

LEARNING MEDIA OF CUBE NETS USING AR AUGMENTED REALITY (AR)

Puryati¹, Idha Novianti²

^{1, 2}Universitas Terbuka (INDONESIA)

Abstract

This study aims to produce a learning model with AR assistance on Spatial Geometry material. In this study, it focused on the topic of the nets of the cube space, where the topic of the nets of the cube space is considered difficult for students because students must imagine how a space builds when opened. With the help of AR, the cube net material is expected to look more attractive in the learning process because in AR the visual display is more dominant so that students are expected to be more interested and motivated to learn mathematics material, especially the problem of the nets of the cube space. The methodology in this study is the Luther method, which is a multimedia development method consisting of 6 stages, namely Concept, Design, Material Collecting, Assembly, Testing, and Distribution.

Key word: AR, Cube nets, Mathematics Learning in schools

1 INTRODUCTION

Human nature always wants to develop according to the dynamics of life. The development of society and science demands that the world of education must also adapt to complex changes. The education system seeks to produce humans who are in accordance with the times to build society in various fields of life. Education is seen as the main aspect which means placing humans as a central position in development. The success of education is a very important issue as an effort to determine the level of progress of a nation. To develop human resources, one of the universities that manages distance education is the Open University (UT) which has played a significant role in increasing opportunities and equity in obtaining education, especially higher education that implements the distance education system. The Distance Learning System (SBJJ) implemented by UT requires students to study independently. In independent learning, students are required to have their own initiative or initiative in studying teaching materials, doing assignments, strengthening skills, and applying their learning experiences in the field or work. Independent learning in many ways is determined by the student's ability to manage time and study effectively. Thus, students must have self-discipline, initiative, and strong motivation to learn. Independent learning can be done individually or in groups by using printed or non-printed teaching materials as learning resources. Helbert (1985) learning is a process that produces relatively permanent changes in knowledge, skills/behaviours on a practical basis. Likewise, according to Sudjana (1991), learning is a change in behaviour. Changes that are realized and arise because of practice, experience, practice, and the moon by chance. The formation of behaviour because of learning has three main characteristics, namely: 1). The behaviour is in the form of actual and potential

abilities, 2) the ability is valid for a relatively long time, 3) new abilities are obtained through effort. Meanwhile, Anderson and Krathwohl (2001) explain three important elements in learning, namely being active, having cognitive elements and constructive processes. In this case, the individual who learns is assumed to be active in carrying out learning activities, being selective about the information received and forming an understanding of the information. The process that occurs emphasizes how to involve the cognitive aspects of what can be known and the ability to give meaning to what is learned.

Understanding mathematical concepts is an important foundation for thinking and solving mathematical problems in everyday life. Understanding mathematical concepts that have been owned by students cannot only be communicated through definitions, but students must practice a lot of working on examples of questions that are relevant to what is in their minds. Therefore, the role and function of mathematics needs to be emphasized to students to have: 1) the ability related to mathematics can be used in solving math problems, other subjects, or problems in real life, 2) the ability to use mathematics as a tool for communication, and 3) the ability to use mathematics as a way of reasoning that can be transferred to use in every situation, such as critical thinking, logical thinking, systematic thinking, objective, honest, disciplined in viewing and solving a problem. According to Soedjadi (2000) mathematics has the following characteristics: (1) it has an abstract object of study, (2). based on agreement, (3) deductive mindset, 4). has a symbol that is empty of meaning, (5). pay attention to the universe of speech, and (6). consistent in the system. Mathematics as a vehicle for education can not only be used to achieve one goal, for example educating students, but can also shape the personality of students and develop certain skills and lead to the learning of values in life through mathematics.

Mathematics is given since elementary school (SD) to equip students with the ability to think logically, analytically, systematically, critically, and creatively, as well as the ability to work together. One of the materials in learning Mathematics is geometry with the subject of cubes, namely making cube nets. To help students understand the material for cube nets, the teacher should prepare props. The props are expected to make it easier to visualize the nets of a cube. Therefore, AR media is needed to help students learn cube nets. In this study, using augmented reality technology as a teaching aid in studying cube nets.

Building space or also known as geometry is a three-dimensional shape that has space and is limited by sides. Building space is a characteristic of concrete objects that we often encounter every day. Rapid technological advances in the world of information technology and computers

also affect the world of education, which offers various conveniences and innovations. Augmented Reality or often abbreviated as AR is a technology that can combine real and virtual conditions at one time which is displayed in real time. With AR technology, it is expected to provide innovation and new learning experiences in recognizing and studying spatial structures, so that it can attract the interest of students who are studying it.

The development of information technology is now increasingly advanced. Almost all fields related to human activities have used easier, more effective, and efficient ways by using technology. And one form of technological development is Augmented Reality (AR). Augmented Reality is a technology that aims to combine digital content created by computers with the real world in real-time. With Augmented Reality, users can see a two-dimensional or three-dimensional virtual object that is projected onto the real world with the help of tools such as computers, Android phones or specially designed glasses.

One way to increase students' attention span and make subject matter easier to understand is to utilize Augmented Reality (AR) in the form of an Android application. AR can effectively summarize material that is not easily explained in writing or in two-dimensional or three-dimensional images, for example geometry material in the subject of Mathematics which requires a strong imagination of students to visualize. AR can help and accelerate students' understanding in the learning process.

Augmented Reality (AR) can bring virtual objects that exist in an artificial environment into the real world. The use of Augmented Reality (AR) as a learning medium is expected to improve student learning outcomes. Some research and development of Augmented Reality (AR) in education has also been carried out and shows positive results that AR technology can be applied in education, especially as a learning medium.

2 METHODOLOGY

The methodology in this study is the Luther method, which is a multimedia development method consisting of 6 stages, namely Concept, Design, Material Collecting, Assembly, Testing, and Distribution. The flow of this method is illustrated in Figure 1 below.

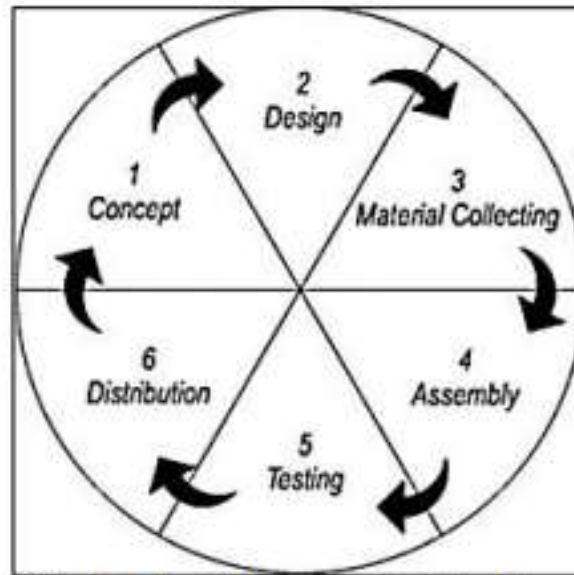


Figure 1. Luther method concept


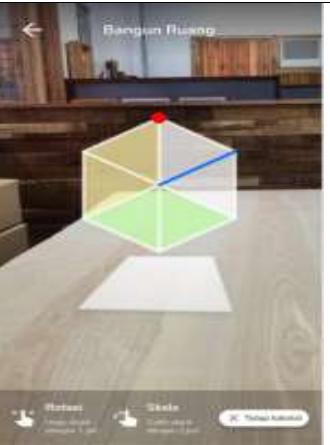
The stages of the Luther Method which is a multimedia software development consisting of several stages, including: 1. Concept is the stage to determine the goals and who the program users are. And determine the type of application (eg: presentation, interactive, etc.) and the purpose of the application (eg: entertainment, training, learning, etc.). 2. Design is the stage of making specifications about the program architecture, style, appearance, and material requirements / materials to make the program. 3. Material Collecting is the stage of collecting materials in accordance with the needs to be carried out. This stage can be done in parallel with the assembly stage. 4. Assembly is the stage where all multimedia objects or materials are created. Application development is based on the design stage. 5. Testing is carried out after completion of the assembly stage by running the application/program and seeing whether there are errors or not. This stage is also known as the alpha testing stage (alpha test) where testing is carried out by the maker or the maker's own environment. 6. Distribution is the stage where the application is stored in a storage medium. At this stage, if the storage media is not sufficient to accommodate the application, then compression is carried out on the application. The following framework is a series of charts that describe the flow of the research process in making the implementation of augmented reality learning media for modeling three-dimensional shapes. Data collection techniques used are questionnaires and document studies. Questionnaires are used to get suggestions and input as well as assessments from media experts, material experts and students. Meanwhile, the document study is to collect data related to space geometry material about cube nets.




3 FINDINGS AND DISCUSSION


In the development of this augmented reality mobile application, a computer with an Intel(R) Core(TM) i7 CPU specification of 2.20 GHz and 4 GB of RAM is used. The software used is Unity to develop applications with augmented reality technology for the design of cube nets 3D objects.

At the concept stage / conceptualization is the stage to determine the concept, goals, and target users as well as matters related to the concept. In the concept stage, the details of the activities determine the type of application and the application design concept. At the Design stage with details of the activities of compiling application storyboards, application interface designs and 3D object designs. And at the Material Collecting stage with details of literature study, text collection, 3D objects creation and other components.

Table 1. The display of interactive cube nets

No.	Part	Picture
1	Opening	
2	Main Content 1	

No.	Part	Picture
3	Main Content 2	
4	Main Content 3	
5	Main Content 4	

No.	Part	Picture
6	Main Content 5	

The result of this research is an interactive cube nets augmented reality application that runs on a smartphone platform with a minimal Android operating system. This application utilizes the camera on the user's smartphone to capture markers that have been previously printed and use the marker location information to add 3D objects (cube images according to the type of marker) into the application and animate them in real-time. The display looks like the following Table 1.

4 CONCLUSION

The focus of media development activities in this study is the type of application using 3D Augmented Reality, Flatporm with Smartphone, Android OS, with the model using a target marker. Mathematics is one of the subjects that must be mastered by students from an early age. One of the learning materials in mathematics is cube nets. At the time of studying it students have difficulty in imagining so that it is difficult to determine the nets of the cube. With this augmented reality application, students can independently find all possible cube nets that can be formed.

REFERENCES

- Anderson, Lorin W., David R. Krathwohl. (2001). *A Taxonomy for Learning, Teaching, and Assesing, Revision of Bloom's Taxonomy of Educational Objectives*. New York: Addison Wesley Longman, Inc.
- Batubara, Hamdan Husein. (2021). *Media Pembelajaran Digital*. Bandung: PT. Remaja Rosdakarya
- Ismayani, Ani. (2019). *Membuat Sendiri Aplikasi Augmented Reality*. Jakarta: PT. Elex Media Komputindo
- Klausmeir, Helbert J. (1985). *Educational Psychology*. New York: Harper and Row Publisher

Ovan. (2022). *Strategi Belajar Mengajar Matematika*. Jakarta: Kencana

Rusli, Muhammad dkk. (2017). *Multimedia Pembelajaran yang Inovatif Prinsip Dasar & Model Pengembangan*. Yogyakarta: Penerbit Andi

Sudjana, Nana. (1991). *Teori-teori Belajar untuk Pengajaran*. Jakarta: Lembaga Penerbit Fakultas Ekonomi Universitas Indonesia

