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Developing Mobile Learning Media on Human Bone Skeleton Material for Grade 5 Elementary School Students

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Abstract

Research on the development of application products as learning media for elementary school students as learning media to increase the spirit of learning. This study aims to test the effectiveness of validity and evaluate applications as learning media. This research uses a development method with the ADDIE model, and the results of the observations show that some students experience problems when learning about the human skeleton. This study developed an application that contains material, questions, and scores at the design stage using Kilonotes and Smart Apps Creator. The results of the application media validity test obtained a score of 95% from media experts, assessing aspects of application display design, fonts, images, and practicality. The assessment given by the material expert was 90% based on the aspects of the material, questions, and practicality of learning. Assessment from students regarding application media as learning support is very helpful because the practical application is easy to use when learning outside and at school. Statistical tests show significant results; the value obtained is, on average, high. The results of data analysis of student responses to the media using the N-Gain Test formula show a positive start with a score of 96% of 30 students. It can be concluded that the use of the application as a learning media on grade 5 human skeleton material shows that this application is valid and feasible for use by students.

INTRODUCTION

Learning media are tools and materials teachers and students use in the teaching and learning process. Learning media stimulates students' mindsets to be more real to achieve learning objectives. (Pohan et al., 2022). According to Kemp and Dayton, the learning process will be more organized if learning media is used as a substitute when the teacher cannot accompany students in class. Interestingly, learning materials are not only seen from the content but also from the way the teacher delivers media that attracts students' attention while in class (Andi Asari dan Sukmarman Purba, 2023).

Broadly speaking, learning media is a tool used by teachers to attract students' attention and stimulate students' mindsets in order to understand learning materials more deeply. This can be done in the form of various methods, such as the use of interactive media, discussions, and direct experiences that support the learning process effectively (Socrates & Mufit, 2022).

Based on the preoperation conducted by the researcher, it was found that there was a lack of variety in the learning media used by educators, especially in class V in the IPAS subject of human bone skeleton material. The media used is only in the form of pictures of the human skeleton, resulting in students having difficulty understanding the learning material, and some students feel bored.

Judging from the aspect of assessing student learning outcomes through worksheets, students do not understand the material conveyed. Besides students' lack of monitoring from parents regarding learning outcomes at school, data information was obtained by the author through the observation of Mrs. Eni Azizah, the 5th-grade teacher of SDN 02 Balung Jember. With these problems, the researcher has an innovation to develop image learning media to be more interesting in the form of applications in order to improve student learning outcomes.

During the observation, the researcher found a problem: students felt bored while learning because the media used were pictures. Therefore. The importance of application development in elementary schools is very helpful for students in learning in an easier and more fun way; of course, the application can be used anytime, anywhere. In addition, this research and development can increase students' interest in learning because this application is designed with an attractive and interactive display. There are material features and questions along with the scores obtained.

Although students do not always rely on apps, their use can help them understand the material more easily. Learning apps can present difficult concepts through clear images; thus, although not the only way of learning, apps serve as an additional tool that enriches the learning experience and increases student interest. The characteristics of this learning app are interactive features, attractive images,

and ease of navigation so that the material is presented systematically and enjoyably (Kaharuddin et al., 2023). Meanwhile, the characteristics of the targeted students are generally able to learn independently, are more responsive to visual and interactive methods, and quickly adapt to technology (Erdawati & Sartika, 2022).

The human body reality application covers the material of the human bone skeleton. Bones are living tissues that can change from childhood to adolescence to adulthood. The human body reality application covers the material and presents images and other interesting features, such as question material and various supporting colors.

Research conducted by Prasetyo with the title Development of Augmented Reality Applications as Android-Based Human Body Anatomy Learning Media succeeded in increasing interest in studying the anatomical organ structure of the human body by presenting an interesting and interactive learning experience (Prasetyo et al., 2024).

The pre-research observations revealed a significant gap in the variety and effectiveness of learning media educators use, particularly in teaching the human skeletal system material in the fifth-grade IPAS (Natural and Social Sciences) subject. Currently, the media employed is limited to static images of the human skeleton, which fails to engage students or facilitate a deeper understanding of the material. This limitation has led to two critical issues: (1) students struggling to comprehend the complex structure and functions of the human skeletal system and (2) a lack of student engagement, resulting in boredom and reduced interest in the subject.

This study addresses this gap by introducing an innovative learning tool that leverages augmented reality (AR) technology to create an interactive and immersive learning experience. By transforming static images into dynamic, three-dimensional models, the developed media enhances students' understanding of the material and increases their engagement and motivation to learn. The research fills a critical void in the literature by demonstrating how AR-based learning media can overcome the limitations of traditional teaching methods, particularly in elementary science education. Furthermore, it provides empirical evidence supporting the integration of technology into the curriculum to improve both learning outcomes and student interest, offering a novel solution to a longstanding educational challenge.

Based on the research problems above, researchers developed media in the form of Human Body Reality Applications that can facilitate the learning process, using the human skeleton material to improve student learning outcomes. (Alvendri et al., 2023). The existence of application media can help students learn at school and home because the designed application can be accessed anywhere and anytime (Kaharuddin et al., 2023).

METHODS

This research uses the research and development method to create new products. (Septiani & Setiawan, 2024) and testing the effectiveness of the product to be used by students in learning (Lutfina et al., 2023). This research uses the ADDIE model, which consists of analysis, design, development, implementation, and evaluation in order to produce effective products (Siswo Handoyo & Suhardianto Suhardianto, 2021).

The stages of the ADDIE Research and Development model are based on the philosophy of education. The application of this model must be student-centered, innovative, authentic, and inspiring. The stages of implementing the ADDIE model have a mutually supportive relationship; the stages of the model are described as follows (Waruwu, 2024).

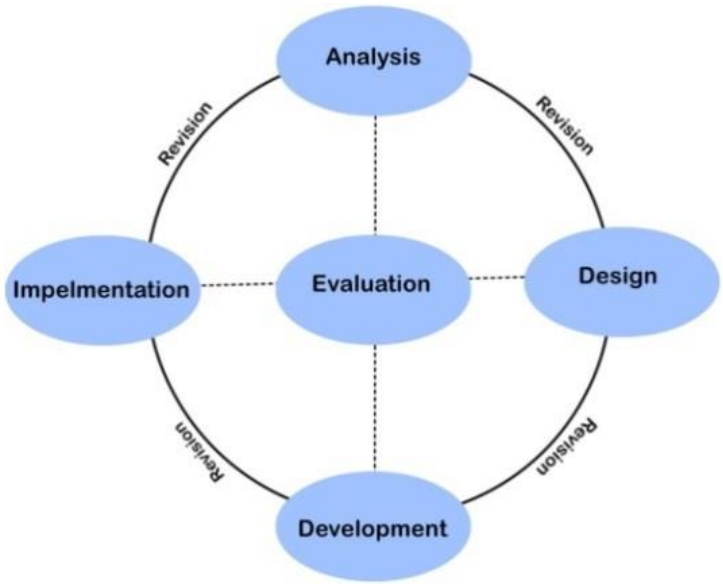

Figure 1. Research And Development Methodos
Sour: Robert Merbie Branch

1. Analyze the needs of students and teachers to determine learning media that suits their needs in order to improve learning outcomes.
2. Designing products according to student needs, such as designing learning media that are attractive, energy-efficient, affordable, and useful long-term, such as learning media using application technology.
3. Developing learning media through the process of creating media, as well as conducting validity tests by experts.
4. Implementation of the media application process in the field.
5. Product evaluation is used to assess the effectiveness of the media to find out the strengths and weaknesses of the media and how it can affect students' understanding.

The development that will be carried out following the procedure aims to achieve effective and efficient results consisting of five steps, namely performance analysis, design, development, and evaluation, which are needed to develop from making to reviewing media improvements (Lyanda et al., 2023).

In development research to measure the effectiveness of the media, researchers use a Liker scale; the answers to each instrument have positive and negative values (Kuntoro & Fajrie, 2023). The measurement results using the Likert scale help to evaluate the effectiveness of the media that will be developed so that the media is more suitable for use during learning.

Learning effectiveness is measured using the N-Gain test to improve student learning outcomes (Shella Zuliana et al., 2023). Comparing pre-test and post-test scores provides a solid foundation for evaluating the extent to which learning contributes to understanding. (Langi et al., 2022). The N-Gain test formula is used to calculate the score obtained; the calculation results are categorized into three parts: low, medium, and high. This aims to distinguish that the learning method effectively improves students' understanding and skills. (Masliah et al., 2023).

Student response using a questionnaire sheet to assess the attractiveness and feasibility of learning media for human body reality applications in IPAS subjects (Miralda & Marhaeni, 2023). Measurement of assessment using a Liker scale, students can fill in answers with information strongly agree (SS), agree (S), moderately agree (CS), disagree (TS), and strongly disagree (STS) with the formula (Kuntoro & Fajrie, 2023).

$$V = \frac{\sum X}{N\ x100\%}$$

Description:

V = Value

$\sum X$ = Score obtained

N = Maximum score

$$V = \frac{average\ number}{\text{maximum score}\ X\ 100\%}$$

Analysis of effectiveness using the N-Gain test obtained through pre-test and post-test to determine high and low N-Gain using the following formula (Ananda et al., 2023).

$$N - Gain = \frac{Skor\ post\ test - \ Skor\ Presentase}{Ideal\ score\ (100) - Skor\ Presentase}$$

Table 1. Normalization criteria score

N-Gain Score	N-Gain Normalization Criteria
0,00 ≤ N-Gain ≤ 0,30	Low
0,30 ≤ N-Gain ≤ 0,70	Medium
N-Gain ≥ 0,70	High

Sumber: Muhammad Andijafir (2023)

The interpretation of normalized scores to determine the value of effectiveness (Mea et al., 2024) By comparing the improvement from pre-test to post-test results, the N-Gain interpretation focuses on measures to be more efficient in improving learning (Meduri et al., 2022).

Table 2. Interpretation of the effectiveness of media use

Presentation	N-Gain Percentage Criteria
≤ 40	Not Effective
40-50	Less Effective
65-75	Effective
≥ 76	Highly Effective

Source : Triwulandari, Adam Muhdinillah (2022)

RESULTS

1. Analysis

At this stage, the researcher analyzes the needs of students in order to achieve learning outcomes; the factors that hinder learning are the lack of variations in learning media. The continuous use of image media without any variation can make students feel bored, reducing student learning outcomes due to the lack of attractiveness used. The results of the analysis show that students need media to improve learning outcomes. Using technology, researchers create media in the form of applications. The purpose of digital media needs to be applied in schools to keep up with the times. Without special media, students get bored and lack enthusiasm, especially in understanding learning. The use of technology is expected to increase student learning enthusiasm.

2. Design

At the design stage, researchers design sketches of the human skeleton, determine colors, present material and questions in games, and add supporting features. The following researchers explain in detail the design of the human body reality application.

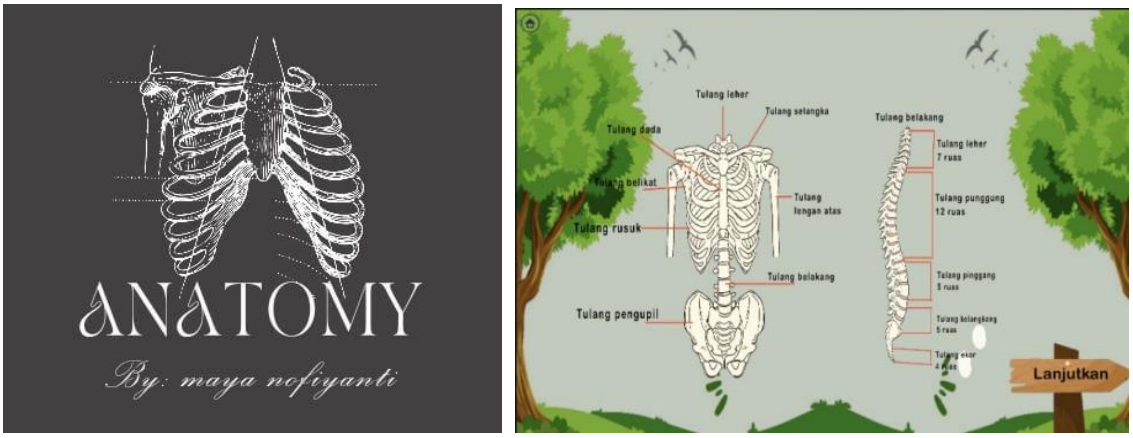

Figure 2. Learning Media View

The background design reflects the theme that will be studied overall in the learning application, can attract students' attention, provide user comfort, and support the spirit of fun learning (Irawan & Rosyani, 2022).

Figure 3. Display of Quiz and Score Page

The initial display contains learning materials that discuss the human skeleton and its parts so that students can understand the topics to be learned. Learning materials that are designed according to student learning needs also support the achievement of goals when learning so that it becomes effective.

The material about the human skeleton is not only a description of the explanation, but this application also displays visuals of the human skeleton and its parts (Akbar et al., 2024). With this feature, students can see in detail and facilitate understanding of the structure and names of bones. This application is equipped with practice questions to test students' understanding of the human skeleton (Nurhayati et al., 2022).

The learning application has question granules along with the student's learning outcomes score. In this display, if the student answers the question correctly, they will get 10 points. If the student answers the wrong question, they will automatically move to the next question (Nurhayati et al., 2022). This feature

helps students to evaluate the level of understanding to improve their understanding of the material that has been learned (Al-Khassawneh, 2023).

After students learn and answer questions, there will be a score of student learning results. The assessment functions as evaluating and supporting the teaching and learning process (Sutarso et al., 2023). The purpose of learning scores is to be structured and directed to achieve maximum results (Cadiz et al., 2024).

3. Development

Creating an application in the form of human body reality that can be downloaded and accessed offline, researchers conducted validity tests by experts in the development stage. Both material experts, media experts, and linguists. Based on the findings of data analysis results from 4 validators of material, language, material, and media, it shows that the learning media meets the valid category and is suitable for use (Fadli et al., 2023).

Table 3. Validation of product eligibility criteria

NO	Aspects Assessed	Total Indicators	Score
1.	Media by student needs	5	5,5,4,5,5
2.	Material by learning objectives	4	5,5,5,5
3.	The language used is easy to understand	6	4,5,5,5,5,4
4.	Media makes learning easier for students and teachers	5	5,4,5,5,5
	Total	**20**	**96**
	Maximum score		**80**
	Presentation		**96%**

According to data gathered from a panel of experts, 93.3% of material experts, 94% of linguists, and 96.6% of learning validators categorized the teaching application as valid, achieving an overall validity percentage of 96%. The application was tested with students to assess its effectiveness. During this implementation phase, researchers received valuable feedback and suggestions for improving the media.

Media experts recommended adding intonation features to the questions answered by students. Additionally, material experts suggested linking the learning content to daily activities, such as demonstrating the movement of the jaw when chewing while eating. Based on this feedback, the researchers made revisions to the media and subsequently tested the updated version with students.

4. Implementation

Experts have deemed the application of human-body reality media feasible for use in fifth-grade classrooms. This application is conducted in two stages. The first stage involves a small-scale implementation with 10 students, followed by a process to gather feedback from both students and teachers. If the responses from both groups are positive, the project will progress to the second stage, which includes a large-scale trial involving 30 students. Both small and large-scale applications will include pre-test and post-test activities. The results from these trials indicate that there was a noticeable improvement in understanding before and after using the media.

CONCLUSION

The research findings demonstrate that the developed learning media is highly feasible and effective for use in elementary school science education. Validation results from material experts (94%), media experts (93.3%), and linguists (96.6%) yielded an overall average score of 94.7%, categorizing the media as *very feasible*. Additionally, the effectiveness of the media was confirmed through pre-test and post-test assessments, which revealed significant improvements in student learning outcomes, with all students achieving the Minimum Mastery Criteria (KKM) after its implementation.

This study highlights the potential of integrating augmented reality (AR) technology into educational tools to create interactive and immersive learning experiences. The positive feedback from experts and students underscores its ability to enhance engagement and understanding, particularly for complex scientific concepts like the human skeletal system. The results suggest that AR-based learning media can serve as a valuable alternative to traditional teaching methods, addressing challenges in science education. Furthermore, this research contributes to the broader discourse on the use of technology in education, providing a foundation for future exploration of AR applications across different subjects and educational levels. Its novelty lies in its successful adaptation of AR for elementary-level science education, offering a practical and innovative solution to improve learning outcomes.

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