



Augmented Reality in Interactive Learning Applications for Hand Tools

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Abstract

The advancement of Information and Communication Technology (ICT) is rapidly growing in line with the educational knowledge taught in institutions today. Such technology should be utilized to enhance the quality of teaching and learning (PdP). The conventional methods that are still commonly used by many educators are perceived as less engaging, weak, and fail to stimulate students' interest. This project was developed with the aim of improving students' mastery of the subjects they are studying and creating a conducive learning environment. Interest, dedication, and focus on a particular subject among students are crucial aspects to consider. The methodology chosen to implement this project is using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) and Augmented Reality (AR) technology. The project is developed through a combination of existing and digital materials, utilizing Adobe XD and Artivive applications as the main platforms to connect with other applications. Augmented Reality (AR) technology is used to display virtual simulations of the procedures for using certain hand tools, which are scanned using smartphones. Virtual objects are shown to exist in the user's smartphone camera display. The success of this project can make the teaching and learning process more systematic with the help of educational technology using the internet. Several advantages have been identified, such as increasing students' interest, creating an active learning environment, facilitating understanding and retention through engaging animations and audio, and allowing access regardless of the user's time and location. Therefore, it is hoped that this project will be beneficial to educators, students, and parents alike.

Keywords: - Augmented Reality, smartphone hand tools, teaching and learning

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1. Introduction

In the current era of globalization, Malaysia is moving forward with strides, and the advancement of information technology is also rapidly progressing. As such, we can witness the development of education that is becoming more advanced. Various technologies and applications are being used for improvement in education. In line with the 11 shifts of the Malaysia Education Blueprint 2013-2025, the seventh shift emphasizes leveraging ICT to enhance the quality of learning in Malaysia. According to Ghavifekr et al., (2014), the teaching and learning process

will become more engaging and proactive through the use of information, communication, and technology (ICT) as a medium of knowledge delivery to students.

With the advancement of technology in the present time, the teaching process can be carried out anywhere, regardless of the students' location. Therefore, the flipped classroom teaching method can be implemented, where students first explore the topics to be learned based on the resources provided by the instructor within the application. Additionally, the learning environment will become active, and students themselves will seek to understand things they are less familiar with, while the

instructor acts as a facilitator (Siegle, 2014). Fig. 1 illustrates the difference between the conventional teaching method and the flipped classroom. The use of technology in teaching and learning can make students more inclined to comprehend the knowledge being conveyed by the instructor, thereby enhancing their understanding even in challenging courses (Bakar, 2013). Improving student-centered teaching strategies should be further promoted in line with the development of increasingly sophisticated technology.

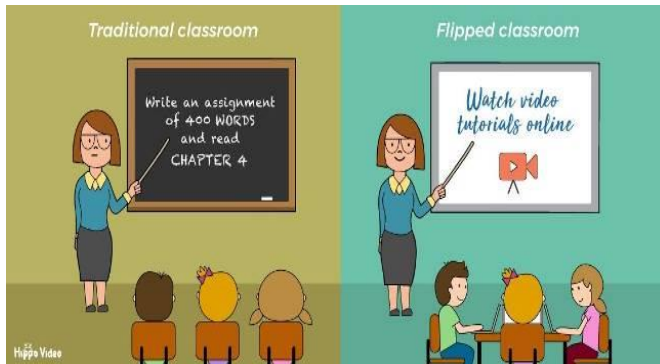


Fig. 1. Comparison of teaching methods

Interest, dedication, and focus on courses involving technical skills among students are seen as crucial aspects that require attention. If this situation is viewed lightly and casually, it will lead to an increased number of students dropping out from this field. This course should not be perceived as something boring, difficult, and suitable only for academically gifted students. On the contrary, it is hoped to create space and opportunities for students who progress more slowly in academics (Mat, 2020). The conventional method or old-fashioned way used today, which mostly involves teaching and rote memorization by teachers, is seen as a situation that students go through. Therefore, it becomes less engaging, weak, boring, and fails to stimulate students' desire and determination to master the subject they are studying.

Furthermore, many students, especially women, are more focused on courses that do not involve technical skills due to factors such as being less proficient in using equipment and not knowing the proper methods of equipment usage. Students also lack sufficient time to learn the correct techniques of using the equipment. Hence, this AR (Augmented Reality) technology is not only capable of transforming traditional modules, program costs, and physical classrooms into online versions, but its implementation can also contribute to a highly flexible teaching and learning environment.

This study was conducted based on several objectives, which are designing the user interface for the learning application and smart card containing information related to hand tools to be displayed to the users. Additionally, developing an interactive learning application using Augmented Reality (AR) technology and testing the functionality of the interactive learning application using Augmented Reality (AR).

The importance found in using this application lies in its ability to facilitate the teaching and learning process while providing enjoyment and expanding students' knowledge. Additionally, the application can enhance students' interest in learning courses involving technical skills more effectively than conventional methods used by instructors, such as traditional classroom teaching and chalk and talk. Teaching and learning processes using this application foster two-way interaction between instructors and students. Students become active participants compared to the one-way interaction in conventional methods where instructors act as facilitators. This makes it difficult for students to absorb and retain information that has been taught. The application also captivates students with engaging visual and audio elements. Indirectly, it stimulates visual, auditory, and kinesthetic senses, making the teaching and learning process more enjoyable than conventional methods.

The concept of pedagogy is increasingly evolving and being utilized in the context of teaching at every educational institution throughout Malaysia, in line with the technological advancements of the present time. Several crucial activities in the teaching process, such as planning, implementation, assessment, and others, need to be further strengthened (Husin & Aziz, 2004). Present-day society is increasingly focused on a reality that aligns with the actual reality. What is referred to as virtual reality (VR) has now become a part of both current habits and many activities carried out during the day. Virtual reality (VR) is also related to the concept of augmented reality (AR) (Arena, Collota, Pau, & Termine, 2022).

AR functions through devices that record the real world and superimpose virtual objects directly in the form of animations, text, data, or sounds visible on the screens of smartphones, tablets, computers, and other display systems (Elmqaddem, 2019). The real world and virtual information are synchronized, adjusting the display based on movements. The use of the flipped classroom model in current teaching and learning activities plays a significant role in the knowledge delivery process (Julia et al., 2020).

According to (Nugraheni, Surjono, & Aji, 2022), the flipped classroom is a blended learning approach that has become popular as a teaching model. The flipped classroom model allows instructors to utilize more opportunities to engage students in applying their knowledge and interacting with both the instructor and peers to share knowledge and ideas, thereby enhancing their higher-order thinking. By implementing the flipped classroom, students can develop critical thinking skills within themselves.

2. Methodology

This application was developed based on the ADDIE model. The ADDIE model consists of five main phases, namely analysis, design, development, implementation, and evaluation. Research findings have proven that the ADDIE model is the most appropriate and systematic approach in developing a learning application (Safitri &

Aziz, 2022). Fig. 2 below illustrates the workflow in the ADDIE model that needs to be followed to develop a quality product that can be marketed.



Fig. 2. ADDIE model

2.1 Analysis Phase

The analysis phase is the initial process of developing a product. This phase involves developers identifying the problems to be addressed. The analysis process is carried out to determine the root causes of the identified problems. The developers of this learning application conduct various needs and technical analyses before developing it.

2.2 Design Phase

The design phase involves the structure, theoretical approach, types of media, and technology to be used. This phase is crucial for planning the strategy in developing this application and the methods to achieve the outlined goals. Fig. 3 below illustrates the design of the PdP card, which will be translated into its content using Augmented Reality (AR) technology.



Fig. 3. Teaching and learning card

2.3 Development Phase

This phase involves building the actual application using all the selected media and technology elements

based on the requirements. Several processes are undertaken by the developers to develop this learning application using Augmented Reality (AR) technology, where Adobe XD and Artivive applications are chosen as the main platforms to facilitate the connection with other applications. Animations and audio are also included to make it easier for users to comprehend the conveyed knowledge more clearly.



Fig. 4. Augmented Reality in learning application

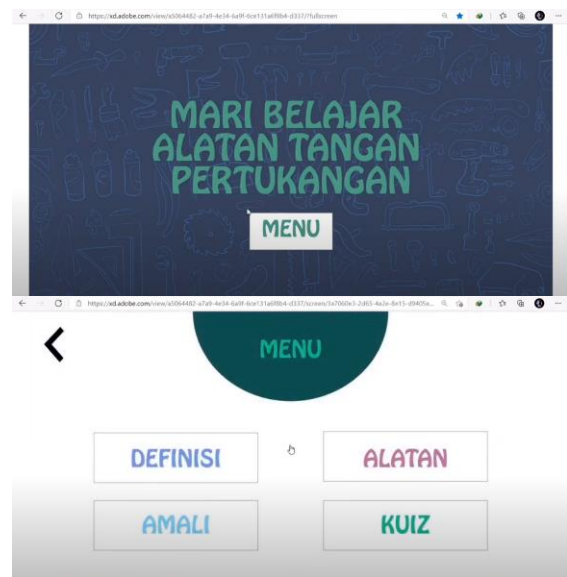


Fig. 5. User interface of the learning application

2.4 Evaluation phase

This phase requires user feedback regarding the functionality of the developed learning application. Questionnaires are distributed to respondents to assess the suitability and effectiveness of this application. The evaluation results are collected to observe the overall average.

3. Result and Discussion

After the questionnaires have been collected again, the summary of respondent distribution is shown in Table 1 below. The overall items assessed for developing this application are presented in Fig. 6, Fig. 7, and Fig. 8.

Table 1. Distribution of respondents

Respondent	Number of Respondent
Educator	10
Student	7
Parent	6

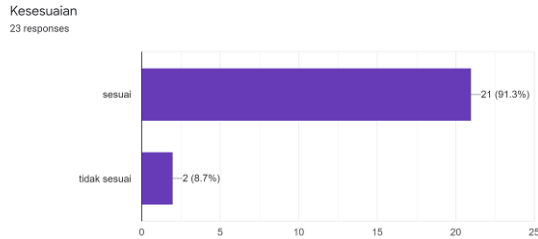


Fig. 6. Factors of product suitability developed

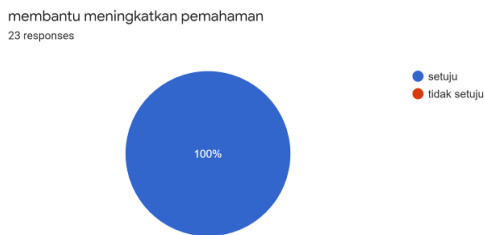


Fig. 7. Factors helping to enhance student's understanding

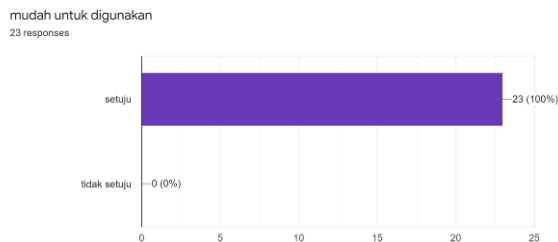


Fig. 8. Factors of user-friendly application usage

Overall, referring to Figures 6, 7, and 8, the development of this interactive learning application using Augmented Reality (AR) technology received positive and encouraging responses. Out of 23 respondents, 21 individuals, representing 91.3%, stated that the application is suitable for use as it helps students comprehend the knowledge presented by the instructor more easily and engagingly. Indirectly, this application can attract the interest of more students, leading them to pay full attention to the subject matter they are studying.

Furthermore, all respondents (100%) agreed that this application can enhance students' understanding of the subjects they are studying, thereby enabling them to achieve high scores in the conducted examinations. Additionally, all respondents (100%) mentioned that this learning application is easy to use and user-friendly. The user interface of the application is also attractive and systematically organized for the users.

However, there are some positive comments provided

by respondents for future improvements. The internet network factor is emphasized to ensure that the application functions well and smoothly, and to increase the presentation of graphic materials.

4. Conclusion

This interactive learning application using Augmented Reality (AR) technology is one of the alternatives capable of increasing students' interest and level of understanding in courses involving technical skills. Overall, this application can also have a positive impact on all target groups. Additionally, the innovation can create an enjoyable learning environment and avoid a passive atmosphere among students. Therefore, students will be more interested in learning courses involving technical skills more effectively. With the resources provided by this learning application, instructors will find it easier to implement the teaching and learning process effectively. Thus, this application can have a positive impact on all educators.

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