Development of Mathematical Snakes and Ladders Based Media Augmented Reality for Class V Students

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ABSTRACT

This research was conducted in one of the elementary schools in the Wates, Kulon Progo area. This study aims to develop learning media based on snakes and ladders mathematics Augmented Reality for fifth grade students and describes the feasibility of mathematics-based snakes and ladders learning media Augmented Reality for fifth grade students. This development research uses the ADDIE development research model which is modified into three steps, namely Analysis, Design and Development. The methods used are qualitative methods and quantitative methods. The results showed that the learning media for snakes and ladders is mathematics based Augmented Reality meets the eligibility criteria as evidenced by the validation results of media experts getting an average score percentage of 99.57% with the "Very Eligible" criteria, the material expert validation results get an average score percentage of 94.29% with the "Very Eligible" criteria and the results of the questionnaire the media trial obtained an average score of student responses as a whole, namely 96.54% with the "Very Good" criterion. Then, the results of observations and interviews showed that teachers and students gave a positive response to the mathematics-based snakes and ladders media Augmented Reality. Thus, learning media based on snakes and ladders mathematics Augmented Reality can be used as an alternative learning media in class V elementary school.

Keywords:Augmented Reality, Learning Media, Mathematical Snakes and Ladders.

ABSTRAK
Penelitian ini dilakukan di salah satu sekolah dasar di daerah Wates, Kulon Progo. Penelitian ini bertujuan untuk mengembangkan media pembelajaran ular tangga matematika berbasis Augmented Reality untuk peserta didik kelas V dan mendeskripsikan kelayakan media pembelajaran ular tangga matematika berbasis Augmented Reality untuk peserta didik kelas V. Penelitian pengembangan ini menggunakan model penelitian pengembangan ADDIE yang dimodifikasi menjadi tiga langkah, yaitu Analysis (Analisis), Design (Desain) dan Development (Pengembangan). Metode yang digunakan yaitu metode kualitatif dan metode kuantitatif. Hasil penelitian menunjukkan bahwa media pembelajaran ular tangga matematika berbasis Augmented Reality memenuhi kriteria kelayakan yang dibuktikan dengan hasil validasi ahli media mendapatkan persentase skor rata-rata 99,57% dengan kriteria "Sangat Layak", hasil validasi ahli materi mendapatkan persentase skor rata-rata 94,29% dengan kriteria "Sangat Layak" dan hasil angket ujicoba media mendapatkan skor rata-rata respon peserta didik secara keseluruhan yaitu 96,54% dengan kriteria "Sangat Baik". Kemudian, hasil observasi dan wawancara menunjukkan bahwa guru dan peserta didik memberikan respon positif terhadap media ular tangga matematika berbasis Augmented Reality. Dengan demikian, media pembelajaran ular tangga matematika berbasis Augmented Reality dapat dijadikan sebagai alternatif media pembelajaran di kelas V sekolah dasar.

Kata Kunci: Augmented Reality, Media Pembelajaran, Ular Tangga Matematika.

INTRODUCTION

Mathematics is one of the subjects in elementary school. According to Hudojo (2005), mathematics is a field of science related to ideas, structures, whose relationships are arranged logically, reasoning is deductive and can enter other branches of knowledge, and is abstract in nature. The existence of learning mathematics is very important for students, where mathematics is given starting from the elementary school level to the next level to equip students with the ability to think logically, analytically, systematically, critically and creatively. Therefore, students' understanding of mathematics must be correct and thorough following the stages of learning mathematics by applying fun methods and media and applying mathematical principles (Papadakis & Kalogiannakis, 2019).

In mathematics learning activities, teachers and students together become actors in implementing learning objectives. Learning objectives will achieve maximum results if learning activities run effectively (Asmara & Nindiati, 2019. In general, the purpose of learning mathematics in elementary schools is so that students are able and skilled in using mathematics, and able to apply reasoning pressure in the effective application of mathematics (Sulistyawati et al., 2020). The success of mathematics learning activities in elementary schools is indicated by the good mastery of the material by students. One of the success factors in learning activities, namely the teacher's ability to plan and carry out learning activities.

Based on the results of an interview conducted on October 4, 2022 with a class V teacher at one of the elementary schools in the Wates, Kulon Progo area regarding mathematics learning, it shows that students are still confused about the material surface area, volume, and spatial properties. In addition, learning activities are still teacher-centered, so that students quickly feel bored and prefer to be busy alone. This causes learning to be noisy. Teachers have not utilized learning media and the use of technology in learning activities due to the unavailability of learning media in schools, especially spatial media. The teacher only uses textbooks or miniature geometric shapes, so that students are less enthusiastic in participating in learning activities because they seem monotonous. The existence of some of these problems causes student learning outcomes to be still low and students are less active in participating in learning activities.

Based on the existing problems, it is necessary to use learning media in mathematics learning activities, especially in geometric material. Learning media is an important element in learning activities (Verawati et al., 2022; Wikan et al., 2022). According to Yaumi (2018), the word media comes from Latin medium which means between or intermediaries, which refers to something that connects information between sources and recipients of information. Literally, the media means an intermediary between the source of the message and the recipient of the message. Almost the same as this opinion by Nurrita (2018) and Widodo (2018) defines learning media as learning media that can help teachers in learning activities, so that the material delivered becomes clearer and learning objectives can be achieved effectively and efficiently.

The selection of learning media must be adjusted to the objectives to be achieved, the conditions and limitations that exist (Widodo, 2018; Widodo et al., 2018). Hamdani (2011) reveals that the most

important criterion in selecting learning media is the suitability of learning objectives. Thus, in choosing learning media, appropriate considerations are needed. Criteria for selecting learning media according to Maimunah (2016), include conformity with learning objectives, ease of acquiring or creating media, teacher skills in using it, available time allocation to use in learning activities, and the selection of media must be in accordance with the level of thinking of students, so that the material contained is easy to understand.

The use of learning media is adjusted to the level of cognitive development of students. According to Jean Peaget, students aged 7-11 years are at the concrete operational stage (Arfani, 2021; Widodo et al., 2019; Widodo et al., 2020). In the concrete operational stage, students begin to use their logic to think logically with the help of concrete media. In addition, the use of learning media must also be adapted to the characteristics of students, where elementary school students like to play. Learning while playing makes learning activities fun and meaningful. Thus, teachers can use educational game media. Educational game learning media is a tool in learning activities in the form of games that have educational properties. Through these media, it allows students to participate actively in learning activities and will feel happy.

Based on the problems and descriptions above, the researcher developed educational game learning media. The learning media developed in this study is the mathematics snakes and ladders learning media. Mathematical snakes and ladders learning media is the development of learning media from the snakes and ladders game. One example of the game, namely snakes and ladders game. Snakes and ladders game is a game that can be used by teachers in learning activities. Snakes and ladders game is interactive, entertaining, simple and practical, so it is loved by children. The use of snakes and ladders media in learning activities can create a pleasant atmosphere for students. According to Catono (2013), the snake and ladder game is a traditional game that uses dice in its game. In line with this opinion, Husna (2009) revealed that snakes and ladders game is a game that uses dice to determine how many steps a piece must take. In addition, according to Salam et al. (2019) and Wati (2021), snakes and ladders game is a game that is played by more than one person using a game board. This game board has a number of small boxes and in some small boxes there are a number of ladders and snakes that connect to other small boxes.

The developed mathematics snakes and ladders learning media was modified by adding several cards, including question cards, answer cards, challenge cards, zonk cards, score cards and game instructions for ease of use. The question cards in this learning media aim to determine the extent to which students understand and master the geometric material. In addition, to make it more attractive, the learning media for snakes and ladders is adapted to technological developments.

Now the world of education can be integrated using technological advances so that learning can keep up with the times (Ayu et al., 2021: 21). The development of technology and communication today has a big impact on the world of education, especially on learning media. Thus, researchers also modify the learning media for mathematics snakes and ladders by integrating with a technology, namely Augmented Reality. According to Schreer, et al (2005), Augmented Reality is a 3D animation that combines the real world with the virtual world real time and interactive. Besides that, according to Azuma (1997), defines that Augmented Reality is the integration between real objects and virtual

objects in 3D form that runs interactively in a real environment. Augmented Reality can bring up three-dimensional virtual objects that exist in the virtual world into the real world at the same time.

Ismayani (2020) reveals that Augmented Reality has the potential to be used in learning activities. Utilization of learning media by using Augmented Reality useful in increasing student interest in the learning process because of the animation display technology Augmented Reality can be a stimulus for students to be more active in learning activities (Pujiastuti et al., 2020: 97). In line with that with media that utilize technology Augmented Reality, learning can look more real and make students more interested in learning mathematics (Huda & Purwaningtias, 2017).

Benefits of use Augmented Reality in learning activities, that is Augmented Reality easy to develop, reach teachers and students because the majority currently have it smartphone basedandroid. In addition, reducing the burden of teaching materials, such as books, mathematical models in the form of wooden blocks, globe models in geography lessons and so on (Mareta, 2015). Thus, learning activities become more interesting and keep abreast of technological developments.

The advantages of the developed Augmented Reality-based mathematics snakes and ladders learning media are learning media with an Augmented Reality application, so that the marker used is the mathematics snakes and ladders board. In the Augmented Reality Building Space application there is a rotation button, so that the spatial animation objects that appear can be seen from various sides. Thus, it is easier for students to understand the spatial properties. In addition, there is also a sound button that can be turned on or off. 3D animation that appears in cyberspace is equipped with material, such as formulas, properties, nets and examples of questions. Then, the learning media for the game of snakes and ladders mathematics is modified by adding cards, including question cards, answer cards, challenge cards, zonk cards, score cards and is also equipped with game instructions to make it easier to use.

This learning media is able to train the cognitive abilities of students because it is not just a game of snakes and ladders that throws the dice and then runs the pawns from start to finish, but snakes and ladders are packaged in such a way equipped with question cards and challenge cards which contain questions with levels HOTS cognitive, so that it can train students to think HOTS and stimulate students in solving problems. In addition, it trains affective abilities because students are required to comply with the rules of the game and cooperate with each other in working on questions. Thus, this game also instills an attitude of cooperation and mutual respect. Then, practicing motor skills because students roll dice to get numbers, take cards and run pawns from one box to the next. This media also trains social language skills because students play with their friends, so that students can interact well and communicate with each other.

Based on the problems and results of the explanation above, it was found that learning mathematics requires concrete learning media because it is in accordance with the level of cognitive development of students and is interactive. Thus, research was carried out to develop an Augmented Reality-Based Mathematical Snakes and Ladders Learning Media. This study aims to (1) develop learning media based on snakes and ladders mathematics *Augmented Reality* on geometric material for fifth grade students in elementary schools (2) describes the feasibility of mathematics-based

snakes and ladders learning media *Augmented Reality* on building materials for fifth grade students in elementary schools.

METHOD

The type of research used is Research and Development or Research and Development (R&D), with ADDIE model. ADDIE steps, namely as follows: 1) Analysis, 2) Design, 3) Development, 4) Implementation and 5) Evaluation (Dwitiyanti et al., 2020; Rusdi, 2018; Widyastuti et al., 2019). The steps can be shown in the Figure 1.
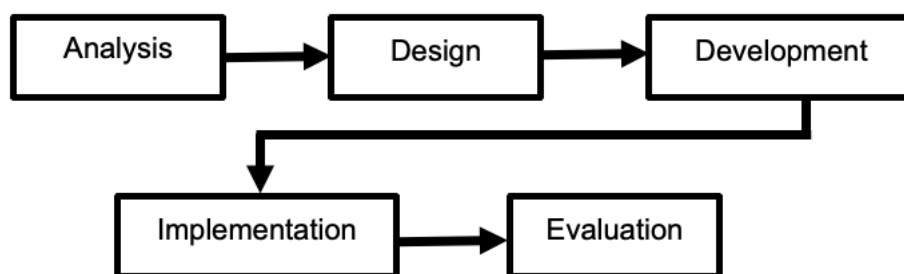

Figure 1. Stages in This Research

However, researchers did not take all the steps of the ADDIE development model. Product development is only up to the third step, namely stage development due to limited time and does not measure effectiveness. Three the steps of this development research, namely: 1) Analysis, 2) Design and 3) Development.

The analysis phase is the pre-design stage to identify problems that exist in schools. At this stage the researcher analyzes the problems behind the emergence of this development. This analysis phase includes 3 stages, namely needs analysis, curriculum analysis and learning environment analysis. The next stage is the design stage. At this stage, the researcher makes a design/design of the product to be developed. At this stage consists of 2 stages, namely determining the structure of the material and making prototype product. Then the last is the development stage. The development stage is the stage in making the product in accordance with the product design at the design stage. The development stage is the production stage. In addition, at this stage the product is revised by the validator in order to get improvements. After that, the product is validated for its feasibility to be used in learning activities. The subjects of this study were fifth grade students at an elementary school in the Wates area, Kulon Progo. which totaled 13 students. Data collection techniques carried out by researchers were observations made when the learning media trials were taking place, interviews were conducted during the analysis stage and after the learning media trials were to find out the responses of teachers and students as well as questionnaires or questionnaires used for evaluating learning media to a team of experts.

Research on the development of mathematics-based snakes and ladders learning media Augmented Reality This study uses qualitative and quantitative data analysis. Qualitative data analysis was used to analyze data in the form of comments and suggestions provided by a team of

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experts, the results of interviews with teachers and students as well as the results of observations during media trials. Meanwhile, quantitative data analysis was used to analyze data in the form of scores from the assessment of the team of media experts, material experts, class teachers and student responses. The results of the validation data scores and product trials are calculated based on the Likert scale. The Likert scale only uses items that are definitely good and definitely bad, including those that are somewhat better, somewhat less and neutral (Nazir, 2005).

The research instruments used were observation guidelines, interview guidelines and questionnaires. The observation guidelines are used at the development stage when testing media in the classroom. This guideline is used to look at class conditions and students' responses to the mathematics-based snakes and ladders learning media Augmented Reality during the trial run. The indicators in the observation guideline include student enthusiasm, creating student activity, increasing student learning enthusiasm, class atmosphere, using media according to the rules, student interest in using media and student responses to media.

The interview guide was used at the analysis stage. This guideline is used for needs analysis, curriculum analysis and facility analysis and is carried out to add information about teacher and student responses to mathematics-based snakes and ladders learning media Augmented Reality. The aspects contained in the interview guide grid at the analysis stage, namely aspects of curriculum and facilities, aspects of mathematics subject matter, aspects of availability of learning media, aspects of using learning media and aspects of the media based snakes and ladders game Augmented Reality. Then, indicators of teacher response interview guidelines, including the advantages of using media, interest in using media, facilitating delivery of material, clarity of media use and creating active learning. Furthermore, indicators of student response interview guidelines, including the attractiveness of media design, the advantages of using media, fostering learning motivation, ease of use of media and feeling helped by the presence of mathematics-based snakes and ladders learning media Augmented Reality.

The last is a questionnaire. The questionnaire is used at the development stage during media assessment to media experts, material experts, class V at one of the elementary schools in the Wates, Kulon Progo area teachers and fifth grade students at one of the elementary schools in the Wates, Kulon Progo area as respondents. The questionnaire is used as an instrument for collecting data from students as well as for product feasibility testing of the products being developed. Aspects in the validation test questionnaire grid for media experts include aspects of media quality, language aspects, design aspects, aspects of the purpose of media presentation, implementation aspects, aspects of media resilience and aspects of media security. Furthermore, the aspects in the validation test questionnaire grid for material experts, including the material aspects, learning aspects and language aspects. Then, the eligibility criteria for learning media based on snakes and ladders mathematics Augmented Reality the classroom teacher validation questionnaire is based on the media expert and material expert validation questionnaire. Then, aspects in the media trial questionnaire grid for students, including material, objectives and benefits, language, attractiveness, learning and implementation.

RESULTS AND DISCUSSION

This learning media was developed using the ADDIE research model using three stages, namely Analysis, Design and Development.

Analysis

In the analysis stage, researchers identify and analyze facts and problems that occur in the field, so that this research can produce products that suit the needs of students. This activity was carried out by interviewing the class V teacher at one of the elementary schools in the Wates, Kulon Progo area. The results of this analysis will become a reference in developing a mathematics-based snakes and ladders media Augmented Reality This. This analysis phase includes 3 stages, namely needs analysis, curriculum analysis and facility analysis. The results of the needs analysis found that it is necessary to develop concrete and more interactive learning media to attract students' learning interest. In addition, so that students are active when participating in learning activities. Then, the results of the curriculum analysis found that the curriculum used was the 2013 curriculum. Then, the results of the analysis of facilities found that the learning facilities owned, especially those used in learning activities in class V, did not support learning activities, such as the unavailability of learning media. The media used by the teacher is only limited to spatial miniatures. Technology owned by teachers, such as laptops and cellphone not yet used optimally.

Design

At the design stage a media design will be produced that will be developed. The design stage of the development of mathematics-based snakes and ladders media Augmented Reality carried out in several processes, namely:

1. Determine the structure of the material

   At this stage, the researcher looks for subject matter regarding geometric shapes that are in accordance with basic competencies from several reference sources.

2. Make prototype product

   At this stage, the researcher determines the components to be made, makes a chart of the components Augmented Reality, determining the appropriate drawings with the subject matter to be included in the design and planning the design of the snakes and ladders game components.

Development

Learning media based mathematics snakes and ladders Augmented Reality which was developed in this study in the form of a modified snakes and ladders game with the addition of several cards, such as question cards, answer cards, challenge cards, cards zonk, score cards and game instructions for ease of use. In addition, integrated with a technology Augmented Reality. Technology Augmented Reality This is in the form of an application that can be installed in smartphone android.

At this development stage, the materials that have been collected previously are arranged and designed using Corel Draw X7 according to the framework that has been prepared. Then, at this stage the researcher also makes an application Augmented Reality. Making Augmented Reality on

this building material using game engine Unity 3D 2017.4.15. The appearance or form of the mathematical ladder snake media can be seen in the Figure 2.

Figure 2 Mathematical Snakes and Ladders Media

The image above contains the components in the mathematical ladder snake, which include the game board, cover media, game instructions, question cards, answer cards, challenge cards, cards zonk, score cards, pawns, dice and a box where toys are stored. Then, for the display of the Augmented Reality application, it can be seen in the Figure 3.

Main Menu Augmented Reality   Build Room Menu Augmented Reality

Figure 3. Display of the Main Menu & Room Building Menu

The main main menu consists of the Layout menu, the Basic Competency and Indicators menu, the Guide menu and the menu About. Then, on the build menu, the user directs the camera at the snake ladder board, where this board is used as marker. After that, it will display 3D geometric objects and also display menus, such as the Formulas menu, which is a menu that displays material about volume formulas and geometric surface areas, the Properties menu, which is a menu that displays material about geometrical properties, the Nets menu, which is a menu that displays material about geometric nets and the Sample Questions menu, is a menu that displays examples of questions about volume, surface area and geometrical properties and how to do it. The KD and indicators menu display basic competencies and learning indicators. Then, on the guide menu shows how to use the application Augmented Reality geometry (Figure 4).
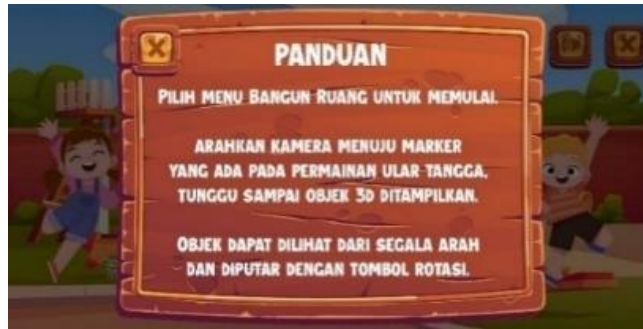
Figure 4 Display KD and Indicator Menu & Guide Menu

Learning media based mathematics snakes and ladders Augmented Reality that has been developed, then consulted with the supervising lecturer to ask for suggestions and comments. Then, validation is carried out using the assessment instrument that has been made. The validation stage was carried out by media experts, material experts and class teachers. This validation aims to obtain comments, suggestions and feasibility assessments of products developed by researchers as a reference for improvement.

1. Media Validation

Media validation was carried out by two validators. Media validation was carried out by two validators. Validator I is a Lecturer in the Elementary School Teacher Education Study Program at a private campus in Yogyakarta who is competent in his field and validator II is a class V teacher at an elementary school in the Wates area, Kulon Progo.

The results of the validator I assessment obtained a score percentage of 99.13% which was included in the "Very Eligible" category to be tested with revisions according to suggestions and the results of validator II obtained a score percentage of 95.65% which was included in the "Very Eligible" category to be tested without suggestions. The comments and suggestions from media experts, namely:

a. Question cards replaced fontits being kind Sans serif

Based on the comments and suggestions from the media experts, the researchers made improvements by changing font Serif that is Times New Roman be fonts Sans serif that is Arial Rounded MT Bold.

Before revision   After revision
Figure 5 Repair font question card

b. Title added class and scope clarified

Based on the comments and suggestions from media experts, the researcher made improvements by adding classes and scope to the title section. These improvements can be seen in Figure 6.

Before Revision   After Revision

Figure 6 Title Improvement

c. Added the campus logo and identity, such as the name of the campus, faculties and departments.

Based on the comments and suggestions from these media experts, the researchers made improvements by adding the campus logo and its identity such as the name of the campus, faculties and departments. These improvements can be seen in Figure 7.
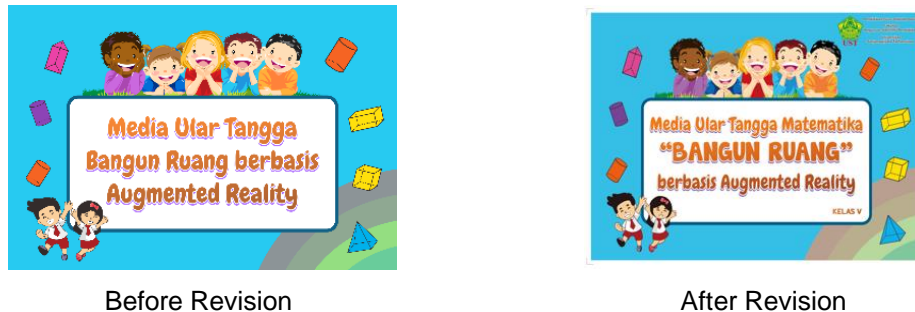

Before Revision   After Revision

Figure 7 Cover Design Improvements

Material Validation

Material validation was carried out by two validators. Media validation was carried out by two validators. Validator I is a Lecturer in the Elementary School Teacher Education Study Program at a private campus in Yogyakarta who is competent in his field and validator II is a class V teacher at an elementary school in the Wates area, Kulon Progo.

The results of the validator I assessment obtained a score percentage of 80% which was included in the "Easy" category to be tested with revisions according to suggestions and the results of validator II obtained a score percentage of 97.14% which were included in the "Very Eligible" category to be tested with revisions according to suggestions. As for comments and suggestions from media experts, namely: re-checking basic competencies and indicators, HOTS has not been seen, so include the grid and level classification of HOTS questions, question packages should be made per sub-material so that they can be used universally in accordance with the material being studied by students, the use of sentences on card questions needs to be clarified, so that they are

not ambiguous, use logical numbers, especially the size of real objects, questions on spatial properties can be more varied and complete challenge cards because there is no answer key yet. In addition, the images in the geometric Augmented Reality application are accompanied by a description of the geometric components/elements. Based on the comments and suggestions from the material experts, the researchers made improvements by adding geometrical elements to the geometric Augmented Reality application. These improvements can be seen in Figure 8.

Before Revision   After Revision

Figure 8 Addition of Component Description

The next stage is to revise according to the suggestions and comments from the validator. After that, the assessment was carried out again to the validator. Then, trials were carried out on fifth grade students at one of the elementary schools in the Wates, Kulon Progo area. The following are the results of the validator's assessment and the results of student responses. The results of the validator's assessment can be seen in Table 1 and the results of student responses can be seen in Table 2.

Table 1. Media Validation Results

Assesment		Percentage	Average	Criteria
Media Expert	Validator I	99,13%	99,57%	Very Worth it
	Validator II	100%		
Material Expert	Validator I	88,57%	94,29%	Very Worth it
	Validator II	100%		

The feasibility of mathematics-based snakes and ladders learning media Augmented Reality this can be seen from the validation results from media experts, material experts and class teachers and student responses. The media is said to be appropriate if it gets a score of ≥ 61% from the expert team and student responses. The results of obtaining an average score from media experts validator I and validator II are obtaining an average score of 99.57% with the criteria of "Very Eligible". Then, the results of obtaining an average score from material experts validator I and validator II are obtaining an average score of 94.29% with the criteria of "Very Eligible".Learning media is said to be appropriate if it includes several indicators including the ability of the media to attract the attention of students and the ability of the media to repeat what students learn (Akbar, 2017).

Table 2. Student Responses Results

Aspect	Gain Score	Max Score	Percentage	Category
Material	191	195	97,95%	Very Good
Objectives and benefits	64	65	98,46%	Very Good

Aspect	Gain Score	Max Score	Percentage	Category
Language	62	65	95,38%	Very Good
Attractiveness	124	130	95,38%	Very Good
Learning	250	260	96,15%	Very Good
Implementation	313	325	96,31%	Very Good
Average	1.004	1.040	96,54%	Very Good

At the time of testing the media, researchers also made observations. The observation results showed that students gave a good response to the mathematics-based snakes and ladders learning media Augmented Reality. The use of media can make students more active and enthusiastic in participating in learning activities. Students work together in a group to work on the questions. This is in line with Slavin's opinion (Afandi, 2015: 79) which reveals that children tend to interact by playing. In addition, the class conditions also became more conducive. Then, judging from how it is used, students use the media according to the rules of the game. It can be concluded that students are interested in mathematics-based snakes and ladders media Augmented Reality.

The results of the interviews can be concluded that teachers are interested in using mathematics-based snakes and ladders media Augmented Reality. The media is in the form of a game that is integrated with a game so it is very interesting. The media can facilitate the delivery of material because the material is complete, starting from understanding, surface area formulas, volume formulas, nets and examples of questions. In addition, the media is equipped with 3D geometric images that contain animation, so that students can see concrete geometric shapes, not just fantasies. The language used is also easy for students to understand. Then, the results of obtaining an average score of student response questionnaires as a whole were 96.54% with the criteria of "Very Good".

This is in line with research conducted by Indah Permatasari (2022) entitled "Development of Learning Media Augmented Reality (AR) Based on Android on Flat Sided Space Building Material to Improve Understanding of Mathematical Concepts" with media and material validation results with a score of 3.50 and 3.56 (feasible to use).

The benefits of using Augmented Reality-based math snakes and ladders learning media in learning activities include increasing the activity of students because in this game learning media all students participate directly, increasing student collaboration because this game learning media is played in groups and in each group. cooperate with each other to solve questions, as well as increase students' interest in learning because students understand geometric material using interesting media. This is in line with opinion Melsi (2015) which revealed that the snakes and ladders learning media has several advantages, including the snakes and ladders learning media being able to train students' dexterity, students become more active, increase student cooperation, motivate students to learn, learning media is easy to play, increase students' learning interest, media snakes and ladders learning is very effective to use, by using snakes and ladders learning media, students will be quicker to answer questions and snakes and ladders learning media are liked by students.

Based on the results of the recapitulation of the results of the validator's assessment and the responses of the students, it shows that the learning media is snakes and ladders based on mathematics Augmented Reality for fifth grade students is feasible to use.

CONCLUSION

Development of Learning Media based on Snakes and Ladders Mathematics Augmented Reality on geometric material using the ADDIE research model which was modified into three stages, Analysis, Design and Development. At the analysis stage, the researcher conducted a needs analysis, curriculum analysis and facility analysis. Then, at the design stage, the researcher determines the structure of the material and makes it prototype product. Furthermore, at the product development stage, the researcher made media, validated, revised and tested the product on students in the class.

Components in the media based mathematics snakes and ladders Augmented Reality, namely Main Menu, Layout Menu, Basic Competency Menu and Indicators, Guide Menu, About Menu, Buttons Sound, Rotation Button, Button Back, Knob Close, game board, cover media, game instructions, question cards, answer cards, challenge cards, cards zonk, score cards, pawns, dice and a box where toys are stored. Application Augmented Reality wake the space installed on smartphone android and a snake and ladder board consisting of 48 squares as marker. The material discussed in the media relates to definitions, surface area and volume formulas, properties, nets, and examples of problems.

The results showed that the learning media for snakes and ladders is mathematics based Augmented Reality meets the eligibility criteria as evidenced by the validation results of media experts getting an average score percentage of 99.57% with the "Very Eligible" criteria, the material expert validation results get an average score percentage of 94.29% with the "Very Eligible" criteria and the results of the media trial questionnaire get an average overall student response score of 96.54% with the "Very Good" criteria. Then, the results of observations, interviews with fifth grade teachers and student interviews also showed that teachers and students gave positive responses to the mathematics-based snakes and ladders media Augmented Reality. Thus, learning media based on snakes and ladders mathematics Augmented Reality for V grade students is feasible to use.

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