Development of interactive learning multimedia for mathematics subjects for grade 5 elementary schools

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Abstract. The learning process during a pandemic requires teachers to be more interactive in making online learning media. The government has designed the Covid Emergency Curriculum, which is that educational units in their current condition can choose one of the several components needed in the learning process, namely still referring to the national curriculum, using the emergency curriculum, or making curriculum simplification independently. For curriculum simplification, only the main material in learning activities needs to be conveyed, while for practice it can be independently or through an application media. This study aims to create an augmented reality-based learning media on geometry in mathematics subjects for grade 5 elementary school. This media can make it easier for students to understand the shapes with augmented reality and there is a learning video feature that also explains the material presented by the teacher. With the black box white box method, the application is developed by adjusting the curriculum simplification planned by the government. Features in the application include objectives and materials, learning videos, augmented reality simulations and integrated with Google Classroom as a learning evaluation platform. The results of this research are digital applications that can be accessed from the web or android applications.

1. Introduction

The learning process is an effort made deliberately by educators to convey knowledge, organize and create environmental systems with various methods so that students can carry out learning activities effectively and efficiently to get optimal results [1]. In delivering the material, the teacher is faced with two main things, namely classroom management where the teacher must be able to create a conducive atmosphere in the learning process so that learning objectives can be achieved and by using the right learning methods it is hoped that the teacher can carry out controlled and directed learning activities [2].

One of the main aspects that support the learning process is the selection of appropriate media in accordance with the learning material presented [3]. In a pandemic like this time, the learning process must be carried out from home (work from home), where students must also be able to learn both independently and accompanied by their parents. Therefore, the learning process during the pandemic requires teachers to be more interactive in making online learning media so that the material presented is in accordance with the learning outcomes.

To ensure that each child's learning rights are fulfilled, the Ministry of Education and Culture has presented several initiatives to support the implementation of learning from home. Some of these
initiatives / breakthroughs include optimizing the distance education platform and preparing policy support for curriculum implementation at special times, namely education units can 1) continue to use the national curriculum; 2) using a curriculum simplification under special conditions prepared by the Ministry of Education and Culture; and 3) to simplify the curriculum independently [4]. For curriculum simplification, only the main material in learning activities needs to be conveyed, while for practice it can be independently or through an application media.

One solution in the pandemic era for education providers is to simplify the curriculum independently where the learning process is summarized into distance learning and network-based media. This study aims to create a medium that can help students learn online. The material summarized in this media is building space taken from grade 5 semester 2 elementary school material. In the media there is the delivery of learning objectives, learning materials, augmented reality simulations, and integrated with the Google Classroom LMS.

2. Methods

The development of instructional media is closely related to the suitability of models and methods in the learning process [5]. A good learning process is good planning and media in accordance with the learning theme. Therefore, so that the learning media developed is in accordance with the learning topic, namely building space for grade 5 elementary schools, the media developed must be in accordance with the learning objectives. In this study, there are two methods used, namely Design and Development (DnD), Rapid Application Development (RAD) and Black Box.

2.1. Design and development method

DnD is used to determine the suitability of media to learning devices. The following is the systematics of the DnD method in this study.

![Figure 1. DnD method in media development method.](image-url)

The figure above shows the DnD method at the design stage. Planning for media needs must be adjusted to the learning objectives, therefore it is necessary to have an appropriate learning design so that the media is suitable for learning [6]. Starting with the formulation of objectives, namely in the form of material adjustments to the lesson plans where the material developed in the development of this media is building space for grade 5 elementary schools. Continued with the last activity at the design stage, namely determining the software for developing media. In this study, the software used is online based, namely using Appgeyser, G-Suits, and MyWebAR to create online-based Augmented Reality.
2.2. Rapid application development method

The development stage of learning media based on augmented reality using the RAD method, following the development stage scheme using RAD.

![RAD Method Diagram](image)

**Figure 2.** RAD method.

The RAD method first begins with analysis and quick design where content analysis and requirements design have been carried out at the DnD design stage then proceed to prototype cycles where every part of the application or material that has been developed is directly tested to find out errors or things that need to be added. Actually, RAD is used to work on application development projects in the short term, so it aims to streamline application development time [7]. If all parts of the application and material are deemed in accordance with the objectives and learning process, they will enter the testing stage which will be tested in the internal researcher. If it is considered appropriate, it will be implemented in the sample class where it is used to assess the learning media developed.

2.3. Black box method

Black box testing is a test that is carried out only observing the results of execution through test data and checking the functionality of the software [8]. Black Box testing is a software testing method that tests application functionality as opposed to internal or work structures. Test cases are built around specifications and requirements, that is, what applications are supposed to do. Use external software descriptions, including specifications, requirements, and designs for deriving test cases.

The black box testing applied in this study is boundary values analysis, which is a software testing technique in which the test is designed to include representation of boundary values [9]. The value can be the input or output range of a software component. Since these boundaries are common locations for errors resulting in software error they are frequently carried out in test cases. The test results are as follows.

2.3.1. Unified modeling language. The learning process and application use can be shown in the following Unified Modeling Language (UML) image.
2.3.2. Output description generated. The output of digital-based media developed using MyWebAR and google sites so that the output that can be accessed by students is a digital book which is shown in the following figure.

Digital books can be accessed at the following link https://bit.ly/3luA1z3. In this media, there are learning tools that teachers can use to assist in the learning process and for students there are materials that can be studied independently. There are learning objectives, material to be studied, lists of pictures, and online classes that are used as a learning management system that is connected to the core class. In addition to output in the form of digital books, there is also augmented reality in each material to display factual examples of the studied objects [10].

2.3.3. Output description used. Output of this media development is digital books and augmented reality media. In digital books, there are learning objectives that are on the home menu. Learning objectives contain learning objectives, descriptions and indicators. The learning material that is learned from this digital book media is mathematics about the discussion of shapes, the material discussed is cubes, blocks, tubes, pyramids, cones, and triangular prisms. This media also displays augmented reality which can help students to understand the building material being studied.
The last output is the google classroom, where after students learn, they can immediately work on and collect assignments given by the teacher in the google classroom.

2.3.4. Control of the system created. Digital book, you don't really need many devices to run depending on the device used. This media requires control devices such as a mouse, keyboard to access search, and a camera to use the augmented reality feature.

3. Results and discussion
From the development of the media, the results obtained are in the form of learning media by lifting the material for building space for grade 5 elementary schools which can be accessed via telephone or desktop computer. With this easy access, this media can be used in any digital device online. By using MyWebAR digital image simulation is not difficult to run because the resources are accessed online [11]. This digital book is also developed in the form of an android application that can be installed on a telephone so that students and teachers can access learning media easily and quickly.

4. Conclusion
With this digital-based learning media, it can help students and teachers to carry out the learning process online. The development of this media is also not too difficult for teachers so that it is hoped that teachers can independently develop augmented reality-based media independently and make it easier for students to understand material or other materials through augmented reality-based simulations that can be made online and accessed directly in learning media. this digital.

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