

Design of Augmented Reality (AR) Learning Media in Ecosystem Meteri in Elementary School Inclusion Classroom

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Abstract: One of the multimedia technologies that is increasingly popular today is Augmented Reality (AR) technology. The current phenomenon is that inclusive schools still do not have learning media that accommodate children with special needs to be able to develop in accordance with the planned learning objectives. This research tries to develop a media that involves verbal elements represented by reading texts and nonverbal media in the form of three-dimensional projections simultaneously by utilizing AR technology in inclusive classes. The stages of the research conducted refer to the Bord and Gall development model. Development research is divided into several levels of research, while the level of this research is at level 1. Where at level 1 the research stages of the research are carried out to carry out development without testing the product. This research produces Augmented reality-based learning media design in ecosystem material on the food chain sub-chain in grade V elementary school. Learning media design is carried out based on the stages of exploring potential problems of making deian based on the results of the literature review and the validation process by experts. The conclusion is that augmented relaiity learning media can visualize abstract concepts for understanding and the structure of an object model allows Augmented relaiity as a more effective media in accordance with the objectives of the learning media.

Keywords: Augmented reality; Ecosystem; Learning media

Introduction

Improving the quality of education in the learning process is inseparable from the role of educators or teachers as channelers of messages, in this case teachers are also required to have the ability to innovate in learning according to the needs of their students, one of the learning innovations with the development of learning media (Danin et al., 2023). Many teachers master learning materials well but most are unable to develop learning media according to the needs of their students. Some teachers think that all forms of learning materials can be presented or presented in digital form. In fact, everything should look at the conditions and situations that allow everything to run optimally. One way to help teachers improve the quality of learning is by using learning media. Learning media according to is anything that can be used to channel messages and stimulate the learning process in students. Media is used

to help create good learning. Learning media is a set of tools or complements used by teachers or educators in order to communicate with students or learners. Media and packaged materials will be clearer, more complete, and interesting for students. Learning media is also able to present material that can arouse students' curiosity, stimulate students to react and be active in learning (Safitri et al., 2023).

A good learning process must contain interactive, fun, challenging, motivating aspects and provide more space for students to be able to develop creativity and independence, according to the talents and interests of students. Although the teacher is only a facilitator in learning, and students are required to be more active, the teacher must be able to create a pleasant learning atmosphere to stimulate students to be more active in learning (Mustaqim, 2017).

In learning, the role of learning media is very important because learning media is related to the

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learning experience of students. With the existence of learning media, it can increase students' interest in learning. Learning media is a tool that can be used and serves to convey a learning message (Fauvel et al., 2018). The development of technology in the digital era is so rapid that it can be utilized in the development of learning media (Rahma et al., 2023). To attract the attention of students involved in learning activities in the classroom can use many types of media that can be used. One of the learning media trends that are starting to be looked at in the world of education is media with Augmented Reality technology.

In Indonesian, AR technology is referred to as augmented reality, namely technology that is able to add reality in the real world with virtual objects so that it seems to have no boundaries between the real world and the virtual world. Augmented Reality (AR) is a present technology that can be a solution for teachers to display learning that is innovative, informative, interesting, and can display virtual objects in virtual 3D in real form and displayed in real time (real time), so that it can present abstract concepts to be more real (Sanaky et al., 2013).

Augmented reality learning media is widely developed in South Korea. In some reading books, especially for early childhood, Augmented Reality learning media are widely developed there. Because such media is able to support student understanding more than just reading text (Sanaky et al., 2013). Improving students' reading comprehension skills using Augmented Reality learning media has provided many results as has been done by several research journals on Augmented Reality media. The reason why Augmented Reality-based learning media is used is because it presents 3D images that are of particular interest to elementary school students.

In addition, the images contained in this Augmented Reality can be seen as if real so students are more comfortable reading and more easily understand the contents of the text with illustrations of existing images. Students can hone the imagination they imagine, compared to just reading ordinary reading books. In addition, the use of images can also make it easier for students to capture abstract things or formulations. This is in accordance with the statement according to Jean Piaget, namely the characteristics of elementary school students who enter the concrete operational stage (Aripin et al., 2020).

AR aims to match a concrete (real) with a virtual environment, allowing users to interact with both physical and digital objects. Augmented Reality technology is still very little developed in the field of education so it has a great opportunity for AR technology-based media development (Nurhayati et al., 2023). Special Education (PLB) is essentially learning designed for students who have special educational

needs. In practice, EE always considers 4 main components, namely: Physical Environment, Teaching Procedures, Teaching Content and Use of Adaptive Equipment. Thus, one of the important components in learning is to use adapted aids. The tools (equipment) in question are all the results of technology ranging from simple to sophisticated (Nur'ariyani et al., 2023).

From the above problems, it encourages researchers to provide innovations in learning that can be a bridge for teachers to provide new experiences for students in the learning process whose purpose is to make it easier for students to capture and understand lessons. One of the innovations made is by developing learning media using Augmented Reality.

Augmented reality is one of the shortcuts and innovations in the field of multimedia and image processing that is progressing. This technology is able to lift an object that was previously flat or 2D, as if it were real, united with the surrounding environment (Marinda, 2020). Augmented Reality is defined as a technology capable of combining virtual objects in two dimensions and 3 dimensions into reality and projected into real time (Aditama et al., 2019).

Augmented Reality has 3 characteristics, namely Combining the real and virtual worlds, Interactive in real time, Allows it to be displayed in 3D (Sari et al., 2022). There are several applications that can be used in making Augmented Reality-based learning media, namely Unity3D, vuforia SDK, java JDK, marker cuboid, marker cylinder, and assembler edu. AR aims to match a concrete (real) with a virtual environment, allowing users to interact with both physical and digital objects. The utilization of Augmented Reality in the learning process is an effort made to correlate learning with developing technology. The purpose of learning by utilizing Augmented Reality technology to support the teaching and learning process, especially in elementary schools so that the teaching process will be more interactive and the subject matter is easily understood by students. By incorporating Augmented Reality into the learning process, it is expected to provide learning experiences to students about abstract concepts or ideas that may be difficult for students to understand. The main purpose of this research is to create media applications (Usmaedi et al., 2020).

Augmented Reality technology is still very little developed in the field of education so it has a great opportunity for AR technology-based media development. In learning Indonesian, the use of AR can display 3D visualizations that can help students to understand each abstract letter to be more real and clear, especially in word reading material. In the results of his research explained that specifically in the fields of literacy and education, AR technology can help in the teaching and learning process (Sanaky et al., 2013).

Augmented Reality (AR) media development in this study focuses on ecosystem material in grade V elementary school. Ecosystem learning material provides a response to a problem that exists in nature because the ecosystem is formed from a community and its abiotic environment such as climate, soil, water, air, and energy (Listiyani et al., 2021). Living things must experience development and growth at every time. This development and growth is not only a factor of change in living things, but also affects their life processes in nature.

The path of eating and being eaten between living things can be described in the form of a food chain. In this scheme, we can see the flow of food in an ecosystem. In addition to the flow of food, the food chain also describes the transfer of energy from one living thing to another when eaten. In the food chain, the path begins with a role called producer. Plants are called producers because they can produce their own food through photosynthesis reactions. To do this, plants need light energy from the sun. Animals and humans are called consumers because they consume other living things for energy.

Method

There are several terms about research and development. Borg and Gall (1998) use the name Research and Development which can be translated into research and development. Richey et al. (2010), use the name Design and Development Research which can be translated into Design and Development Research. Thiagarajan (1974) uses the 4D Model which stands for Define, Design, Development and Dissemination. Dick and Carry (1996) use the term ADDIE (Analysis, Design, Development, Implementation, Evaluation), and Development Research, which can be translated into development research.

Borg and Gall (1998), stated that "What is research and development? It is a process used to develop and validate educational products". What is research and development? Research and development is a process/method used to validate and develop products. Furthermore, by "product" we mean not only such things as textbooks, instructional films, and computer software, but also methods, such as a method of teaching, and programs such as a drug education program or a staff development program.

Research and development serves to validate and develop products. Validating a product means that the product already exists, and researchers only test the effectiveness or validity of the product. Developing products in a broad sense can be in the form of updating existing products (so that they become more practical,

effective and efficient) or creating new products (which have never existed before).

Richey et al. (2010) in the field of learning state that this research is now called Design and Development Research. Previously it was called developmental research. Design and Development Research is, "the systematic study of design, development and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and noninstructional products and tools and new or enhanced models that govern their development". Design and development research is a systematic study of how to design a product, develop the design, and evaluate the performance of the product, with the aim of obtaining empirical data that can be used as a basis for making products, tools and models that can be used in learning or non-learning.

The research stages carried out refer to the Borg and Gall development model developed by (Sugiyono, 2021). Development research is divided into several levels of research, and the level of this research is at level 1. Where at level 1 the research stages of the research are carried out to carry out development without testing the product. The development level is as follows.



Figure 1. Borg and Gall research development levels

Research and development at level 1 (the lowest level) are researchers who conduct research to produce a design, but do not proceed to make a product and test it.; Research and development at level 2, is where researchers do not conduct research, but directly test existing products. Existing products are tested for validity. Research and development at level 3, is that researchers conduct research to develop existing products, followed by making development designs, making products and testing the effectiveness of the developed products. Research and development at level 4, is a researcher conducting research to create a new product, making the product and testing the effectiveness of the created product.

This research is limited to the research product design development stage. The stages of this development research can be seen in the chart below.

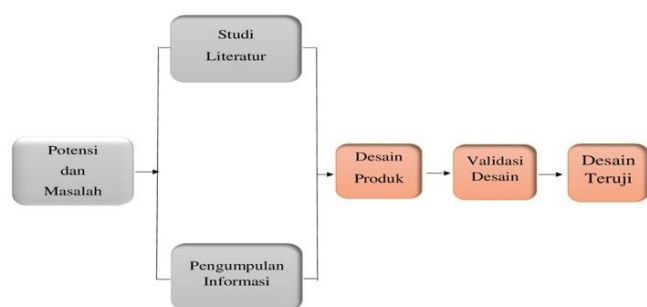


Figure 2. Borg and Gall development stages level

The lowest position of research and development (level 1) is conducting research but not continuing with making products and not conducting field testing. In this case the research carried out only produces a product design, and the design is internally validated (expert and practitioner opinions) but not produced or not tested externally (field testing). In this case the research is carried out to produce valid, reliable, up to date objective and complete data which is then used to design a product. Examples: research to produce a car design with sunlight fuel, textbook design, teaching methods, evaluation systems and so on. In this research can use qualitative, quantitative, or a combination of qualitative and quantitative methods mixed to be used together.

Result and Discussion

The product in this research is Augmented Reality-based learning media in Ecosystem material in grade V elementary school. The steps in making the learning media product development design begin with analysing potential problems, gathering information and doing product design. The stage of analyzing potential and problems is carried out to identify potential and identify problems obtained from the preliminary study conducted by the research. According to Sugiyono (2021) potential is the ability possessed by each individual which, if developed, will be useful so that it has added value, while a problem is any type of deviation that occurs that is not in accordance with the expected situation. Identification of the potential for the development of learning media based on Augmented reality is useful in improving the learning process and students' interest in learning because AR itself has entertainment aspects that can increase students' interest in learning and playing and projecting it realistically and involving the interaction of all five senses of students with this AR technology. This is because AR has characteristics and functions that are almost the same as learning media, which functions to convey information between the receiver and sender or educator and students, can clarify the delivery of information

provided by educators and students in the learning process, can provide stimulation of motivation and interest in learning (Dewi et al., 2023).

The reality in primary schools based on the results of problem identification, students also have difficulty in understanding the material contained in the book. Most of the directions, instructions, mind maps, and learning steps are still confusing for students. Another impact is that students cannot learn independently and are very dependent on the presence of teachers or other people. Especially on ecosystem material in the food chain section (Zulhulaifah et al., 2021). Abstract material is not in line with the cognitive development of elementary school students. Where the age of elementary school students requires the delivery of concrete material for a thorough understanding of the material. Failure to understand concepts in ecosystem material results in low learning outcomes in several schools in Langsa City. This is the basis for the importance of this research, related to understanding the material from the learning objectives that have been set, the right learning media is needed. The solution to be able to solve the problem is to develop augmented reality-based learning media on ecosystem material.

Where learning media in the world of education functions as a tool to help the learning process succeed well and effectively (Faizah, 2020). Students find it easier to understand lessons that use learning media than just listening to lectures without using learning media. The main function of learning media is for students to be able to capture the true meaning of the material being explained. This also causes students' understanding of the content of the material delivered by the teacher to be reduced. Learning media is very important as an intermediary to convey the content of the material in the learning process (Bakhri et al., 2023). Learning using digital media is very suitable for the current generation.

Augmented reality is a concept of combining the virtual world with the real world to generate information from data taken from a system on a designated real object so that the boundary between the two becomes thinner (Saurina, 2016). Augmented reality can create interaction between the real world and the virtual world, all information can be added so that the information is displayed in real time as if the information becomes interactive and real. The concept of Augmented Reality itself was first introduced by Thomas P. Caudell in 1990 in The Term 'Augmented Reality'. There are three characteristics that state that a technology applies the concept of Augmented Reality Able to combine the real world and the virtual world., Able to provide information interactively and in real time and Able to display in three-dimensional form (Safitri et al., 2023).

From the results of the identification of potential and problems, it can be concluded that Augmented reality-based learning media is very appropriate to use in ecosystem material on the food chain sub in grade V elementary school because at that age students will easily understand the material with concrete objects.

Augmented Reality-based learning media design on Ecosystem material Food Chain sub- material can be seen in the Figure 3.

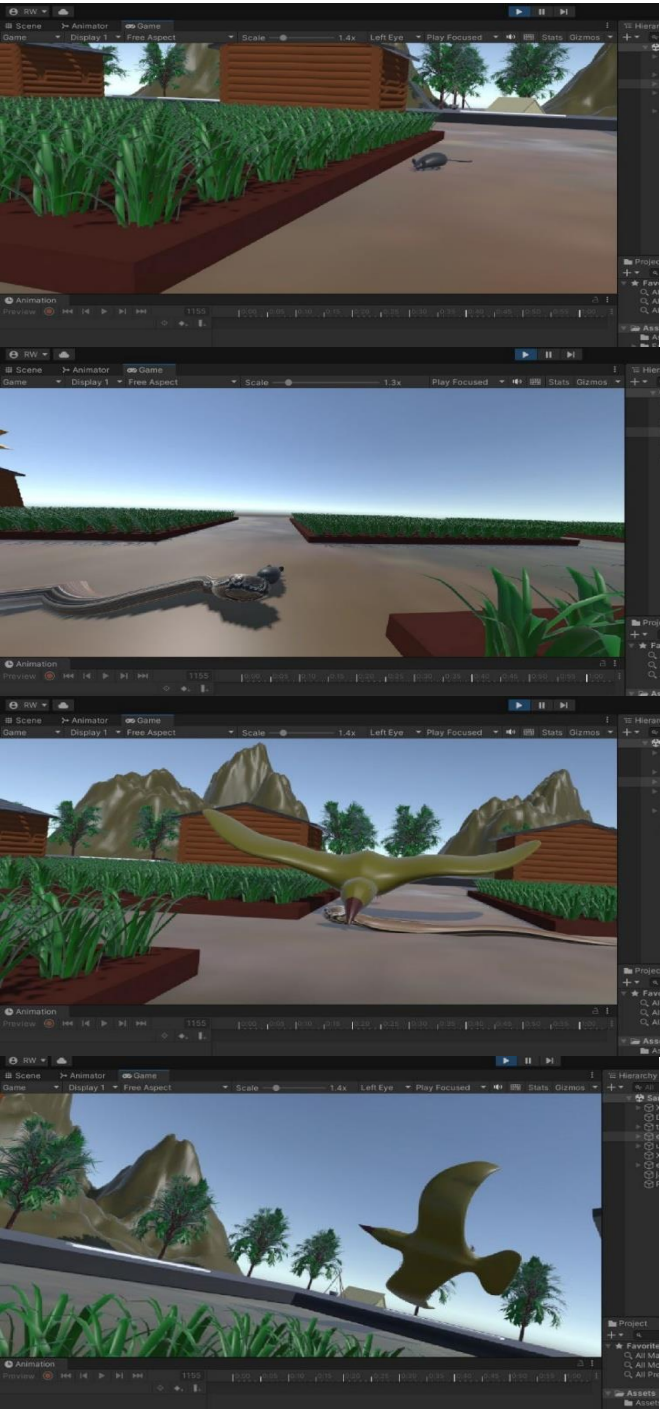


Figure 3. Augmented reality-based learning media design

Next, the product design that has been made is validated by media expert validators and material expert validators. Where validation activities are carried out to determine the quality of the design that has been prepared before the trial is carried out on the design. Design validation is an assessment of product design, whether or not it is appropriate when viewed rationally and product specifications should be.

Table 1. Learning Media Expert Validation Test

Assessment Aspects	Percentage (%)	Criteria
Content	90	Very Valid
Interface	87	Very Valid
Interaction Tools	94	Very Valid
Technology	89.7	Very Valid
Total	90.3	Very Valid

Table 2. The Results of the Validity Test of the Food Chain Ecosystem Material

Assessment Aspects	Percentage (%)	Criteria
Eligibility of content	95	Very Valid
Feasibility of presentation	91.5	Very Valid
Language eligibility	86.2	Very Valid
Total	90.9	Very Valid

The product design was declared valid and became a tested design because it met the criteria in the instrument. The validation results stated that the design was very valid with a percentage of 90.3% for media experts and 90.9% for material experts.

Conclusion

The use of educational media using Augmented Reality can stimulate the mindset of students in thinking critically about problems and events that exist in everyday life, because the nature of educational media is to assist students in the learning process with the presence or absence of educators in the educational process, so that the use of educational media with augmented reality can directly provide learning wherever and whenever students want to carry out the learning process. Augmented Reality Learning Media can visualise abstract concepts for understanding and the structure of an object model allows Augmented Reality as a more effective media in accordance with the objectives of learning media.

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Author Contributions

The authors' contributions include R.F creating and developing Augmented reality learning media product designs, collecting data and analysing data; B.M compiling research work steps and compiling research article outputs; R.A compiling research instruments and collecting data.

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Conflicts of Interest

The authors declare no conflict of interest regarding the publication of this article

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