



Original Article

## Development of augmented reality to facilitate floor exercise movement skills for junior high school students

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### ABSTRACT

*Augmented reality is part of technological developments to help make interactions and learning activities more enjoyable. This research aims to develop augment reality technology to facilitate floor exercises for junior high school students. The final product in this research is an augment reality application that can be installed on a smartphone. This research and development method is adopted from Borg and Gall which is divided into 7 stages, namely the research and data collection stage, planning stage, initial product development stage, initial field trial stage, test results revision stage, field trial stage and product refinement stage, while for data collection using non-test methods (interviews, observation and documentation), and test methods. The subjects in this research involved media experts, gymnastics learning experts, and students of junior high school 1 Karangploso. The results of research on test subjects show that augmented reality floor exercise media can be implemented well with media material validation results getting an average result with a score of 88.75%, media validation getting an average result with a score of 89.75%, expert test users getting the average result was 90%, and the trial results obtained an average of 90.2%. So it can be concluded that AR (Augment Reality) technology media is suitable for use as a floor exercise lesson for Junior High School 1 Karangploso.*

**Key word:** *augment reality, floor exercise, front roll, back roll*

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## INTRODUCTION

Children's educational needs are a necessity that needs to be improved, through education children will be able to interact with the environment and can increase their knowledge and skills to a wider and better direction. Physical

Education, Sports and Health is a subject that has a variety of physical activity learning materials, one of which is floor gymnastics, floor gymnastics is characterized by tumbling movements which are characterized by being fast and acrobatic which utilize various forms of flexibility and balance (Agus & Mahendra, 2001). Floor exercise learning is considered to have a high level of difficulty, this is because the teaching methods and models presented by the teacher are not easily understood by students (Mahmudah & Darmawan, 2022) as well as the existence of internal factors in the form of disinterest in floor exercise material (Syafei et al., 2023). The emergence of these problems is one of the learning difficulties, which is characterized by conditions in the learning process that arise due to the occurrence of obstacles in achieving learning goals. The obstacles referred to in this case are the student's ability to receive learning, and aspects that arise from outside the student's personal environment (teachers, learning resources, and environmental factors).

Technological developments play an important role in the world of education and social life. So this is something that everyone must have. One of them is the transformation of cell phone models from mobile phones to smart phones (smartphones)/Android, in the era of technological modernization this has become a technology that has very complete features. In line with technological developments, the role of technology-based learning media has become an intermediary for increasing activeness, logical thinking and solving problems in the learning process. Apart from that, learning media functions as a tool for conveying messages to stimulate students' thoughts, feelings and abilities to encourage an efficient and effective learning process (Amir et al., 2018), Learning media can be in the form of sound, images, animation and even video, one of which is the development of learning media in Augmented Reality technology to display various sketch elements of 3D image objects using markers. (Dimas et al., 2018), Augment reality is known as a combination of the real and virtual worlds, (Milgram & Kishino, 1994) (Guritno et al., 2009), Augmented reality uses technology assisted by markers to display 3D image objects on smartphone/Android mobile devices.

The augmented reality work system is to render various objects, such as cards, paper and other devices which enable this application to detect markers via

the cellphone camera so that it can display a real and attractive appearance as an educational application (Wang & Lv, 2020). The marker or fiducial image referred to in this case is an object marker that has a certain reference/pattern as a direction for calculating many parameters that will be needed in the image in the form of color or image. Augmented Reality is one of the best learning tools, proven by its advantages: (1) interactive, (2) effectiveness and ease of use, (3) can be implemented in various media, (4) changing basic object models into 3D objects (Mantiasia & Jaya, 2016).

This technology has become one of the most rapid developments in the last 3 years, almost every year the use of AR applications based on mobile phones always becomes a particular interest from various groups (Marneanu et al., 2014), AR technology devices are affordable software, making this technology more widely developed and sought after in the world of education as an appropriate learning medium (Elmqaddem, 2019), AR (Augmented Reality) learning in the fields of sports and physical education has been tested for efficiency levels, as well as getting better results in student and teacher engagement (Liu et al., 2022). Floor gymnastics learning is one of the learning materials that has a high level of difficulty, resulting in students not being active in carrying out floor exercise skill activities. This can be caused by the methods, models and media used not being varied so that it can cause difficulties in learning (Mahmudah & Darmawan, 2022), something similar in this research (Fitriastuti et al., 2023), the difficulty of learning floor exercise is the lack of teachers methods in providing instructions or lessons about floor exercise and the need to combine augmented reality with learning tools to increase children's interest and enable efficient and active learning part from that, students in junior high schools tend not to like floor exercise material (Wijaya et al., 2023), learning difficulties are characterized by learning obstacles such as a lack of ability to accept learning (Asnawi et al., 2018).

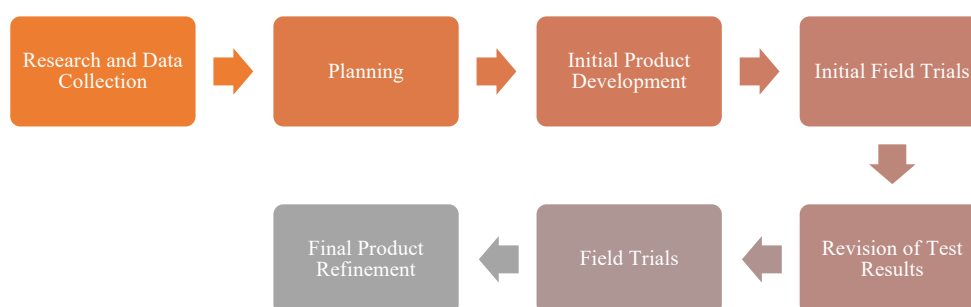
The problems above are important to solve, with the development of augmented reality (AR) technology, students can be facilitated to improve their floor exercise movement skills. With the help of Augmented Reality learning media on floor exercise material, it is hoped that students will be helped and there will be an

increase in understanding and practice of various basic movements in floor exercise skills.

## METODE

### Development style

This research and development method is adopted (Borg et al., 2007), which consists of 7 steps:



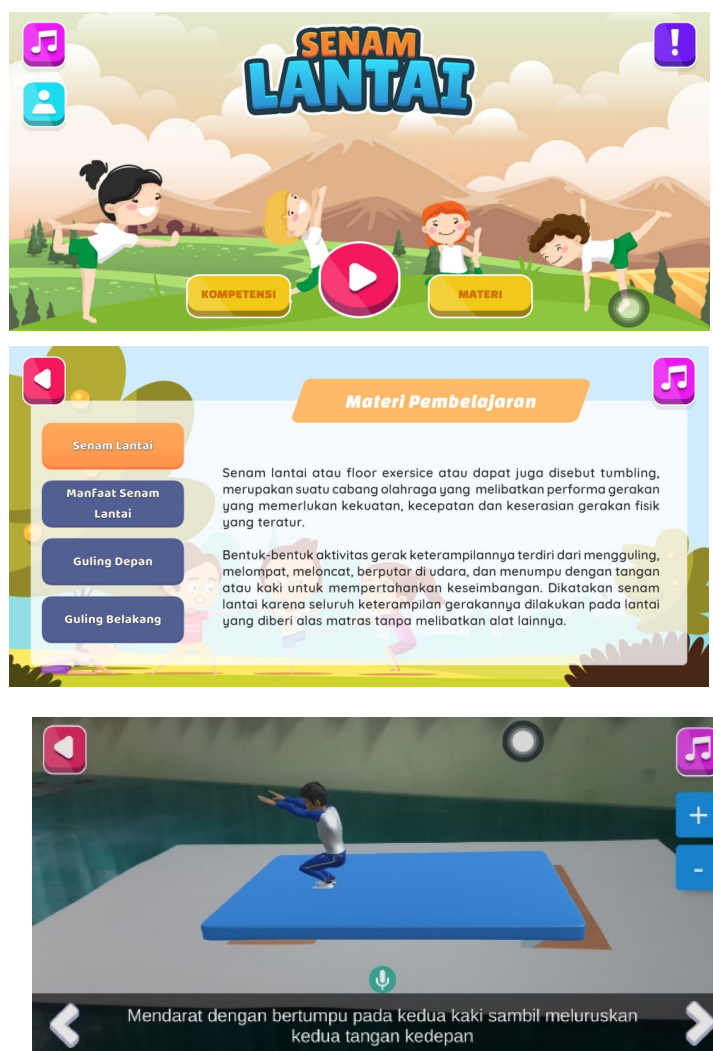
**Figure 1.** Development style

### Development Procedure

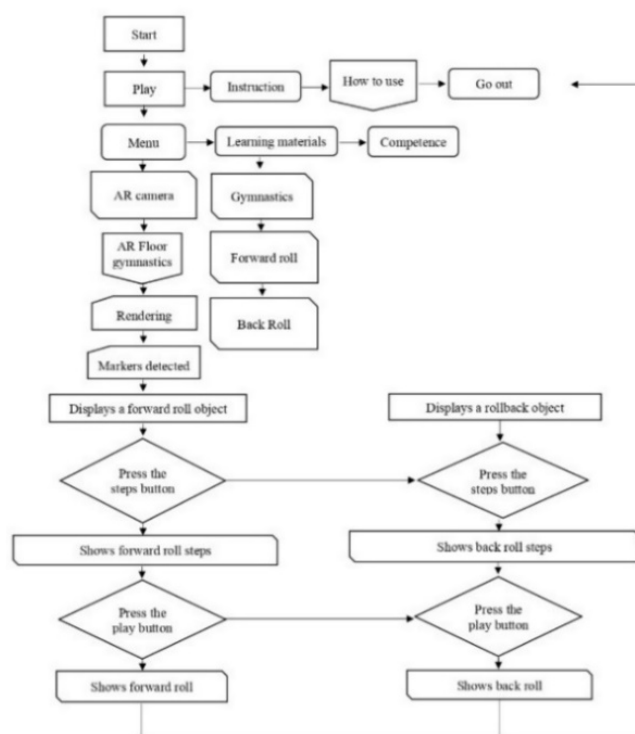
The development procedures for this research include: (1) Carrying out research and collecting data. The research begins by analyzing the needs of junior high school students, by conducting tests and non-tests. The non-test begins with conducting interviews with teachers and distributing questionnaires to students. Meanwhile, practical tests are carried out to determine floor exercise skills, (2) carry out planning at the planning stage, researchers design concepts that are adapted by formulating indicators of learning achievement based on core competencies and basic competencies, (3) carry out initial product development, products that are in accordance with the scope core competencies and basic competencies, then validity tests are carried out on media experts and material experts (4) limited trials, carried out by researchers and media developers by analyzing and carrying out trials and errors in the products being developed (5) revising the results of limited product trials , (6) conducting field trials, after reviewing the results of the initial product trials, field trials were carried out again on a medium scale with a total of 10 students. (7) improving the trial product according to the results of student responses to the augment reality product.

## Augment Reality Procedure

Research and development procedures on AR (Augment Reality) media were carried out based on initial needs carried out in schools through interviews with teachers and questionnaires shown to students and teachers. The interviews resulted in the need to develop media that is interesting and can improve floor exercise skills in junior high school students at grade VII level. Researchers carried out an analysis of AR (Augment Reality) media designs that were appropriate to the characteristics and development of skills in junior high school students. The design and flowchart diagrams consist of how AR (Augment Reality) media works and is used.



**Figure 2.** Augment Reality Floor Gymnastics Design



**Figure 3.** Flowchart for Using Augment Reality Floor Exercises

## Analisis Data

Floor exercise movement skills are achieved through skills assessment sheets, then data analysis is carried out using percentages with a formula adapted from (Arikunto, 2013) as follows.

$$P = \frac{x}{y} \times 100\%$$

Table 1. Classification of achievement levels

No	Classification	Achievement Level
1.	85,01% - 100,00%	Very good
2.	70,01% - 85,00%	Pretty good
3.	50,01% - 70,00%	Deficient
4.	01,00% - 50,00%	Not good

## RESULTS AND DISCUSSION

### Results

The results of the development of Augmented Reality (AR) to facilitate junior high school students' floor exercises using the borg and gall model will be

presented as follows. The results of the development of Augmented Reality (AR) to facilitate floor training for junior high school students using the borg and gall model will be presented as follows. (1) initial needs analysis stage, showing that junior high school 1 Karangploso students do not yet fully have good and correct floor exercise movement skills, and are still found in front rolls and back rolls with less than perfect starting and ending positions, (2) planning implementation stage, to apply the use of augmented reality technology only to the front roll and back roll, this is because there are still poor movements found in the front roll and back roll in junior high school 1 Karangploso students, (3) initial product development stage, carried out making an application with a processing time of 2-4 months and carrying out material and expert validation tests on augmented reality products which resulted in percentage levels of 89.75% and 88.75%, (4) limited trial stage, based on the testing there were related suggestions and input the animated form of the augmented reality application is still not in accordance with the front roll and back roll movements, and there is a menu on the augmented reality display that does not yet explain the indicators for each aspect of the front roll and back roll, (5) the revision stage of the product trial is limited, the researcher carried out re-improvement of the augmented reality application by improving every indicator and animation on the product with a work duration of 2 days, (6) field trial stage, the researcher applied augmented reality technology to junior high school 1 Karangploso students, and obtained a change in rolling skills front and rear rolls, (7) stage of perfecting the final product, based on the results of the field trials the researchers only perfected the product on the marker, because during the trial some students' smartphones had difficulty rendering the marker, so minor marker improvements were made.

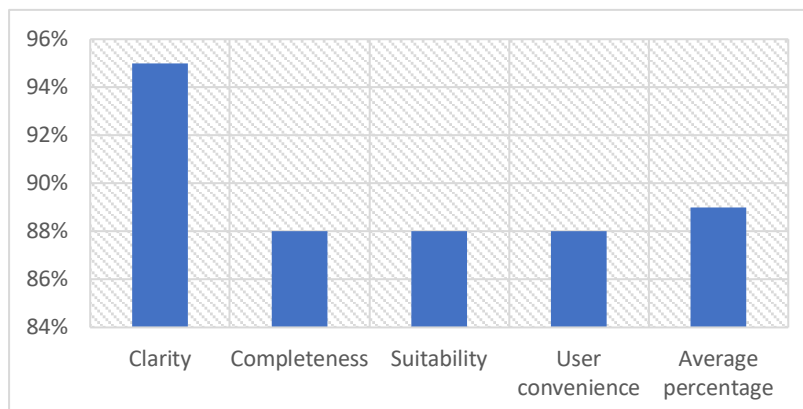
## Research result

### 1. Media Validation Test Results

Table 2. Media validation test results

Category	Eligibility	Indicators
Clarity	95 %	Very good
Completeness	88 %	Very good
Suitability	88 %	Very good
User convenience	88 %	Very good
Average percentage	89,75 %	Very good





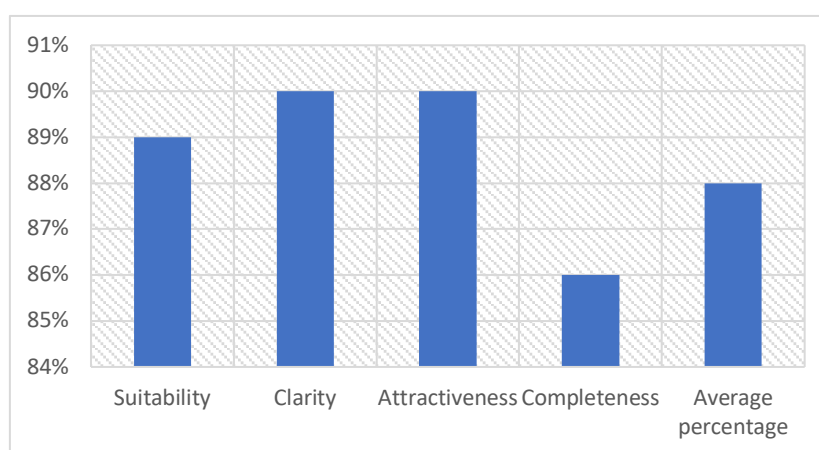
**Diagram 1.** Media Validation Analysis Results

Based on the AR (Augment Reality) media validation results, an average result was obtained with a score of 89.75% in the (very good) category. With clarity indicators of 95%, completeness of 88%, suitability of 88%, ease of use of 88% and it was found that all indicators were in the very good category.

## 2. Material Validation Test Results

Table 3. Material Validation Results

Category	Eligibility	Indicators
Suitability	89 %	Very good
Clarity	90 %	Very good
Attractiveness	90 %	Very good
Completeness	86 %	Very good
Average percentage	88,75 %	Very good



**Diagram 2.** Results of Material Validation Analysis

Based on the AR (Augment Reality) material validation results, an average result was obtained with a score of 89.75% in the category (very good). With suitability indicators of 89%, clarity of 90%, attractiveness of 90%, user

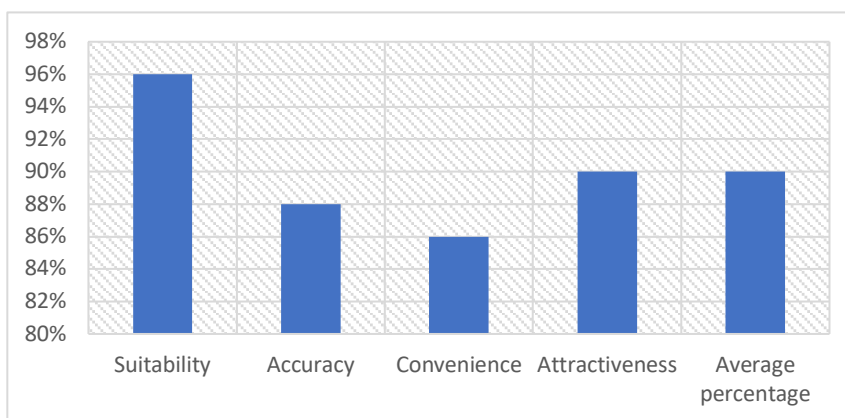


completeness of 86% and it was found that all indicators were in the very good category.

### 3. User Expert Test Results

Table 4. User Expert Results Conclusion

Category	Eligibility	Indicators
Suitability	96 %	Very good
Accuracy	88 %	Very good
Convenience	86 %	Very good
Attractiveness	90 %	Very good
Average percentage	90 %	Very good



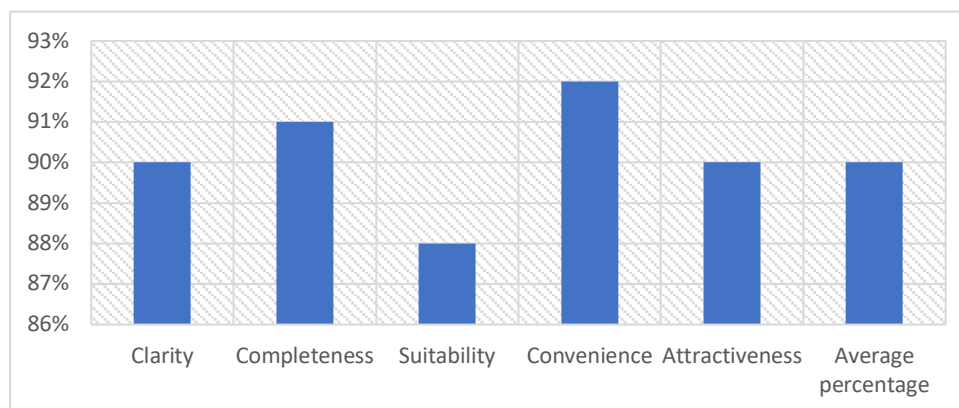
**Diagram 3.** User Analysis Results

Based on the results of experts using AR (Augment Reality) media, an average result was obtained with a score of 89.75% in the category (very good). With suitability indicators of 89%, clarity of 90%, attractiveness of 90%, user completeness of 86% and it was found that all indicators were in the very good category.

### 4. Test Results

Table 7. Conclusion of Trial Results

Category	Eligibility	Indicators
Clarity	90 %	Very good
Completeness	91 %	Very good
Suitability	88 %	Very good
Convenience	92 %	Very good
Attractiveness	90 %	Very good
Average percentage	90,2 %	Very good



**Diagram 4.** Trial Analysis Results

Based on the results of the AR (Augment Reality) media trial, an average result was obtained with a score of 89.75% in the category (very good). With suitability indicators of 89%, clarity of 90%, attractiveness of 90%, user completeness of 86% and it was found that all indicators were in the very good category, and there are differences and changes in the level of ability to roll forward and roll back after using augmented reality (AR).

## Discussion

The role of AR is one way that can be done in providing sports teaching (Liu et al., 2022) Apart from that, AR technology is one of the media that is used in the process of learning and teaching activities, including to help students increase attractiveness, increase motivation and can increase concentration in learning. (H.-Y. Chang et al., 2013), (K.-E. Chang et al., 2014), (Martín-Gutiérrez et al., 2015). Study (Safadel & White, 2017) explained that the role of AR media has a good influence on learning and can improve skills in the front and back roll aspects.

In line with various studies that this research has a role in facilitating and helping students in developing students' motor skills, this was identified based on the results. The use of Augmented Reality (AR) for students is concluded as follows, (1) students who are assisted by AR media during the learning process can increase their understanding of floor exercise movements, this is because the AR media learning process is combined with animated images or videos that have 3 dimensions. , (2) with the help of AR media which is integrated with 3D students

can see models in the form of images and videos from various different angles, (3) the learning material displayed can attract students' interest and improve floor exercise learning, (4) use on smartphones can makes it easier for students to access it at home and outside the school environment. So this shows that the role of AR media has a good influence on learning (Safadel & White, 2017) and can improve skills in the front roll and back roll aspects.

The involvement of teachers in using AR technology shows that the role of technology is very helpful for teachers in explaining (Calabuig-Moreno et al., 2020), provide examples and construct a new understanding of floor exercise learning. This study can explain the importance of using augment reality technology as an effort to provide examples in movement tasks (K. E. Chang et al., 2020), AR floor exercise technology which is designed with various features and flexible use of smartphones means that this technology can be used at school and at home to carry out movement tasks. The convenience of AR technology creates opportunities to carry out movement tasks that need help from parents to facilitate children in practicing.

## CONCLUSION

This research produces augment reality (AR) technology which is packaged in an Android application and supported by floor exercise material. Through various series of research and development, it has been shown that this media has a very good level of practicality and attractiveness for junior high school students, so this is one of the media that needs to be applied to increase floor exercise activities. It is hoped that in future research, augment reality technology can be used as learning material on head stands, hand stands and other sports materials.

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