

Conference Paper

Design of Virtual Lab Geometry Using Virtual to Supplement Learning In Mathematics Classes

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Abstract.

In learning the geometry of the parallels, there is a misconception between the position of the two lines and the position of the two angles. One way by which students can learn this material better is by virtual reality-based virtual lab media that is able to display objects like in the real world. The purpose of this research is to design the learning media, Virtual Laboratory Geometry Based on Virtual Reality so that students of the mathematics education study program at the Universitas PGRI Semarang are able to understand the alignment material accurately. This study uses ADDIE model development research with five steps that are carried out systematically. Virtual reality-based geometry lab application products have been validated by learning materials experts and learning media experts with scores of 91 and 92, which are categorized as very suitable for use in learning geometry in the classroom.

Keywords: Design; Virtual Geometry Lab; Supplements; Learning Media

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1. Introduction

During the current pandemic, there are various challenges in the world of education, one of the challenges is how to package learning that requires student performance or practice, such as geometry courses. When the covid-19 disaster still hasn't happened, students can still use a compass and ruler to sketch flat shapes and build spaces under the guidance of lecturers in offline classes, but now they can no longer meet face to face in class, this is a concern for us as educators. to provide the best solution so that they are able to master the geometry material properly and correctly. One solution is to provide learning media that can make it easier for students to understand the material and become a supplement to learning media in geometry learning in the classroom, the learning media in question is virtual reality-based virtual reality-based geometry lab that is packaged well and follows the times.

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Domestically, there are already virtual labs for science lessons which show that mobile virtual reality can improve students' analytical skills in studying physics material (1). Then using virtual reality packaged in the form of games can increase student motivation and learning outcomes in learning biology (2). It was later shown that virtual reality-based virtual labs were able to improve the cognition of kindergarten children in Bali in learning a variety of fish for children (3). spatial data for students (4), then mobile augmented reality is very effective in learning geometry at the college level because it displays augmented reality that fosters student achievement motivation and is easy to use on all smartphones (5).

According to the results of observations made by researchers at the Universitas PGRI Semarang, the learning process of geometry courses is less active and less interesting, this is due to the absence of learning media used by tutors so that students become bored quickly. Teaching and learning interactions in the classroom are inseparable from the influence of the media used by educators in delivering teaching materials. The existence of technology, especially smartphones, which are now growing, must be addressed wisely. The phenomenon of the high number of smartphone users is certainly a challenge and opportunity in the world of education. The challenge is abuse for negative things. Besides being a challenge, the existence of smartphones also brings great opportunities to develop useful technology in the field of education. One of the benefits that can be taken from the existence of this technology is to use it as an effective, creative and educational learning medium. So that educational application media can continue to be developed, one of which is Virtual Reality (VR) technology.

In overcoming the problem of understanding the problems of Universitas PGRI Semarang students in understanding geometry material, it links to the Universitas PGRI Semarang research strategic plan related to the prototype of professional development of educators and education personnel in the digital era with a focus on improving the ability of lecturers to present learning in class in an exciting and fun way. This is stated in TKT 4 to 6, which are produced by renewable learning media products adapted to the level of student thinking. From the problems and solutions offered, research is proposed on the Design of Virtual Lab Geometry Using Virtual Reality, especially Alignment Material to Supplement Learning Media in The Class.

2. Method

This research method is research and development (Research and Development). Research and development (Research and Development) is a method used to produce

specific products such as designs, models, learning media prototypes, and testing the effectiveness of these products (6). The research model uses the ADDIE model development research design model. This model, as the name implies, consists of five main phases or stages, namely (A) analysis, (D) design, (D) development, (I) implementation, and (E) evaluation. The five phases or stages in the ADDIE model need to be carried out systematically and systematically (7). This study, it was only carried out until the development stage. The explanation of the three stages is as follows.

2.1. Analysis (Analysis)

The analysis consists of two stages: performance analysis and needs analysis. The first stage, namely performance analysis, is carried out to find out and clarify whether the performance problems faced require solutions in the form of program implementation or management improvements. In the second stage, the needs analysis is a necessary step to determine the abilities or competencies that students need to learn to improve learning achievement (8)

2.2. Design

Product design, what is done is the next stage of the ADDIE model, namely innovation. At this step, it is necessary to clarify the learning program designed so that the program can achieve the learning objectives as expected.

2.3. Development (Development)

This development step includes creating, buying, and modifying learning media to achieve predetermined learning objectives. In other words, the development step consists of selecting and determining the appropriate methods, media, and learning strategies used in delivering the material (8). In this development stage, the framework will be realized to produce a product that can be implemented. The virtual reality-based geometry lab media's development stage will be made according to the material. After the virtual reality-based geometry lab media is complete, media experts and material experts will validate it by the validator to get input and evaluate it according to the feedback given by the validator. Furthermore, the virtual reality-based geometry lab

media was revised according to the feedback provided by the validator to improve the product.

3. Result and Discussion

This study developed a Geometry Virtual Lab product using the ADDIE model. This research carried out three stages: Analysis, Design, and Development. The product development results are described in detail according to the ADDIE development procedure.

3.1. Analysis

Analysis related to geometry learning problems at Universitas PGRI Semarang in the Mathematics Education study program has been carried out. It shows that 60 per cent of students are still weak in understanding geometry material, especially related to parallel material. Their cognitive and spatial abilities are still below 70 based on the results of the initial pretest. Then the students said that during the 2020-2021 pandemic, 90% of Universitas PGRI Semarang students really needed learning media that could improve their knowledge and spatial abilities related to geometry material, especially alignment material.

3.2. Design

Product designs are arranged based on the needs and achievement of learning objectives. It is a Geometry Virtual Lab application that focuses on alignment material with virtual reality technology. The explanations related to Alignment become clearer so that it is hoped that students' geometric spatial abilities will be better compared to the use of other conventional media, in making This virtual geometry lab design begins with designing in Corel Draw, then creating animations with Unity 3D, Blender software and Vuforia Development, after the application design product is finished, a focus group discussion is held regarding the design display and the depth of the material displayed, namely alignment, from the results of the focus group. The discussion shows that students need to be given practice to determine the parallel position of flat figures to understand the mathematical concepts better. The results of the virtual reality-based geometry lab display can be presented in the following figure.



Figure 1: Front View of the Virtual Lab Geometry Material Alignment.



Figure 2: Menu Display of Virtual Lab Materials Geometry Alignment Material.

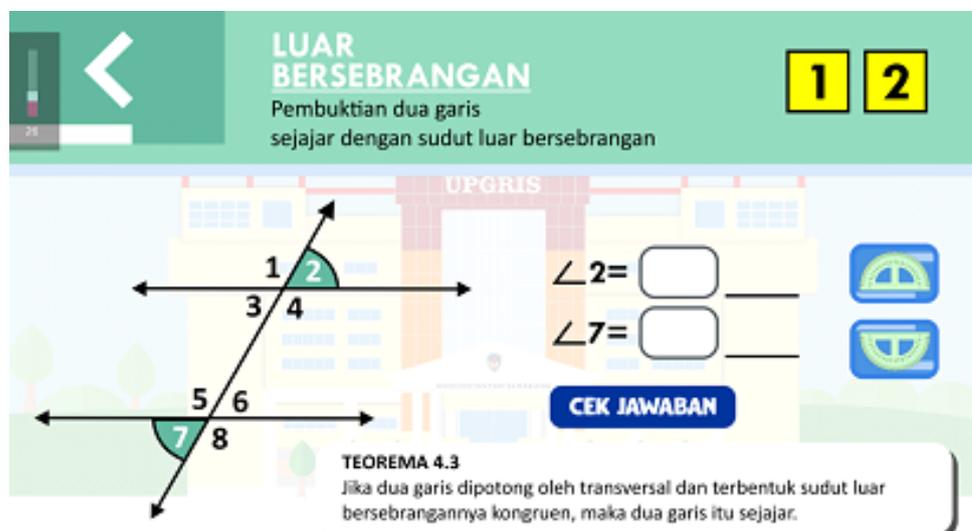


Figure 3: Explanation of the Virtual Lab Materials for Geometry of Alignment Materials.

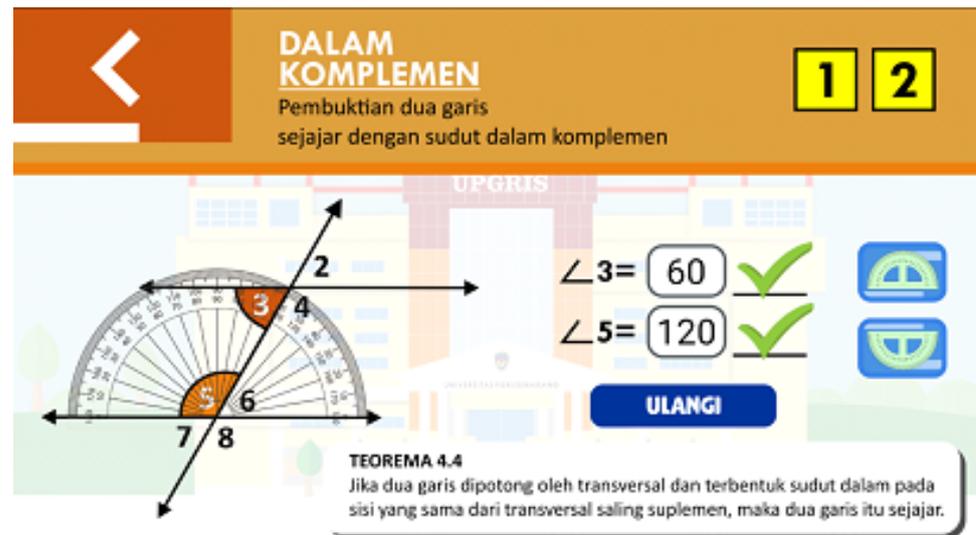


Figure 4: Experiment Display using Props in the Virtual Lab Geometry Alignment Material.

3.3. Development

In this development stage, the framework that has been designed is realized so as to produce a product that can be implemented. At the stage of developing the Geometry Virtual Lab media, after the android-based media is complete, it is validated by media experts and material experts by the validator to get input and evaluate according to the input given by the validator. Furthermore, the Virtual Reality-based media is revised according to the input given by the validator to improve the product.

In this development stage, a virtual geometry lab product has been produced. It has been adapted to the results of a focus group discussion between lecturers and students, which includes the design of the virtual geometry lab media and the depth of the geometry material taken. Then the product before being tested in the field, expert validation is carried out first including geometry material experts and virtual reality-based learning media experts. The product validation process to experts can be presented in the following figure

The Geometry Virtual Lab product was validated by media experts with the following results: (1) the appearance of this virtual geometry lab product is suitable as a virtual supplement for geometry course material, (2) color gradations related to geometric alignment material can be understood virtually and attractively, (3) the virtual geometry lab application is interesting for lectures because quizzes are displayed with exciting animations, (4) the menus in the virtual geometry lab application can be used in a fun, easy and fun way, (5) the product can relate this parallel material to spatial skills students with 3D objects, (6) Existing questions need to be related to the context of the latest



Figure 5: The Process of Material Validation of Virtual Geometry Lab Products by Dr. Imam Kusmaryono.



Figure 6: The Process of Validating Virtual Geometry Lab Product Media by Dr. Muhammad Abdul Basir.

triangular congruence problems, (7) virtual geometry lab applications can be applied properly and in accordance with KKNi material, (8) students can solve questions about parallelism geometry sequentially and attractively, (9) users will have no difficulty in operating the product this virtual geometry lab application, (10) This application is able to increase student learning motivation, from the validation results it is shown that the average result of the learning media expert assessment is 92%, which indicates that the virtual geometry lab product in terms of the feasibility of the geometry lab virtual product design is very good. suitable for use in learning.

The results of the Validation of Learning Media Experts on Virtual Geometry Lab Products can be presented in the following graph.

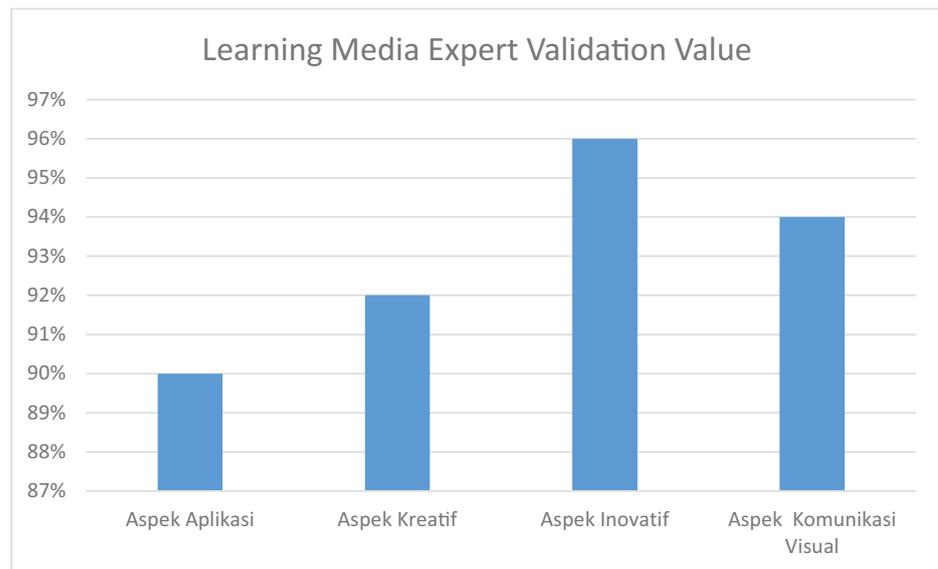


Figure 7: Validation Results of Learning Media Experts on Virtual Geometry Lab Products.

Meanwhile, based on the results of material expert validation, the following results were obtained: (1) this virtual geometry lab product is suitable as a virtual supplement of geometry course material, (2) concepts related to this geometric alignment material can be understood virtually, (3) virtual applications the geometry lab is interesting to use in other courses, (4) the menus in the virtual geometry lab application can be used in a fun and fun way, (5) the congruence and alignment of geometry material can be related to students' spatial skills, (6) questions existing questions need to be related to the context of the latest alignment problems, (7) this virtual geometry lab application can be appropriately applied and following the IQF material, (8) students can solve questions about alignment sequentially, (9) have no difficulty in operating the product. This virtual geometry lab application, (10) the Geometry Virtual Lab application is able to improve students' cognitive abilities Students, based on the expert's assessment of geometry learning materials, showed that the material presented in the virtual media of this geometry lab was very feasible to be applied in learning geometry courses with an average value of 91%, meaning that the geometry material presented was very suitable for use in learning.

The results of the validation of learning material experts on the depth of the material Geometry Virtual Lab products can be presented in the following graph.

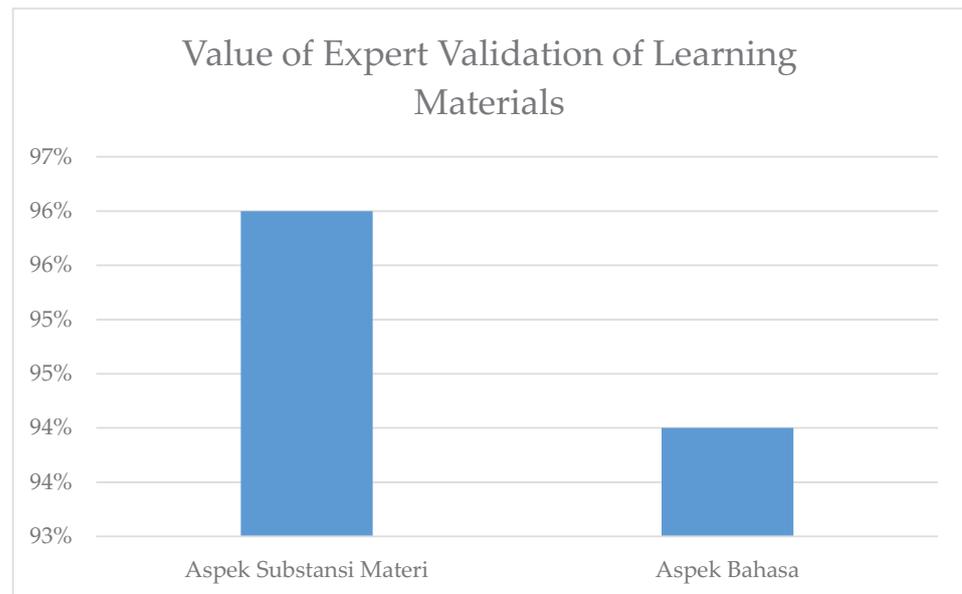


Figure 8: Expert Validation Results of Learning Materials on Material Depth Geometry Virtual Lab Products.

4. Conclusion

The conclusions obtained from this development research are: (1) A virtual reality-based virtual reality-based geometry lab media product is produced in the form of an apk application which discusses geometry courses. (2) The design of the Virtual Geometry Lab using Virtual Reality, especially the alignment material to complement the learning media in the classroom, is suitable for use by students. This can be seen from the assessments of media experts and material experts. The result of validation by media experts is 92%. The results of validation by material experts are 91%. After being converted to a scale conversion table, the percentages of media experts and material experts are in the range of 81% - 100%, so virtual reality-based geometry lab media has an outstanding category.

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