Development of automotive basics learning module Sub-Subject Special Service Tools (SST) based on augmented reality

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ABSTRACT

The preliminary research in the Automotive Engineering class of SMK Negeri 3 shows that the obstacles faced by students in the learning process were 90% of 30 students stated the lack of modules or other handbooks to learn the Special Service Tools (SST) sub-material. Further results indicate that 73.3% said that they find it difficult to understand the material through teaching materials and methods applied by the teacher, so students had difficulty understanding how to use the types of Special Service Tools (SST) according to their functions. The other 90% of students stated that they were delighted and interested if the learning activities of SST sub-material were presented using learning media that varied with audio, visual, audio-visual media. This research produced learning media in the form of Augmented Reality-based modules that can be accessed individually with a smartphone device to display 3-dimensional objects of SST type and how to use them. The research method used is research and development using the ADDIE model which consists of analysis, design, development, implementation, evaluation. The results of this study show that the learning module automotive basics SST based on augmented reality is stated to be very feasible and very practical to use. The percentage of material experts, media experts, small and large group trials are 93%, 87.89%, 88.55% and 90.83%, respectively, categorized as very feasible and practical.

Keywords: Augmented Reality, Special Service Tools (SST), Development

INTRODUCTION

The learning process is a series of activities carried out by two parties, namely students as education recipients and educators as facilities providers (Lusiana & Maryanti, 2020; Solikin et al., 2022). The supporting factor of a learning process at the Vocational High School (SMK) level is the learning media educators use with their students. Learning media can be interpreted as a tool that carries messages and information between teachers and students (Suryadi, 2020; Anugrah, 2021). The use of media in the learning process is very helpful for educators to attract the attention of students to be more active and concentrate on the content of learning

mateaikenrials, besides that the use of media will increase students' understanding of learning (Widiastika, Hendracipsapta, and Syachruroji 2020; Taufiq et al., 2021).

The rapid development of Information and Communication Technology (ICT) affects the use of existing media. With the existence of information technology, learning media should be developed by educators in accordance with the times and is expected to be able to update the education system which concerns all pedagogical aspects of the old system to new or modern following the development of the times (Wahyuningtyas 2019). 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. An example of an educational application media that continues to be developed in recent times is Augmented Reality (AR) technology. Augmented Reality (AR) is a technology that at the beginning of its development (1968) had the main scope in "visual augmentation", the addition of digital objects in visualization (Danto et al., 2011). (Karisman and Wulandari 2019; Elfitra et al., 2021) define AR (Augmented Reality), is a techaryahnology that combines two-dimensional virtual objects and one or three dimences into a real three-dimensional environment then projects the virtual things in real-time. According to (Mustaqim 2016; Akçayır and Akçayır 2017; Ismail et al., 2021) Augmented Reality is a concept of merging between the virtual world and the real world, to produce information taken from a system on designated real objects, so that the boundary between the two becomes thinner and thinner.

With the existence of Augmented Reality (AR) technology which is used as a learning medium, it is hoped that it can improve student understanding and learning outcomes (Pujiastuti & Haryadi, 2020). Based on research that has been carried out previously learning using Augmented Reality media, the results were obtained that there was a significant influence on student learning outcomes (Muktiani et al., 2022; Fidan & Tuncel, 2019). The use of Augmented Reality-based learning media makes students more active in the learning process (Wong et al., 2018). In addition, learning using Augmented Reality (AR) technology can also encourage students to learn independently, foster a desire to explore new possibilities, and replace expensive practicum equipment with multimedia models (Singh et al., 2019; Majeed & Ali, 2020; Noroozi et al., 2019; Wang et al., 2018).

The preliminary research in the Automotive Engineering class of SMK Negeri 3 shows that the obstacles faced by students in the learning process were 90% of 30 students stated the lack of modules or other handbooks to learn the Special Service Tools (SST) sub-material. Further results indicate that 73.3% said that they find it difficult to understand the material through teaching materials and methods applied by the teacher, so students had difficulty understanding how to use the types of Special Service Tools (SST) according to their functions. Automotive Basics Lessons, especially in the sub-principal of SST, must be taken by students of SMK class X Automotive Engineering at SMK Negeri 3 Singaraja. In this learning, students are required to

be able to identify and use types of SST according to their functions. However, students never do practicum about special service tools because of the limitations of practicum tools. So that students have difficulty in understanding how to use the types of SST according to their functions. 90% of students stated that they were very happy and interesting if the learning activities of the SST sub-material were presented using learning media that varied with audio, visual, audio-visual media. Based on the above problems, it is necessary to develop a learning media in the form of an Augmented Reality-based module. The main purpose of this study is to find out the process of developing Augmented Reality-based learning modules in automotive basics subjects, the sub-subject of SST for SMK students and to find out the level of feasibility and practicality of Augmented Reality-based learning modules according to material experts, media experts, small group tests and large group tests.

METHOD

The development model used in this research is a type of Research and Development (R&D) research. According to (Sugiyono, 2013), research and development methods, or research and development methods, are used to produce certain products and test the effectiveness of these products. The method used in this study uses a development model with the ADDIE approach. This development model, there are 5 stages: Analysis, Design, Development, Implementation, and Evaluation.
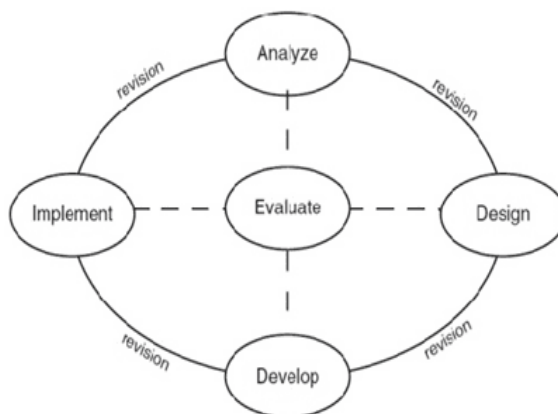

Figure 1. R&D Research Steps with ADDIE Approach
(Sources: Branch 2009)

RESULTS AND DISCUSSION

Description of the stages of media development

The development of automotive basics learning module sub-subject SST based on augmented reality was carried out using the method presented in the previous stage. There are five steps that have been taken in the development of this learning module, namely:

a. Analysis

The first stage carried out in research with the ADDIE model is analysis. At this stage, preliminary research was carried out at SMK Negeri 3 Singaraja, researchers identified the problems found so that information and needs could be used as a reference in developing an of automotive basics learning module sub-subject SST based on augmented reality The data obtained in this preliminary research are:

1. In the initial survey researchers found that 90% of the 30 students stated that they did not have modules or other handbooks to study the SST sub-material.
2. In the second survey, 73.3% of researchers found that students had difficulty understanding the material through teaching materials and methods applied by teachers.
3. Students never do practicum about special service tools because of the limitations of practicum tools.
4. Last survey researchers get results 90% of students stated that they were very happy and interesting if the learning activities of the SST sub-material were presented using learning media that varied with audio, visual, audio-visual media.

b. Design

The initial stage carried out at the design stage is the creation of 3D objects, for this stage Solidworks and Blender software is needed. The next stage is to design the module and the Augmented Reality SST Application. In the process of creating the module design, and the design design of the application interface, the researcher used Adobe Photoshop software. The following is the process of making the design.
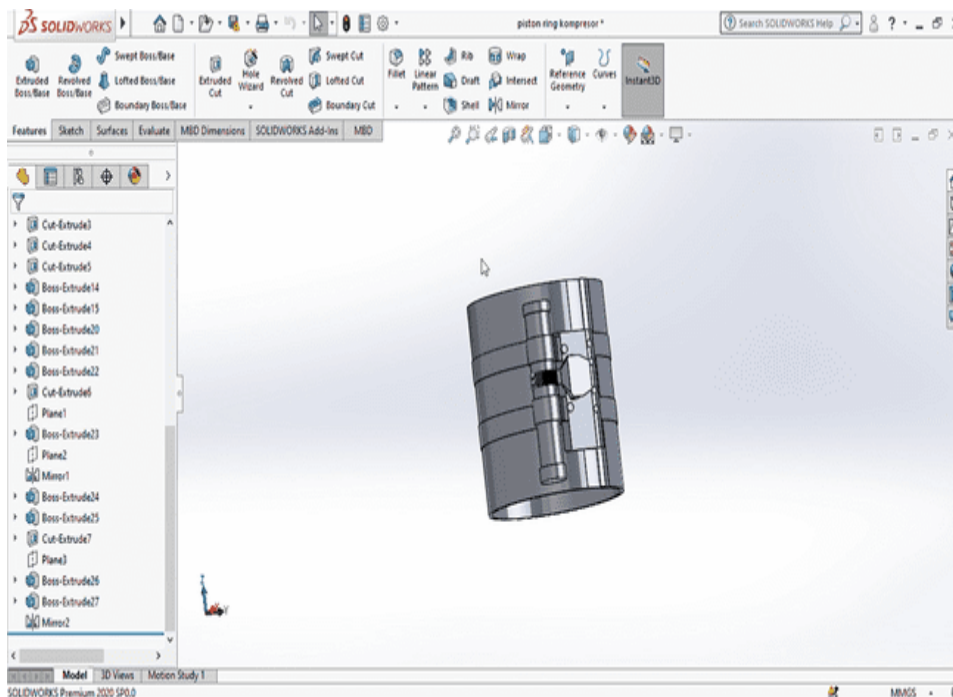

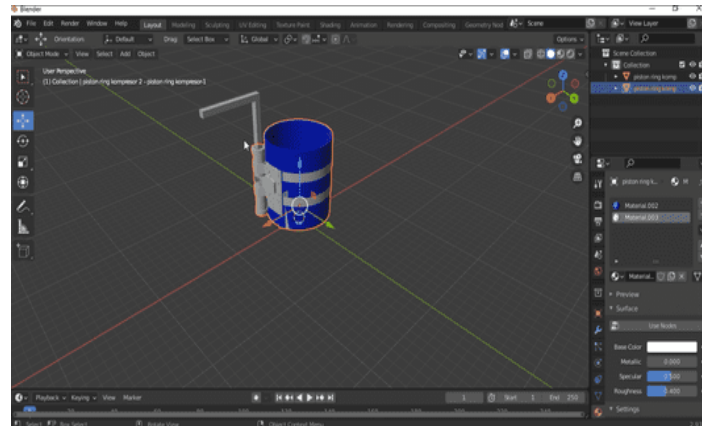Figure 2. 3D Design Creation Process Using Solidworks Software

Figure 3. The Process of Adding Colors and Animation of 3D Objects Using Blender Software
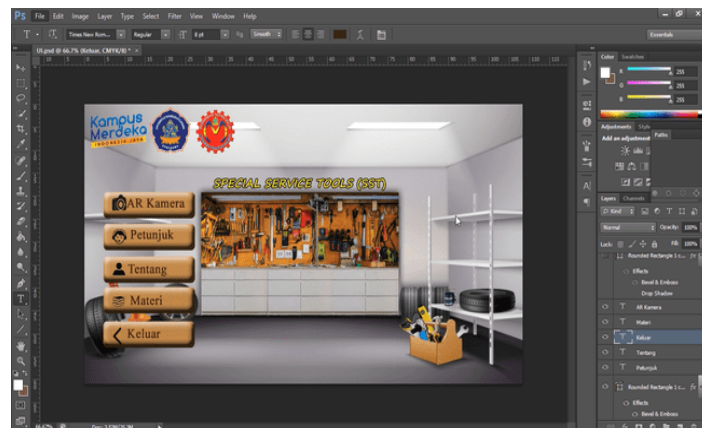

Figure 4. The Process of Creating a UI Design for Adobe Photoshop Software Application
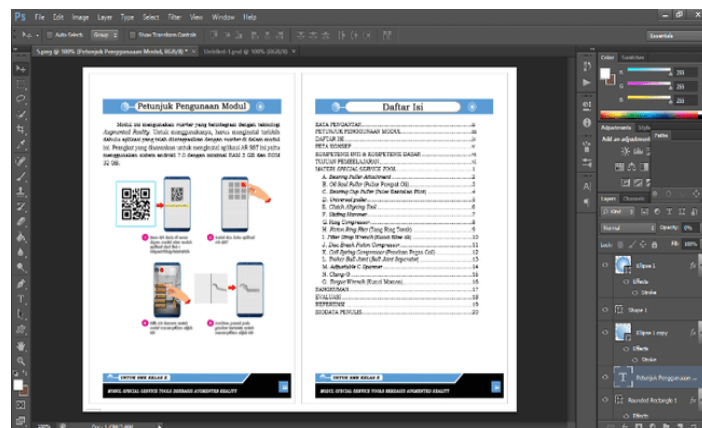

Figure 5. Module Design Process Using Adobe Photoshop Software

c. development

In this stage, an application is created using Unity 3D, with the SDK library using the Vuforia SDK.
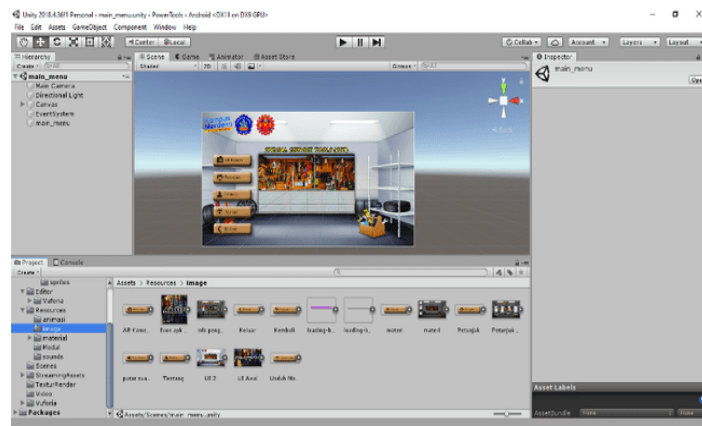

Figure 6. Application Development Using Unity 3D

d. Implementation

At the implementation stage, the process of testing the Augmented Reality-based SST learning application was carried out by 2 material experts, 2 media experts. Field trials in this study were conducted at SMK Negeri 3 Singaraja. The small group trial was carried out in class X TO 1 with a total of 34 respondents, while for large group trials, it was carried out in two classes, namely class X TO 2 and X TO 3 with a total of 60 respondents.

e. Evaluation

After carrying out the implementation process, the next stage is to carry out the evaluation stage. The evaluation stage aims to correct the deficiencies in the automotive basics learning module, sub-subject SST based on augmented reality, so that it becomes the final media or the final media.

Description of the results of media development

The results of this research and development are in the form of modules and applications of augmented reality-based learning in the subject of Automotive Basics, Sub- subject of SST with an android opreration system to introduce types of SST in 3D.

The results of the material expert test were obtained through the distribution of a questionnaire questionnaire containing 10 statement items that must be answered by two material experts and get a percentage result of 93% with very decent qualifications. The results of the media expert test were obtained through the distribution of a questionnaire questionnaire containing 19 statement items that must be answered by two media experts, where the percentage results obtained were 87.89% with very decent qualifications.
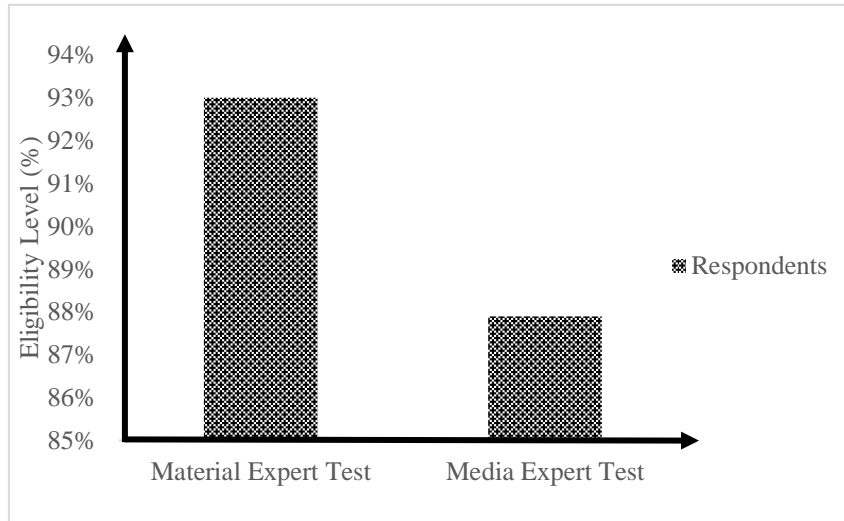
Figure 7 Graph of Percentage of Material Expert Test Results and Media Expert Test

After conducting the validation test process of material experts and media experts, as well as improving the media in accordance with the criticism and advice given by experts, the field trial process is then carried out.(1) Small group tests were carried out in class X Automotive Engineering 1 SMK Negeri 3 Singaraja with a total of 34 respondents, students getting results of 88.55% with very practical qualifications. (2) Large group tests were carried out in class X of Automotive Engineering 2 and 3 SMK Negeri 3 Singaraja with a total of 60 respondents and the results were 90.83% with very practical qualifications.
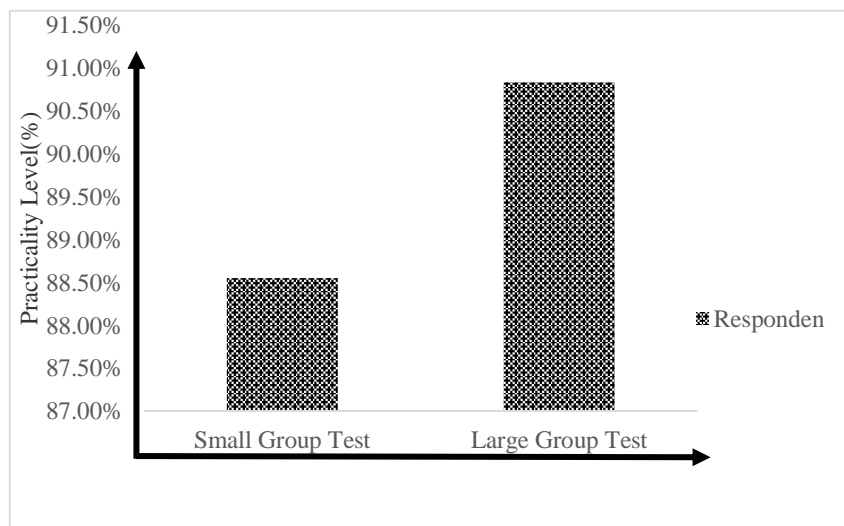
Figure 8. Percentage Graph of Small Group Test Results And Large Group Tests

After conducting the process of material expert testing, media expert testing, small group trials and large group trials for the final media display or final media of the module and augmented reality applications for SST in the automotive field as follows:
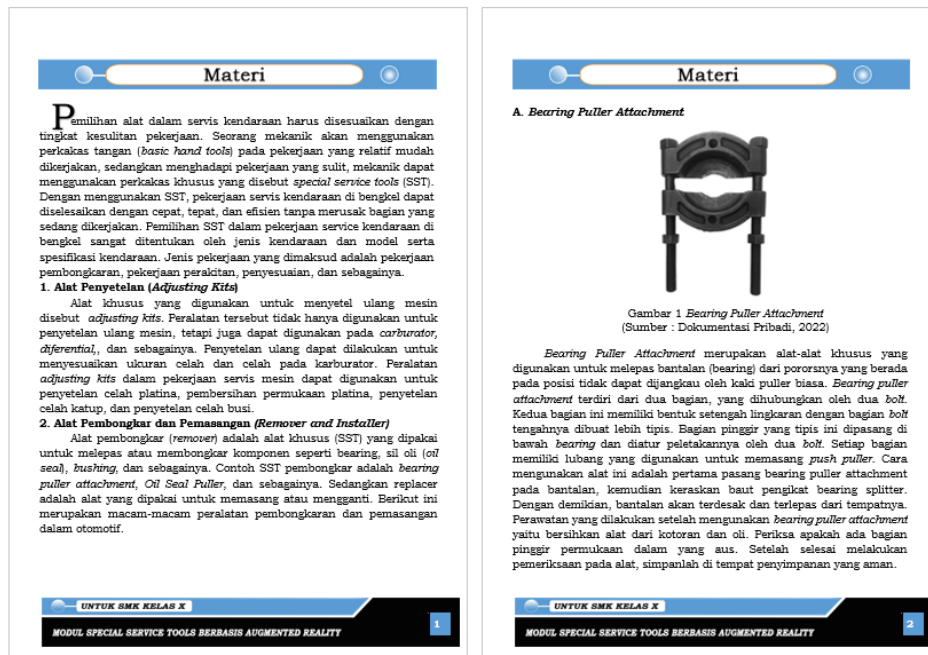
Figure 9. Material Display in Modules

The module contains material about SST and marker images that can later be scanned using the AR SST application to see images in 3 D and videos of how to use them. Before using this augmented reality-based module, it is necessary to install the AR SST application. To install the application, the module user can scan the barcode on the module user instruction page, after being scanned using a mobile phone, it will be directed directly to the link to download the AR SST application.

Figure 10. Main Menu Display in The App AR SST

Figure 10 displays the main menu in the AR STT application, there are 5 menus in this AR SST application including the AR camera menu, instructions, about, and exit.

Figure 11. Ar Camera Menu Display In Apps

In the AR Camera menu, the user must point the camera at the marker image contained in the module. 3D objects will appear along with a video of how to use them, in addition to that on the AR menu of the camera there is a sound play button, when the play sound button is clicked, a sound will appear explaining the function of the scanned tool.

Figure 12. Application Instructions Menu Display

Figure 12 is the appearance of the instructions menu, in the instructions menu there is how to use the AR SST application.

Figure 13. About App Menu View

Figure 13 is the about menu view, on the about menu there is a brief profile of the AR SST application maker.
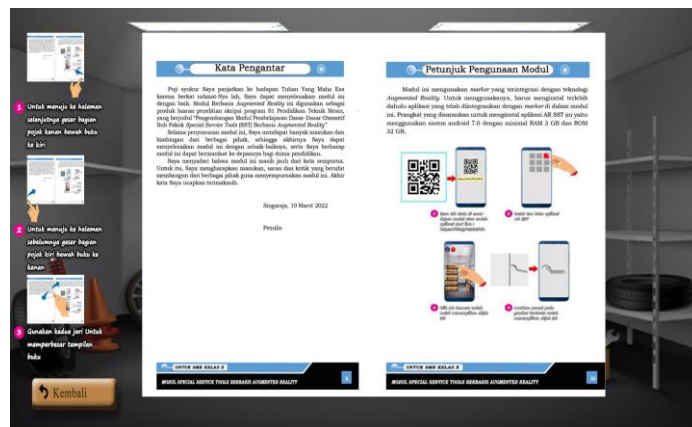

Figure 14. Application Material Menu Display

Figure 14 is a display of the material menu, in the material menu there is a module containing material about SST. From the results of the research obtained in the development of automotive basics learning module sub-subject SST based on augmented reality has theoretical implications, namely: (1) Augmented reality-based learning modules can be used in studying automotive basics subjects of the SST sub-subject. (2) The Augmented Reality-based Learning Module in the automotive basics subject of the SST sub-subject is very feasible for teachers to use to help the process of teaching and learning activities in schools and is very suitable for students to use for learning at home. The practical implications are: (1) Can help users to explain the sub-subject matter of SST. (2) As input for educators to apply learning models that can improve student learning outcomes, interests and talents of students, and motivation in the educational process in schools. (3) As reference material or comparison for researchers conducting similar research.

CONCLUSION

Development of Automotive Basics Learning Module Sub-Subject Special Service Tools (SST) Based on Augmented Reality, declared very worthy based on material and media experts' judgment. As for the level of practicality, it is stated to be very practical based on the results of small and large group tests. As for the advice that can be given from developing a learning module on Automotive Basics Sub-Subject SST based on Augmented Reality, for other researchers who want to develop this media, the content of the material and evaluation questions contained in the module can be added and developed. In addition, the Augmented Reality-based Automotive Basics Sub-Subject SST learning module can be applied in the learning process to determine whether there is an increase in student learning outcomes when using this media.

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