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Assemblr Edu Learning Media Based on Augmented Reality to Improve Learning Outcomes of Grade V Elementary School Students

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Abstract: Based on the results of observations made by researchers in class V elementary school which proves that there are problems in the learning process, the lack of types and kinds of learning media used, one of which is on the learning content of Natural and Social Sciences (IPAS) on the content of the structure of the earth's layers. The reason researchers conducted this study was to develop learning media with creative and innovative to foster higher student interest in learning. This research not only aims to develop learning media but also to determine the feasibility of the media and the effectiveness of Augmented Reality-based Assemblr Edu learning media. Research that used by researchers using the Research and Development (R&D) method, and the method used uses the ADDIE method. Then, for data collection conducted by researchers through observation, interviews, and student learning outcomes. The subjects in this study were students, teachers, and a team of experts (media experts and material experts). The use of qualitative descriptive techniques, quantitative descriptive, and also iferential statistics are techniques in analyzing data on the development of this learning media. The results obtained in this study from the media expert test 87.5%, material expert test 70.8%, teacher test 91.25%, learner test 95%, as well as the results of the pretest and postest to test the effectiveness of the media developed which has very decent results from small and large groups. The N-gain results which state that the Augmented Reality-based Assemblr Edu learning media has a decent category in the use of the learning process. So, it can be concluded that the Augmented Reality-based Assemblr Edu learning media on the material of the structure of the earth's layers is well used, effective, and feasible to use in the learning process.

Keywords: Augmented Reality-based Assemblr Edu learning media; Natural and Social Sciences

Introduction

Education is an important component of national development because it promotes growth and improvement of skills as well as enhancement of human dignity and quality of life (Musri et al., 2023). According to the Law on the National Education System of the Republic of Indonesia No. 20 of 2003, concerning the national education system, it is written that education is a basic and planned effort to create a learning atmosphere and learning process so that students can actively develop their potential in the form of religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and state. Education should give top priority to helping each student achieve their potential

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for self-development by creating a learning environment that encourages their overall development (Ilham, 2023).

Learning is a process where an individual uses various learning resources to gain knowledge, skills, and positive values (Handriyatma & Anwar, 2021). In the learning process in the current era, it is important to choose interactive media that is in accordance with the development of technology. Technology can be utilized in the field of education through various media to enable the delivery of information (Muslimah et al., 2023). Teachers can take advantage of the use of technology so that learning can be centered on students as well as by delivering information through learning media.

Learning media are all forms of objects and tools used to support the learning process (Hamdan, 2020). According to Alfianita et al. (2022), learning media is a means for teachers to convey learning in schools, the media itself makes it easier for teachers and students to channel learning information messages. The use of learning media can increase student interest, motivation, and understanding in the learning process (Handriyatma & Anwar, 2021).

Learning media is something that can convey messages through various channels that can feel the thoughts, feelings, and desires of students to ensure learning is achieved and channeled (Hamid et al., 2020). Learning media can be designed to be interesting and interactive by utilizing technology in today's digital era. The use of smartphones among elementary school-age children seems to have become commonplace in the digital era, it has even become a mandatory bag for every child (Rachmawati et al., 2020). Digital technology includes devices such as tablets, laptops, gadgets and others. One of the features of this technology operating system that appeals to the general public is application support. One of the applications that can be utilized by educators and students is Assembrl Edu.

Assemblr Edu is a mobile application that allows its users to create three-dimensional (3D) works by putting together various objects that have been provided (Choirunnisa, 2023). Assemblr Edu is an educational application presented through Augmented Reality (AR), creating interactive learning media with interesting 3D animated images, and stimulating student curiosity (Griffith & Alpert, 2022; Nugrohadi & Anwar, 2022). Augmented Reality (AR) allows our interaction close to the actual physical space. By using learning media, Augmented Reality (AR) provides a more real and less boring experience, and can help students understand and analyze problems that arise during the learning process (Novita, 2023; Octaviani et al., 2022). Augmented Reality (AR) technology integrates virtual elements generated by computers, such as text, images, and videos, with physical reality (Ilham, 2023).

The Assemblr Edu application was chosen due to its ease of use compared to other 3D software, especially since it does not require complex programming (Octaviani et al., 2022). In addition, Assemblr Edu has a 3D perspective, supports Augmented Reality technology, and allows users to perform editing processes as well as import 3D images from various sources in formats such as .fbx, .obj, and others (Muharmi & Nadriati, 2023).

There are many applications based on 3D augmented reality, one of which is the Assemblr Edu application. Assemblr Edu is an augmented reality application specifically made to help needs in the world of education, especially in the learning process (Hafizhah et al., 2023). In this application there are various features such as classes, topics, scans and profiles. This application is based on augmented reality which can provide more interactive learning for students (Majid et al., 2023).

Therefore, researchers used this application to study because this application is easy to use with mobile devices and 3D displays where the appearance of objects looks more attractive than when only describing images in books, thus increasing student interest in learning (Agustin & Wardhani, 2023). This Assembler Edu-based augmented reality application can be used in various fields depending on the needs (Rosyidah et al., 2023).

In education, the relatively new use of augmented reality is being implemented. The field of study explains that augmented reality has attracted more attention as a tool in learning that can enhance learning in most educational environments (López-Belmonte et al., 2023). In the academic environment, this technology uses three-dimensional graphics into the terrain (Alzahrani, 2020). The use of augmented reality (AR) in education is implicit. While there has been extensive research on AR, there has also been a lot of research in the field of education. Due to the recent effectiveness of this technology, there is an increasing amount of research on AR (Lee, 2022).

The use of technology can help students learn through different approaches, with the potential to improve their learning outcomes (Chairudin et al., 2023). Learning outcomes are the end result of student achievement during the learning process (Arnandi & Zulfadewina, 2023). In teaching and learning activities, intervention from a teacher is needed to evaluate the achievement of student learning outcomes. The utilization of Augmented Reality (AR) based learning media is expected to make a positive contribution to improving learning outcomes, especially in IPAS subjects.

Learning outcomes are changes in the level of skills that students have after participating in the learning process, which can occur through expression both in

writing and orally (Saragih et al., 2021). According to Yanto (2019), learning outcomes include everything that is obtained during the learning process, including changes in behavior, knowledge, skills, and attitudes of students. Learning outcomes can be interpreted as the achievement of behavioral changes that tend to remain in the affective, psychomotor, and cognitive domains of students after they experience the learning process, as explained (Dewi et al., 2023; Hutauruk & Simbolon, 2018).

Based on interviews conducted with fifth grade teachers at SDN Kediren, Randublatung Subdistrict, Blora Regency on October 28, 2023, teachers have not utilized creative, interactive and innovative learning media. They still do learning with the lecture method and practice it makes students bored. Teaching materials used during learning are only printed books or package books. Teachers have never utilized technology in learning media in the subjects of Natural and Social Sciences (IPAS). In the learning outcomes of IPAS class V SDN Kediren, some students are still low, there are 59% of students whose scores are still below the Criteria for Achieving Learning Objectives (KKTP) which is ≤ 70. In fact, to understand the explanation of the structure of the earth's layers, a high level of concentration and imagination is needed from students, accompanied by a conducive learning atmosphere. Therefore, learning media is needed as a tool to create a conducive and effective learning environment.

Then, with other research findings, it also states that assemblr edu learning media based on augmented reality is feasible to use and effective in helping the teaching and learning process take place (Sari et al., 2023). The benefits of using augmented reality-based assemblr edu learning media include, among others, being able to foster student motivation in reading, which there is animation and adudio contained in the augmented reality-based assemblr edu learning media, and making it easier to communicate to others. Other research findings also say that augmented reality-based assemblr edu learning media is feasible and effective in helping the teaching and learning process take place (Muslimah et al., 2023; Özeren & Top, 2023; Dewi et al., 2022b; Mardinawan & Manurung, 2024).

Method

The method used in this research is Research and Development (R&D). This research is development research (Research and Development), development research is a research approach used to create special products and test the effectiveness of these products (Sugiyono, 2019).

Table 1. Media Expert Instrument Lattice

Assessment aspect	Indicator	1	2	3	4
Augmented Reality-based Assemblr Edu media display	Quality of 3D images or animations in the media				
	Selection of the right font type and size				
	Writing is easy to see and read				
	Interesting and interactive				
	Design colors in accordance with learning materials				
	Display can increase user comfort in learning				
	Display 3-dimensional images in accordance with learning materials				
	Display can increase learning motivation				
Presentation of Augmented Reality-based Assemblr Edu media	Media capabilities with minimum specifications				
	Media readiness				
	Media connectivity and stability				
	Ease of operation				
Total					12

This research was conducted in the fifth grade of SDN Kediren. This research requires a subject, including media and material experts, teacher, and students. The model used in this study uses the ADDIE model. The ADDIE model has 5 stages, namely analysis, design, development, implementation, and evaluation. In the first stage, namely analysis, at this stage the researcher can make an initial identification of the results of observations, classroom teacher interviews, student learning outcomes, and documentation of grade 5 SDN Kadiren.

The second stage is the design stage. This stage is the design stage of the design process in product development by compiling a media framework such as a 3-4 dimensional image. The next stage, the product development stage which is carried out after the design

stage. If there is a revision in the media correction, it will be made based on the input suggestions from the expert team. The fourth stage is the implementation stage. This stage is about the process of developing products that have been made which have been tested for product feasibility using product validity tests. The product validity test was carried out by a team of media experts and material experts, and product trials were conducted in large groups and small groups. This stage has the aim of seeing the effectiveness and feasibility of the products developed.

The evaluation stage as the fifth stage, which discusses the weaknesses of the product developed from the results of the previous stage, namely the implementation stage. Then, an analysis is needed for the improvement of the media developed so that the media or product is in accordance with the indicators achieved. If there is no revision, then the media can be declared suitable for use. In this research activity in developing a product, the use of inferential statistical methods for testing hypotheses on Augmented Reality-based Assemblr Edu learning media products developed by researchers using statistical formulas (Dewi et al., 2022a).

To determine the effectiveness of Augmented Reality-based Assemblr Edu learning media developed by researchers, analysis techniques are used to find the measurement results of pretest and posttest test instruments before and after the use of Augmented Reality-based Assemblr Edu learning media in improving students' understanding of the material of economic activities of IPAS learning content. Furthermore, to find out the difference from the previous results using the dependent sample t-test. Followed by the use of the N-gain test to determine the increase in student learning outcomes obtained from the results of the pretest and postest selections of the maximum score and the pretest obtained.

Table 2. Material Expert Instrument Lattice

Assessment aspect	Indicator	1	2	3	4
Content or material aspect	The material is in accordance with the learning outcomes				
	The material is in accordance with the learning objectives				
	Accuracy of concepts and definitions				
	Accuracy of images and illustrations				
	Accuracy of illustrations of 3-dimensional objects with reality				
Presentation aspect	Conciseness of concept				
Language Aspect	Ease of understanding the material				
	Suitability to the intellectual development of learners				
	Appropriateness to the level of emotional development of learners				
Total					9

Table 3. Teacher and Learner Response Instrument Grid

Assessment aspect	Indicator	1	2	3	4
Material or material content	The Augmented Reality-based Assemblr Edu learning media includes material on the structure of the earth's layers in the independent curriculum.				
	The material on the Augmented Reality-based Assemblr Edu learning media can attract student interest in learning and understanding student knowledge.				
Media needs	Augmented Reality-based Assemblr Edu learning media can be used anytime and anywhere.				
	Augmented Reality-based Assemblr Edu learning media is dancing and easy to use.				
	Augmented Reality-based Assemblr Edu learning media can increase student learning inventiveness.				
Media display	The display of Augmented Reality-based Assemblr Edu learning media uses the right resolution, namely 3 dimensions.				
	On Augmented Reality-based Assemblr Edu learning media that looks clear.				
	The fount level on the Augmented Reality-based Assemblr Edu learning media is clear and easy to understand.				
Total					8

Result and Discussion

Result

Research conducted by researchers in developing an Augmented Reality-based Assemblr Edu learning media product has three main points, namely effectiveness, feasibility, and Augmented Reality-based Assemblr Edu learning media. The model used by researchers in developing Augmented Reality-based Assemblr Edu learning media uses the ADDIE model, this model which has five stages including analysis, design, implementation, assessment or evaluation. Activities carried out by researchers at the beginning of the study by conducting observations, interviews with class teachers, and data on student learning outcomes in class V SDN Kadiren Randublatung District Blora Regency into the analysis stage is the initial stage in research.

In the interview activities conducted by researchers to the class teacher, there were questions about the content of IPAS learning and also the problems that occurred in the classroom in the learning process and the material that was considered difficult in the learning process. On student learning outcomes that are still lacking have not met the KKM standards. Not only that, researchers and teachers also discussed the lack of ideal use of learning media in the classroom learning process on the material of the structure of the earth's layers in the independent curriculum. Ideal use of learning media in the classroom learning process on the material of the structure of the earth's layers in the independent curriculum.

Figure 1. Augmented Reality-based Assembrl Edu media display

The next stage is the implementation stage. This stage explains the product developed by the researcher whether the product is appropriate to be used as a tool to assist the learning process in the classroom, especially in class V material on the structure of the earth's layers. To be able to determine whether the media is effective or not can be witnessed from the results of the pretest and posttest given to students. In giving the test twice from before using the product to after using the product. This was done to determine the initial knowledge and understanding of students in the provision of material without the use of media. Then, the learning media is given to test the level of understanding of students on the material presented.

Given to fill out a questionnaire about Augmented Reality-based Assemblr Edu learning media before giving pretest and posttest questions. Furthermore, for product tests can be done by utilizing t-tests that can produce differences between before the use of media and after the use of media. Then, the use of the N-gain test which aims to determine whether the results of the maximum score of the pretest and posttest can provide student learning outcomes more improved or developed.

Affirmation of a product developed by researchers, namely Augmented Reality-based Assemblr Edu learning media with validation of a team of experts from PGSD UNNES lecturers. Media expert lecturers namely Dr. Deni Setiawan, S.Sn., M.Hum and material expert lecturers namely Dr. Barokah Isdaryanti S. Pd., M. Pd validation of whiteboard animation media is also carried out by teachers and fifth grade students of SDN Kadiren, Blora District. Media trials can also be carried out with small groups of 18 students and small groups of 9 students.

The last stage is the evaluation stage. This stage is a stage of improving the responses given by the expert team, from media experts and material experts to

determine the improvement of media feasibility, t-test, and N-gain test. details can be seen from Table 4 as a product validity test, then Table 5 of the product effectiveness test results (average), and finally in Table 6 of the N-gain test results as follows.

Table 4. Product Validity Test Result

Validity Subject	Validity Result (%)	Description
Material Ahli Test	70.80	Feasible
Media Expert Test	87.50	Very Feasible
Class V Learner Test	91.25	Very Feasible
Class V Teacher Test	95.00	Very Feasible

Table 5. Product Effectiveness Test Results (Average)

Test Subject	Pretest	Posttest
Small Group Test	59.44	81.66
Large Group Test	38.27	83.28

Table 6. N-Gain Test Result

Class	Number of Students	Average		N-Gain	Criteria
		Pre	Post		
Small Group	9	59.44	81.66	75.97	High
Large Group	18	38.72	83.27	70.79	High

From the above results, it can be said that the Augmented Reality-based Assemblr Edy learning media is in the category of media that is feasible to use and quite effective in learning takes place in class V SDN Kadiren Blora District on the material of the structure of the earth's layers. In this study, the effectiveness of the media can be proven from the increase in the knowledge of students from before using the media and after using the Augmented Reality-based Assemblr Edu learning media in class V SDN Kadiren Blora District on the material of the structure of the earth's layers.

Discussion

Based on the results of the description of the data in the table above, the Augmented Reality-based Assemblr Edu learning media is very feasible to use and is quite effective and feasible to use (Nilamsari & Dewi, 2023). With the element of influence in the purpose of using Augmented Reality-based Assembrl Edu learning media using the ADDIE model that is appropriate and organized, because with this model has five phases of stages that can develop student learning outcomes much higher than before and can be believed in the presence of Augmented Reality-based Assembrl Edu learning media can be feasible to use in learning.

With the Augmented Reality-based Assembelr Edu learning media can indirectly help in the learning process taking place in the classroom, because the existence of this media provides convenience to educators as a tool in explaining a material to students to attract their learning attention (Elfeky & Elbyaly, 2021). In the Augmented Reality-based Assemblr Edu learning media, there are many 3-dimensional moving icons that explain the material of the earth's layer structure, clear and encouraging audio for students, and text in the media that makes it easier for students to read material through Augmented Reality-based Assemblr Edu learning media (Padang et al., 2021).

In presenting the material contained in the Augmented Reality-based Assemblr Edu learning media that is compiled and in accordance with learning outcomes and learning competencies. With the Augmented Reality-based Assemblr Edu learning media to train the focus of students in understanding the learning material that takes place, especially in the learning content of IPAS material on the structure of the earth's layers in class V. The existence of Augmented Reality-based Assemblr Edu learning media is a tool for educators in the learning process that makes the quality of learning much more interesting and easy for students to understand and certainly learning becomes more fun (Hita et al., 2021). With the use of Augmented Reality-based Assembelr Edu learning media on the material of IPAS content economic activities, it is appropriate as a strategy for educators or teachers to show the material presented and animated where students are unconsciously invited to carry out reading activities, with animations in the form of images and text that make reading comprehension of the material more improved (Rozi et al., 2021).

With the development of Augmented Reality-based Assembelr Edu learning media conducted by researchers, there are also previous research findings also state that the use of Augmented Reality-based Assemblr Edu learning media can provide higher student interest in reading, with the learning media making students able to learn to communicate more with others (Chen et al., 2019). With the findings of previous research stating that Augmented Reality-based Assemblr Edu learning media provides a good effect in learning is not only effective and feasible to use but also changes student learning outcomes much higher (Fakhrudin et al., 2019; Muslimah et al., 2023; Dewi et al., 2022b; Mardinawan & Manurung, 2024).

Conclusion

From the results of this study in developing Augmented Reality-based Assemblr Edu learning media, it can be concluded that Augmented Reality-based Assemblr Edu learning media can have a good

impact on teaching and learning activities in the classroom in the material of the structure of the earth's layers of IPAS learning content. With the learning media Assemblr Edu based Augmented Reality gives a good impact in learning outcomes much more increased compared to before the use of learning media. Students are much easier to understand the material with the help of learning media in class V SDN Kadiren Blora District.

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Z. N. conceptualized the research idea, research methods, data analysis, acquisition of funds, and management and responsibility for the planning and implementation of research activities. S. S. A. guided, supervised, and validated the instruments in the research.

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Conflicts of Interest
The authors declare no conflict of interest.

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