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Developing a Digital Learning Interactive 3D Exploded View Automobile Brake System

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Abstract: This research aimed to design and develop an Exploded View 3D Model learning media on the brake system topic, as well as knowing the feasibility of learning media 3D Exploded View model on brake system topic. This study used the research and development method. The development model used the ADDIE, which consists of five stages: analysis, design, development, implementation, and evaluation. The subjects of the product trial were teachers and 11th-grade students in Public Vocational High School 11 Malang. Material experts and media experts carried out the product feasibility test phase. A media test was conducted on students. The data analysis technique used questionnaire and evaluation questions, as well as descriptive statistical analysis techniques. The results of this study were an Android-based learning media in the form of a 3D Exploded View model on brake system topic, and the results of the feasibility assessment by material experts got a percentage of 89.6% in the category of "feasible". The feasibility assessment by media experts received a percentage of 95.8% in the category of "feasible". The percentage obtained from small group trials was 85% with the category "feasible". The results of the student evaluation found that the average field trial score was 89. The conclusion of this research was the development of Android-based Learning media on the brake system topic is declared feasible to be used in the learning process.

Keywords: 3D Exploded View, Brake System, Learning Media

INTRODUCTION

The era of education that was influenced by the revolution industry 4.0 is called Education 4.0. Education 4.0 is characterized by education utilization digital technology in the learning process [1] with make use of technology so that the learning process could take place in a manner continuous without limit time and space. The development of science and technology can provide a stimulus for efforts to improve the utilization of technology in education [2]. Along with the growing technology of android smartphones, it can support a combination of smartphone technology and printed media in learning activities [3].

One of the emerging technological developments is smartphones [4]. Smartphones are mobile phones that have various functions to support daily activities. Various smartphone vendors compete to embed features that are useful for smartphone users. Smartphones can have features such as camera, internet, NFC, infrared blaster, and games. At present most smartphones use touch screens so that their use is more practical and efficient. Most applications on a computer can be accessed via a smartphone so that a smartphone is a communication media that has capabilities like a computer [5].

Media is a tool used to deliver messages from the communicator to the recipient of the message [6]. Examples of media that are often encountered, such as television, magazines, radio, telephone, and others. The media can function as a support for the learning process if it aims to deliver learning material. Learning media serves to create a learning environment that is more effective for learners. Communication is an activity to convey a message by someone to others through a particular media. Once the message is received and understood to the extent of its ability, the message recipients then convey responses through certain media as well as message delivery [7]. Learning activities must occur a process of exchanging information and messages between students and educators through a

good communication process. Through this communication process, information and communication can be understood by the recipient of the message. In the communication process, there can be different perceptions so that the media need to clarify information and messages contained in communication [8]. Learning Media can be interpreted as everything that can be used to stimulate thoughts, feelings, attention and abilities or skills of learners so that it can encourage the learning process.

After making observations in Public Vocational High Schools XI Malang, on the subjects of the chassis and power transfer system, the brake system is one of the learning materials that students must understand. In the brake system material, there are essential components that must be understood by students. Lack of learning media used in teaching and learning can hinder the learning process. The use of appropriate learning media can improve the learning process. Based on the results of observations, smartphone users in the class show more than 90% of students use Android-based smartphone technology. By utilizing technology as a learning medium, it can create an effective and efficient learning process for students.

Learning using a smartphone is called mobile learning. Mobile learning is a form of learning that uses a wireless mobile device so that everyone can access information and learning subject anywhere and anytime [9]. The device can be in the form of a smartphone, tablet PC, laptop, and others. Students can learn using mobile devices independently, without having to be in a school environment so that users can access learning content without being bound by time and place [10]. Some of the capabilities that need to be possessed by mobile learning devices are that they can be integrated with various e-learning systems, academic systems and communication service systems between educators and students.

The application of Android-based smartphone technology in the world of education has begun to be used in Indonesia. But in formal education, Android-based learning is still rarely used. One reason android-based learning media are still rarely used because the development of android-based applications is too complicated and requires a long time to develop. Hence, teachers always tend to use learning media that is fast and easy to use, such as textbooks and Microsoft PowerPoint. Students tend to use books to study at school because they are not mobile. The choice of the Android platform as a learning medium is the best because users of smartphone devices based on the Android operating system are the most numerous in the modern era.

Research Development of android-based learning media has been conducted for example by Imam [11] which produces Android-based learning media for 11th-grade students on the structure and function of cell organs, media categorized as feasible to use. But the application has the disadvantage of a less interactive display. Singgih [12] developed an android learning media application on the competence of operating an electronic control system. But in developing learning media application products still present material in the form of text and images, while the competence of operating an electronic control system requires animation and simulation. Therefore we need supporting aspects to add information to the media that can improve the learning process at school.

One aspect that is easy for students to understand is the 3D model. 3D models represent 3-dimensional objects using dots in 3-dimensional space, connected by various geometric objects such as squares, lines, triangles, and so on. Each point has its coordinates in the grid, by combining these points into shapes, then the surface of an object can be created. 3D models can be made by hand, algorithms (procedural models), or 3D scanners. Exploded-view is a diagram, technical or schematic image that shows the relationship or assembly sequence of various components of an object. In the exploded view, the display of components of an item separated by a distance in a three-dimensional diagram. An object is displayed again as if a small explosion occurred at the centre of the object, causing the component of the item to be separated from a certain distance from its original position. Any machine or mechanism constitutes individual parts assembled to form a wholesome and

complete product [13]. An exploded-view is usually used in part catalogues, manual installation and dismantling, and other instructional books. Exploded view projections are generally shown from the top and slightly crossed from the right or left side of the image.

Unity is one of the software for making learning media. Unity is a software used to develop multiplatform games [14]. Unity can be used to create 2D or 3D video games, 2D and 3D animations, and other architectural visualizations. Unity can perform various functions using the scripting language. In the game development process, users can use scripts such as JavaScript, C #, and Boo [15]. Unity Editor can use external plugins to add features and produce multiplatform games. Unity facilitates users by providing Unity forums, which are places where users can discuss, answer questions, update announcements, and guide application development. The purpose of this study was to create a suitable and appropriate learning media for the learning process of 11th-grade students on the chassis and power transfer in Public Vocational High School 11 Malang.

METHODS

The subjects of the study were 11th-grade students who were taking the Brake System course at the TKR Department of Public Vocational High School 11 Malang, which amounted to 45 students. The trial design used was in the small group trials totalling 15 students and field trials totalling 30 students—media feasibility tests conducted by media experts and material experts before tested on the subject research.

The development of Android-based learning media used the research and development methods. Research and development aim to produce new products through the development process [16]. The development of this Android-based learning media used the ADDIE development (analysis, design, development, implementation, and evaluation [17]. The ADDIE research model is used because the ADDIE model research and development steps are arranged programmatically and systematically so that this model can solve learning problems related to learning resources which are by the characteristics and learning needs that exist in Vocational High School.

Data collection techniques used several instruments to collect data, including questionnaires and test learning outcomes. After the data was obtained, then it was calculated using the calculation data formula (media experts, material experts, and students). The percentage results of the data then were evaluated according to feasibility criteria refer to the score of the questionnaire and test results. (1) If the results of the analysis get the criteria of (75 -100 %) then the application is called a good and is worthy of being used for learning inside class; (2) if the results of the analysis obtained criteria of (50 -74.99%) then the application of said qualification is quite excellent and suitable for use in learning in class, however, should be repaired; (3) if the results of the analysis obtained criteria of (25 to 49.99%), then the application of said qualifications are not useful, applications must be revised, and that means applications not suitable for use in classroom learning; (4) if the results of the analysis obtain the criteria of (<25) then the application the intended qualification is terrible and must be replaced.

RESULTS AND DISCUSSION

In the product development phase, the Android-based smartphone application has been created. The application contains features that emphasize the aspect of the exploded view 3d model of the brake system (seen in Figure 1).

Based on the results of due diligence by subject matter experts, it was shown that for indicator quality of the content and the purpose of obtaining a score of 44 out of a maximum score of 48 that percentage to 91.7%. If the percentage value of 91.7% was converted to the feasibility table, then the quality and objective quality indicators are in the good criteria. Then in the learning indicator, the score obtained 21 from the maximum score of 24 and the percentage value to 87.5%. If the percentage

value of 87.5% was converted to the feasibility table, then the quality and objective quality indicators were in the good criteria. The total value of the score was 65 from the score of 72, then the feasibility test by the expert gets a percentage value of 89, 5 % so that when converted it was in the good criteria.

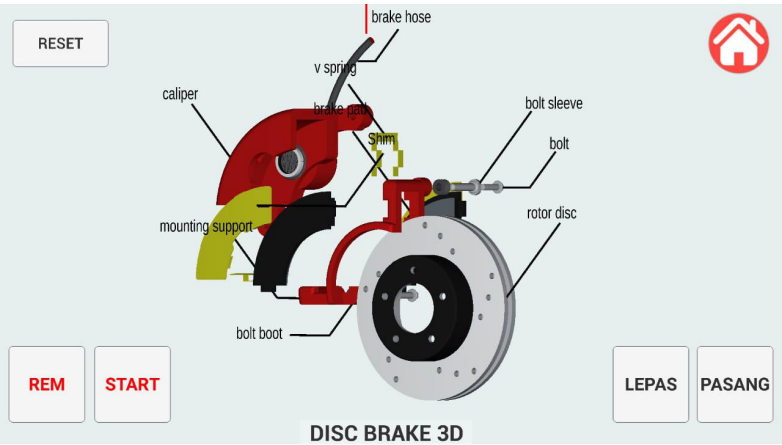

Figure 1. Exploded View Media

Based on the data from the results of the small group trials in Figure 2, it shows that the indicator of learning gets a score of 258 from the maximum score of 300 so that the percentage value becomes 86%. If the percentage value of 86% is converted to the feasibility table, then the quality and objective quality indicators are in good criteria. Then the visual communication indicator scores 352 from the maximum score of 420, and the percentage value becomes 84%. If the percentage value of 84% is converted to the feasibility table, then the quality and objective quality indicators are in good criteria. The total score is 1020 from a score of 1200, then the feasibility test by an expert gets a percentage value of 85% so that if it is converted, it is in good criteria. Based on the data from the results of the field trials conducted by 30 students, three students scored 80, fourteen students scored 87, twelve students scored 93, and one student scored 100.

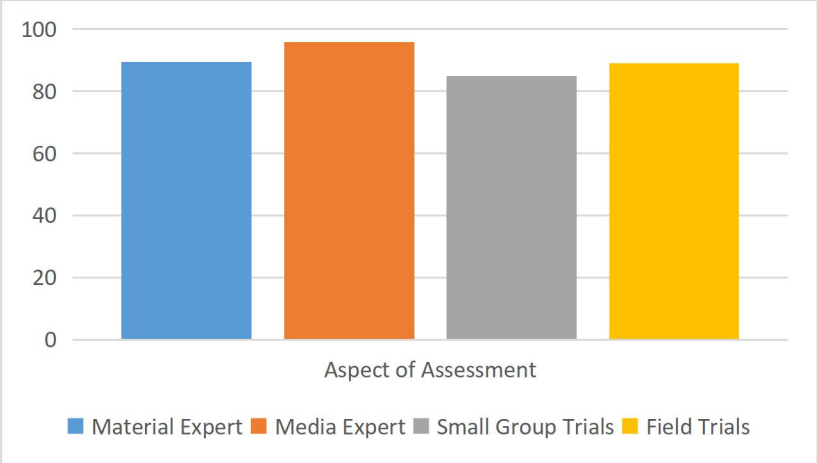

Figure 2. Media assessment result diagram

Android-based learning media in the material and media categories were declared feasible with the acquisition of feasibility results by material experts indicating that this media received a percentage of 89.5% which was good while the results of the feasibility test by media experts showed that this media obtained a percentage of 95.8 % that is good. Small group trial data shows that based on the analyzed data get a percentage of 85%, which was good, and 89% field trial was good.

CONCLUSION

Based on the results of the development of the 3D Exploded view Android-based learning media on the brake system subject in Public Vocational High School 11 Malang, it was concluded that the learning media was declared feasible and appropriate for 11th-grade students of Public Vocational High Schools 11 Malang. The research on the development of this Android-based 3D Exploded view learning media model can still be further developed related to devices, interactions, learning activities and learning content. The 3D Exploded view model provided a new alternative in presenting learning resources with a note of material suitability, the format and form of presentation and device specifications must be considered

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