Effectiveness Analysis of Geometry Learning of 3-Dimensional Form with Augmented Reality Method

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Abstract: Three-dimensional form in geometry learning material is a part of mathematics material which is considered difficult to be understood by students. The result of preliminary survey conducted in Badung Regency involving 200 students, 43.2% of students stated that it is very difficult and 33.7% of students stated that it is difficult when learning process is done conventionally. In this research, 200 students were given an augmented reality application treatment in learning process, then the result were analyzed using variant analysis and randomized block design (RBD). The research result shown that the student’s ability to understand the geometry concept of 3-dimensional form with augmented reality application was 54.72% with a significance level at α = .05 and corrected model at 2.79%. It shows that the use of augmented reality method in learning 3-dimensional geometry is capable to facilitate students in understanding the concept of 3-dimensional form.

Keywords: Geometry Learning, Treatment, Augmented Reality, The Variant Analysis

1. Introduction

Student’s comprehension in the learning process of 3-dimensional geometry is a part of mathematics learning that is considered difficult by students. Most students feel the fear when they have to learn geometry, especially in 3-dimensional form such as cubes, cones, spheres and prisms. Students find it difficult to imagine the 3-dimensional form as it requires a high level of imagination to build the image of the 3-dimensional form [3].

With a fairly high level of difficulty, from a survey of 200 students conducted in several junior high school in Badung, 43.2% of students stated that geometry lesson of 3-dimensional form is very difficult, 33.7% of students stated that it is difficult, and only 22.1% of students stated that 3-dimensional geometry lesson is not difficult. It can be seen from the data description that the students generally have difficulty in understanding 3-dimensional geometry lesson so that the students experience anxiety with mathematics lessons at school.

But with the development of information technology in recent years with the presence of augmented reality method which is capable of displaying 2-dimensional images to the form of 3-dimensional model, is expected to help in the geometry learning process. Learning shapes such as cubes, cones, spheres, and prisms may be easier and it could facilitate the comprehension of students in learning the geometry of 3-dimensional form. Augmented reality is a special 3D application which allows the user to show and live view animation or digital contextual information in a computer program directly or indirectly from the physical world environment which elements have been added or equipped with computer-generated sensing inputs such as sound, video and graphics [2].

The application of augmented reality technology is expected to help the student’s learning process of 3-dimensional geometry [3],[5],[6]. Augmented reality application is also expected to help students in Badung Regency to understand the geometry concept of 3-dimensional form.

2. Methodology

2.1 The Concept of 3-Dimensional Form

The 3-dimensional form is a shape which have points, edges, and sides. Conventionally [3], 3-dimensional form is drawn with only points and edges so it is difficult for students to understand the concept of 3-dimensional form. Whereas with augmented reality technology [5], besides a visualization with the formation of points and edges, 3-dimensional form can be visualized with the sides that composed the 3-dimensional forms, such as cubes, pyramids, and prisms. The 3-dimensional cube is a form or shape that has the same length of edges so that the area of each side is the same for the eight sides. To ease the students’ understanding, the cube is visualized with augmented reality method to display the eight sides of the cube as shown in Figure 1, while Figure 2 and Figure 3 shown the 3-dimensional form and parts of a pyramid and a prism.
2.2. Research Design

This research studied 200 students who were taking geometry lessons of 3-dimensional form. The 200 students divided into two groups and given different treatments, 100 students learn conventionally and 100 students learn with 3-dimensional visualization using augmented reality method to learn cubes, prisms, and pyramids. By using randomized block design method, effectiveness level of learning process with 3-dimensional visualization will be calculated statistically [1],[7],[8].

<table>
<thead>
<tr>
<th>Treatment</th>
<th>K-1</th>
<th>K-2</th>
<th>K-3</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>12</td>
<td>14</td>
<td>13</td>
<td>39</td>
</tr>
<tr>
<td>Conventional + Visualization</td>
<td>28</td>
<td>31</td>
<td>36</td>
<td>95</td>
</tr>
<tr>
<td>3-Dimensional Visualization</td>
<td>21</td>
<td>23</td>
<td>22</td>
<td>66</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>68</td>
<td>71</td>
<td>200</td>
</tr>
</tbody>
</table>

Using a randomized block design method, statistically by calculating the sum of squares for each group and treatment to produce the F-Test value of the treatment used, the results obtained as shown by Table 4 below:

3. Results and Discussion

Two hundred students were chosen as a research sample. Two-treatment of randomized block design was used to find out the effectiveness level of learning geometry of 3-dimensional form. The learning process was repeated three times with different treatment in each repetition. 1st-treatment is a conventional learning method (without 3-dimensional visualization), 2nd-treatment is a conventional learning with an animated 3-dimensional collaboration, and 3rd-treatment is a learning process with an animated 3-dimensional visualization. Table 3 shown the result obtained from the research.

From the data analysis, it is found that at the level of significance α=.05 the addition of animated 3-dimensional visualization treatment in students’ geometry learning process can increase students’ comprehension by 54.72% with the corrected model of 2.79%, compared by students’ comprehension in the learning process which was done conventionally, only 36.35% of students understand the lesson.

4. Conclusion

1) The geometry lesson of 3-dimensional form is quite difficult to be understood by the students. Only 36.35% of students could understand the lesson if the learning process is done conventionally. Students’ comprehension
can be improved by adding 3-dimensional visualization in the geometry learning process.

2) The addition of 3-dimensional visualization was able to increase students’ comprehension of geometry of 3-dimensional form by 54.72%.

References