Augmented Reality (AR) subject Natural Science media for human framework topics

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Abstract. The purpose of this study is to develop media based on augmented reality for the subject of Natural Sciences on the topic of human skeletons. The research and development method used is the ADDIE model, focusing on the more technical design and development sections. This research produces augmented reality media by using Corel draw application, personal unity, blended 3d, vuforia free edition. With this augmented reality media design to facilitate users in understanding the human framework.

1. Introduction
The digital age focuses on online communication and interaction. So, technology becomes a basic requirement for everyone who uses it specifically in the field of education. Educational media is needed as an intermediary to deliver messages, in order to minimize failures during the communication process [1]. So far, most users consider Natural Science material to be monotonous and unattractive because it requires users to memorize only generally with conventional lecture methods in explaining without having a supportive learning media [2]. In most cases, users cannot explain the material to the maximum if the media and approach taken do not meet the good appeal.

Permendiknas No. 22 of 2006 concerning Content Standards states that IPA is science related to how to find out about nature systematically, so that science is not only mastering a collection of knowledge in the form of facts, concepts, or principles, but also is a process of discovery. The nature of science can be as a product, process, and attitude [3]. The use of learning media for 3D human framework based on augmented reality runs according to the plan which can be implemented into the teaching and learning system because the material is considered very good based on the validation of the material expert [4]. The skeletal system is an organ system that provides physical support to living things, consisting of a human skeleton divided into two parts, the axial skeleton (appendix) and the appendicular skeleton (limbs) [5]. The use of instructional media facilitates users to convey topic material on human frameworks well [6]. During this modern era, users must be able to be innovative in developing teaching instruments, especially teaching media. It is inevitable that new learning media are needed in this modern era to improve the quality of learning.

Based on observations made in elementary schools in Malang Regency, the teachers, in presenting the topic of the lesson, only use conventional textbooks and pictures. Therefore, it does not encourage active participation of students in learning activities. In addition, the existing learning media provided by schools such as the human torso are not effectively used by teachers. As a result, students do not pay attention when learning activities take place. The students also feel bored during the lesson.
Furthermore, when doing assignments by teachers, they cannot complete them and, in the end, they do not reach the minimum standard of learning set by the school.

Based on technological developments, it is important to integrate learning media into the latest technology. Augmented reality is a technology that combines 2D and 3D virtual images to be presented digitally and virtually in the form of real-world projections through the camera. Usually, augmented reality is operated by an Android-based smartphone through an application. AR applications that want the replacement of real objects from the environment with virtual objects that cannot be directly detected by the human senses [7]. Augmented reality applications can help medical students to learn complex anatomical structures better than just traditional methods such as visual aids or printed books [8]. can also be used in temple historical material for archaeological studies [9], and more.

This research aims to develop learning media based on augmented reality (AR) science subjects from the topic of human framework to increase the interest in learning of elementary school students.

2. Methods
This study uses the ADDIE model [10,11]. This model consists of five stages as follows: Analysis, Design, Development, Implementation, and Evaluation. This research focuses to the third stage. The first stage of the analysis of the determination of concepts in the manufacture of augmented reality human skeleton material. The second stage of design makes the design of media display and compiles material in the form of making flowcharts, colour selection, type of writing and animated images. The flowchart made can be seen in Figure 1 below.

![Instructional media flowchart.](image)

At this stage the researcher makes a design of the Augmented Reality media. Researchers designed the Augmented Reality media by using Corel draw, personal unity, 3D blender, and vuforia free edition. The researcher also made a guidebook as a supporting media in which there are ways to use media, practice exercises, and markers to scan images.

The third stage is development, this stage is the stage of organizing various layouts, designs, and various components that have been prepared into an interactive media. There are 4 steps to be taken,
namely the manufacture of Augmented reality components including the scan button to check the body marker, the [?] button briefly uses the application, the command button [!] knows the designer and the [x] button to exit from the application.

3. Results and discussion
The development of augmented reality media is done with the ADDIE model. The ADDIE model was chosen because the stages are simple, systematic and uncomplicated. Figure 1 below illustrates the flow chart of media development.

During the analysis phase, field surveys and literature studies are only focused on the subject of Natural Sciences, specifically the topic of human skeleton. Then, an analysis is carried out to observe the difficulties when using in studying the topic of human skeleton. Obtained that students are not actively involved in the learning process and lack of interest. Next, the analysis focused on the media used by educators. Unfortunately, educators only rely on textbooks and pictures in textbooks to deliver material. After obtaining related data for further development, the researchers proceeded to the design phase. At this stage, researchers compile media designs based on augmenter reality. The researchers also designed a guidebook for the media. To design the media, the researchers used Corel Draw software, Unity Personal, Blender 3D, and Vuforia Free Edition. Following the stages of development of the media Augmented reality material human skeleton (Figure 2-8).

![Figure 2. The application loading process and the first appearance of the human skeleton application.](image1)

![Figure 3. Display the main menu and brief application usage instructions.](image2)
Figure 4. Profile of the researchers display the SCAN menu.

Figure 5. Display head frame and head frame function material.

Figure 6. Display body frame and material function of body frame parts.
Based on the assessment of instructional media based on augmented reality, the media developed are categorized as valid and feasible. The average score obtained from the three validators appointed was 95%. Then, the score obtained in terms of practicality and effectiveness of the media based on augmented reality is taken from the responses of the teacher and students from fifth grade. The average score obtained from the teacher is 95% (Media presentation, content, language, and readability) and the average score obtained from students is 96% (graphic design, language, and content). Both scores are considered very valid. Therefore, it is concluded that learning media developed based on augmented reality are practical to apply. To test the effectiveness of instructional media based on augmented reality for the topic of human skeleton, the learning outcomes test was used. It was given to 28 students. The results confirm that the media is valid and effective to apply because it gets a score of 91%. Furthermore, responses regarding students' learning interest obtained a score of 91%. It is categorized very high. Thus, instructional media developed based on augmented reality are able to increase student interest in learning [12] and able to encourage active participation of students in the learning process [13] subjects of Natural Sciences [14-15].
4. Conclusions

In short, this research confirms that augmented reality media uses Corel draw application, personal unity, blended 3d, vuforia free edition technology that combines 2D and 3D virtual images to be presented digitally and virtually in the form of real-world projections through the camera. Usually, augmented reality is operated by an Android-based smartphone through an application. The analysis showed that it was valid and feasible to be applied because it obtained a score of 95% from three validators. Regarding the practicality of the media, a score of 95% was obtained from the two teachers and 96% from the students. This figure shows that the developed media is practical and valid for use. Furthermore, in terms of effectiveness, this learning media is based on augmented reality for the subject of Natural Sciences on the topic of the human framework very effectively. It is seen from the score of student learning outcomes. It was obtained an average score of 91%. Last but not least, in terms of student interest in learning, he scores an average of 91% and is categorized as very high. Thus, augmented reality media is appropriate for the user to use in adding insight or knowledge to the human framework.

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