The effectiveness of learning media based on digital augmented reality (AR) technology on the learning outcomes of martial arts

La eficacia de los medios de aprendizaje basados en tecnología de realidad aumentada digital (AR) en los resultados del aprendizaje de las artes marciales

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Abstract

Introduction and Objectives : The educational potential of Augmented Reality (AR) and Virtual Reality (VR) technologies has gained significant attention in recent years. Understanding teachers' willingness to adopt new technologies is crucial for supporting their integration into education. This study aims to assess the effectiveness of AR-based digital technology applications as learning media for improving martial arts learning outcomes in the Basic Engineering Materials course at the Faculty of Sports Science, Padang State University.
Methodology : This experimental study used a quantitative approach. The sample consisted of 62 students from the Faculty of Sports Science, Padang State University, selected through cluster random sampling. The subjects were divided into a control group and an experimental group. Data was collected using a pretest-posttest design. Statistical analysis was performed using the Shapiro-Wilk and Wilcoxon tests in SPSS software.
Results: The results showed a significant difference in learning outcomes between students using AR-based learning media and those who did not. The p-value of 0.000 (< 0.05) indicates that the use of AR-based learning media significantly improved students' learning outcomes at the Faculty of Sports Science, Padang State University.
Conclusion: The study concludes that AR-based learning media are effective in enhancing students' learning outcomes, particularly in martial arts education. This finding contributes to the development of mobile-assisted learning and technology-enhanced education.

Keywords

Augmented reality; learning media; martial arts.

Resumen

Introducción y objetivos: El potencial educativo de las tecnologías de Realidad Aumentada (RA) y Realidad Virtual (RV) ha ganado una importante atención en los últimos años. Comprender la voluntad de los docentes de adoptar nuevas tecnologías es crucial para apoyar su integración en la educación. Este estudio tiene como objetivo evaluar la efectividad de las aplicaciones de tecnología digital basadas en RA como medios de aprendizaje para mejorar los resultados de aprendizaje de las artes marciales en el curso de Materiales Básicos de Ingeniería en la Facultad de Ciencias del Deporte de la Universidad Estatal de Padang.
Metodología: Este estudio experimental utilizó un enfoque cuantitativo. La muestra estuvo constituida por 62 estudiantes de la Facultad de Ciencias del Deporte de la Universidad Estatal de Padang, seleccionados mediante muestreo aleatorio por conglomerados. Los sujetos se dividieron en un grupo control y un grupo experimental. Los datos se recolectaron mediante un diseño pretest-postest. El análisis estadístico se realizó mediante las pruebas de Shapiro-Wilk y Wilcoxon en el software SPSS.
Resultados: Los resultados mostraron una diferencia significativa en los resultados de aprendizaje entre los estudiantes que utilizaban medios de aprendizaje basados en RA y los que no lo hacían. El valor p de 0,000 (< 0,05) indica que el uso de medios de aprendizaje basados en RA mejoró significativamente los resultados de aprendizaje de los estudiantes en la Facultad de Ciencias del Deporte de la Universidad Estatal de Padang.
Conclusión: El estudio concluye que los medios de aprendizaje basados en RA son efectivos para mejorar los resultados de aprendizaje de los estudiantes, particularmente en la educación en artes marciales. Este hallazgo contribuye al desarrollo del aprendizaje asistido por dispositivos móviles y la educación mejorada por la tecnología.

Palabras clave

Artes Marciales; medios de aprendizaje; realidad aumentada.

Introduction

Educational effectiveness is a productive system in which the materials and human potential are concurrently taken into account in certain contextual conditions to produce academic performance (Burušić et al., 2016). The quality of the teacher-student relationship, which is intended to be a continuous correlation and is included into the shared repertoire that allows for the absorption and implementation of educational information, has a significant role in how effective education is. The fundamental framework for any educational or training activity is provided by teacher-student connection. It conveys the necessity for self-training, self-continuation, involvement, and togetherness in psychosocial alliances (Ilham & Dimyati, 2021; Moraru & Cristea, 2013).

Teaching and learning activities are the process of forming students' self-understanding of knowledge and development both in terms of knowledge, psychologically and socially. The purpose of the learning process includes various aspects that are determined because of the learning itself, one of which is the cognitive aspect. Cognitive aspect is the intellectual ability of students in thinking, knowing, and solving a problem. As stated by (Bloom, 1956), the cognitive aspect has a goal domain consisting of six parts, namely knowledge, understanding, application, analysis, synthesis, and evaluation.

The use of new technology in a variety of fields, such as education, has caused positives impact in European societies in the 21st century (Festiawan et al., 2024; Kamp, 2019). The development of science and technology leads to increasingly significant changes and towards a practical era. In the education sector, the development of information technology has penetrated the management system and the learning system in the classroom (Bradley, 2020). The use of increasingly varied media becomes a challenge for teachers in carrying out their duties as teachers in schools in order to achieve learning objectives but students can be motivated by using another learning technique, such as a game, to bring in a new and contextual information, or digital entertainment can excite the brain from the inside out (Perdana et al., 2021; Puspitarini & Hanif, 2019). Due to their portability and ability to run apps, smartphones are the most popular mobile device used as a communication tool in the information technology industry (Darko-Adjei, 2019).

Owners of smartphones have conquered the world, and their tremendous influence on education has led to changes in both teaching and learning processes. The use of smartphones which are relatively easy to carry, easy to access and affordable as a medium in learning will greatly impact students (Baert et al., 2020). In addition to facilities that are relatively new, students will be more interested in using facilities that are contemporary and familiar with students' daily life situations.

When it is associated with sports, especially in the branch of martial arts, the determination and selection of media will determine the success of students in mastering the training material. Because it is well known that in martial arts the mastery is more demanding on motor skills (Fuller & Lloyd, 2019).

In this regard, some studies such as (Cruse, 2006) has shown several advantages of using video such as a teaching medium, namely: Students with strong visual orientations in their learning styles may benefit from watching videos to enable them to learn. Students' enthusiasm to study can be increased and their inactivity can be decreased through the use of appropriate media and variety in the learning process (Alfa & Karim, 2016).

For many students with learning challenges who might otherwise miss out on learning opportunities offered only by print-based materials, video can offer visually attractive access to knowledge. Videos offer students studying a second language crucial learning opportunities in this regard. Therefore, researchers want to see: (1) Are there differences in learning outcomes between students who use and do not use learning media based on digital augmented reality applications at the Faculty of Sports Science, Padang State University. (2) Does the use of learning media based on Augmented Reality digital applications influence increasing the learning outcomes of martial arts students of the Faculty of Sport Science, Padang State University?

The user must always adapt to the ongoing technology in the digital world, particularly with computer technology. Now, the computer and the virtual world can coexist beside each other in the physical world (Ciloglu & Ustun, 2023; Laurens-Arredondo, 2022). This innovation is augmented reality (AR). Through use of learning media can intrigue students' attention and inspire them to understand because it can make the lecture of messages and information clearer, which facilitates and improves the learning

process and outcomes; it can focus the reader's interest better and more purposefully, which inspires the students to develop through more direct interaction; it can get around the constraints of the senses, space, and time; it can offer students similar experiences about their environmental events; and it can overcome these limitations (Dewi et al., 2018; Nelson et al., 2022).

This study aims to determine the effectiveness and response of students to the use of learning media based on digital Augmented Reality applications on student learning outcomes of the Faculty of Sports Science, Padang State University.

Method

This research is an experimental study conducted at the Faculty of Sports Science, Padang State University. The research design was pretest-posttest-group design, with cluster random sampling method. The research sample was selected like class A as an experimental class with learning treatment using learning media based on digital Augmented Reality applications, and class B as a control class without treatment

Participants

The whole sampling was 62 students taken by cluster random sampling. The data collection method was carried out by test and non-test methods, the test method used an instrument in the form of a practical test which is used to determine the basic martial arts technical skills of Sport Science Faculty students, while the non-test method used a student response questionnaire instrument to determine the learning media based on digital technology Augmented Reality.
In addition, data collection was also obtained from documentation.

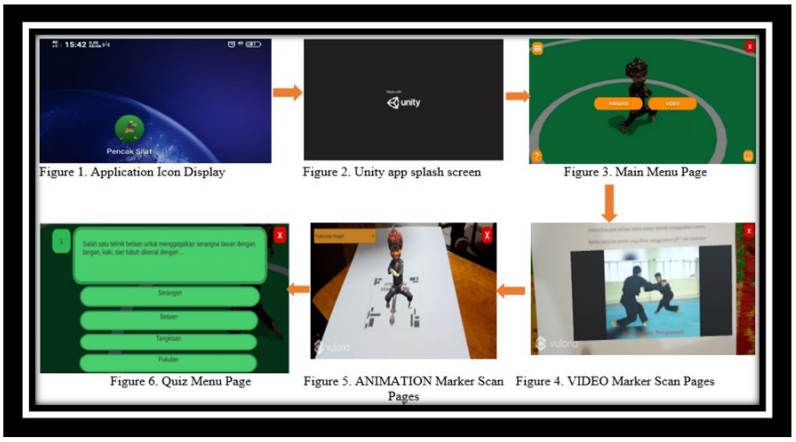
Data analysis

The data from the pretest and posttest results from the experimental class and the control class have been analyzed by Shapiro Wilcoxon because the parametric statistics normality, and homogeneity test showed that the data were not normally distributed.

Results

The main distinguishing characteristic of the learning applied to the experimental class and the control class will be the use of digital augmented reality-based learning media. While other learning tools such as lecturers, syllabus, lesson plans, materials, learning methods and instruments are the same. Some of the menu views on the android application are presented below:

Figure 1. Android Menu



The explanation of each caption is given below from figure number one to six

1. Application Icon Display

On this page there is an application logo in the Android menu which if you click the logo it will allow to the user to enter in the application.

2.Application Icon Display

On the splash screen, this is the first page that appears when the user opens the Augmented Reality Interactive Media application for Introduction to Martial arts. This page will be displayed a few seconds before entering the main menu page.

3. Main Menu Page Display

On the Main Menu page view, the user can choose an option menu, namely the application usage guide menu, the info menu or about the application, the Quiz Menu, Animation Menu and Video Menu.

4.Scan Marker Page Display

The scan marker page or Augmented Reality page is a page that contains an Augmented Reality application. This camera is useful for detecting markers contained in the module. If the camera is successful in tracking the marker, the object will be displayed according to the database of each marker. In this application, there are 2 menu options for the scan marker page, namely the ANIMATION menu and VIDEO where if the user selects the ANIMATION menu it will display 3D objects, whereas if the user selects the VIDEO menu it will display a video.

5.Quiz Page View

The quiz page is a page that displays a quiz about the introduction of basic martial arts movements that serves to evaluate the understanding of the material contained in the Augmented Reality Interactive Media application for Introduction to Martial arts.

6.Instructions Page

This page explains the use of the application. This page will explain the functions of the menus and buttons on the application so that users can easily run the application.

7.Instructions Menu page

The activity, interest and interaction that occurred in both the experimental class and the control class were the same.

Figure 2. Instructions Menu page

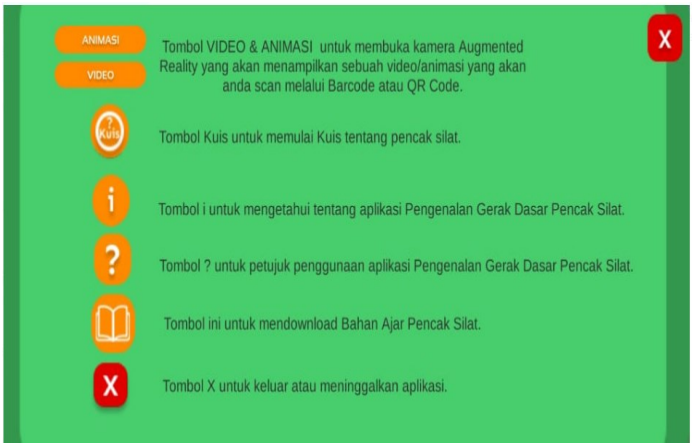


Table 1. Control group/Conventional and Experimental Group

	Control group		Experimental Group	
No	Pre-test	Post test	Pre-test	Post test
1	0	50.00	0	50.00
2	0	50.00	0	80.00
3	0	60.00	0	60.00
4	0	60.00	0	65.00
5	0	60.00	0	70.00

6	0	50.00	0	60.00
7	0	60.00	0	60.00
8	0	60.00	0	60.00
9	0	50.00	0	70.00
10	0	60.00	0	60.00
11	0	50.00	0	60.00
12	0	60.00	0	70.00
13	0	60.00	0	80.00
14	0	50.00	0	70.00
15	0	50.00	0	60.00
16	0	40.00	0	60.00
17	0	60.00	0	60.00
18	0	50.00	0	50.00
19	0	60.00	0	90.00
20	0	60.00	0	60.00
21	0	60.00	0	70.00
22	0	50.00	0	60.00
23	0	70.00	0	60.00
24	0	50.00	0	70.00
25	0	60.00	0	70.00
26	0	50.00	0	60.00
27	0	60.00	0	60.00
28	0	50.00	0	60.00
29	0	70.00	0	80.00
30	0	50.00	0	75.00
31	0	70.00	0	80.00

The table above showed the result from pre-test, and posttest for the two groups like control group, and experimental group. The following data were analyzed with Shapiro Wilcoxon because the data were not normally distributed.

The research hypotheses were:

HO: There is significant difference between the learning outcomes of students who use and do not use learning media based on digital augmented reality applications at the Faculty of Sports Science Padang State University.

HA**:** There is no significant difference between the learning outcomes of students who use and do not use learning media based on digital augmented reality applications at the Faculty of Sports Science Padang State University. The verify those hypotheses the researcher conducted the Shapiro Wilcoxon analyzing test.

Table 2. Statistic of Analyzing of the different between the group control and experimental data

Test Statistics	
	Control Group – Experimental Group
Z	-3.949[b]
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

The table 2 showed that the P value was less than 0.05 which means that There was a significant difference between the learning outcomes of students using and not using digital augmented reality application-based learning media at Padang State University Faculty of Sports Science. The learning media based on Augmented Reality digital applications has a strong positive impact on increasing the learning outcomes of martial arts students of the Faculty of Sport Science, Padang State University.

Discussion

The result from this research showed a strong influence of digital augmented reality application-based learning media. The subjects who used that application well performed more than those who used another media. The same result has been found in a meta-analysis research with Data Types.

These data are in the form of post-test results for the derived control and experimental classes from research articles on the use of AR-based learning materials in professional training. The results analyzing showed that AR-based learning materials have a high impact on learning Vocational training results.

Augmented reality-based learning materials are therefore suitable for use at work Education Learning process to produce graduates capable of working in a job or creating the job themselves (Mubai et al., 2021). The similar study has examined whether pedagogical and content technological knowledge (TPACK), social norm (SN) and motivational support (SM) for teachers' influences teachers' intention to use technologies. The results imply the importance of providing professional technological development (PD) and support for educators to enable the use of AR and VR classrooms (Hsu & Shih, 2016). The application has helped the subjects to well performed the martial arts. A similar look out showed that to create interactive and educational augmented reality (AR) experiences that support situated and experiential learning remains a challenge for teachers without programming capabilities. In order to incorporate AR into everyday teaching, teachers need to be designed their own immersive experiences for their students (Dengel et al., 2022).

This study objective was to determine the effectiveness and student response to the use of learning media based on digital augmented reality applications on student learning outcomes at the Faculty of Sports Science, University of State of Padang.

The outcome has shown that the application was more efficient and increasing the learning outcomes of martial arts.

Conclusions

This study was conducted with intention of determining the effectiveness and response of students to the use of learning media based on digital Augmented Reality applications. This study was an experimental study conducted at the Faculty of Sports Science, Padang State University by designing a pretest-posttest-group design, with cluster random sampling method.

The learning Media based on Digital Augmented Reality (AR) Technology on the Learning outcomes of Martial Arts was like a technology teaching using a mobile application.

The study's findings have indicated that the developed mobile application was more effective to increase outcomes of the subjects in martial arts. The authors realized that Augmented Reality technology can be applied in many fields of education or learning.

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