions for students in form of essays. The test instruments referred to 4 criteria, namely a) content validity, it consisted of 3 competent validators in Mathematics, b) reliability ($r_{11} > 0,70$), c) differential ($D > 0,3$), and d) the level of difficulty ($0,3 < P < 0,7$). The analysis prerequisite tests were the normality test used Lilliefors method and homogeneity test used F-test. Finally, the data normality and homogeneity were fulfilled, then it was analysed using t-test with separated variances and significance level of 5%, it was considered that the variances were not homogeneous ($\sigma_1^2 \neq \sigma_2^2$).

3. Results and Discussion

Based on the study about the use of winggeom software in experimental class and without using it in control class, the results of students' post test can be seen in the following table.

Table 2. The Results of Students' Post Test

Class	Variances	Mean
Experimental	75,0	84,9
Control	58,3	75,0

From the results of post test, the researcher did normality test, homogeneity test, and hypothesis testing.

3.1 Normality Test

Based on the result of normality test used Lilliefors method for every class with significance level of $\alpha = 5\%$. The critical area for this test was $DK = \{L \mid L > 0,16\}$. The results of normality test analysis can be seen in the following table:

Table 3. The Results of Normality Test

Class	L_{obs}	L_{table}	Conclusion
Experimental	0,01	0,16	Ho accepted
Control	0,12	0,16	Ho accepted

Based on the table above, $L_{obs} < L_{table}$ so, Ho is accepted. It means that the sample comes from a normally distributed population.

3.2 Homogeneity Test

It was done using F-test the denominator of $dk = 24$ and the numerator of $dk = 24$, the significance level is $\alpha = 5\%$. The value of $F_{table} = 2,12$ and the value of $F_{count} = 0,78$. It means that $F_{count} < F_{table}$ (0,78

$< 1,88$) so, H_0 is accepted. Based on the result of homogeneity test, it can be concluded that the variances of experimental and control classes are homogeneous.

3.3 Hypothesis Testing

Hypothesis testing in this study was conducted by using t-test with the separated variances. The significance level is $\alpha = 5\%$ and $dk = 26$. The value of $t_{table} = 1,7$ and the value of $t_{count} = 3,85$. Because of $t_{count} > t_{table}$, H_0 is rejected and H_1 is accepted. According to the analysis of hypothesis testing, it can be concluded that students' learning outcomes who taught using wingeom software are higher than those who taught without using wingeom software.

The learning outcomes of the experimental class is higher than the control class because wingeom software is used. The results of the study [25] show that the natural stages in quantum learning model using wingeom software can help students to have better understanding about the abstract shapes of geometric elements. A study [26] shows that the students abilities in solving geometrical problem by using STAD (cooperative learning) with wingeom program are higher than those who using STAD without wingeom program. The other study [27] reveals that the use of wingeom program needs appropriate skill in managing time so they can complete the given task correctly. ntences based on the pictures with its syntactic functions. The pictures can be seen as follows.

4. Conclusion

Hypothesis testing is done by using t-test with separated variances shows that the value of $t_{count} = 3,85 > t_{table} = 1,7$. The mean of experimental class is $\bar{x}_1 = 84,9$ and the mean of control class is $\bar{x}_2 = 75,0$, it is concluded that H_0 is rejected and H_1 is accepted. The conclusion of this study compared to the direct instruction is that the implementation of wingeom software is more effective in influencing the students' geometrical learning outcomes at SMP Islam kedungbondo, Balen, Bojonegoro.

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