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Development of Flashcard Learning Media to Build a Space Using Assembler Edu in Elementary Schools

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ABSTRACT

Development of Learning Media Flashcard AR Build a space using Assemblr Edu in elementary school. Thesis, Elementary School Teacher Education Study Program, Faculty of Education (FIP), Hamzanwadi University.

The purpose of this research is to develop AR flashcard learning media to build a space using assemblr edu in elementary schools, as well as to determine the feasibility level of learning media by media experts and material experts. This research is a type of research and development. The development of this learning media product uses the ADDIE development procedure which is simplified to the development stage, namely: analyze, design, and development. The instruments in this study are interviews and questionnaires, and observations are used as student analysis. The validation of the learning media involves four validators consisting of two expert lecturers and two teachers according to their backgrounds relevant to the field being studied. The data from the validation results were analyzed based on the calculation of the Gregory index, showing the media validity coefficient for media experts in the study of 1 with very valid criteria and for material experts in this study also showed a validity coefficient of 1. So it can be concluded that the AR flashcard learning media to build a space using assemblr edu meets the criteria of high validity and is very feasible to be used by teachers as a student medium to learn building space materials in elementary schools.

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INTRODUCTION

The development of technology that is increasingly developing into a human need and plays an important role in various aspects of life, this has ushered the world at the point of the industrial revolution era 4.0 and also the era of society 5.0. The concept of the society 5.0 era is a form of improvement in the 4.0 era where humans are active players and objects at the same time who can cooperate with technology in achieving goals. Japan, which is advanced in technology, has the slogan

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"Fukuku Kyohei" which is always echoed to be able to advance its country which is lagging behind in various fields, one of which is the field of education, by studying technology or utilizing technology that is developing and increasingly advanced, to be able to help humans to meet their needs. This is a step or inspiration, various countries, including the State of Indonesia, in an effort to advance or be able to improve the joints of rules in the country so that each is no less advanced and lagging behind in terms of technology, and quality human resources. One of the efforts to improve the state of the country is in the field of education by presenting an independent curriculum as a new curriculum.

The independent curriculum is a real effort from the government to be able to improve the quality of Indonesia's education related to the demands of society in the 5.0 era. (Manalu et al., 2022). An independent curriculum can provide opportunities for

which is full for teachers to use their innovative ideas when in teaching activities, students have full opportunities to be able to develop. (Suryaman, 2020). The main concept in the independent curriculum is independence or freedom of thought so that teachers are also free or independent to innovate, in order to be able to answer the needs of students. The Decree of the Ministry of Education, Culture, Research and Technology Number 56 of 2022 explains that the curriculum structure in primary and secondary education is divided into 2 main activities, namely intracurricular learning, and the Pancasila student profile strengthening project. Intracurricular learning competencies are learning outcomes or called CP which is divided into several phases. After the teacher understands the learning outcomes, the teacher then enters the learning objectives (TP) to then develop into the flow of learning objectives (ATP) and then into learning modules. The learning process in CP in the independent curriculum is divided into several phases such as phase C for class V and class VI. One of the subjects taught in this phase is mathematics.

Mathematics is the main subject in every education, and the symbols and symbols present in mathematics are used universally so that mathematics has its own language. Mathematics activities aim to build a logical and organized conceptual system of thinking, so that students must be equipped with mathematical concepts from an early age, in education. All students must be given mathematics lessons so that students have the ability to think logically, analytically, systematically, creatively, and be able to work together. But in reality, mathematics subjects are always considered difficult because they have conceptual characteristics that abstract. Students consider mathematics as scary, difficult and boring learning, mathematics is not fun and is a dry science, contains only theory and only contains formulas so that it seems to be outside the reality of the student. (Nisa et al., 2021). There are several mathematics materials that are quite complicated and difficult for students, one of which is the material for building space.

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The space building material is found in the learning of elementary school students in the independent curriculum, this can be seen from the learning objectives of phase C of the geometry domain. Some of the things that cause students to feel difficulties in learning space building materials are the ability of students who cannot imagine the form of concrete space building drawings and have different shapes, types, and formulas so that students do not understand the learning material. Therefore, to overcome the difficulties of students in learning space building materials, learning media that are able to display 3-dimensional and interesting objects are needed.

Learning media according to Aqib (in Hasan et al., 2021) is everything that can be used to convey a message, stimulate students' thoughts, feelings, attention, and willingness so that they can encourage the learning process in the classroom. Learning media. According to azhar Arsyad 2020, learning media based on its form is divided into two, namely electronic and non-electronic. Electronic media consists of transparent media or overhead projector (OHP), slides, films, Augmented Reality, television and the internet. Meanwhile, non-electronic media is print media, such as books, modules, worksheets, flash card, display media such as whiteboards, exhibitions, and experimental demonstration media.

Determining the learning media must of course be very careful according to needs. Referring to the theory of the triangle of experience Edgar Dale Where the activities Observing can meet the characteristics of students, where as much as 50 percent of what they see and read and 75 percent is obtained from the sense of sight (Lino Padang et al., 2021). So that in the selection of learning media, efforts are made that can be easily captured by the sense of sight in visual form, one of which is the media flashcard.

FlashCards is a picture card that contains photos or pictures equipped with words to improve students' understanding in learning. (Maharani et al., 2022). FlashCards It can improve students' right brain to be able to remember visual things with word inserts, and its practical nature to carry everywhere, easy for students to remember and become a fun thing using flashcards as a learning medium. The results of the research (Dessy Harisanty in 2020) with the title "The Utilization of Flashcards in Children Information Literacy Development" The use of flashcard media shows that elementary school-age children prefer and are interested in media that is equipped with various images and has various colors.(Maharani et al., 2022). From this, it can be seen that flash card media is very suitable for elementary school students, especially if the flash card media is integrated with a touch of Augmented Reality (AR) technology so that it can display objects in 3 dimensions.

Augmented Reality or abbreviated as AR is a technology that helps three-dimensional (3D) virtual objects to be viewed interactively in the real world. (Mardian et al., 2023). The function of AR is to help a static image or abstract become more specific and more tangible to improve understanding.

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Technology Augmented Reality can help teachers explain subjects that require 3-dimensional visualization in the learning process. As well as research on the use of learning media Augmented Reality which was carried out by (Jihan Setia Salsabila and Delia Indrawati in 2021) with the title "Development of Augmented Reality-Based Question Cards for Characteristics of Building Classroom V Elementary Schools. The results of the study show that AR-based question card media gets a practicality level value of 92.2% with a very practical category to be used as a learning medium. In addition, other research on the application of media Augmented Reality carried out by (Meilindawati et.all,. 2023) with the title "The Application of Learning Media Augmented Reality. In Mathematics Learning". The results of this study show that Augmented Reality can improve the concept of student understanding in learning mathematics and student learning outcomes are better and improved. One of the augmented reality applications that can be applied in schools is assembler edu.

Assembler edu is an application that has a learning feature using AR technology, so that teachers can easily create an interesting and easy-to-understand learning environment or experience for students in learning. If you only use 2-dimensional images, students sometimes find it difficult to learn the subject matter being taught, as well as teachers or educators who find it difficult to teach learning materials with complicated materials, while at the same time they also do not have adequate learning media, so that the Assembler edu application can help in making the learning process more fun and interactive.

Based on the results of interviews and observations conducted with 5th grade teachers, learning media at school is still limited, the teaching and learning process activities at SD Negeri 4 Selong, still use package books, cardboard media, and whiteboards in mathematics learning. The objects drawn on the blackboard are static or stationary, the building of space is only seen from the front side, this makes it difficult for students to imagine how to build space, and it is difficult to understand. In addition, in the learning process, teachers have never tried to use flashcard media and edu assembler in learning, but teachers have a desire to try AR technology with the edu assembler application on space building materials. Based on the described background, the researcher is interested in conducting a research entitled "Development of AR Flash Card Learning Media Building a Space Using Assembler Edu for Grade 5 Students in Elementary School".

B. Problem Identification

Based on the background of the problems raised, the identification of the problems found is as follows:

1. Mathematics learning of space building materials is considered a difficult subject matter by students, because it is difficult to imagine abstract materials such as building space.

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2. Teachers are still not optimal in utilizing technological innovations to create mathematics learning media.
3. Teachers have an interest in implementing flashcards learning media to build AR spaces using edu assemblers with augmented reality technology
4. Learning media is still limited and conventional and there is no learning media based on augmented reality to display 3-dimensional objects to build space.

C. Focus on the Problem

Based on the identification of these problems, the focus of the problem in this development research is focused on the development of AR flashcards learning media to build a space using an edu assembler.

D. Problem Formulation

Based on the identification of the problems that have been presented, there are several things that are the formulation of the problems in the research, namely:

1. How to prototype AR flashcards learning media to build a space using assembler edu?
2. What is the feasibility of learning media for AR flascards building materials using edu assembeler?

E. Research Objectives

1. To find out the prototype of how AR flashcards learning media builds a space using an edu assembler
2. To find out how feasible the learning media is to build a space using the edu assembeler

F. Specificationization of the developed product

1. The learning media product that will be developed is in the form of AR flashcards using applications that students can download
2. The AR flashcards learning media building this space is divided into two sides, the front and back sides. On the front side there is a smart formula for building space, and on the back side there is a barcode marker that can detect or display 3-dimensional objects to build space.
3. AR flashcards are designed with canva and the edu assembler application to operate or to create media objects to build augmented reality spaces to give the impression of 3 dimensions.

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4. AR flashcards that contain space building materials such as definitions, formulas, characteristics of building space, space building nets and examples of building space.

G. Development Benefits

This research is expected to obtain the results of the research, so the author can conclude that the benefits that can be taken from this research are as follows:

1. Theoretical benefits

a. This research is a reference in the concept of the teaching and learning process by using AR flashcards learning media assisted by the assembler edu application.

b. Adding knowledge and insight, science and references regarding the use of AR flashcards learning media to build a space using an edu assembler

2. Practical Benefits

a. For Students

This research is expected to be an insight and with the implementation of this media in the learning process, students are more enthusiastic to learn and understand from the building materials of the mathematics learning room.

b. For Teachers

As a reference for teachers in the learning process for building materials for grade 5 mathematics rooms using AR flashcards (augmented reality) and as an inspiration for teachers to be able to implement technology-based learning media so that not only Conventional are used, and can attract students' interest or attention in the learning process which will have an impact on students' motivation to learn.

c. For Schools

This research is an input to schools to improve the quality of education by teachers by implementing the right learning media by utilizing technology that can be used in the learning process.

H. Development Assumptions

The assumptions that are the basis of this development research are to produce how to develop AR flash card learning media to build a space using a grade 5 edu assembler in elementary schools, including:

1. Make it easier for students to understand mathematics learning or teaching aids to help visualize the 3-dimensional shape of building space

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2. AR flash card learning media to build a space using an edu assembler has the power of innovation so that the teaching and learning process in the classroom is not boring because it is more interesting. AR flash card learning media to build a space using an edu assembler can increase students' interest in learning mathematics building materials.

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METHOD

A. Development Model

The research in this development uses the ADDIE model. The development of the ADDIE model can produce the final product in the form of learning media Flash Card AR build space using assembler edu and can be developed in accordance with research procedures so as to produce products that are suitable for students according to the needs and characteristics of students. The researcher has a reason for choosing to use the ADDIE development method, namely because this model has the advantage of systematic steps. Each phase of the step is revised or evaluated so that the product to be developed becomes valid. The ADDIE model is simple but at the implementation stage it is systematic. The five stages proposed in this model are 1) analyze (analysis) is a stage to analyze learning needs and objectives, including in terms of understanding students, how they learn 2). Design (design) is a stage involving the development of a plan in learning, teaching methods, content of learning materials, 3). Develoment (development) at this stage of learning materials and resources are created or produced to be used in learning and implemented teaching strategies, 4). Implementation at this stage is the design or product specifications that have been made and implemented in the learning program, 5). Evaluation (evaluation) stage of implementing program evaluation from learning.

Based on the above explanation, it can be concluded that the ADDIE model provides a systematic approach in the development of instructional or learning programs through the analysis stage, can identify specific needs and challenges, a design that allows the detailed design of the learning material, the development stage involves the implementation of the design, the implementation and evaluation help ensure its effectiveness and provide room for continuous improvement, with The ADDIE model of this research is directed at the development and improvement of a systematic learning process. This can be shown through the steps to be taken which are always based on the previous steps that have gone through the renewal or revision process, so that they can produce interesting learning media products and will create effective and efficient learning. The following is an image of the development of learning media using the ADDIE development model:

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Figure 3.1

ADDIE Development Model

B. Development Procedure

The development procedure in this study uses the development procedure by adopting the ADDIE development model. In order to design quality learning media and improve the quality of learning, good planning and schemes are needed. The ADDIE development model has five stages of research and development, namely analysis, design, development, implementation and evaluation.

In this research, it is only carried out until the product development stage and produces a valid learning media in the form of AR flashcard learning media to build a space using assemblr edu so that it implements three of the five steps, which are as follows:

1. **(Analysis) Analysis**

Needs analysis, analysis of students and materials is carried out by conducting interviews and observations with homeroom teachers and teachers of grade V mathematics subjects, the purpose is to obtain information about the teaching and learning process in the classroom related to the learning materials, learning methods, and learning media used. This analysis aims to make the products developed relevant to the needs of schools, students and teachers.

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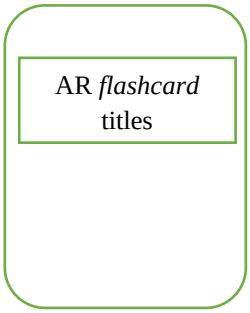
The results of the analysis are then used as a reference in the development of learning media Flash Card with AR technology that can support concrete stages in children's congenital development because it provides an interactive experience, visualization of concepts, which is more real In addition, the analysis of learners' needs is used to see how much learning media is needed Flash Card AR (Augmented Reality) Build a space using Assembler Edu in the learning process.

2. Design

This design stage makes it easier for researchers to design AR flashcard media to build the space to be created. The materials that will be used in making the AR flash card learning media to build a space using an edu assembler are arranged. At this stage, the researcher designed a flashcard learning media to build a space using the Canva application, the 3-dimensional components of the building material and the appearance of augmented reality were made using the assembler edu application and markers using assembler edu. The activity continued by making an AR flashcard storyboard using Assembler edu as the initial sketch shown in the following table:

Table 3.1

Storyboard Media

It	Sketch Design	Information
1.	Back Side 	Contains the title *of the* *flashcard* to build *an AR* room using *Assembler edu*

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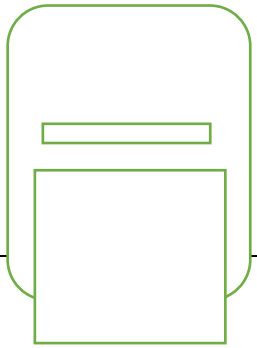
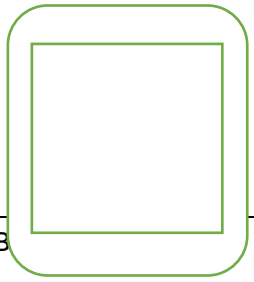
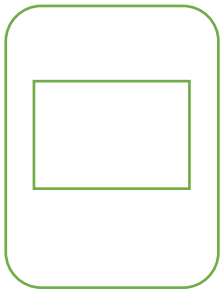
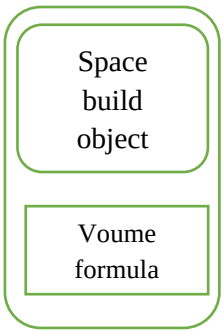
2.	Back Side 	Contains how to use *AR flashcards* using *edu assembler*
3.	Front Side 	Contains TP or grade 5 learning objectives
4.	B 	Concept of building a space
5.	Front Side 	Contains an image of the object building space with the formula below it

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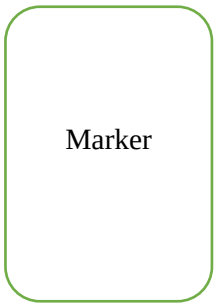
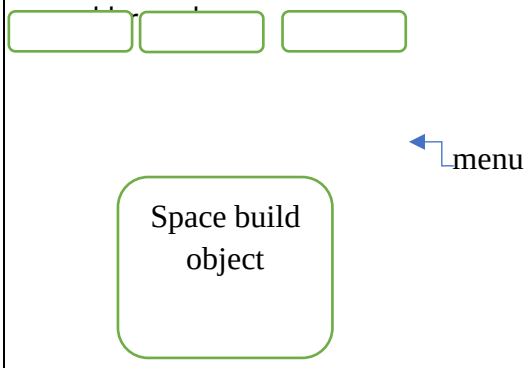
6.	Back Side 	Marker *AR assembler edu* which contains an explanation of building a space
7.	Initial design of the contents of the edu 	The initial display *of Flaschcard AR* after being scanned using the edu assembler consists of several menus, namely the formula menu, mesh, and ribs.

3. **Development**

Development is a follow-up to the planning stage. At the development stage, the researcher developed a product in the form of an AR flashcard for building materials for class 5 using an edu assembler. In this development stage, product development is carried out in accordance with the design or design, then it will be followed by the re-correction of the media product used before the validation, then the validation is carried out by media experts and material experts, the results of the validation will be scored, suggestions and comments which will be used as guidelines or references in revising the developed media products.

C. Product Trial Design

1. **Test Design**

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The test design is used to obtain data as a basis for revising the product. After validation by material experts and learning media experts, a trial design was carried out, this was done with the aim of being able to find out the feasibility of the learning media that will be developed in terms of practicality, appearance and learning media to make it easier for students to achieve learning goals. The design of the test carried out is:

a. Media Expert Validation

The validation of learning media experts will provide suggestions, values and comments on the products developed, which are seen from the practical aspects, the feasibility of the learning media developed or not.

b. Material Expert Validation

The validation of material experts aims to test the completeness or suitability of the material with the curriculum, the accuracy of the content of the product and matters related to the product, The test of material experts is material experts which is professional education in mathematics subjects. This trial activity was carried out after the researcher made the initial product of the AR flashcard learning media to build a space using an edu assembler.

2. **Data Collection Techniques and Instruments**

The techniques in data collection used in this study are as follows:

1) **Interview**

Interview is a technique to be able to collect data directly from the source by asking several questions about the research conducted (Sugiyono, 2019). Interviews were used when conducting pre-research by interviewing homeroom teachers and grade 5 mathematics teachers at SD Negeri 4 Selong. This is done to analyze or obtain information about the product to be developed according to the needs of students in school. The interview grid in this study is:

Table 3.2

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Interview Grid

It	Interview Aspects
1.	The process of teaching and learning activities in grade 5
2.	Methods used when teaching mathematics
3.	Availability of media and teaching materials for mathematics learning in schools
4.	Teachers' difficulties when teaching in the classroom
5.	Difficult material in mathematics learning
6.	Causes of students' difficulty understanding the material in learning
7.	Teachers' opinions when researchers develop AR flashcard learning media using edu assembler

2) **Observation**

Observation is carried out by collecting data through direct observation in the field by researchers related to the research problem, so as to obtain a comprehensive view of the problem that occurs.

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3) **Questionnaire**

This study uses a questionnaire instrument, with the Likert scale as a scale in measurement to measure the feasibility level of the media product to be developed. The grids of each instrument that will be used are as follows:

Table 3.3

Validation Instrument Grids for Media Experts

It	Aspects	Indicators	Number of Grains
1.	The feasibility of the display or physical display of learning media	AR flashcard *design and layout*	4
		Use of letters or information in *AR flashcards*	2
		Ease of use	2
2.	Benefits of Learning Media	AR flash card learning media for students in the learning process	4

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3.	Application of learning media Aseembler edu	Attractive and easy-to-understand edu assembler display	4
		Integration in text from media assembler edu	1
		Combinations between objects in edu asselembler	2
		Sensitivity level of marker assembler edu	1
Number of question items			20

Table 3.4

Validation Instrument Grids for Material Experts

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It	Aspects	Indicators	Number of Grains
1.	Content eligibility	Learning materials are in accordance with learning outcomes (CP), learning objectives (TP), and learning objectives (ATP)	2
		The content of the learning material is according to the needs of the students	1
		Accuracy of the material	4
		Encourage students' curiosity	2
2.	Learning Effect Strategy	Techniques for delivering the content of the learning material presented in the AR flascard accompanied by a guide to use	1
		Submission of learning material content	3
3.	Qualifications in languages	Dialogue and interactive	3
		Language suitability with the development of elementary school children	2
		In accordance with PUEBEI rules	1
		Clear and straightforward	1
Number of question items			**20**

4) **Documentation**

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Documentation is a technique in data collection that will be used to be able to obtain information in the form of photos, archives, documents or books so that it can support the course of research (Sugiyono, 2019). In this study, documentation techniques are used in obtaining information when conducting interviews, and validating the feasibility of media and materials, textbooks or learning media used in schools

3. **Data Analysis Techniques**

a. Data Analysis Techniques in Media Eligibility

The data analysis used was by using Likert scale analysis and the data was obtained from the validation sheets of material experts, and media experts based on the Likert scale.

Table 3.5

Likert Scale Assessment Criteria

Criterion	Grade/Score
Excellent	5
good	4
Keep	3
Bad	2
Very bad	1

Source: Sugiyono (2019)

The results of the validation of media experts and material experts will be analyzed through the content validation coefficient or Gregory index using the equation of Gregory. However, before

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determining the Gregory index, the relevance of the strong and weak assessments of media and material validators is determined through the following table contingency table:

Table 3.6

Contingency for calculating Gregory's index

		Validator 1	
		Weak (1-2)	Strong (3-5)
Validator II	Weak score (1-2)	A	B
	Strong (3-5)	C	D

The contingency table shows that there are four categories as follows:

a. If both validators give the same score, with a score range of 1-2, on the same item, the relevance category is weak symbolized by A.

b. If in the same item validator 1 gives a score assessment with a range of 3-5, while validator 2 gives a score assessment with a range of 1-2, the relevance category is strong and weak symbolized by B.

c. If on the same item validator 1 gives a score assessment with a range of 1 2, while validator 2 gives a score assessment with a range of 3-5, the relevance category is weak-strong symbolized by C.

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d. If both validators give the same score rating on the same item with a range of 3-5, the relevance category is strongly symbolized by D

The next step is to determine the value of the content validity coefficient based on the contingent matrix table using Gregory's formula:

$$V = \frac{D}{A+B+C+D}$$

Information

V : Content validity

A : The number of points obtained if both judges declare no

B : The number of scores obtained if validator 1 states that it is irrelevant but expert II specifies that it is relevant

C : The number of scores obtained if validator 1 states relevant but expert II states irrelevant

D : The number of scores obtained if both validators declare relevant

The content validity coefficients are further interpreted into three categories expressed in the form of a validator agreement index as follows:

Table 3.7

Content Validity Coefficient

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Coefficient	Validity
0,8 -1	Very high validity
0,6 -0,79	High validity
0,4 - 0,59	Medium validity
0,2 - 0,39	Low validity
0,00-0,19	Very low validity

b. Processing Interview Results

The data analysis technique for interviewing in this research activity is in a qualitative way, namely explaining the results of the interview into a paragraph to describe what the teacher has conveyed about teaching and learning activities in the classroom, before the AR flashcard learning media is used when learning mathematics in class. Furthermore, the results of the interview are used or processed to determine the learning media products to be developed.

RESULTS AND DISCUSSION

A. Initial Product Development Results

This research strives to develop AR flashcard learning media to build a space using assemblr edu. The development of this learning media is carried out using the ADDIE model in several stages, namely the analyze, design, and development stages . The following are the results of the development of AR flashcard learning media to build a space using assemblr edu.

Analyze

The first step taken by the researcher in developing AR flashcard learning media to build a space using edu assemblr is by analyzing needs, analyzing students, and determining materials.

Needs analysis

The analysis of student needs was carried out by interviewing the guardian of the 5th grade

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teacher of SD Negeri 4 Selong, Mrs. Kamisah S.Pd, and the mathematics teacher, Mrs. Diana Komala Puspa Suriyani, S.Pd. The purpose of the direct interview was to find out the needs needed to be in accordance with the learning media to be developed. Based on interviews with teachers, it can be found that SD Negeri 4 Selong uses 2 curricula, namely the independent curriculum and K13 For the independent curriculum, it is used for grades 1, 2, 4 and 5 while K13 used for grades 3 and 6. In addition, the method used, namely the lecture method, in the learning process teachers still have limitations or are not optimal in making a technology-based learning media only in the form of ordinary PPT.

Mrs. Kamisah stated that the availability of learning media in schools is still only using package books, cardboard media, and whiteboards that are static or arguably 2D when teaching mathematics in the classroom, most students have difficulties in learning mathematics building materials.

Mrs. Diana stated that students have difficulty in imagining the shape of the building of a space because the building of a space consists of various types, and almost similar, for example, between a cube and a block, this makes students dislike learning mathematics because of the students' assumptions that it is difficult and unpleasant. Mathematics teachers hope that there is a 3-dimensional visual media that can help students in learning mathematics of building space.

Student Analysis

Student analysis is carried out by carrying out observations in the classroom, when in mathematics learning, in this case it is seen that many students feel that mathematics is a difficult thing, this assumption makes students tend to be less focused and look less interested and some are even engrossed in the middle of learning mathematics. When the teacher asked the question of building a space, students still had difficulty distinguishing the characteristics of the shape of building a space between one building a space and the other. So learning media is needed that is able to increase enthusiasm for learning and attract students' interest in learning mathematics which is considered difficult by students.

Material Analysis

The analysis of this material aims to make the material developed in the learning media appropriate. The material developed is based on the results of a needs analysis by means of interviews with teachers. Based on the results of the interview, the material that will be used in the learning media is the material to build a space so that a media with images and visualization with 3D is needed.

After determining the material, the researcher then conducted an analysis by examining the

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learning outcomes, learning objectives and the flow of learning objectives in class V with the achievement of learning objectives as follows:

Table 4.1

CP and ATP

Learning outcomes	Learning objectives
At the end of phase C, students can construct and decompose the building of the block cube space and its combinations and recognize the spatial visualization of the top, front, and sides. They can compare the characteristics between flat and spatial buildings. They can determine the location on a map that uses a mobile system.	1. Explain and identify blocks and cubes and the shape of their nets. 2. Explain and identify prisms and limas as well as the shape of their nets. 3. Calculate the build volume of cubes, blocks, prisms and limas

Design

The second stage of the ADDIE development model is the design stage, at this stage the researcher designs the AR flashcard learning media product, this stage is the initial design of the AR building space flexchard learning media, this design stage is carried out in several steps, namely determining the means needed, determining the scope of the material to be included in the learning media, and making a storyboard for the learning media.

a. Determine the required means

Researchers at this stage collected information used in the manufacture of AR flashcard learning media products, so that the Assmblr edu application was found, which can be used in the manufacture of AR flashcard learning media. Assembler edu is an application

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used in the manufacture of 3D object components and markers that will be included in flashcards, which is the core of making learning media to appear real. In addition, to support the creation of products, other applications are needed, such as the Canva application which is used to design flashcards and where to put markers, as well as geyser and taplink applications in the manufacture of AR flashcard learning media products to build spaces.

b. Determination of material scope

The scope of the material included in the learning media is based on the results of the analysis of the previous material. Furthermore, the researcher made material on the assmblr edu application, namely building materials in a space according to the flow of learning objectives.

c. Creating a storyboard for learning media

The creation of AR flashcard learning media storyboards is carried out by the way the researcher designs learning media starting from flashcards using the canva application and AR materials using the assmblr edu application to be used as a marker of each space, the creation of learning media storyboards serves as a reference when making media more effective and also more efficient so that it can make it easier and easier for researchers when making learning media products. The following are some storyboard creations shown by the following table:

Table 4.2

Media Storyboard

It	Sketch Design	Information

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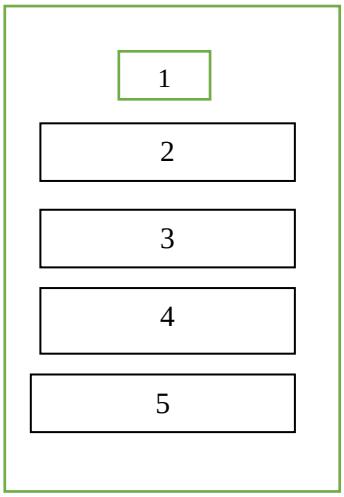
1.	**Storyboard Intro**  The creation of a storyboard on the intro page of the material menu contains the name or title of the learning media which is used as the initial display in the media opener when you want to scan the	1. Media Title 2. Material Button 3. Material Button 4. Material Button 5.material button

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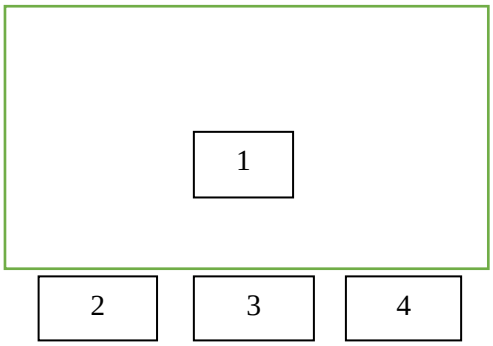
	AR marker flashcard to build a space using assemblr edu.	
2.	**Storyboard Main Menu** 	1. AR flashcard title wake up space 2. Options button to view the contents of the marker 3. Options button to view the contents of the marker

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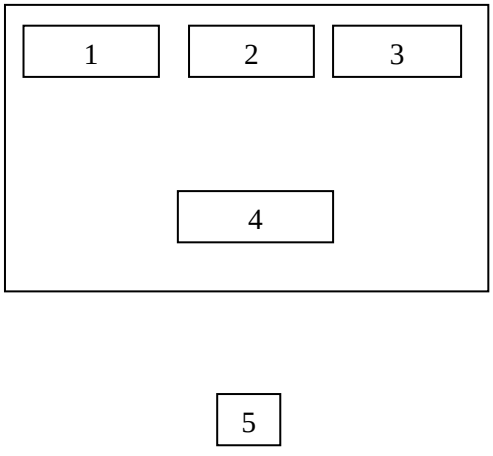
	The next part is the creation of a storyboard of learning media which contains a selection of menu buttons to see the contents of markers from cubes, pyramids, blocks and prisms in 3D form and scan markers.	4. Options button to view the contents of the marker
3.	***Storyboard* Material Menu Page** 	1. Rib Button 2. Spear Nets -Nets 3. Formula Button 4. Heading 5. Begin

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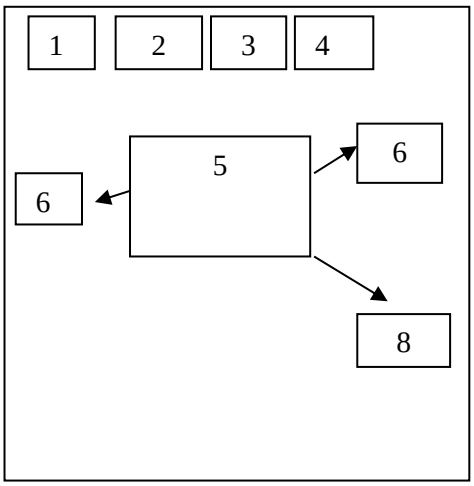
	Storyboard page material menu is a page that will go to the 3-dimensional object material to be seen.	
4.	***Storyboard*** **Materials** 	a. Home button b. Rib buttons c. Mesh Button d. Formula keys e. 3D space building object f. Material Explanation g. Material Explanation h. Material Explanation

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	The storyboard material contains an elaboration of each space building accompanied by examples as material concepts, which consists of the definition of building space, the characteristics of building space. In addition, rib buttons, nets and formula buttons are available to deepen the building material of the space.	

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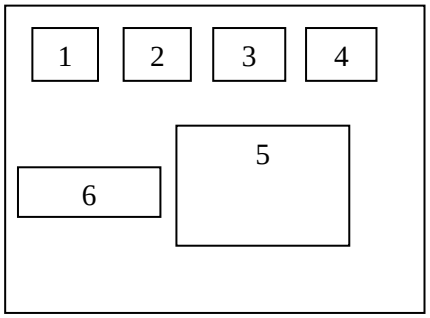
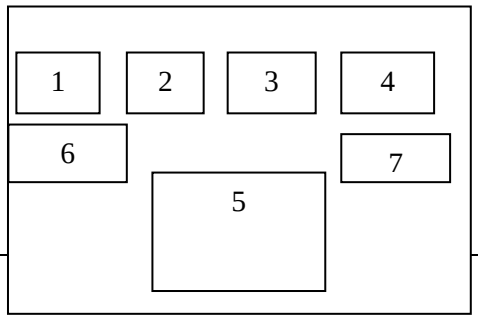
5.	***Storyboard*** **Ribs Build Space**  The storyboard contains the shape of the space building ribs available in the previous scane, and there are the number of ribs from the space building.	1. Home button 2. Material options 3. Material options 4. Material options 5. Rib description
6.	***Storyboard*** **Net-Nets Build Space** 	i. Home button j. Material options k. Material options l. Material options

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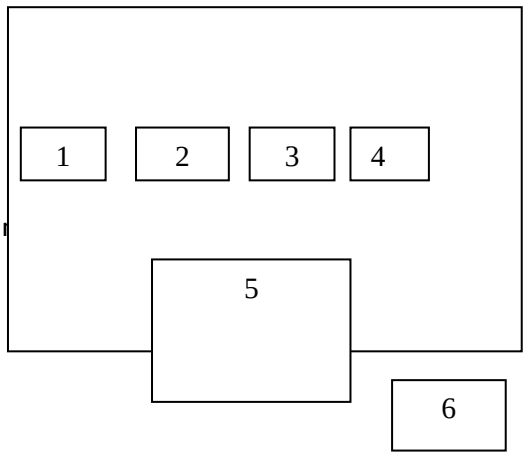
	The storyboard of the webs builds the space contains the shape of the webs in this scene, the open and close buttons are made to animate the shape of the nets.	m. Space building nets n. Open button to open the nets o. Close button to close the nets.
7.	***Storyboard* Formula Build Space** 	1. Home button 2. Material options 3. Material options 4. Material options 5. Example of a formula for building a space 6. Formula for building a space

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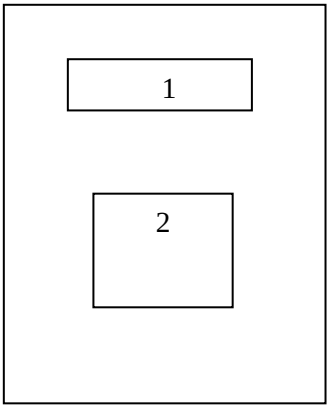
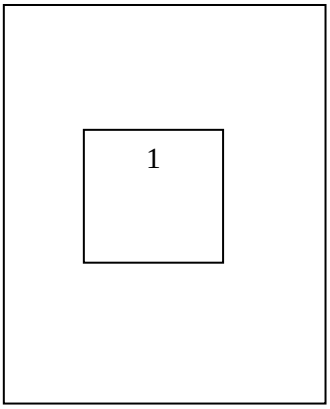
	The story board of the formula for building a space contains a formula for building a space and sample questions with their answers.	
8.	Storyboard flashcard AR Marker 	1. Name of the object build space 2. Space building objects
9.	*Storyboard* flashcard AR Marker 	1. Scan the AR Marker assemblr edu

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Development

The stage of development is to realize Storyboard learning media that has been designed in the design before becoming real. The stages of research development are carried out as follows:

a. Creating Product Prototypes

The initial form of the product to become a standard product is called a prototype, in this prototype it is not yet the final product because it still needs advice or improvements to the product in order to get a quality product. This improvement process is carried out when the media is validated by media experts and material experts. Here are the steps in compiling AR flashcard learning media to build a space using assmblr edu.

1) **Prototype flashcard AR**

The AR lashcard prototype is designed using the Canva application and the sketchfab application to download 3D images of this AR flashcard consisting of 2 sides, namely the front side and the back side. The front side is the 3D object and the back side is the back is the scanner for the AR marker. The 3D objects were downloaded using the sketchfab application, in this case the researcher downloaded 4 objects to be used as AR markers in the form of glb so that they could be adjusted to the edu assembly.

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Figure 4.1

Sketchfab Apps for Downloading 3D Objects

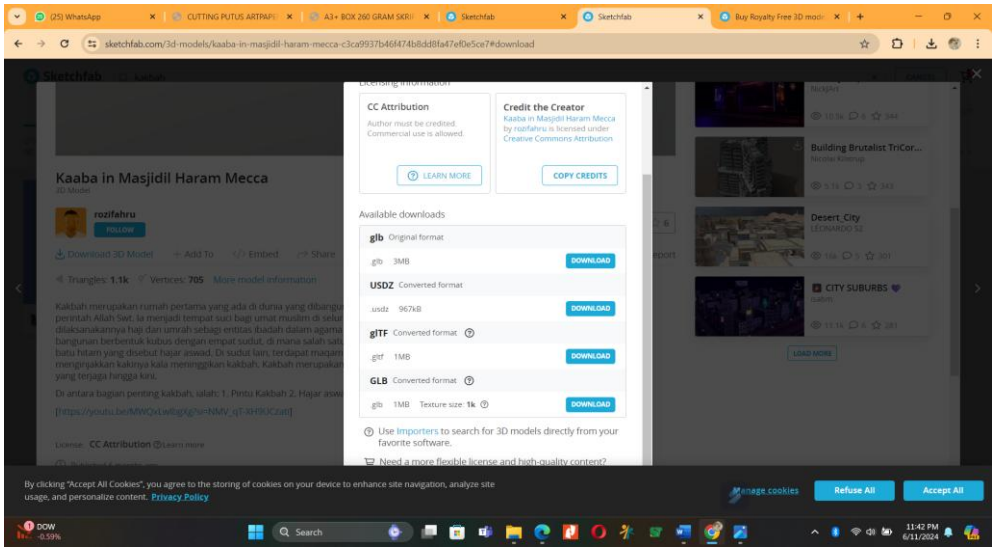

Figure 4.2

AR Flashcard Packaging Prototype

The AR flashcard wrap contains the title of the material, and the school level. while the back side contains biodata from the developer which functions as the identity of the AR flashcard learnin media.

Figure 4.3

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Front AR flashcard prototype

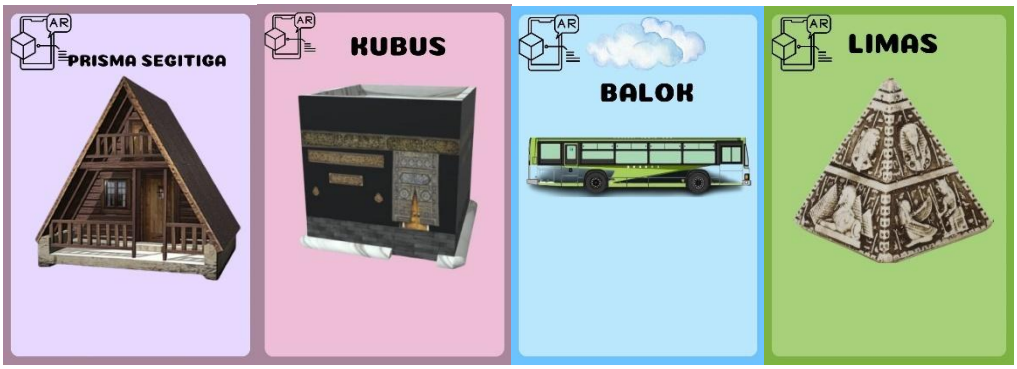
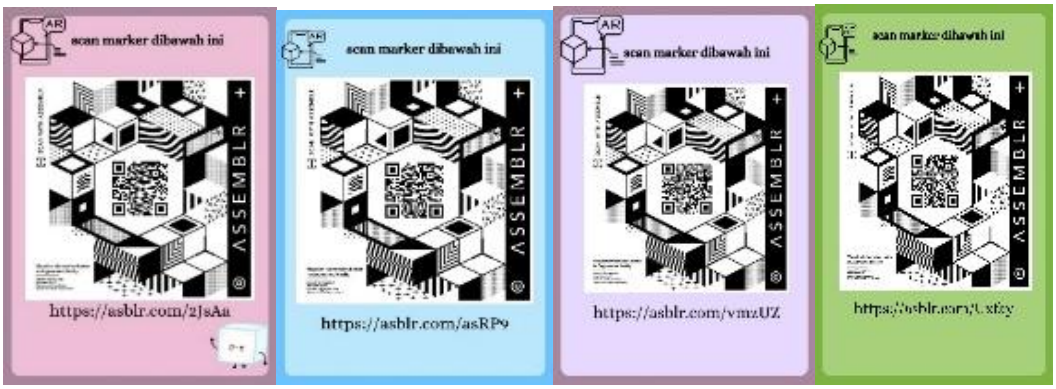


Figure 4.4

Prototype AR flashcard on the back



This AR flashcard consists of two sides, namely the front and back sides, the front side contains 3D objects that build space encountered in life while the back side contains the markers of each 3D object

Figure 4.5

Prototype of AR flashcard material for the characteristics of building a space that will be integrated with assemblr edu

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Flashcard AR consists of learning materials consisting of the characteristics of each space building, namely cubes, blocks, prisms and pyramids.

2) Prototype of AR application display design and marker creation using the Assembler Edu application.

Creating an AR flashcard display design and 3D markers is an important stage because this 3D model will be Augmented Reality on the learning media developed. The creation of this 3D model uses the asssmbler edu application and is made according to the storyboard, which has been created before. The AR display consists of several scanes, namely the intro scane, the AR and 3D main menu scenes, the material menu scene, the rib scene, the net-mesh scene, and the formula scene.

Table 4.3

Prototype of AR Application Display Design Using Assemblr Edu

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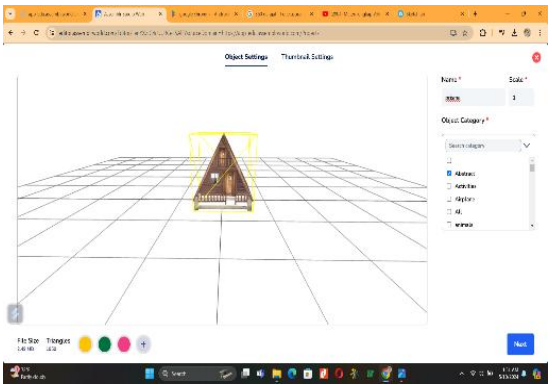
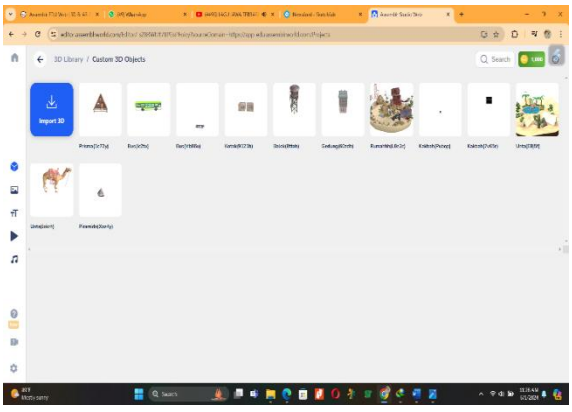
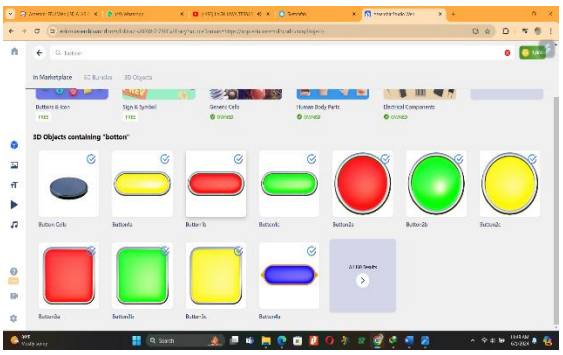
It	Creation of AR display designs	Information
1.		• The first step is to import all 3D objects to build space in the form of glb files that have been downloaded in the sketchfab application and assembler edu, to be included in each project scane. The building of this space is illustrated with the shape of objects such as the Kaaba is in the shape of a cube, the prism of the roof of the barn is a bus-shaped beam and the
2.	 	

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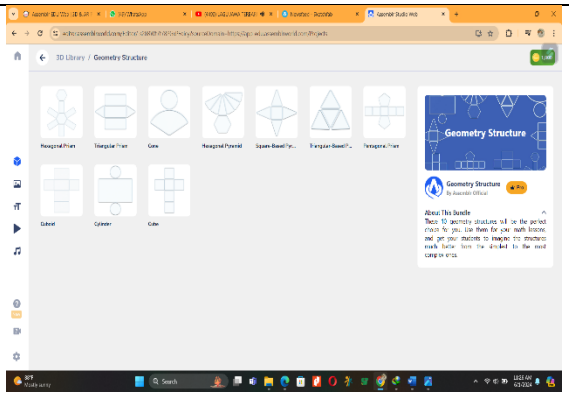

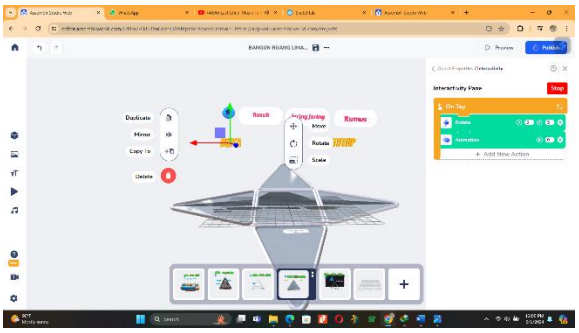

pyramid of the emapat is a pyramid in Egypt.

- Furthermore, there are several features that will appear to change the scale or size of each space building here to design the display.

- Create trigger buttons on each scan and add interactivity so that objects can be animated. The buttons will be the material, home, ribs, nets, and ribs menus and to create buttons so that the

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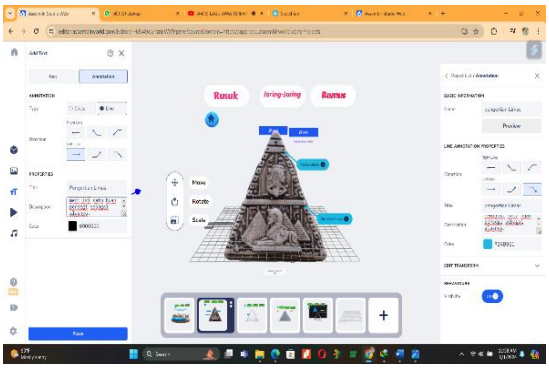
		nets can be opened and closed, in each scane. • After all objects are built or placed in Dallam one scene, they are combined or arranged so that they are clearly visible when they are scanned in the
3.	**Creation of material texts in learning media** 	• The next process is to enter learning materials in each scan to build a cube, block, prism and limas space.

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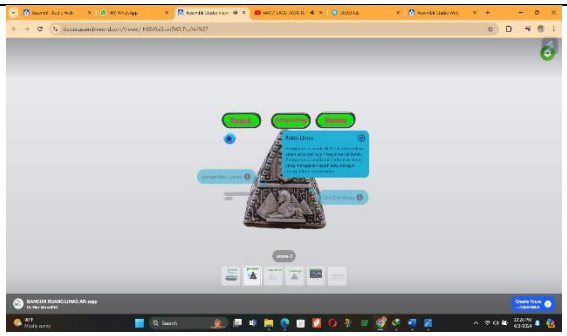
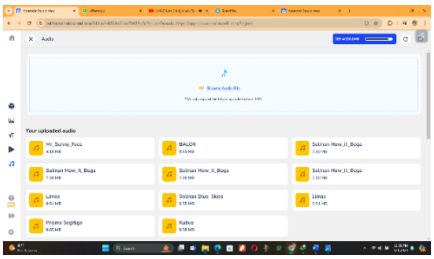
		
4.	**Creation of audio material in learning media** 	• The process of making audio of the space building material that has been recorded previously and uploaded on google drive is inserted in each scan of the 3D object image of the edu assmblr, so that when the student presses the menu

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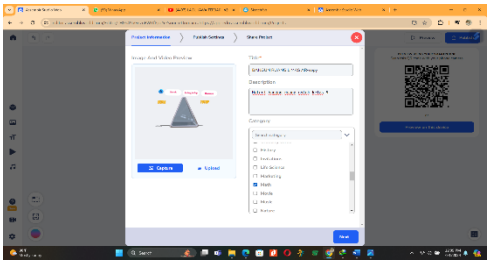
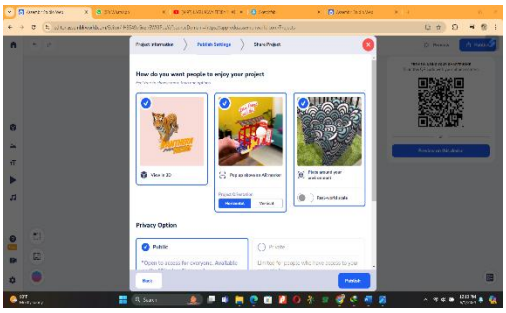
		button can listen to the learning material.
5.	**Publish a 3D AR project to build a space**  	• After each 3D object scan has been completed in the design, the researcher publishes the project, builds a roar and makes a capture to cover the display of the project file • Then fill in the project title and select the category, namely mathematics • After selecting the category, click publish to generate the marker.
6.	**Insert AR Marker on the back side of the flashcard to build a space**	• After publishing, the researcher downloaded the

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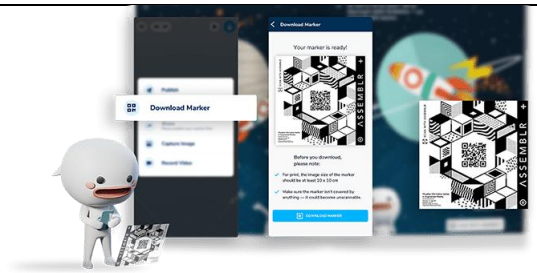
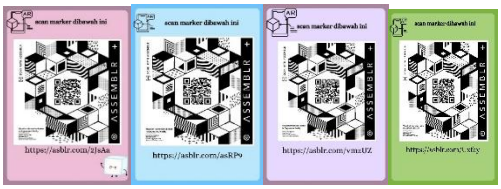
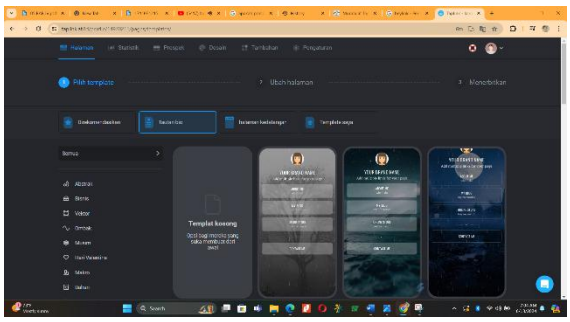
	 	markers from each scan to build the space, so that there were 4 total markers and 4 web links • After downloading the AR 4 markers and 4 different web links, the next step is to integrate the markers on the flashcard to be scanned in 3D AR form
		The last stage is the web link to build a space that has been downloaded when publishing in the assembler edu application, then it will be inserted into the

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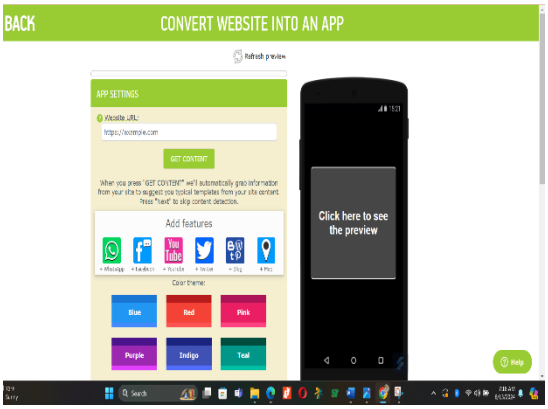
		heylink by selecting the template that is provided.
	Combining the links of several links that have been created by the Assemblr Edu application into one link, this utilizes the Assemblr Edu application  	Furthermore, the web will unite a permanent link connected to assmblr edu and the assemblr edu AR flashcard application using assmblr edu can be installed on a mobile phone.

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		AR flashcard display after being scanned using the application.

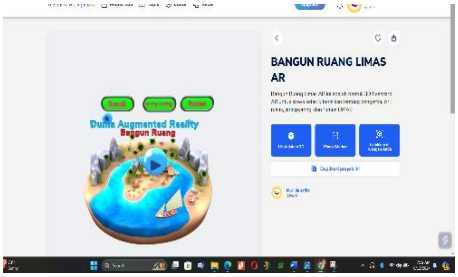
Figure 4.6

Prototype Intro

The intro page of the material menu contains various menu options such as the building material menu, cube space, blocks, prisms and limas that are presented.

Figure 4.7

Prototype Main Menu Page



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The main menu page consists of a selection of menu buttons to see the contents of the markers of cubes, pyramids, blocks and prisms in 3D form and scan the flashcard markers

Figure 4.8

Material Opening Menu Page Prototype

The material opening menu page is the introduction page before starting the material

Figure 4.9

Prototype of the material page of the building space

Creating a space building material page contains the meaning of each space building, such as the

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meaning of cubes, rectangular pyramids, prisms and blocks. Each of the building spaces presented is presented with concrete examples that resemble each form of building space, such as the Kaaba, buses, barn roofs, and Egyptian pyramids, scane of the material page is equipped with audio explanations of the building material, and consists of several buttons as presented in the picture

Figure 4.10

Prototype of Spatial Building Nets

Creating a rib menu page, after discussing the meaning, characteristics of building a space is done if scanning the shape of the ribs of the ribs of the space, students can observe the ribs by rotating the rib object, so that it can be interactive and can enlarge the size of each rib.

Figure 4.11

Prototype of Spatial Building Nets

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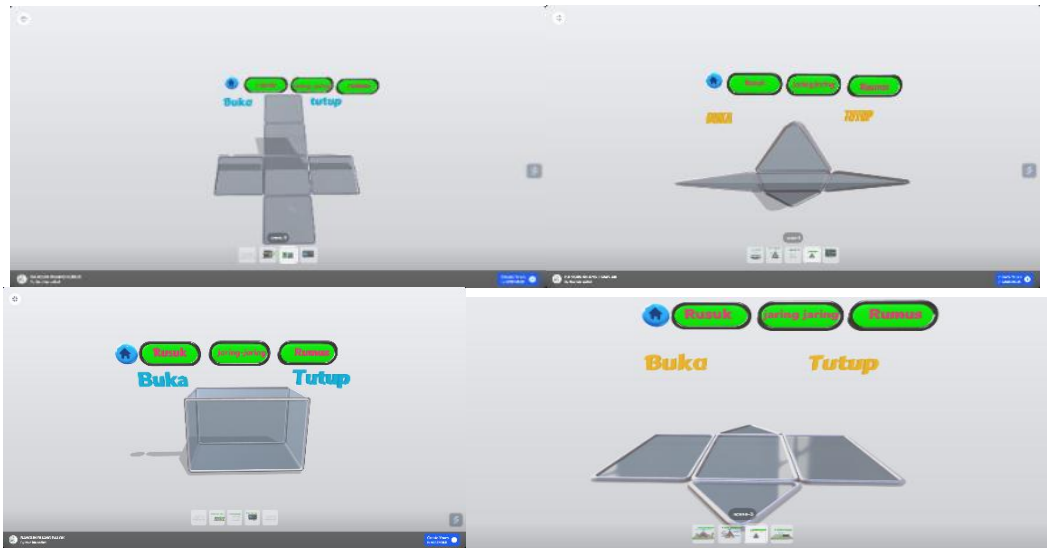
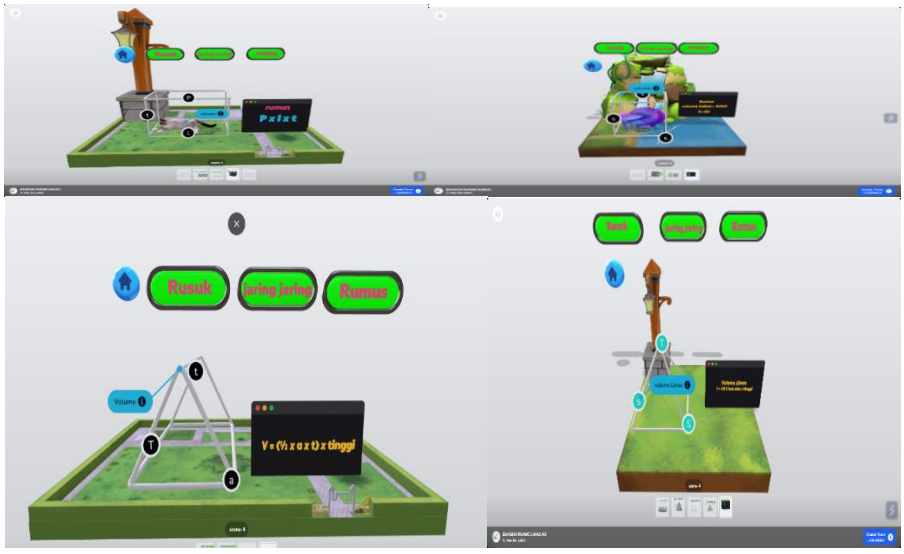


The page of the building nets is presented as shown in the picture above, the nets are provided with open and close buttons, to help students in opening and closing the building nets

Figure 4.11

Prototype of the Formula Page Building Space



The formula page for building a space is provided with a formula for the volume of building a space and an example of the formula, each formula from the volume is also equipped with a discussion of the answer to the question.

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b. Expert Validation

The validity of the learning media is carried out after the product prototype has been developed, to determine the validity of the media and get responses for consideration in improving the AR flashcarad learning media using the edu assmblr. The learning media validation process is carried out by 4 expert teams, namely by 2 lecturers (expert judgemnetent) as media experts, and 2 teachers as material experts

1) Material Expert Validation

The validity of the AR flashcard learning media product using assmblr edu was carried out by 2 material experts who are experts in the field of mathematics materials, namely Mrs. Kamisah S,Pd as the homeroom teacher of grade 5 SD Negeri 4 Selong and Mrs. Diana Puspita Suriyani S.Pd a mathematics teacher at SD Negeri 4 Selong, this validation process was carried out from June 3-10, 2024

Table 4.4

Validation Results of Material Experts

Assessment Aspects of Assessment Validator				
		V1	V2	Tabulation Results
Aspects of Material Relevance				
1.	The material presented is in accordance with the learning outcomes of phase C class V	5	5	D

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2.	The material presented is in accordance with the learning objectives	4	5	D
3.	The material presented is in accordance with the needs of students	4	5	
4.	The material presented is in accordance with the title of the AR flashcard learning media building a space using an edu assembler.	4	5	D
5.	The completeness of the material in the AR flashcard learning media builds a space using an edu assembler.	4	5	D
6.	The material presented is systematic	4	5	D
7.	Visualization builds a 3D space according to the material.	5	5	D
8.	The material contained in the flashcard is equipped with AR markers to encourage the curiosity of participants	4	4	D
9.	Visualization of material in the form of AR flascard illustrations helps students in remembering the components of building space.	5	5	D

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	Aspects of the effect of learning strategies			
10.	The material in the learning media is accompanied by a user guide that can make it easier for users.	4	5	D
11.	The material presented can increase students' understanding in learning to build space.	5	4	D
12.	The use of illustrations in FLASCARD AR can minimize misconceptions in students in imagining the shape of the space.	4	4	D
13.	The visualization of building 3D spaces in daily life encourages students to learn more about the material.	4	4	D
	Language Qualifications			
14.	Communicative language encourages student motivation in learning	4	5	D
15.	The language used in the AR flashcard learning media builds space, encouraging students to learn space building materials.		5	D

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16.	The language used is easy to understand	5	5	D
17.	The language used is in accordance with the thinking level of grade 5 students	4	5	D
18.	Suitability of the writing to the material	4	5	D
19.	The language used is in accordance with the rules of the Indonesian Language which are good and correct	5	5	D
20.	The sentences used are clear and straightforward	5	5	D

2) Media Expert Validation

The validation of learning media was carried out by 2 media expert validators, Mrs. Dr. Donna Boedi Maritasari M.Pd who is a lecturer in learning technology and Mr. Amri Muliawan Nur, ST. M.Kom who is an information systems lecturer. This validation process is carried out from May 30 – June 15, 2024. The results of the validation of learning media can be seen in the following table:

Table 4.5

Media Expert Validation Results

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Assessment Aspects of Assessment Validator				
		V1	V2	Tabulation Results
Appearance or Physical Aspects of Learning Media				
1.	The design of the AR flashcard shape to build a space looks attractive	4	5	D
2.	Color combinations on image objects, text and baground are appropriate	4	5	D
3.	Colors used in AR flashcards are attractive	4	5	
4.	The size of the AR flashcard learning media is according to the needs of students	4	5	D
5.	The writing or font used appropriately can be read properly	3	5	D
6.	The distance between the image and the object corresponds	4	5	D
7.	The use of learning media is easy to use	3	5	D
8.	AR flashcard media can be used for a long time	4	4	D
	Aspects of the effect of learning strategies			
9.	Visualization with examples of 3-dimensional object space buildings in the edu assembler application makes it easier for students to imagine the shape of the space and its components	4	5	D
10.	AR flashcards can help students in	4	5	D

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	arousing students' interest in learning space building materials			
11.	Illustrations and formulas presented visually and in 3D can help students in remembering the building materials of the space	4	4	D
12.	The content of AR flashcard learning media makes it easier for students to learn the concept of building a space	4	4	D
	Application of learning media **Aseembler edu**			
13.	A menu containing nets, formulas, and ribs is easy to understand	4	4	D
14.	AR 3D objects in the edu assembler app are clearly visible after being displayed in the form of 3D objects	4	5	D
15.	The layout between the information and the image of the object illustration does not interfere with understanding	3	5	D
16.	The display of 3D component objects in the assembler edu application looks attractive.	3	5	D
17.	The text used in the explanation of the material is easy to read	4	5	D
18.	3-dimensional bumps that are made exactly according to reality	4	5	D
19.	2D and 3D object layout according to	4	5	D
20.	Markers can be detected through the edu assembler application	4	5	D

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B. Product Trial Results

The process of product test results was carried out by two expert validators, to determine the quality of the validity of the learning media products developed. This validation process was carried out by two material experts. The first material experts were the homeroom teacher of SD Negeri 4 Selong, Mrs. Kamisah S.Pd and Mrs. Diana Komala Puspita Suriyani, one of the mathematics teachers of SD Negeri 4 Selong. In the assessment of the product by material experts, the validator assesses it through a questionnaire based on the aspects of material relevance, material onization, and the effect of learning strategies and language aspects. The results of validation by material experts are as follows:

Table 4.6

Results of Material Expert Assessment

		Validators	
Aspects	Item No.	1	2
Aspects of Material Relevance	1	5	5
	2	4	5
	3	4	5
	4	4	5
Aspects of material analysing	5	4	5
	6	4	5
	7	5	5

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Aspects of the Effect of Learning Strategies	8	4	4
	9	5	5
	10	4	5
	11	5	4
	12	4	4
	13	4	4
Linguistic Aspects	14	4	5
	15	4	5
	16	5	5
	17	4	5
	18	4	5
	19	5	5
	20	5	5

Based on the table, the results of the assessment from 2 validators of material experts were obtained, which consisted of 4 aspects, namely the relevance of the material, the organization of the material, the effect of learning strategies and the linguistic aspect. The relevance aspect of the material consists of 4 items. In the material items presented in accordance with the learning outcomes of phase C class V, the two validators gave a score of strongly agreeing. While the other three items received a score of four (agree) by the first validator and five (strongly agree) by the second validator. This shows that despite being in different value ranges, the two are of strong relevance based on the tabulation results. This shows that the material presented in the AR flashcard learning media to build a space using assemblr edu is in accordance with CP and learning objectives, this suitability can make it easier for students in elementary school so that it is in accordance with the needs of students when learning and learning goals can be achieved.

The second aspect of organizing the material consists of 3 items, namely the completeness of the material in the media, systematic materials, and visualization of building 3D space according to the material, of the three items, 2 items get the maximum score with a

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score in the range of strong relevance values. From this, it shows that the material presented in the AR flashcard learning media using assemblr edu is complete and systematically arranged with the visual form of building a 3D space that has been adapted to the learning material. Furthermore, the aspect of the effect of the learning strategy consists of 6 items, namely the material contained in the AR flashcard learning media equipped with markers can encourage students' curiosity, the visualization of material in the form of illustrations helps students in remembering the components of building space, the material presented increases students' understanding, the use of AR flashcards minimizes misconceptions in students when imagining the shape of building space and visualization of building 3D space in life daily encourages students to learn more material. Of the six items, both validators gave a score range of 4-5, the score is included in the strong relevance category. This shows that the AR flashcard learning media equipped with AR markers can encourage the curiosity of students, and visualization helps students in remembering the components of building a space such as rib components, corner points, nets and the formula for building the space, so that remembering the components of building a space can increase the level of understanding of students in learning. In addition, the use of this media can minimize misconceptions when students imagine the shape of the space, because the form of visualization of the 3D space in each space that is presented is associated with daily life, which can make students to be able to learn the material further.

The language aspect consists of seven items, both validators give a maximum score on 3 items, namely the language used in the learning media is easy for students to understand, in accordance with the rules of the Indonesian language that are good, clear and straightforward. In addition, on 4 items, validators provide different score ranges, but remain at a score of strong relevance. This shows that the use of appropriate language aims to help students learn to build space.

The validators also gave their responses related to the media developed, such as the AR building space learning media really helped students understand the building material realistically because students were immediately presented with the form of building a space in 3D. The media can also be accessed or opened with a chroombook or mobile phone. The advice given was also related to the shortcomings of the media developed, namely adding a

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volume formula with sample questions and discussions. Furthermore, all data on the relevance of the validator's assessment were included in Dallam's contingency of recategorizing assessments from two material experts.

Table 4.7

Contingency Recategorization From Material Experts

		Member 1	
		Weak	Strong
Member 2	Weak	0	0
	Strong	0	20

The table shows the agreement index of the subject matter experts in the validity of the content of the many items from the two experts with a category that has strong relevance to all items, namely as many as 20 items, to calculate the Gregory index, then the following content validity formula is used:

Table 4.8

Recategorization contingency to calculate the Gregory index of the material expert

		Member 1	
		Weak	Strong
Member 2	Weak	A	B

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	Strong	C	D

Content validity $= \frac{D}{A+B+C+D}$

Validity Coefficient $= \frac{20}{0+0+0+20} = 1$

Based on the results obtained from the two validators are 1. With the contingency of reclassification of all material experts obtained strong relevance, the interpretation of the results is that if the agreement index of the two experts is less than 0.4 categories is of low validity. If it is between 0.4-0.79 categories are of moderate validity, if the agreement index of the two experts is more than 0.8 then the validity is high. The calculation of the Gregory index obtained a coefficient of media validity in this study of 1 with very valid criteria. Thus, based on the assessment of experts, AR flashcard learning media uses an edu assemblr that has been developed that meets the criteria of high validity or very valid.

Furthermore, the assessment from media experts was carried out by 2 media validators, namely Mrs. Dr. Donna Boedi Maritasari, M, Pd and Mr. Amri Muliawan Nur, ST.M.Kom. In the product assessment by media experts, the validator assessed it through a questionnaire based on the appearance or physical aspects of the learning media, the benefits and application aspects.

Table 4.9

Results of Media Expert Assessment

		Validators	
Aspects	**Item No.**	**1**	**2**
Appearance or Physical Aspects of Learning Media	1	4	5
	2	4	4
	3	4	4

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	4	4	4
	5	3	4
	6	4	4
	7	3	5
	8	4	5
Benefits	9	4	5
	10	4	5
	11	4	5
	12	4	4
	13	4	4
Application aspects	14	4	5
	15	3	4
	16	4	5
	17	3	4
	18	4	4
	19	4	4
	20	4	4

Based on the table, an assessment result was obtained from 2 validators of media experts, consisting of aspects of the appearance or physical of the learning media, the benefits and application aspects. The display aspect consists of 8 items where the validator gives a score of agreement and strongly agrees, this shows that the design used by Dallam is a teaching medium in terms of color, measurement and shape of the media AR flashcard Building a space looks interesting and in accordance with the needs of students, but here there is a difference of opinion from the two validators in item 7, namely the use of easy-to-use learning media, validator 1 gives a value of 3 and validator 2 gives a value of 5, even though both value ranges are in the category of strong relevance. Furthermore, in the aspect of benefits consisting of

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five items, of the five items the two validators gave a score range of 4-5 which shows that with an AR flashcard to build a space using assemblr edu can make it easier for students to imagine the shape of building a space, 3D visuals can also help Dallam students remember the material of building a space, because of the convenience of the learning media provided such as the nets menu, formula and ribs.

The third aspect is the application aspect or application part consisting of seven items, both validators give a score range of 3-5 in the strong relevance category, this shows that the layout of the 3D object is clear and appropriate, so that the maker can be detected through the application clearly when run. In addition, suggestions and improvements were also given by the first validator to improve and overcome the difference in values of the two validators, namely the first validator gave suggestions to add a more complete user manual consisting of learning modules, how to make media and instructions for use, make 3D objects more stable when scanned or not shake and enlarge the obejk nets. In addition, the second media validator gave suggestions to use various new applications so that objects can look more vivid such as using AI applications, and added space build components such as space build sides, and improved the appearance of applications with other web sites such as taplinks. Furthermore, all data on the relevance of the validator's assessment were included in Dallam's contingency of recategorizing assessments from two media experts.

Table 4.10

Contingency of recategorization from media experts

		Member 1	
		Weak	Strong
Member 2	Weak	0	0
	Strong	0	20

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Some items have different value ranges given by the two validators but even so, overall the results of the validity level analysis show in the high validity category on the results of the agreement index value, this agreement index is a comparison of the number of items from two experts with a strong relevance category to the entire item item, then the Gregory index is calculated with the following Gregory content validity formula:

Table 4.11

Recategorization contingency to calculate Gregory's index from media experts

		Member 1	
		Weak	Strong
Member 2	Weak	A	B
	Strong	C	D

Content validity $= \frac{D}{A+B+C+D}$

Validity Coefficient $==1\frac{20}{0+0+0+20}$

Based on the results obtained from the two validator assessments, a value of 1 was obtained which shows that the validity of the media field is in the category of high validity validity or very valid, so that the learning media developed in the form of AR flashcards to build a space using assmblr edu is suitable for elementary school students

C. Product Revision

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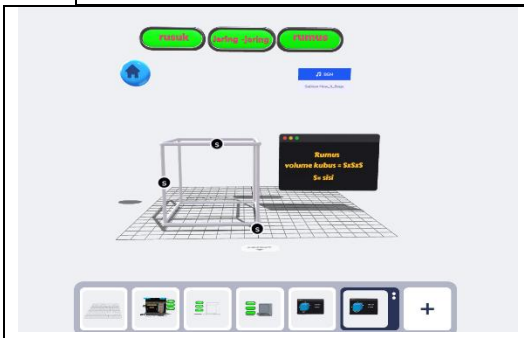
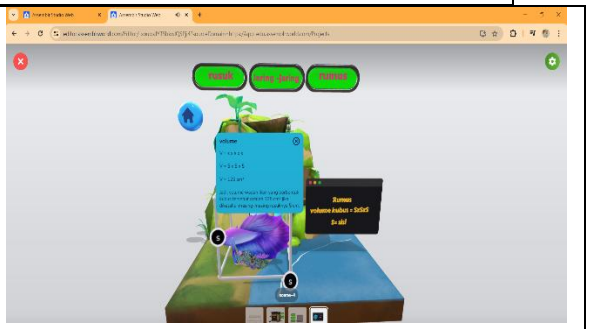
The revision process is carried out after validation by media experts and material experts, this is done to correct the shortcomings of the media products that have been developed, which are adjusted to the comments and suggestions of each validator, so that the learning media can be used properly by students. The following are the results of the media revision from the validator which can be seen in the following table:

Table 4.12

Product Revision by Media and Materials Experts

Before	After
Material Expert	
	
The need to add an explanation in the formula menu section with more interesting examples and animations	Explanations of formulas with more interesting examples and animations after adding

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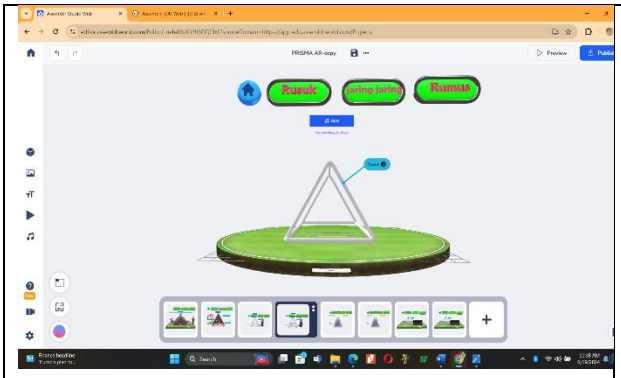
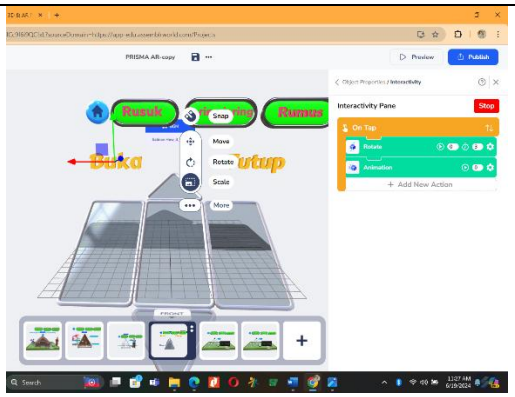
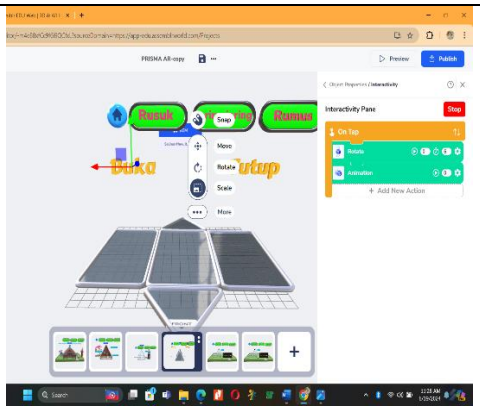
	
The need for added corner points and more interesting animations.	Point angles and animations have been added
	
Enlarged nets	The nets after enlargement in size
	
Extend the net animation which is only 3 seconds	Animation of the nets extended to 7 seconds

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Need to unite several AR flashcard links to build an edu assembler room	 Unify AR flashcard links to build an edu assembler room.
 Changing the appearance of the edu link assembler application when downloaded adjusted to the AR flashcard box cover	 The appearance of the app after replacing according to the cover of the AR flashcard box

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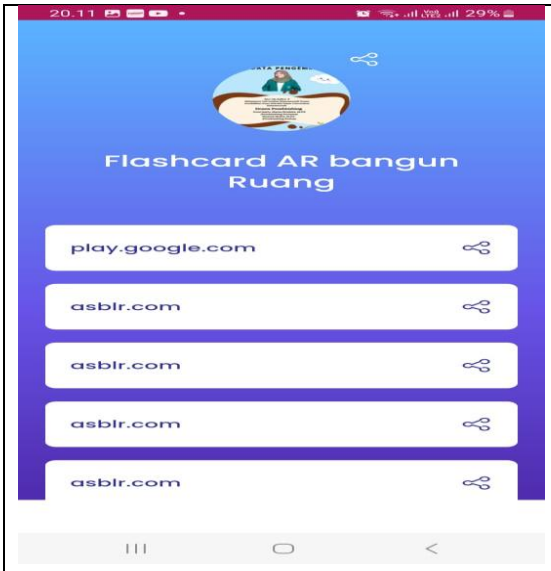
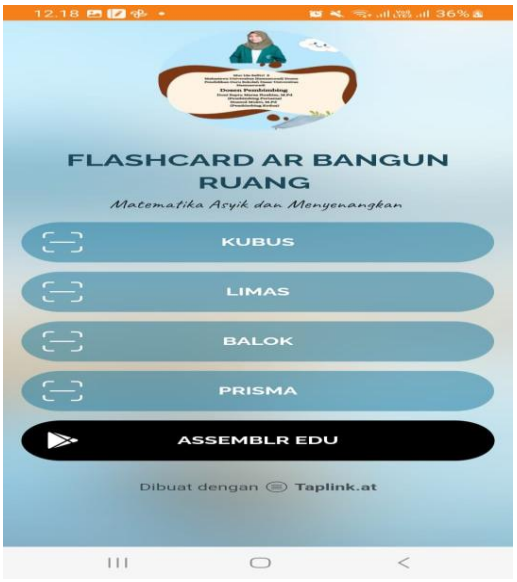
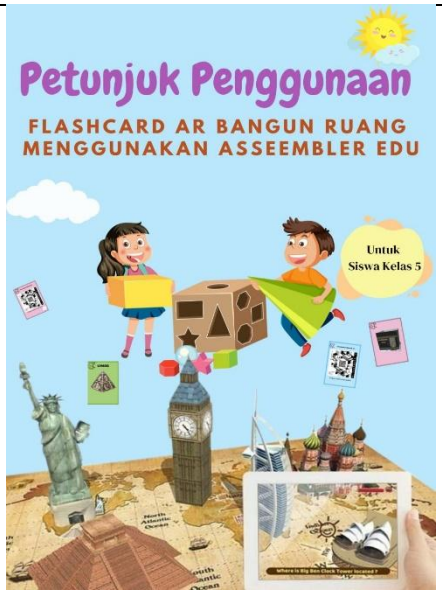


It is necessary to change the menu display more clearly according to the name of the building space, not only in the form of a link from each building space using a web taplink



Menu display after change that is customized with the name of the build room using the web taplink

Add a user manual consisting of modules, materials, and how to make learning media and how to use more complete media.



Instruction manual after creation

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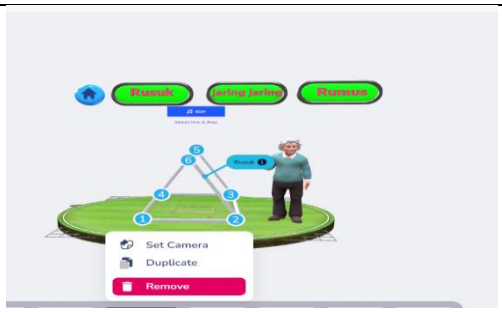
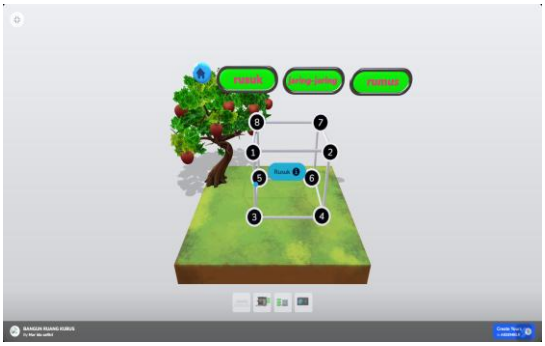
Make 3D objects more stable when scanned or not shaken.	 Make 3D objects more stable by setting the camera so that it does not shake when scanned.
 Added a side caption to build a space and changed the corner point of the number to letters	 Create a side space after adding a side using a letter

D. Final Product Review

This research process uses the R&D method with the ADDIE model but is limited to the development stage, which produces a product in the form of valid learning media, namely AR flashcard learning media to build a space using the edu asemblr. The development of AR flashcard learning media to build a space using edu assemblr begins with the analysis stage. At this stage, it consists of needs analysis, student analysis and material

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analysis. This stage of analysis aims to collect information about the mathematics learning process in the classroom based on the results of interviews and observations that have been carried out Most students feel difficulties in learning mathematics building materials, learning media at school is still limited, the teaching and learning process activities at SD Negeri 4 Selong, still use package books, cardboard media, and whiteboards in mathematics learning. The object drawn on the whiteboard is Static Or silent, building a space is only seen from the front side only, this makes it difficult for students to imagine how the shape of the building space is, and difficult to understand, students' difficult assumptions when learning mathematics make it difficult for students to understand in learning to understand the material. Therefore, it is hoped that a learning media that is able to represent 3D objects, one of the learning media that can be used to overcome this is the AR flashcard learning media to build a space using an edu assembler.

The next step is the analysis of the material based on the data that has been obtained during the needs analysis where it is concluded that the material used in accordance with the independent curriculum is At the end of phase C, students can construct and decompose the building of the cube space and its combinations and recognize the spatial visualization of the top, front, and sides. To achieve students' constitutive ability, the researcher analyzed CP so that ATP was obtained which was used as a reference to develop AR flashcard learning media to build a space using assemblr edu. In this case, the teacher also gave suggestions about the material included in the learning media such as what objects can represent the construction of cubes, blocks, prisms, limas and prisms so that students understand better, so that the researcher takes the objects of the Kaaba, buses, Egyptian pyramids and the roofs of traditional houses.

The stage after conducting the analysis is the design stage by determining what facilities are needed, determining the scope of the material and storyboarding of learning media as a benchmark for making AR flashcard learning media to build a space using assemblr edu. The next stage is development, storyboarding of learning media that has been designed previously realized to be real so that it will produce a product, this stage begins with making an AR flashcard prototype first starting from making the packaging of the AR flashcard place, then making a prototype the front and back AR flashcard display as a place to put the AR marker,

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when the process of making the AR flashcard is completed by making a prototype part for the display of the AR marker application using the edu assmblr which consists of several pages, namely the intro page, and the main menu of the space building material page.

The product prototype has been completed, it will be continued with the validation stage by media experts and material experts, this aims to determine the validity and quality of the media that has been developed. The criteria for the validity of learning media can be seen in the aspects of material relevance, material organization aspects, learning strategy aspects and linguistic aspects for material experts, while media experts assess the appearance aspect, benefit aspect, and application aspect. The results of the validation of the AR flashacard of space building materials using assemblr edu based on the results of the Gregory index calculation obtained a validity value of 1 which is included in the very valid category of media experts and material experts so that it meets the criteria of high validity and is suitable for use by teachers as a student media to learn space building materials in elementary schools.

Based on the stages that have been carried out, the product produced in this study is in the form of an AR flashcard to build a space equipped with an android application by utilizing the Assembler edu application to be used on mobile phones and in addition to that it is also in the form of a link that can be accessed online using Chroombok. So that it can be accessed flexibly anywhere and anytime. The advantage of this learning media is the presentation concept that makes it easier for students to learn to build a more realistic space because of the presence of 3D AR objects that help students remember the material to build a space and describe the shape of each space. Learning media products in terms of presentation can have the potential to foster students' interest in learning mathematics so that difficult assumptions about mathematics can be fun, which can help students understand the material for building a room easily.

E. Research Limitations

The limitation of research and development of this learning media product is that the product developed has not reached the level of implementation or practical test and effectiveness test to students more broadly. However, it only goes so far as to test the validity carried out by two media experts and two material experts based on account Gregory Index,

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This agreement index is a comparison of the number of items from two media experts and two material experts so that a strong relevance category is obtained, which is shown by the coefficient of media validity for media experts in this study is 1 with very valid criteria and for material experts in this study also shows a media validity coefficient of 1 with very valid criteria, so that learning media AR flashcard Using this Edu ASSEMBLR, it is very feasible to be tested in the process of learning Mathematics Building Space in elementary schools. The researcher hopes that there will be further researchers who will improve the shortcomings for future research.

CONCLUSION

This study successfully developed Augmented Reality (AR) flashcard learning media for geometric shapes using Assemblr EDU, which can be used in elementary school learning. Based on the research results, it can be concluded that:

Development of Learning Media

1. The developed AR flashcard learning media can display 3D models of geometric shapes interactively and attractively.
2. The development process through analysis, design, development, implementation, and evaluation stages ensures that this media meets the needs of both students and teachers.

Improvement in Student Understanding

1. The implementation of this learning media showed a significant improvement in students' understanding of geometric concepts. The average post-test scores of students increased by 22.8 points compared to the pre-test scores.
2. Statistical tests indicated that this improvement in students' understanding is statistically significant ($p < 0.05$).

Positive Response from Students and Teachers

1. Students demonstrated high enthusiasm and motivation in using this learning media. They were more actively engaged and found it easier to understand the material taught.

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2. Teachers gave positive feedback on this learning media, stating that it greatly helps in explaining geometric concepts and makes learning more interactive.

Potential for Further Development

1. The AR flashcard learning media has the potential to be further developed by adding additional interactive features and other learning materials.
2. The use of AR technology in learning can be adapted to various other subjects, providing a richer and more enjoyable learning experience for students.

Overall, the AR flashcard learning media for geometric shapes developed using Assemblr EDU has proven effective in enhancing students' understanding and making learning more engaging. This study demonstrates that technological innovation in learning media can positively contribute to the quality of education, particularly at the elementary school level.

A. Conclusion About the Product

This research aims to develop an AR flashcard learning media product to build a space using assemblr edu. Based on the results of the research that has been carried out, it can be concluded as follows:

1. The research procedure for the development of learning media uses R&D research methods and the ADDIE development model which is limited to the development stage because it only measures the validity of the learning media. So there are three stages used, namely the Analyze, Design and Development stages.

2. Based on the results obtained from validators, media experts and material experts, the effectiveness of media in the study was 1 with very valid or very high criteria. Thus, based on the assessment of experts, AR flashcard learning media uses an edu assemblr that has been developed that meets the criteria of high validity or very valid.

B. Product Utilization Suggestions

Based on the results of the research on the development of AR flashcard learning media, build a space using assemblr edu for purposes and also further development suggestions, namely:

1. In the next study, the researcher hopes to carry out an implementation stage to test the effectiveness of building materials for classroom 5.

2. The researcher hopes that the AR flashcard learning media using assemblr edu can help students understand mathematics learning or teaching aids to help visualize three-dimensional shapes to build a space

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