Kinestetik : Jurnal Ilmiah Pendidikan Jasmani 7 (3) (2023)
Kinestetik : Jurnal Ilmiah Pendidikan Jasmani
https://ejournal.unib.ac.id/index.php/kinestetik/index
DOI : 10.33369/jk.v7i3.28524

Development of Futsal Learning Media Based on Augmented Reality 3D Visualization to Improve Physical Education Students Practicum Learning Results

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Article Info

Article History :

Received : June 2023

Revised : September 2023

Accepted : September 2023

Keywords:

Augmented Reality,
Futsal, Learning Media,

Abstract

This study aims to develop interactive learning media based on Android using the 3D Augmented Reality Visualization application as an innovation of practical and theoretical collaboration in one place in practicum learning, where learning in the 21st century is cross-learning for physical education students in futsal courses in the independent learning era. - independent campus. This study uses the Research and Development (R&D) method which refers to the 4D (four-D) research and development model, namely define, design, develop, and disseminate. The developed Android-based learning media will be tested on students taking the Futsal course, the FKIP UNIB Physical Education Study Program. The research instrument used to collect data in this study used questionnaires and test techniques. There are three questionnaires that will be distributed in this study, namely the material expert questionnaire, the media expert validation questionnaire, and the student response questionnaire. As a result, the total score obtained from the combined validation of material experts, media, and users is 139.5 or obtains an average value of 4.1, which means that the Android Based Futsal Learning Media with 3D Augmented Reality Visualization that the researchers developed falls into the category Suitable for use in learning activities.

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ISSN 2685-6514 (Online)
ISSN 2477-331X (Print)

INTRODUCTION

Bengkulu University as part of an educational institution agrees with the social distancing steps that have been decided by the government to indicate that Covid-19 has begun to reduce its spread. After almost 2 years have passed, it turns out that this pandemic is starting to disappear with a significant decrease in cases by making the government relax social distancing by again allowing face-to-face learning, but when we start 21st century learning with a technological approach including the era of independent-free campus and work the same among fkip throughout Indonesia (FORKOM). Learning in this era needs to be prepared as well as possible because there are several students from other regions who take part in inter-cross learning so that special attention is paid to its implementation.

The concept of independent learning aims to provide freedom for students to study outside the campus. This means that students (students) are given independence in exploring the knowledge needed. (Dananjaya, 2023). According to Hadio et all (2020), the application of this concept must be accompanied by sufficient technological readiness so that the independence of students in exploring knowledge can be realized. One of the readiness of this technology is to provide learning media that can be accessed anywhere and anytime by students, both practical, theoretical or collaborative practice and theory.

FKIP Unib's Bachelor of Physical Education Study Program has one of the compulsory subjects, namely the Orpil Futsal course with a weight of 2 credits. Elective Sports is given in odd semesters (VII) with learning outcomes, namely students are able to know and understand and carry out futsal sports games properly and correctly. Futsal itself contains basic techniques that must be developed so as to create a good quality game. The techniques in playing futsal are: ball control techniques, ball feeding techniques, ball dribbling techniques, ball kicking techniques, speed and physics (Lhaksana, 2011). In this era there needs to be innovation in order to control practical and theoretical learning. Futsal is closely related to practical material, but there needs to be theory in its support so that this affects the quality of learning outcomes in the subjects to be taught (Sastiawan, 2019).

The instructional media provided are not only meaningful for improving the quality of learning but will also be better if the media is close to students. Students in the current era are students of generation Z where they grow up in the era of the rapidly developing digital world so that this generation is a generation who is literate with technology. The closeness of students to technology products such as gadgets requires educators to see opportunities in implementing education, for example by developing Android-based learning media using Augmented Reality applications.

Teaching and learning interactions in the classroom cannot be separated from the influence of the media used by the teacher in delivering teaching material. (Zaifullah, et al, 2021) The more interesting the media used and supported by the delivery of material by communicative teachers, the more interested students will be in following the lessons in class. According to Hamalik (Azhar, 2015) the use of learning media in the teaching and learning process can generate new desires and interests, 2 generate motivation and stimulate learning activities and even have a psychological influence on students.

Media by utilizing Information and Communication Technology in the current era is a promising factor in the success of a learning process. (Anshori, 2018). Now, teachers must understand technological advances so they don't lag behind information from students. Teachers must be able to play the role of a facilitator for students, especially in utilizing various learning resources so that teaching and learning activities are more effective, efficient and not monotonous. (Asmani, 2016). However, in reality the use of Information and Communication Technology in learning is not optimal. This can be seen that there are still a few schools that have made good use of the existence of Information and Communication Technology as a learning medium. One of the reasons for this condition is that most teachers have not mastered the technology. (Siahaan, 2020). It cannot be denied that learning media based on Information and Communication Technology are currently not packaged for learning that is ready to be used by students and teachers in the learning process (Diski, 2021). One of the rapidly developing technologies today is the smart phone/smartphone. Smartphones are very useful because the internet facility they bring is a window to the world for exchanging information. (Hidayat, et all 2022). So that this encourages the number of smartphone users to increase from year to year. In fact, a research institute 3 released on the detik.com portal stated that Indonesia is ranked fifth in the list of world's largest smartphone users after China, America, India and Japan.

The existence of technology, especially smartphones which are now growing, must be addressed wisely. The benefits that exist from the existence of this technology must continue to be explored for the sake of better human survival. (Silalahi, 2022). The phenomenon of the high number of smartphone users is certainly a challenge and opportunity in the world of education. (Surani, 2019) The challenge is in the form of abuse for negative things. Besides being a challenge, the existence of smartphones also brings great opportunities to develop useful technology in the field of education. One of the benefits that can be drawn from the existence of this technology is to use it as an effective, creative and educative learning medium. (Rosita & Dikcita, 2020) So that educational application media can continue to be developed, one of which is Augmented Reality (AR) technology. According to the explanation of Haller, Billinghurst, and Thomas (2007), Augmented Reality aims to develop technology that allows real-time merging of digital content created by computers with the real world. Apart from computer media, currently AR technology has been developed on Android smartphones. Smartphones with the Android operating system have many advantages, apart from the fact that there are so many users in Indonesia, the Android platform is also open source for developers to create applications.

According Sugeng, et al (2022) Augmented Reality technology that is used as a learning medium is expected to improve student learning outcomes. Based on Maulina Fitira Nigsih's research in 2015 entitled The Effect of Augmented Reality-Based Learning Media on Student Learning Outcomes, it was found that there was a significant influence with the use of Augmented Reality-based learning media on student learning outcomes. The average value of student learning outcomes using Augmented Reality-based learning media is higher than the average value of student learning outcomes without using Augmented Reality-based learning media. If this technology is used as a learning medium,

students will be invited to think in real terms, without having to bring practical tools directly. This is an advantage for vocational schools which still lack practice tools.

One of the research that researchers will do is from the subjects who will be included in the research, where researchers develop Android-based Futsal learning media with a focus on Augmented Reality application assistance. The limited research on the use of Augmented Reality applications as a tool in developing learning media, especially in Futsal courses is also the reason researchers want to do this research. The development of android-based learning media using the Augmented Reality application allows learning objectives to be achieved in the era of the independent learning policy - independent campus and allows for the effectiveness of futsal learning in the midst of difficulties in practical and theoretical collaboration as a result of inter-cross learning in the era of independent learning.

METHODS

This research refers to the 4D (four-D) research and development model. The research and development carried out will produce a product in the form of Android-based learning media with Futsal learning materials. By using 4D model steps.. According to (Lawhon and Thiagarajan 1974) the 4D research and development model consists of 4 main stages, namely defining, designing, developing, and disseminating. In the opinion of Mulyatiningsih (2014) expressed his opinion that the 4D model and ADDIE essentially have similarities. The difference from this model lies in the development activities in the 4D model which ends with the dissemination stage whereas in the ADDIE model after development it still goes through stages with implementation and evaluation stages. The 4D model does not include the stages of implementation and evaluation which are considered rational at the stages accompanying the process of product creation, evaluation and improvement. The 4D model was chosen for this research and development because the stages in the 4D model are very clear, concise and simple in every step.

Participants and Sampling

The population of this study were all students of the Physical Education Study Program FKIP UNIB T.A. 2023/2024. While the samples in this study were 5th semester students who took the Futsal game course, Physical Education Study Program, FKIP UNIB.

Place and time of research

This research was conducted at Bengkulu University on odd semester students T.A. 2023/2024 Physical Education Study Program FKIP UNIB.

Data collection technique

There are three questionnaires that will be distributed to collect data in this study, namely a material expert questionnaire, a media expert validation questionnaire, and a student response questionnaire. The purpose of distributing the questionnaire was to determine the feasibility of developing learning media that the researchers made. In addition, there is also a technical test in the form of giving questions to students which aims to find out the extent to which students understand the material after the Android-based Futsal learning media with 3D Visualization Augmented Reality is tested.

Data analysis

The analysis of the data used in this study is questionnaire data for material experts and media experts as well as a student response questionnaire conducted with five rating scales, where the highest score is 5 (strongly agree) and the lowest score is 1 (disagree). (Gulo 2013) To calculate the average total score of each questionnaire, the following formula is used: = /N. The score obtained is then converted according to the table reference below:

Table 1. Conversion of scores on a scale of five.

Value interval	Category
X > Xi + 1,8 Sbi	**Strongly agree**
Xi + 0,6SBi < **X** ≤ Xi + 1,8Sbi	Agree
Xi - 0,6SBi < **X** ≤ Xi + 0,6Sbi	Just Agree
Xi – 1,8SBi < **X** ≤ Xi - 0,6Sbi	Disagree
X ≤ Xi – 1,8Sbi	Don't agree

RESULT

The development of an Android-Based Practical Learning Media with 3D Visualization Augmented Reality to improve students' critical thinking has been tested on 34 Physical Education students who take the Futsal course. The results of the distribution of material expert questionnaires, media expert questionnaires, and student response questionnaires showed that in the form of Android-Based Practical Learning Media with 3D Visualization Augmented Reality this was feasible to be used in Futsal learning activities. In addition, there were also trials conducted on students, the results of which showed an increase in students' understanding of the Futsal teaching material after using Android-based 3D Visualization Augmented Reality learning media with the help of applications so that students got learning outcomes with good average scores. The following is an explanation of the stages of carrying out research using the Research and Development (R&D) method that the researchers have done.

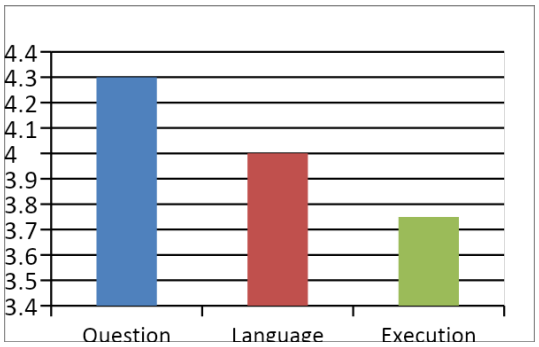

Figure 1. Bar Diagram of Material Expert Validation Results

The validation of the material carried out by the lecturer in charge of the Futsal course aims to assess the feasibility of the questions that represent the material used in the 3D Visualization Augmented Reality learning media through a questionnaire. Before using this questionnaire, CV (content validity) has been calculated where the result is 0.875, which means that this material expert validation instrument can be used. The questionnaire uses a Likert scale with 5 alternative answers where the highest score is 5 (strongly agree) and the lowest score is 1 (strongly disagree). This questionnaire consists of 16 statements which are grouped into 3 aspects, namely the material aspect, the language aspect, and the implementation aspect.

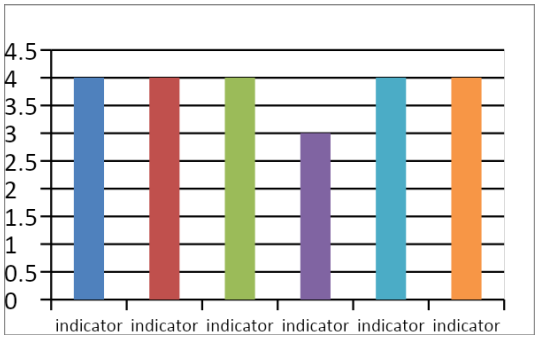

Figure 2. Bar Diagram of Media Expert Validation Results

The purpose of holding the validation of the media is to assess the feasibility of the 3D Visualization Augmented Reality Futsal learning media that the researchers made. Before using this questionnaire, CV (content validity) has been calculated, where the result is 0.83, which means that this media expert validation instrument can be used. This validation is carried out by the lecturer in charge of the Futsal course because the teacher who is also the user is the party who will feel the benefits of this media in the future. Just like the validation carried out by material experts, the validation results from media experts are also based on the Likert scale. Where the answer strongly agrees (SS) gets a value of 5 and for the lowest number, namely 1 if the chosen one is strongly disagree (STS) in the questionnaire distributed by the researcher. This questionnaire consists of 1 aspect, namely the appearance and use of learning media which consists of 6 indicators in the form of statements.

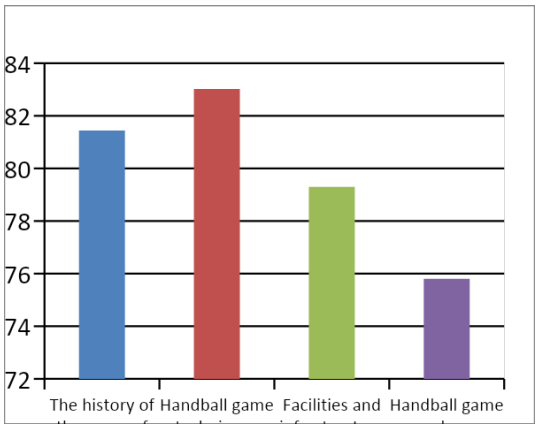

Figure 3. Bar chart of the results of the 3D VR Commando learning media trial

Next is the trial stage 3 and stage 4 which the level of difficulty of the questions is categorized as high. In the trial phase 3 with the material Facilities and infrastructure for Futsal. The average value obtained by students in this material is 79.3. Not much different from the trial stage 3 with the material for the rules of the Futsal game, the results of the trial at stage 4 showed that students obtained an average score of 75.8 for the discussion of the rules. All of the trials conducted by the researcher from the 1st phase of the trial to the 4th trial showed good results, namely the four trials obtained an average score of 79.89. This means that the transformation of Futsal material into the form of Android based Commando 3D VR learning media provides a fairly good understanding for students or users. This is in line with the results of the validation of materials and media, where the learning media that the researchers created obtained results that were suitable for use in learning. The following are the results of trials conducted on 34 students in the form of a bar chart.

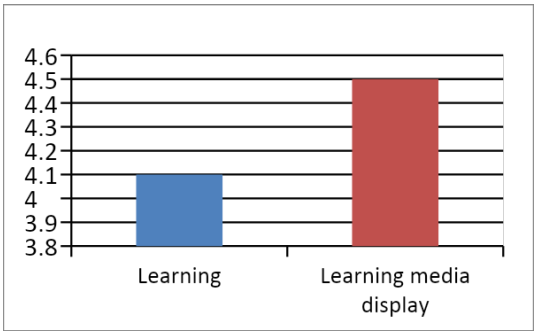

Figure 4. Bar chart of the 3D VR Commando learning media trial

The figure above shows the results of user responses, namely students. There are 7 statements in aspect 1 and 5 statements for aspect 2. In the first aspect, namely the learning process, the final score obtained for the seven aspects is 28.9 or obtains an average score of 4.1 which means the first aspect is in the very category. worthy. Next is the second aspect, namely the display and use of learning media, the final score obtained for the five aspects is 22.6 or an average of 4.5, which means that this second aspect is also included in the very feasible category.

The results of the preparation of this media are then validated by media experts as well as material experts and learning media users. Overall the results of the three validations are summarized in the table below:

Table 2. Assessment Aspect

No	Assessment Aspect	Total Score	Average Score	Category
1	Material expert assessment	65	4,06	Worthy
2	Media expert assessment	23	3,8	Worthy
3	User ratings	51,5	4,29	Very worthy
Amount		139	4,1	Worthy

DISCUSSION

The research conducted by researchers shows that the development of Android-based Augmented Reality Visualization 3 Dimensional Futsal learning media with the help of this application is suitable for use as a learning medium in Futsal courses. This research and development adapts a learning model consisting of 4 main stages. However, based on the research objectives mentioned previously, it needs to be underlined that research adapting the 4D model was only carried out at the development stage. Where at this stage there are only product trials that have been validated by material experts and media experts on students. This research procedure consists of the definition stage, design stage and development stage.

The definition stage is a stage carried out to analyze needs related to users, namely lecturers who teach courses and also students who take Futsal courses. Apart from analyzing needs, this stage also aims to determine trends in the use of learning media in literature courses in the Physical Education Study Program. Data from this needs analysis was obtained from a questionnaire that was answered by prospective users of the 3-Dimensional Augmented Reality Visualization learning media which was distributed using Google Form. The results show a scale of 4.7 and 3.4 from an average interval of at least 3. This means that developing Android-based 3-Dimensional Augmented Reality Visualization learning media is feasible.

Simple media creation using the help of an Android application to create VR Commando and also a fast distribution flow to students and the hope of a more interesting and interactive learning situation for students using online 3-Dimensional Augmented Reality Visualization media. The conclusion is that Android-based 3-dimensional Augmented Reality Visualization learning media is needed for development. Apart from that, from the needs analysis by giving 8 questions to students as part of media users, it can be concluded that there is great interest from students in using learning media in the form of 3-Dimensional Augmented Reality Visualization games where the games are packaged in Android technology so that students become more interested and feel more embraced by technological adjustments in the generation Z era.

The design stage is carried out with the help of an application. The stages that the researcher carried out in this stage were selecting the material, designing the question items, and finally designing the appearance. Researchers chose Futsal with the aim of arousing student interest in the game material. The combination of classical material with technology is the key to making students more enthusiastic in learning the game of Futsal. Next is the question item design stage where the main source of material that the researcher will transform into the form of

statement questions and 3-Dimensional Augmented Reality Visualization questions is from Herwanto's book entitled Futsal Games. The final stage is the stage of designing a 3-Dimensional Augmented Reality Visualization box based on the questions that have been created. At this development stage, researchers are assisted by the application. The results are then distributed to students in the form of a link via any social media. Users just have to click on their respective Android displays and then the 3-Dimensional Augmented Reality Visualization game will appear which is a transformation of the Futsal material. The results of this media preparation are then validated by media experts as well as material experts and learning media users. Based on the table above, it can be seen that material expert validation was carried out to see the suitability of the questions presented as a transformation of Handball material. This validation is carried out by giving a questionnaire to the material expert validator. This questionnaire contains 16 statements which are grouped into 3 aspects, namely the question material aspect, language aspect and implementation aspect. Overall, the material aspect of the questions received an average score of 4.06, which means it is in the category suitable for use as learning media.

Next is validation carried out by media experts which aims to assess the suitability of the media that researchers have created. The questionnaire distributed to media experts consisted of 1 aspect with 6 statements. The result was a score of 3.8, which means this media is suitable for use in learning. After validation was carried out by media experts and material experts, the next stage was a trial of the Augmented Reality Visualization 3 Dimensional Futsal learning media on 34 students as users. The trial was carried out 4 times with 4 materials varying in level of difficulty. The material is 1) History of the Futsal game 2) Development of Futsal, 3) Futsal game techniques (Passing & Dribbling), 4) Futsal game techniques (Shooting & Catching). Overall, the test results show that students on average got a score of 79.89, which means that the transformation of Futsal material into the form of Android-based Augmented Reality 3 Dimensional Futsal Visualization learning media provides quite good understanding for students or users.

After the trial was carried out, the researchers distributed a questionnaire containing student responses to the Android-based Augmented Reality Visualization 3 Dimensional Futsal learning media. This questionnaire consists of two aspects, namely the learning aspect and the learning media display aspect. Overall, the user assessment of the Futsal 3 Dimensional Augmented Reality Visualization learning media received a score of 51.5 or an average score of 4.29, which means that for users, namely students, this media is categorized as very suitable for use in learning activities. The total score obtained from the combined validation of material experts, media and users is 139.5 or an average score of 4.1, which means that the Futsal 3 Dimensional Augmented Reality Visualization learning media that the researchers developed is in the category suitable for use in learning activities. .

Overall, the results obtained in this research state the feasibility of the learning media that the researchers developed. However, there are still limitations in implementing the development of 3 Dimensional Futsal Augmented Reality Visualization learning media. First, the experiment that the researchers carried out was only on

one class, namely 34 people, of course the measurement of the results of the experiment could be said to be insufficient. Therefore, in the future, researchers hope that the distribution of Augmented Reality Visualization 3 Dimensional Futsal media will get the same good or even better response from users compared to users during the trial phase.

CONCLUSION

The conclusions that researchers can formulate from the development of learning media for 3D Visualization Augmented Reality Android-based Futsal assisted by Android.

1. This research and development adapts the learning model consisting of 4 main stages. However, it should be underlined that the research that adapts the 4D model is only carried out until the development stage. Where at this stage there are only product trials that have been validated by material experts and media experts to students. This research procedure consists of the defining stage, the design stage, and the develop stage.

2. Overall the total score obtained from the combined validation of material experts, media, and users is 139.5 or obtains an average value of 4.1 which means that the 3D Visualization Augmented Reality learning media Futsal that the researcher developed is in the category suitable for use. in learning activities.

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