Design of Game Education Basic VAR in Geometry Learning

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ABSTRACT

The condition of the educational game now is so rapid development, one of the indicators is that students are busy playing games in between lectures, so that it raises concern as teachers to add value to the benefits of games in lectures adapted to the current millennial era. The purpose of this study is to determine the design of making educational games based on VAR (Virtual Augmented Reality) in learning geometry that is valid (feasible) at tertiary institutions. The research method uses the ADDIE R&D model (Analysis, Design, Development, Implementation, Evaluation). The results of this study are the design of VAR-based geometry educational games that are suitable for use in classroom learning based on product validation by material experts at 90.67%, media experts at 92.86%.
Keywords: educational game, Virtual Augmented Reality, geometry

1. INTRODUCTION

The development of Information and Communication Technology is currently developing very rapidly. These developments cause changes in people's behavior and activities in daily life. One technology that is developing very fast now is information and communication technology. One of them is VAR (Virtual Augmented Reality) based game that is able to display interesting virtual objects and reality. Billinghurst, M. (2002) states that Augmented Reality technology needs to be explored in the world of education because it offers unlimited interaction between the real and the virtual world and is applied in the school environment. Meanwhile, according to Buchori (2017), mobile augmented reality can motivate student learning so that it affects student cognitive learning outcomes.

Mobile technology is currently not only used as a communication tool, but also as a tool to facilitate users in their daily lives. This can happen because in mobile technology there are many facilities, including: internet access, e-mail, organizer, music, games and can be used anywhere, anytime faster and easier. According to Sunandar, W. K., Achmad, B., & Dini, R. N. (2017) learning mathematics using mobilemath will provide better learning outcomes. Learners can be more interested in learning mathematics online with the game features provided. This is supported by Moreno-Ger, P., Burgos, D., Martínez-Ortiz, I., Sierra, JL, & Fernández-Manjón, B. (2008) who state that the use of educational games in the learning environment is an increasingly trend relevant. Implementation of the game on learning will facilitate students in understanding a particular concept. Games are computer games created with animation techniques and methods. This finally becomes its own challenge to make an educational game that is both fun and has benefits. In this case, i.e. making a geometry learning game in college on an android device. It is hoped that this game will also provide learning benefits and play a role in the development of mobile games in Indonesia.

Siwanto (2012) discusses the making of an educational game for the study of Natural Sciences (IPA) in grade VI elementary school students. This research is based on Java Mobile Edition (J2ME) as a medium used to build applications. Then Yulianti (2012), conducted a study that discussed basic learning games for kindergarten children. Where in this game there is no game level, but if the player succeeds in completing the game according to the instructions given, there will be an animation or sound that indicates that the player has successfully completed the game.

Based on the results of research conducted by Huizenga, J., Admiraal, W., Akkerman, S., & Dam, G. T. (2009) concluded that learning strategies based on mobile games are very effective when compared to learning without using game applications. This is because students find something more fun when learning. Whereas Ebner, M., & Holzinger, A. (2007) conducted research on the use of online games for learning in higher education with the aim of making complex theoretical knowledge easier to understand. So that the results of his research are learning outcomes of students who use online game application assistance is better than the results of student students who use conventional learning.

Based on the background above, the purpose of this study is to determine the design of making educational games based on VAR (Virtual Augmented Reality) in learning geometry that is valid (feasible) at tertiary institutions. In this case, according to media experts and material experts to be used in learning geometry in tertiary institutions.

2. RESEARCH METHODS

This research method is a research and development (Research and Development). Research and development (Research and Development) is a research method used to produce certain products, and test the effectiveness of these products (Sugiyono, 2010: 407). The research model uses the ADDIE learning design model. This model, as the name implies consists of five main phases or stages, namely (A) analysis, (D) esign, (D) e-development, (I) implementation, and (E) valuation. The five phases or stages in the ADDIE model, need to be done systematically and systematically (Personal, 2010: 125). These stages can be seen in Figure 1.
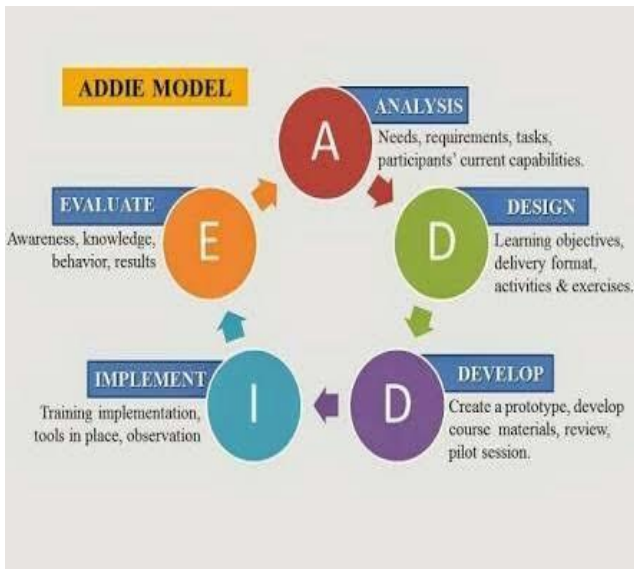

Figure 1 ADDIE learning design model

3. RESULTS AND DISCUSSION

Based on the learning system design procedures using the ADDIE development model, the stages of the implementation of this study are as follows:

3.1. Analysis

The analysis step consists of two stages, namely performance analysis and performance analysis or need analysis. At this stage interviews were conducted with several lecturers in the mathematics education study program at Semarang PGRI University. From the results of the interviews produced the fact that 95% of students of mathematics education study programs still use media games or simple games, there is no touch of renewable technologies such as augmented reality, virtual reality, and other applications. For this reason, it is necessary to develop learning media that can accommodate these problems. Based on observations made by researchers in 3 first semester classes 2019-2020 academic year Semarang shows that the learning process of geometry material that is less active and less interesting, it is caused by the absence of learning media used by game-based lecturers so that students become bored quickly . Teaching and learning interactions in the classroom are inseparable from the influence of the media used by lecturers in delivering teaching material. The existence of technology, especially smartphones that are now increasingly developed must be addressed wisely. One of the benefits that can be taken from the existence of this technology is to use it as an effective, creative and educative learning media. So the educational application media can continue to be developed, one of which is the technology of Augmented Reality (AR) and Virtual Reality (VR).

3.2. Design

At this stage the researcher designs the product to be developed based on the results of the analysis that has been done. From this research an android-based learning media is produced using Virtual Augmented Reality (VAR) called Educational Games based on virtual augmented reality. The material in this media is geometry. VAR-based educational game display can be seen in the following picture.
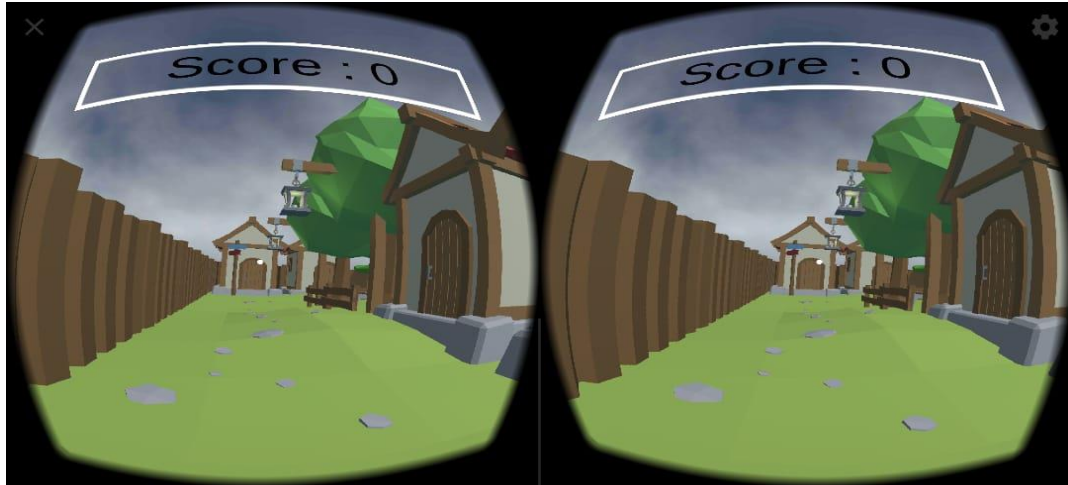
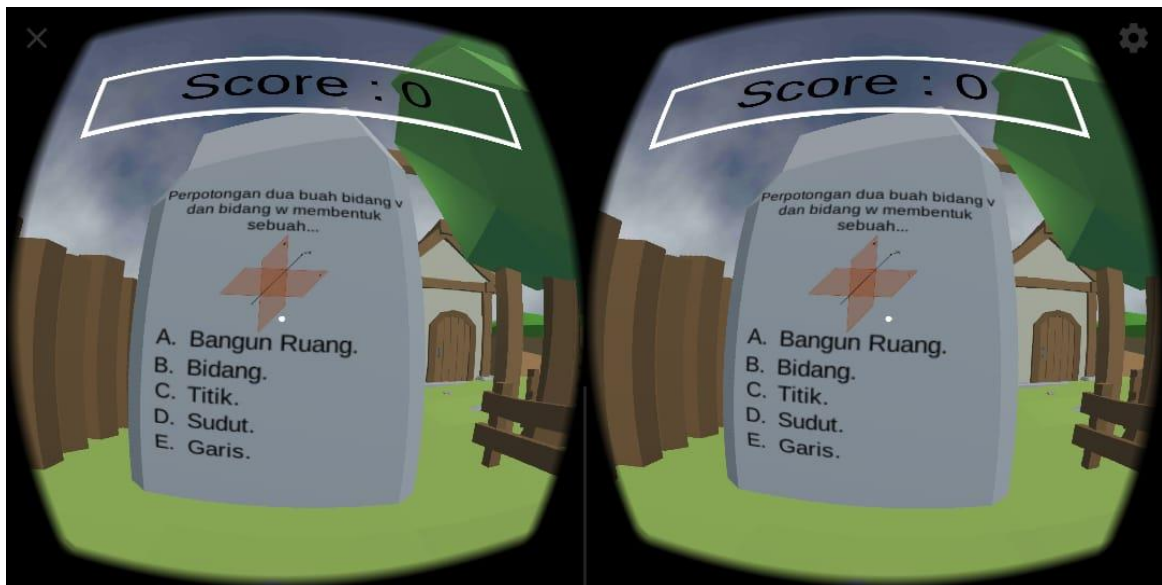**Figure 2** The initial menu in the Educational Game based on Virtual Augmented Reality

Figure 3 Quiz Menu on Educational Games based on Virtual Augmented Reality

Figure 4 Discussion Menu in Educational Games based on Virtual Augmented Reality

3.3. Development

At the stage of developing android-based learning media using Virtual Augmented Reality (AR) will be made in accordance with the material, after the android-based media using Virtual Augmented Reality (AR) is finished, it will be validated by media experts and material experts by the validator to get input and evaluate accordingly input provided by the validator. The results of the validation will be described below.

3.3.1. Material Validation

Validation by the material expert is done so that the media that will be tested is truly feasible to be used in research. Development products evaluated by material experts are Virtual Augmented Reality (VAR) based Educational Games using a questionnaire that must be filled out by material experts. The questionnaire filled out by material experts has four scales with the following criteria.

Score 5: Strongly Agree

Score 4: Agree

Score 3: Quite Agree

Score 2: Disagree

Score 1: Strongly Disagree

The validation assessment criteria have 4 aspects, namely the Material Extent Aspect, Material Update, Language Usage and Evaluation Questions. The results of the validation and assessment of the learning material experts for each aspect are presented in the following table.

Table 1 Assessment by material experts

No.	Aspect of Scoring	Expected Score	Evaluation Score	appropriateness
1.	Extent of Material	25	23	92,00%
2.	Update of Material	10	10	100,00%
3.	Use of Language	15	13	86,67%
4.	Evaluation Questions	25	22	88,00%

The next stage the researcher analyzes the overall results of the assessment by material experts.

$\sum$ (answer x weights per choice) = 68

n = 15

Highest weight = 5

Then the data above is calculated using the following formula:

$$Percentage = \frac{\sum(answer \times weight\ of\ each\ choice)}{n \times highest\ weight} \times 100\%$$

$$Percentage = \frac{68}{15 \times 5} \times 100\%$$

$$Percentage = 90,67\%$$

From the above calculation, the percentage of eligibility for Educational Games based on Virtual Augmented Reality (VAR) of 90.67% by material experts. After being converted to a scale conversion table, the Virtual Augmented Reality (VAR) based Educational Game media is in the range of 81% - 100%. So placing the position on the criteria is very good.

3.3.2. Media Validation

Validation by media experts is done so that the media that will be tested is really feasible to be used in research. Development products evaluated by media experts are Virtual Augmented Reality (VAR) based Educational Games using a questionnaire that must be filled out by media experts. The questionnaire filled out by media experts has four scales with the following criteria.

Score 5: Strongly Agree
Score 4: Agree
Score 3: Quite Agree
Score 2: Disagree
Score 1: Strongly Disagree

There are 3 aspects of the validation assessment criteria, namely General Display Aspect, Special Display Aspect, Media Presentation Aspect. The results of the validation and assessment by media experts for each aspect are presented in the following table.

Table 2 Rating by Media Experts

No.	Aspect of Scoring	Expected Score	Evaluation Score	appropriateness
1.	General Display	25	24	96,00%
2.	Display Language	15	14	93.33%
3.	Media Presentation	20	18	90,00%
4.	Evaluation	10	9	100,00%

The next stage the researcher analyzes the overall results of the assessment by media experts.

$\sum$ (answer x weights per choice)   = 65
n   = 14
Highest weight   = 5

Then the data above is calculated using the following formula:

$$Percentage = \frac{\sum(answer \times weight\ of\ each\ choice)}{n \times highest\ weight} \times 100\%$$

$$Percentage = \frac{65}{14 \times 5} \times 100\%$$

$$Percentage = 92,86\%$$

From the above calculation, the percentage of eligibility of Educational Games based on Virtual Augmented Reality (VAR) of 92.86% by media experts. After being converted to a scale conversion table, the Virtual Augmented Reality (VAR) based Educational Game media is in the range of 81% - 100%. So placing the position on the criteria is very good.

4. CONCLUSION

Has produced an educational game design based on virtual augmented reality in geometry learning with the results of validation by material experts at 90.67%, media experts at 92.86% meaning this educational game product is fit for use in geometry learning in Higher Education.

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