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Developing 3d Flashcard-Augmented Reality Learning Media for Pre-service Teachers

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Abstract. The advancement of technology in the field of education is currently accelerating. Today's media must keep pace with technological advancements. The development of technology-based learning media needs to be developed to increase student motivation. One of the media that can be used is augmented reality technology. Augmented reality is an innovation from computer graphics that present visualization and animation of objects. The augmented reality application in the world of education has a strong appeal to students and provides freedom for students to carry out the process of observing themselves. The research method used is R&D with a 4-D model and has four main stages, namely Define, Design, Develop and Disseminate. Product feasibility is reviewed from the material and media expert's assessment and student responses. The results showed that the 3d flashcard-augmented reality learning media was feasible to use in learning mathematics, especially in geometry material. The following results are that each of them gets a score of 85% from material experts, 87% from media experts, and 90% from student responses.

INTRODUCTION

Media can be used to relay messages and trigger thoughts, arouse excitement, and interest to promote students' learning processes [1]. Almost every learning situation involves media that includes verbal and visual information such as text and pictures that must be continuously analysed and processed by students [2]. The trend of educational media programming for adults and children has used several media platforms that present interactive and non-interactive [3]. Compared with non-interactive media, interactive media increases more various types of learning [4]. Learning media can make learning activities more effective and efficient, using this learning media is expected to make it easier for students to understand the material [5]. Media plays an important role in the learning process [6]. However, the media must meet several conditions before it is used in the teaching-learning process [7]. Such conditions include the media should contain knowledge that is not known to students [8]. The media should be practical in which it is easy to use by teachers and students as well as it should be efficient in which it can improve student learning outcomes and it should be feasible [9].

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The definition of learning media is a combination of materials and tools or a combination of software and hardware [10]. Learning media can be understood as the media used in the learning process and objectives [11]. In essence, the learning process is also a communication, so learning media can be understood as a communication medium used in the communication process [12]. Learning media has an important role as a means of channelling learning messages [13]. Media can be divided into two categories, namely instructional aids and instructional media [14]. Learning aids or tools to assist teachers (educators) in clarifying the material (messages) to be conveyed [15].

In accordance with the preceding statement, it is necessary to develop an innovative learning media. One of the learning media that can be used is 3D flashcard media as interactive learning. 3D flashcards, as a way to enjoy the learning process, uses new nuances, namely, technology Augmented Reality. Augmented Reality is a technology used to combine the virtual world with the real world.

Augmented Reality (AR) is a variation of the Virtual Environment (VE) or more generally Virtual Reality (VR) [16]. Augmented reality has been developed by many experts and can be applied to various objects [17]. Augmented reality is a technology that combines two or three virtual dimensions in a real form and then is projected into a real form [18]. There are two types of Head - Mounted Display (HMD) used in applications Augmented Reality: Opaque Head - Mounted Display and See-Through Head-Mounted Display Markers which are usually illuminated in black and white shapes with a bold black border and white background [19].

Based on the explanation above, augmented reality has an important role in the learning process because it can motivate students to learn and retrieve information from the learning topics [20]. Vuforia is an Augmented Reality Software development kit (SDK) for mobile devices that allow the creation of augmented reality applications. To recognize objects using computer technology such as square, round or similar objects. Vuforia is used as the Pug In in the software Unity 3D software so that it can produce applications augmented reality that can be used on mobile phones, open-source Plug-In software, which can be downloaded via the Vuforia website [21] [22].

A system that uses the AR method has several advantages including (1) The interaction feels so real. (2) the user can interact with the virtual object directly. (3) The implementation is cheaper. (4) AR does not require a special device which makes the implementation of the AR system cheaper. (5) Fewer possible system lags are displayed. (6) AR-based system will only render a certain object when it sees a sign or is at the right location [23]–[26]. This of course makes the AR system much lighter, the likelihood of the system choking when running is much smaller. However, Augmented Reality (AR) also has disadvantages, namely: (1) users do not see the mixing of virtual objects and the real world. Users will certainly feel that the entire environment that is generated virtually feels more real than just an object positioned in the real world. (2) The technology that is currently being developed is more profitable for VR. (3) Several technologies that are currently developed are more suitable to be implemented side by side using a VR-based system. Armband, VR headset, and Omni treadmill are some examples of these enhancements. (4) It does not support the production facility to the overall environmental design. (5) AR does not describe the environment as a whole. The overall environmental design is not very supported in implementing AR-based systems [25], [27]–[30].

The novelty of this research is the use of android media and portable cards that can be used for learning. Another novelty is that there are materials as well as questions and discussions on the application menu that can improve student learning outcomes. Furthermore, this application is also equipped with practice questions that the teacher can monitor. And the results can be known immediately.

METHOD

The research method used in this research is R & D (research and development), with a 4D development model. This model consists of four stages, namely: Define, Design, Develop and Disseminate. The following 4D stages can be seen in the Fig. 1 below [31].

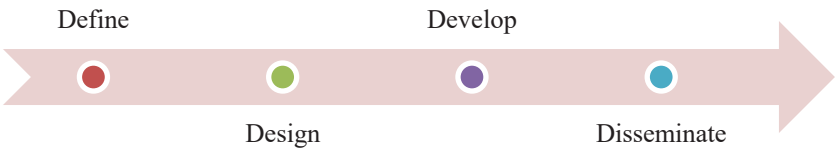

FIGURE 1. Research Methods

The participants of the trial were student teacher candidates at Sultan Ageng Tirtayasa University. The validators of this study consisted of media experts and material experts. Media experts assess the feasibility of designs augmented reality flashcards in terms of Display Design. Material experts assess the feasibility of design augmented reality flashcards from the aspects of the content of the material and the quality of learning.

RESULT AND DISCUSSION

Define

The stage of defining or analysing needs is carried out through an analysis of the use of augmented reality-based learning media. The results of the analysis of the use of learning media used can be seen in Fig. 2 below.

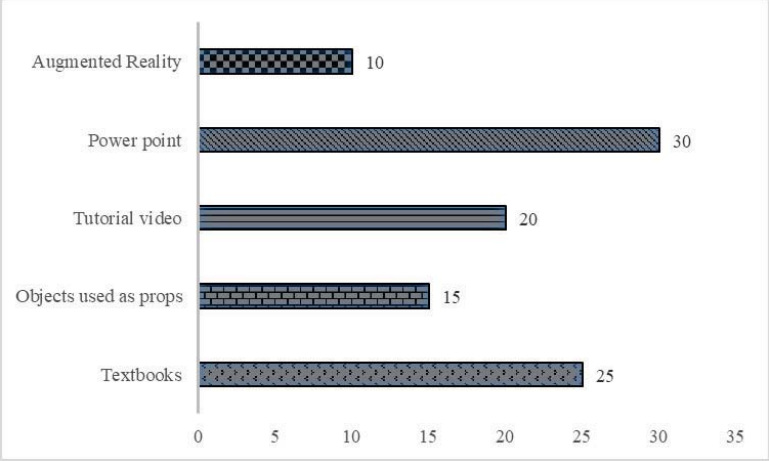

FIGURE 2. Analysis of the Use of Learning Media

Based on Fig. 2, it is found that the use of augmented reality learning media has not been used at all by teachers of the first high school located in the city of Serang, Banten, Indonesia.

Design

The next step is designing a learning media prototype based on flashcard 3d augmented reality. The following are the results of the augmented reality learning media that have been developed.

FIGURE 3. Flashcards with Augmented Reality

Develop

At this development stage, the learning media are validated by material experts and instructional media experts. Experts who validate are the experts who have at least 5 years of experience in their respective fields. Following the validation results.

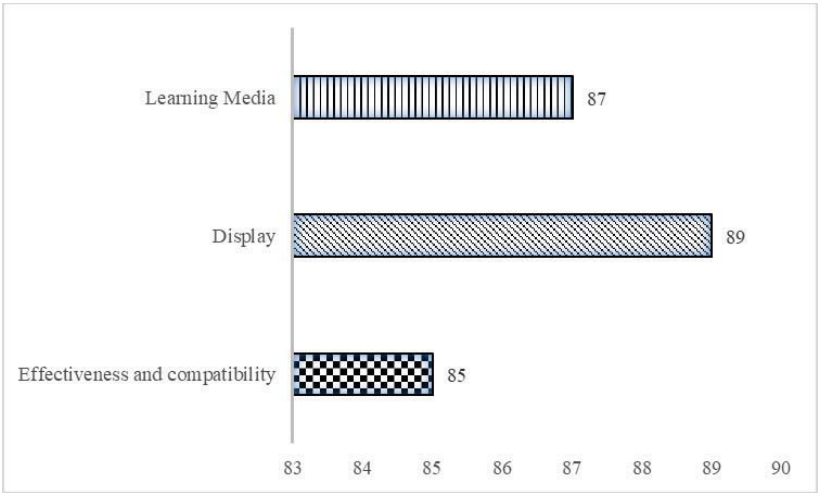

FIGURE 4. Learning Media Expert Validation

Based on Fig. 4, it can be said that the flashcard 3d augmented reality learning media shows an average result of 87, this means that the 3d flashcard media augmented reality developed is very feasible to be used as a learning medium. Furthermore, validation is carried out to material experts. This stage is carried out to measure the material used in the learning process. The following results can be seen in figure 5.

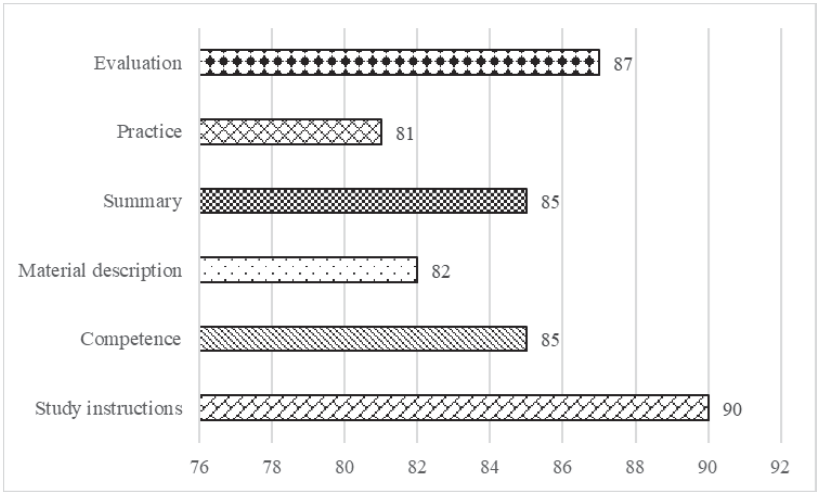

FIGURE 5. Learning Material Expert Validation

Based on Fig. 5 it can be said that the learning material for flashcard 3d augmented reality shows the average result is 85, which means that the learning material for the flashcard 3d augmented reality developed is very suitable for use in learning.

Disseminate

Furthermore, in the evaluation stage, it tests the student's response to the use of media augmented reality 3d flashcards. The following results of student responses to augmented reality 3d flashcards.

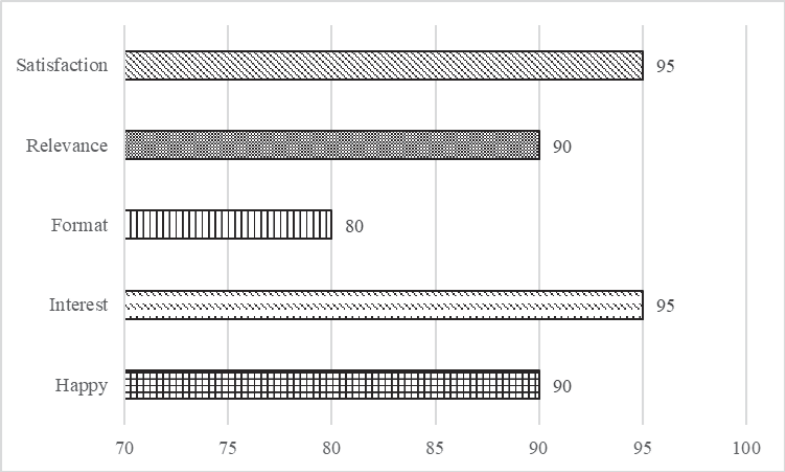

FIGURE 6. Results of Student Responses

The results show an average score of 90 so that it is categorized as feasible to use and students are interested in using learning media. 3D flashcard augmented reality in learning activities. Furthermore, the learning outcomes of the use of learning media of augmented reality 3d flashcards were tested on 25 student-teacher candidates at Sultan Ageng Tirtayasa University. Each consisted of 13 male students and 12 female students. The results show that the value of the n-gain calculation is 56%. It can be said that 56% result is categorized as good. The following results can be seen in Fig. 7 below.

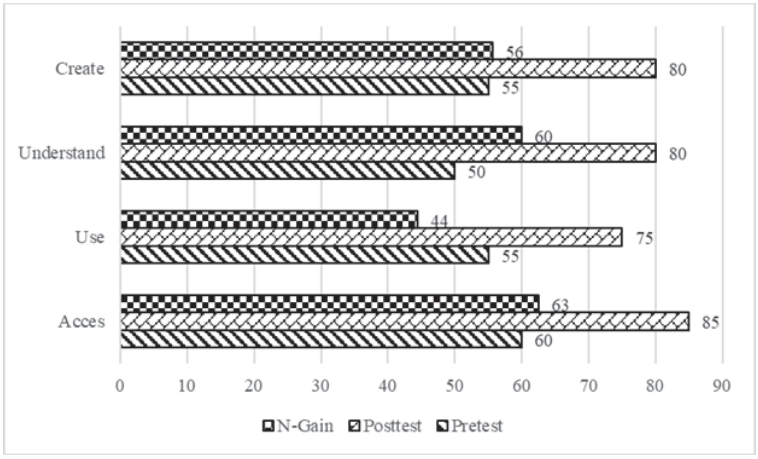

FIGURE 7. N-gain from the Use Learning Outcomes Flashcard3d Augmented Reality

Based on the results above, it is concluded that the use of augmented reality 3d flashcards can be applied in the learning process to improve student learning outcomes. In this study, it has been proven that the learning media flashcard 3d augmented reality can improve student learning outcomes. These results are in line with research that shows that learning media is a learning aid that can convey information or learning material and can be used to improve student learning outcomes in the process of learning activities [32]. This is because the use of media is learning augmented reality flashcards used to combine knowledge and understanding and develop student skills.

CONCLUSION

This augmented reality 3d flashcard learning media has the following functions, namely: a) it can attract students' attention to learn; b) it can generate interest in learning, motivation, and curiosity of students; c) It can stimulate students to think and teach students to discuss in answering questions; d) It can develop active learning; e) it can improve learning outcomes.

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