The Use of Interactive Media Ispring Suite 8 Supported by Google SketchUp to Improve Students’ Geometry Skills Based on Hoffer’s Theory

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Abstract. The basic Geometry skills are needed by the students to solve the geometrical tasks in daily life. There are five aspects of the Geometry ability based on the Hoffer’s theory. They are visual, verbal, drawing, logical, and application. These are the abilities that the students in junior high school level need to master. The purpose of this study is to find out and describe the effectiveness of the interactive media supported by Google SketchUp to improve the students’ basic Geometry skills based on Hoffer’s theory. The subject in this research is 30 students from class 9E in Junior High School of Mojogedang 1, Karanganyar regency. This study uses a pre-test and post-test experiment and analyzed with the t-test hypothesis with the significant level of 5%. The result of this study can be seen from the difference average score between the pre-test and post-test, which shows a significance difference. It means that through the interactive media supported by Google SketchUp, the students’ five basic abilities are improved. Therefore, it can be concluded that the interactive media supported by Google SketchUp is potential and can be used to help the students in improving their basic Geometry skills based on Hoffer’s theory.

1. Introduction
Geometry is a branch of mathematics concerned with a point, straight line, plane figures, space, spatial figures, and the relation between them [4]. In the teaching and learning process, Geometry has a distinctive spot in the mathematics curriculum since it has a lot of variety of concepts [5]. These varieties such as shape and size, or its system related to visual thinking are the basis for Geometry thinking. They make the teaching and learning of Geometry as a complex mathematics lesson. On the geometrical problem solving, it needs a clear concept for the students to be able to apply the Geometry skills that they have. These skills are such as visualizing, recognizing various types of plane and Geometry, describing a picture, sketching, labeling particular spots, and also knowing the difference and the similarity among Geometry shapes. Therefore, Geometry becomes one of the most difficult and most disliked lessons by the students [9]. Besides, it is also one of the mathematics materials which the students also find it hard to understand [2]. However, it will still become the part of mathematics that has to be learned by the students.

There are several reasons why it is essential to learn Geometry [21]. First, it helps the students to have a complete appreciation of their world. Second, the Geometry exploration can help them to develop their problem-solving skill. Third, it has the main role in the other mathematics fields. Fourth, Geometry is used by people on the daily basis. Fifth, it is challenging and interesting. It also covers every aspect of life. These are the reasons why the students have to explore about shape, line, angle,
and Geometry, which links to their life [12]. It is supported by some of the statements that Geometry is a part of mathematics which related to student’s life because almost all of the objects around them are Geometry [13], and the study of Geometry contributes to helping students develop the skills of visualization, critical thinking, intuition, problem-solving, deductive reasoning, logical argument and proof [17]. It makes the Geometry as an important part of mathematics.

Considering the importance of learning Geometry, especially for the students, therefore they need to have several basic skills. Generally, based on the Hoffer’s theory, these are the skills that they have to master: 1) able to analyze the characteristics of geometrical shape in two or three dimensions, and able to make a statement about the relation between them; 2) able to specifically determine the position of a point and describe the spatial relationship with the other systems; 3) apply the transformation and use it simmetrically to analyze mathematical situation; 4) use the visual skill, spatial reasoning, and Geometry modelling to solve the problem [16].

These Geometry skills can be broken down into five types. They are visual, verbal, drawing, logical, and application [10]. These skills are linked to each other. For example, students will be able to apply the concept of Geometry into the daily life tasks if they are able to develop their logical thinking and able to explain it verbally. This is supported by the statement that says the verbal and visual skills has to develop the basic logical reasoning [9]. Furthermore, it is also important to balance these skills with proving and problem-solving which needs an integration it [10]. This is supported by a statement which says a broad and structured Geometry knowledge has a positive correlation with a better geometrical problem-solving skill [15]. So, these five basic skills are an intact unit that the students on junior high school level have to master to solve geometrical problems.

To improve it, it is necessary to have an innovation in the teaching and learning process. One of them is by using a software-based media. Since these days, the technology has a rapid development, especially in the software development. On the education itself, the use of the software also grows along with this development to support the teaching and learning process. This is supported by the statement that the use of technology in school has broadly known as one of the ways to elevate the teaching and learning process [3]. The term Technology-Enhanced Learning has also increasingly been used in England, Europe, and other countries in the world to shows that the use of technology can be used on the lessons in school [19]. So, the teaching and learning process with the computer-based program is getting more attention to develop an innovation on it.

One of the software that is continuously changing is the interactive presentation flash-based Ispring Suite 8 software. It is a flash-based program which is integrated with the presentation program of power point. It presents the learning materials in the form of a flash slide that contains pictures, animation, video, or audio. Basically, it can be used as the alternative learning media for the teacher to deliver the learning materials in an interesting way. It is also more practical and optimal since it also can engage the students more in the lesson.

In mathematics, there are also several available software to be used in the lesson. This makes many educators conduct some research about the teaching and learning process which utilizes that software. For example, the software Cabri 3D is used in the learning of three-dimensional shapes for junior high school students [19], and the Geogebra program as the media which is used in teaching calculus for the university level students [11]. Further, Google SketchUp presents as a 3D graphics software which rapidly developed these days. It is able to help the students in their visualizing, constructing, associating, and also thinking process. Moreover, it has the orbit tool that can be used to rotate the plane or the Geometry in all directions easily. Other than that, the Google SketchUp also has a distinctive feature on its push/pull tool to draw the object, so it does not take a long time for the students to form it. The students who use Google SketchUp with this feature has a better performance compared to the students who do not use it [8]. The students who use it also do not have a lot of difficulties to draw in it [6]. This supports the statement that says Google SketchUp is easy to be used and learned. It also has a variety of objects in its library [7]. The diversity of its feature and the simplicity to use it makes the Google SketchUp is used in many fields especially as the interactive media in learning, in which beliefs can compete or even exceeds the other 3D graphics software [18].
To find further about the effect of using interactive media supported by Google SketchUp in teaching and learning process, it needs to have a research on it. The research is also to find out the students’ Geometry skills based on the Hoffer’s theory. Moreover, it is also important to conduct this research to be the teachers’ consideration in choosing the right media on their lesson. The right choice on the media can help the students in learning the lesson or specifically in this study, is to improve the students’ Geometry skills.

2. Methods of the Study
This study is an experimental study with the design of one group pre-test and post-test. The study is conducted in Junior High School of Mojogedang 1, Karanganyar regency. The population of this study is all of the students in grade 9. This study uses the cluster random-sampling technique, then chooses one group/class which will be given the treatment on the teaching and learning process of mathematics especially in Geometry using the interactive media supported by Google SketchUp. The students’ Geometry skills are measured before and after the experiment. In this study, the pre-test is given to the students to find out their skill first. Then, it implements the interactive media to the students. After that, the students are given the post-test to measure their skills. The result of the pre-test and the post-test then is compared to find the conclusion. Whether there is an improvement in their Geometry skills or not.

3. Result and Discussion
Before the treatment, (using the interactive media supported by the Google SketchUp on the teaching and learning process) the students are given the pre-test to find out their initial skills on Geometry material especially on the curved-face-three dimensional objects. The result of the pre-test then is analyzed by the researcher and gets the $\mu = 2.84$ as the mean score and $\sigma = 1.67$ as the standard deviation score. This score is used as the reference to categorize the students pre-skills. This categorization is based on their pre-test result which can be seen from the Table 1 below.

| Interval     | Category | Frequency |
|--------------|----------|-----------|
| $X \geq 4.78$| High     | 3         |
| $1.44 \leq X < 4.78$ | Medium | 23        |
| $X < 1.44$   | Low      | 4         |

Table 1. The Students’ Pre-Skills

Based on the analysis of the students’ pre-test score, the students are divided into three categories. They are the high, moderate, and low category. The data shows that there are 3 students (10%) on the high category, 23 students (76.6%) on the moderate category, and 4 students (13.3%) on the low category. Then, the researcher conducts the treatment in the form of the curved-face-three dimensional objects teaching and learning process using the interactive media Ispring Suite 8 supported by Google SketchUp. The experiment is broken down into 5 meetings. The 4 meetings are for cylinder and cone materials. The last meeting is for conducting a test. In the beginning of the experiment, the students are introduced to the media that will be used, the function of the Google SketchUp tools, and how to use it. After that, the students are given the post-test to find the effectiveness of the media that has been used on the teaching and learning process, also to get the result of the students’ basic Geometry skills. The post-test is related to the five basic Geometry skills based on the Hoffer’s theory. The result of the pre-test and post-test then are analyzed to find the improvement of the students’ basic Geometry skills based on the Hoffer’s theory. Before it is analyzed to test the hypothesis, these data are tested using the normality test to find whether these two data has a normal distribution or not. The normality test is used the SPSS software with the significant level of 5%.
Table 2. The Normality Test from the Pre-Test and Post-Test of Basic Geometry Skills

|                | Kolmogorov-Smirnov\(^a\) | Shapiro-Wilk |
|----------------|---------------------------|--------------|
|                | Statistic | Df | Sig. | Statistic | Df | Sig. |
| Pre-Test       | 0.127     | 30 | 0.200\(^*\) | 0.946     | 30 | 0.135 |
| Post-Test      | 0.145     | 30 | 0.109\(^*\) | 0.942     | 30 | 0.104 |

\(^a\) Lilliefors Significance Correction
\(^*\) This is a lower bound of the true significance

Table 2 is the result of the normality test from the pre-test and post-test. The result shows that the observed significance level from the pre-test is 0.135 > 0.05 and on the post-test is 0.104 > 0.05. It indicates that from these results the sample for both data drawn from population which has a normal distribution. After that, these output is analyzed by the hypothesis test. It is used is the Paired Sample Test, because the data has the normal distribution.

Table 3. Paired Sample Test of Geometry Ability

| Paired Differences          | T     | df | Sig. (2-tailed) |
|-----------------------------|-------|----|----------------|
| Mean | Std. Deviation | Std. Error of Mean | Lower | Upper |
| Pre-Test - PostTest         | -2.90000 | 1.07198 | .19572 | -3.30028 | -2.49972 | -14.817 | 29 | 0.000 |

Table 3 shows that the observed significance level that reaches 0.000 which less than 0.05, so the \(H_0\) is rejected. Therefore, the result of this test is that both pre-test and post-test average scores are not identical. It means that there is a significant difference between the pre-test and post-test score of the students’ basic Geometry skills. Furthermore, it shows that the teaching and learning process using the interactive media Ispring Suite 8 supported by Google SketchUp is proved to improve the students’ basic Geometry skills based on the Hoffer’s theory significantly. Based on the analysis result table, the average score on the pre-test is 3.11 and 6.01 on the post-test. The use of both media at the same time or separately is considered advantageous on the teaching and learning process. It also has the benefit on the result of the learning on the prior research [8] [11] [20].

3.1 The Basic Geometry Skills based on the Post-Test Result

Before the hypothesis test on the students’ basic skills of Geometry, the data of the post-test has to be tested with the normality test first. This is to determine whether the result of the post-test has a normal distribution or not.

Table 4. The Normality Test Based on the Pre-test Result

|                | Kolmogorov-Smirnov\(^a\) | Shapiro-Wilk |
|----------------|---------------------------|--------------|
|                | Statistic | Df | Sig. | Statistic | Df | Sig. |
| High           | 0.385     | 3  | .   | 0.750     | 3  | 0.000 |
| Medium         | 0.134     | 23 | 0.200\(^*\) | 0.958     | 23 | 0.427 |
| Low            | 0.333     | 4  | .   | 0.763     | 4  | 0.051 |

\(^a\) Lilliefors Significance Correction
\(^*\) This is a lower bound of the true significance

Based on the table above, the score of the students’ basic Geometry skills based on the Hoffer’s theory on the high category has a observed significance level of 0.000 < 0.05. This result makes the \(H_0\) is rejected, in the other words, the population in this category do not have a normal distribution. On the moderate and low categories, the observed significance level of 0.427 > 0.05 is on the moderate level and 0.051 > 0.05 on the low level so the \(H_0\) is accepted. It means that the population on these categories has a normal distribution. Next, the hypothesis test from the average of the post-test result is conducted to find the differences on the students’ basic Geometry skills based on the Hoffer’s theory. This test is calculated using the Kruskal-Wallis H, since it has a nonnormal distribution. It is also
used three categories in it. Table 5 below shows the result of the hypothesis result using the Kruskal-Wallis H test.

| Table 5. Test Statistic| Score |
|------------------------|-------|
| Chi-Square             | 7.010 |
| Df                     | 2     |
| Asymp. Sig.            | 0.030 |

Based on the result of Table 5 above, it shows the result of 0.030 which is less than 0.05, so the $H_0$ is rejected. It indicates that there will be at least one category which has the difference average. To find which category that has the difference average, it has to be calculated using the Mann-Whitney test.

| Table 6. The Diffence of the Students’ Basic Geometry Skills Based on the Pre-Categories |
|-----------------------------------------------|
| Mann-Whitney U | Wilcoxon W | Z | Asymp. Sig. (2-tailed) | Exact Sig. [$2^*$(1-tailed Sig.)] |
| High-Moderate  | 11.000     | 287.000 | -1.894 | 0.058 | 0.064$^b$ |
| High-Low       | 0.000      | 10.000  | -2.160 | 0.031 | 0.057$^b$ |
| Moderate-Low   | 20.500     | 30.500  | -1.749 | 0.080 | 0.082$^b$ |

Table 6 shows the difference between the high and moderate categories. This difference has the observed significance level of 0.058, where it is more than 0.05. It means the $H_0$ is accepted. Therefore, there is no significance average difference in the students’ basic Geometry skills. It also occurs in the moderate and low categories. The result shows the observed significance level of 0.080, where this is more than 0.05. Since this result is less than 0.05, it means that the $H_0$ is accepted. On the other words, there is a significance average difference between the high and low categories.

Those results show that the implementation of the interactive media Ispring Suite 8 supported by Google SketchUp significantly improves the students’ basic Geometry skills. Some of the best answers from the students on the pre-test and post-test are chosen to find out the improvement of the five basic Geometry skills based on the Hoffer’s theory. The explanation can be seen as follows.

| Table 7. The Example of Students Answers Improvement |
|-----------------------------------------------|
| Pre-Test | Post-Test |
|-----------------------------------------------|
| 1. Take a look at the following picture.       | 1. Take a look at the following picture. |
| ![Image](image1.png) | ![Image](image2.png) |
| a. What are the shapes which form this figure?| a. What are the shapes which form this figure? |
| ![Image](image3.png) | ![Image](image4.png) |
| b. How many sides of those shapes? Mention and explain it. | b. How many sides of those shapes? Mention and explain it. |

**Answer:**

![Image](image5.png)

**Figure 1.** The Visual and Drawing Skills:
The students were still mistakenly mentioned the elements which formed that structure. Therefore, it could be said that they were not able to recognize the elements of it. The students were also still unable to show and draw the sides of the figure yet.

**Answer:**

![Image](image6.png)

**Figure 2.** The Visual and Drawing Skills:
The development of these skills is improved. Students are able to answer it correctly and able to show the sides of the figure by drawing it.
2. Take a look at the following picture.

![Picture 1](image1)

a. Based on the base side from the pictures above, write the definition of picture 4!
b. What are the shapes which form the figure in picture 4? Try to figure it out and write the area formula on each of it!
c. Based on your answer to the point b, find the area formula for the picture 4!

**Answer:**

Figure 3. The Visual, Verbal, and Logical Skills:
Based on the answers above, it could be said that the students were able to describe the figure verbally. However, they still could not show their logical analysis skill yet. They were not able to write the formula of the figure.

3. A company will make a water storage container in a cone shape with the radius 2 meter. This container is expected able to store water for about 37.68 m³. Then, how much is the minimum material area needed to make it?

**Answer:**

![Figure 4](image2)

Figure 4. Visual, Verbal, and Logical Skills:
The development of these skills is improved. The students are able to describe the figure verbally. They are also able to show their logical analysis, by writing down the formula of the figure. Therefore, they can get the conclusion of the formula.

3. A company will make a water storage container in a cone shape with the radius 2 meter. This container is expected able to store water for about 37.68 m³. Then, how much is the minimum material area needed to make it?

**Answer:**

![Figure 5](image3)

Figure 5. Logical and Application Skills:
Based on the answer above, the students were only able to write the formula correctly. However, they could not apply it to its calculating. Therefore, the students were indicated to not fully capable yet to apply the formula that they have learned on the daily basis events.

3. A company will make a water storage container in a cone shape with the radius 2 meter. This container is expected able to store water for about 37.68 m³. Then, how much is the minimum material area needed to make it?

**Answer:**

![Figure 6](image4)

Figure 6. Logical and Application Skills:
There is an improvement or development of these skills. The students are able to write the formula correctly. They are also able to apply it to its calculating process, even they still have not get the correct answer yet. It indicates that the students are already able to apply the formula that they have learned on the daily basis events.
4. Conclusion

Based on the test results and its analysis above, it can be concluded that the interactive media Ispring Suite 8 supported by Google SketchUp is potential can help to improve the students’ basic Geometry skills (visual, verbal, drawing, logical, and application) based on the Hoffer’s theory. The improvement itself has a significance difference. This can be seen from the comparison of the pre-test and post-test average results. Further, it also can be concluded from the analysis of the students’ answers. Based on this study, interactive media supported by Google SketchUp can be an alternative teachers to enhance the students’ basic Geometry skills and to create learning activity that more variation. This study can be developed further in other geometries and materials at a higher level, in order to sharpen the assumption that the use of this media can be widely recognized.

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