Development of Fukado Learning Media on Mathematics Content of Space Building Materials on The Improvement of Student Results Class VI at SD Negeri Sadeng 01 Semarang City

Nizar Farid [a,1], Nursiwi Nugraheni [a,2]

[a] Universitas Negeri Semarang, Indonesia

[1*] fnizar1123@students.unnes.ac.id ; [2] nursiwi@mail.unnes.ac.id

* corresponding author

Abstract

The purpose of this study was to develop Fukado media with Borg and Gall's development theory through 10 stages of development so that the developed media can be used to achieve learning objectives, namely improving student learning outcomes. The research subjects used 6th-grade students at SD Negeri Sadeng 01 Semarang City with 27 students. Augmented reality is one of the media that can help with learning. The development of this media is done by analyzing problems, designing media, media validated by experts, and testing on learning. The effectiveness of this learning media is seen with assessment instruments on validity, effectiveness, and practicality. Media development that has gone through various stages of development is declared successful with a level of validity of media, material, and language of 88%, 95%, and 91% respectively, The effectiveness of the media can be seen from the increase in learning outcomes in mathematics learning with the difference in the average student score reaching 15 from the original 61 to 76 obtained from trials with pretest and posttest.

INTRODUCTION

Education has a very important role in helping to realize the nation's vision of building a better future of a nation. In the Constitution of the Republic of Indonesia, paragraph 4 defines the purpose of how important education is in realizing the goals of national education, namely

educating the nation's life, showing how important education is as a tool to improve the quality of human resources. Education is a conscious effort to prepare students in their future roles through guidance, teaching, and training activities (Ananti, 2022). The goal is to foster individuals who have national ideals, professional excellence, and strong competencies that can be effectively utilized for the progress of the nation and state (Gabriela, 2023).

The purpose of education is to generate a sense of patriotism and nationalism, which are important foundations for strengthening national unity. Through education, we seek to foster attitudes of tolerance, empathy, and cooperation in each individual, so that they can play an active role in creating a harmonious and inclusive society. In addition, education aims to instill democratic values such as freedom of speech, respect for differences, and deliberation, which allows every voice to be heard and every decision to be made through constructive dialogue. All of this plays an important role in preserving and developing the nation's culture, ensuring that our culture is not only preserved as a heritage but also continues to develop and reflect the identity and progress of society (Ki Hajar Dewantara in Kilas Rakyat, 2024). The Indonesian nation is committed to developing human resources that have adequate skills and knowledge so that other countries become destinations in the competition that encourages healthy nations. The educational process can make humans explore new things in themselves that are latent and abilities that have existed since birth, including the ability to think critically, creatively, and innovatively. Education can also provide support to individuals in gaining an understanding of moral and ethical values that are important for forming good character. In addition, education can also support individuals in developing essential skills for everyday life, including the ability to read, write, count, and communicate effectively (Ohlssen & Krempecki, 2020).

In teaching and learning activities, educators are responsible for delivering learning materials effectively and providing a conducive environment for students to learn (I Wayan Cong Sujana, 2019). Meanwhile, students are responsible for being active in learning activities, paying attention to learning materials, and asking questions when needed, including learning mathematics content at the elementary school level. Students are expected to be able to absorb the knowledge that has been conveyed by the teacher in class and become the successor of the nation who can apply the knowledge that has been conveyed to real life, in which application students need to actively increase knowledge at school. Elementary school (SD) level in understanding learning, especially in the discipline of mathematics, potentially still has many shortcomings. The shortcomings that can be owned by students are the lack of student interest in learning in class, lack of activeness, and students often think that math is a difficult subject that requires calculating and understanding abstract things. Mathematics learning also has several problems, especially in the school studied by the researcher, namely Sadeng 01 State Elementary School, Semarang City. One of the problems in this school is the lack of understanding of abstract things in math learning. The lack of interest or enthusiasm of students in participating in learning is also driven by learning mathematics which according to students is a difficult lesson so in Mathematics lessons, students have low learning outcomes.

Based on observations, students tend to understand learning better when given media that is relevant to what the students are learning, so with the media, students can easily understand abstract things that students cannot understand only with shadows. In learning at this school, there are obstacles to learning, namely the lack of maximum students in understanding learning. Especially in explaining abstract concepts in math subject content. To explain these abstract concepts, teachers need the right learning media to describe and explain to students the form of these abstract concepts so that it has an impact on low student learning outcomes. Media is crucial

in helping students understand abstract concepts (Kozma in Yaumi, 2017) in mathematics content, especially at Sadeng 01 State Elementary School in Semarang City. Media becomes a learning tool for students to understand the content taught in class (Reiser and Dempsey in Yaumi, 2017). One of the influences in learning is how students can understand the concept. This also affects the learning outcomes of mathematics students.

The results of the observation found that student learning outcomes in class VI SDN Sadeng 01 Semarang were still low, due to a lack of variation in the use of media, so the use of learning media did not help students understand the material and had an impact on low student learning outcomes. Therefore, the media becomes a tool needed to make students more happy to respond in the process of joint activities in the classroom such as the use of appropriate and effective media. In this study, it discusses the various variables it, namely learning media in the form of Augmented Reality-based Fukado Learning Media and Flashcards. Based on the problems regarding learning in schools that have been observed by these researchers, researchers are interested in developing two different media on one platform. The learning media is assisted by physical media in the form of Flashcards which in its use can help facilitate student understanding in understanding abstract things where the development of learning media is in the form of media that can visualize abstract things in the form of Augmented Reality. Therefore, researchers want to conduct the development of Fukado Learning Media at SD Negeri Sadeng 01 Semarang City to improve the learning outcomes of grade VI students of Mathematics subject matter of building space.

The novelty in this research is that the development of Fukado learning media was developed using Unity 3D software. The content on the learning media is the content of mathematics lessons with the material of building space. The learning content contains material with a cognitive level in the C4 domain or already in the HOTS stage and the appearance of this media has an attractive color and media design so that students are not bored in learning. Other content that can be accessed on this media is its use in completing LKPD which attracts students by providing a game that contains finding answers together using AR, where students will use the media to correct the answers they get from working in groups outside the room by scanning flashcards. This research will answer the formulation of the problem under study in the form of the design and feasibility of developing Fukado Learning Media on Mathematics subject matter of building space class VI at SD Negeri Sadeng 01 Semarang City and questioning the effectiveness of the use of learning media in its application in learning on its effect in improving learning outcomes.

LITERATURE REVIEW

In recent years, especially in the field of education, the development of Augmented Reality and Flashcard media has been the focus of study. Augmented Reality and Flashcards can help students better understand the subject matter, here are some literature reviews that exist in this study:

Development

Development is a process, method, or action. According to the General Indonesian Dictionary by WJS Poerwadarminta, Development is the process of making something develop, change completely (knowledge, thinking, etc.). Planning, implementation, and evaluation are part of the development process. with refinement activities to achieve a form that is considered sufficient.

Learning Media

In its early development, the term "learning media" only included teachers, chalk, and textbooks at first, and is still used today. According to the opinion of Reiser and Dempsey in the thesis prepared by Sarif Nirwana, a student of Semarang State University written in 2023, learning media is more often considered a tool for delivering lessons today. Learning media is considered a physical tool to convey lessons to students. According to this definition, all physical tools used for teaching are categorized as learning media. This includes equipment such as computers, textbooks, audio, visual, or other devices. We can see that learning media are all tools and physical materials that are used to organize learning in the classroom and help achieve predetermined goals in learning. According to Scanlan's opinion in the thesis prepared by Sarif Nirwana, a student of Semarang State University written in 2023, learning media can include traditional media such as real objects, chalk, diagrams, slides, overheads, and videotapes or films, as well as modern media such as computers, DVDs, the Internet, and interactive video conferencing.

Flashcard

Budi Febriyanto (2019) in his journal entitled "The use of Flash Card media to Improve Elementary School Student Learning Outcomes" cites several definitions of Flashcards from several researchers. The first is Asyhar argues that when viewed from the form of flashcards containing media that can be seen as flat or two-dimensional, in other words, media that are long and wide, especially those used as a form of communicating messages in education, facts can be revealed when used through the use of words, numbers, and symbols or symbols in various forms. Susilana and Riyana also said that "Flashcards have several advantages, namely: (a) portable, (b) practical, (c) easy to remember, and (d) fun. The discussion continues by including opinions by Fitriyani and Nulanda who state that flashcards are practical media that when used by teachers and students simultaneously can facilitate learning. Learning by seeing images can be more easily recognized by students than writing, this is evidence that visual imagery can provide a more effective flow of knowledge into the brain. Therefore, flash cards can be a medium that can be used to mediate the problem of running activities on the lessons discussed and help students improve their learning outcomes.

Augmented Reality

James R. Valino describes Augmented Reality technology as a technology can unite two-dimensional and three-dimensional virtual objects and then display them in the form of virtual objects in real life (Sada Dwi Artika, 2020). Augmented Reality is a technology that can combine the virtual world and the real world in one use, which in its implementation can interact in real time and resemble three-dimensional animation (Mafalda, 2017). Therefore, Augmented Reality (AR) is the development of technology that integrates two-dimensional or three-dimensional virtual objects into the real world and then displays them in the form of virtual objects in real time. The virtual world and the real world combined in one Augmented Reality (AR) concept allow interaction between the real world and the virtual world. It allows concepts that the technology system collects and then places objects in the real space so that the separation between the two has a space that becomes thinner. In this way, all information can be displayed in real time as if the data is interactive and real. In a journal written by Nabila Alfitriani (2021) in the Journal of Educational Research, Thomas P. Caudell is the person who first used the term "Augmented Reality" to describe AR. Combining the virtual world and the real world, providing explanations in a more interesting and realtime manner, and displaying in the form of three-dimensional objects with three characteristics that show that the technology can actually display the concept of Augmented Reality (AR).

Learning Outcome

An important point in the learning process that is always considered by learning actors is learning outcomes. In a journal written by Pradana (2020) quoting Nana Sudjana's opinion on the definition of learning outcomes that the important point is a change in students' conscious or unconscious movements as a result that shows changes in learning with a broader understanding that includes matters related to cognitive, effective, and psychomotor. Assessment of learning outcomes and processes has a bond with each other that helps each other. Agus Suprijono in a journal written by Pradana (2020) also has the opinion that the results of changes in learning are in the form of attitudes, morals, understandings, appreciation, and skills. From the teacher's side, after the process. learning is carried out and then ends. with an assessment process to show the results. learning. From the student's side, learning outcomes become the final benchmark of the learning process by declaring the completion of the teaching. The statement as well as the opinion of an expert is reinforced by the opinion of Nana Sudjana in a journal written by Pradana (2020) which states that the results of learning changes are written or unwritten skills that students can have after students finish receiving their learning experience. The learning outcomes that are the benchmarks of this study are focused on the learning outcomes of the cognitive domain of Mathematics on the material of building spaces in class VI. Learning outcomes are measured through pretest and posttest.

RESEARCH METHOD

The research method referred to in making this research is a method that helps in research and development (Research and Development). This research is research used to make a product that can be used with detailed and detailed research steps to be used to test the final product with product effectiveness parameters (Sugiyono, 2015: 407). The procedure or stages of developing Fukado learning media for the content of Mathematics class VI building material at SD Negeri Sadeng 01 Semarang uses the development theory from Borg and Gall whose development stages consist of up to ten stages, namely potential and problems, data collection, product design, product design validation, product design revision, product trial (small scale), product revision, product trial (large scale), final product, mass production (not implemented). In the research and development of Fukado learning media, from 10 development steps, researchers will carry out development starting from analyzing potential and problems to limited product production for research purposes at the research elementary school. In the mass production of learning media in the form of applications that if you want to be mass produced so that it can be used by many audiences, especially teachers who utilize this learning media, it cannot be implemented due to the limitations of researchers in releasing these applications on digital platforms on Android.

The research subjects in this study were grade VI students at SD Negeri Sadeng 01 Semarang with a sample size of 27 students. The independent variable or independent variable that is the focus of this research is Fukado learning media with the dependent variable or bound is the effect on improving the learning outcomes of grade VI students. The technique used by researchers to test the feasibility of media after designing media before being tested on grade VI students is to test the validity of the media that has been developed and assessed by product experts covering media experts, material experts, and language experts. The value that has been obtained from the assessment obtained from the expert assessment questionnaire is then converted into a percentage with the formula = (score obtained: maximum score) x 100%. The percentage of product validation results by experts is then determined by its feasibility with a scale based on

the criteria of very feasible, feasible, quite feasible, less feasible, and very unfit which the rating scale can be seen in the table below.

Table 1. Expert Validation Assessment Criteria

Percentage	Criteria
86% - 100%	Very Feasible
76% - 85%	Feasible
60% - 75%	Quite Feasible
55% - 59%	Less Feasible
< 55%	Very Unfit Feasible

Source: Purwanto, 2013:102

The data obtained from the results of the product or media trials that have been developed, then tested to find out the data that has been obtained from the test results are normally distributed using the normality test before testing the effectiveness of the product or media developed using the paired t-test and N-gain.

The normality test is a test that is devoted to the requirements before the data obtained can be tested for effectiveness before and after the product trial can be normally distributed. The test used for the normality test is the Shapiro Wilk test with the criteria for assessing the significance of data said to be normally distributed if the significance value> 0.05 and the data is said to be not normally distributed if the significance value is <0.05. Data that has been tested for normality and said to be normally distributed can then be tested for product effectiveness using the paired t-test and N-gain. The paired t-test can be concluded by testing the initial hypothesis of the product with the following hypothesis.

H_0 = The development of Fukado Learning Media is not effective in improving the learning outcomes of 6th grade students on the material of building space at SD Sadeng 01 Semarang City

H_a = The development of Fukado Learning Media is effective in improving the learning outcomes of 6th grade students on the material of building space at SD Sadeng 01 Semarang City.

To find out the results of hypothesis testing that has been carried out, it can be tested using the paired t-test with decisions taken according to the article written by Ade Setiawan (2024), it can be concluded by determining the results of the data calculation then if the calculated significance value data is more than 0.05 then Ha is rejected and H0 is accepted or if the calculated significance value is less than 0.05 then Ha is accepted and H0 is rejected. To measure the results of changes in students' abilities after testing the media in learning, the N-gain test was carried out with assessment criteria.

Table 2. N-gain Interpretation

Interval Gain	Criteria
$g \geq 0,7$	Very Feasible
$0,3 \leq g \leq 0,7$	Feasible
$g \leq 0,3$	Quite Feasible

Source: Melzer dalam Yudi Guntara, 2020

Hake in Yudi Guntara (2020) wrote a formula to determine the results of the N-gain test for pretest and posttest data in order to make it easier to know the achievement of learning in the classroom as seen from the results of student learning. The N-gain test score for each student can be calculated in the formula = (Posttest - pretest) / (100 - pretest) and the results of the N-gain score are tested on SPSS to find the average N-gain of student learning outcomes.

RESULTS AND DISCUSSION

The Research and Development (R&D) is a research design in this study which was chosen for guidelines for developing products because the researcher quoted from Sugiyono's statement (2016: 407) which describes the meaning of Research and Development (R&D) research as a research design that can be described as a form of creating finished results or products then calculations are carried out that find out the effectiveness of the products developed first from the products that have been developed in order to produce products that are relevant to the objectives to be achieved. In addition, Batubara (2020: 43) argues that learning media development research is a process of producing and developing media through a research process so that the media obtained is valid and suitable for use in learning. In this study using the development model according to Borg and Gall in Sugiyono (2015: 409) with ten stages of implementation, which include: (1) potential and problems; (2) data collection; (3) product design; (4) design validation; (5) design revision; (6) product trial (small scale); (7) product revision; (8) usage trial (large scale); (9) product revision; (10) mass product manufacturing (not implemented). These stages will help a product designer to create a product that achieves the product design goals that have been conceptualized by the designer by going through the potential and problem analysis stages, which then the data can help in the preparation of the product. Product design is quite easy to understand if you can follow the steps in detail.

Learning media development is the focus of this research. Learning media is a tool that can assist in learning in conveying messages or material from teachers to students. Learning media has benefits as a tool for teachers to achieve learning objectives so that the material can be explained more easily and can be understood by students. Another benefit of learning media is that it helps in the presentation of material that can produce quality learning so that in the use of learning, learning media can help in improving learning outcomes which are the variables affected in the study. In this study, the media developed is Augmented Reality-based media. Augmented Reality combines the virtual world and the real world, providing explanations with more interesting and realtime, and displaying in the form of three-dimensional objects that in its application to learning media can explain abstract concepts in learning mathematics space building materials that become the content of the media developed. Augmented Reality combines the virtual world and the real world, provides explanations with more interesting and realtime, and displays in the form of three-dimensional objects in its application to learning media.

This research has been conducted by several researchers, so this research was conducted using several references in the form of journals or previous theses that have tested media development with RnD research methods as learning media applied to learning with reference research results stating that Augmented Reality-based learning media has an effect in improving student learning outcomes. Journals or theses that are references for the preparation of this journal include a thesis prepared by Muhammad Taqiyuddin, a student of Semarang State University in 2018 with the title "Development of Augmented Reality-Based Science Learning Media on the Subject of the Human Body Organ System for Class VII SMPN 41 Semarang", a journal prepared by Krishna Huda Bagus, a student of PGRI Semarang University in 2020 with the title "Android-Based Learning Media Development Using Augmented Reality on Flat-Sided Space Buildings Material", thesis prepared by Maulina Fitria Ningsih, a student of Syarif Hidayatullah State Islamic University in 2015 with the title "The Effect of Augmented Reality Learning Media on Student Learning Outcomes on the Concept of Waves", a journal prepared by Valentina Rossi Wibowo, a student of Universitas Nusantara PGRI Kediri in 2022 with the title "Development of

Augmented Reality-Based Learning Media on Animal Classification Material for Class V Elementary School".

This research was conducted at SD Negeri Sadeng 01 Semarang City in class VI with a total of 27 students in the Mathematics subject matter of building space. This research refers to the results of interviews, observations and documentation. The data listed is the basis for the development of Fukado learning media on the content of Mathematics on the material of building spaces. This research uses the Borg and Gall development theory with 10 stages of development which are as follows.

Potential and Problems

Researchers conducted a media analysis by interviewing teachers about the use of learning media in the content of grade VI Mathematics lessons at SD Negeri Sadeng 01 Semarang City. From the results of the analysis of the problems in the media used by teachers to attract students' interest can be reached by the teacher by applying the media so that students in participating in learning are happy but less able to reach students' understanding and less variety in the use of media in learning Mathematics in grade VI so that it does not help understand abstract things in learning activities. Teachers are less able to make media that helps students explain abstract things, teacher creativity in utilizing the facilities and infrastructure provided by the school is good in learning but tends to be less attractive to students and less helpful to students in understanding abstract things. In the problems that have been obtained from the results of interviews, observations, and questionnaires, this problem has an impact on low student learning outcomes.

Data Collection

Data collection is assisted by a questionnaire as a means for researchers to obtain data from the data sources to be studied, namely teachers and students. The questionnaire is in the form of needs in the use of AR media. Obtained data on the needs of grade VI teachers and students at SD Negeri Sadeng 01 Semarang City stated that they agreed and needed it in the process of learning mathematics in grade VI. Researchers also took data on the learning outcomes of grade VI mathematics students at SD Negeri Sadeng 01 Semarang City for benchmark comparison before and after using. It was found that the average learning outcomes of mathematics students in grade VI of SD Negeri Sadeng 01 Semarang City were 61.11.

Product Design

In designing a learning media using Canva as a media design tool and unity as a tool in developing a media so that the display can be interactive and can be used in learning. The media design is described as follows.

Figure 1. Main menu, syntax menu, and syntax menu 2

Design Validation

The Augmented Realty-based Fukado learning media assisted by Flashcards developed by the researcher shows the material is feasible to use in learning, the material expert gives a positive response with a total score of 57 and a percentage of 95%. The results show that Fukado's learning media based on Augmented Realty assisted by Flashcards can be tested with a very feasible predicate but revisions are in accordance with criticisms and suggestions, namely problem orientation must be contextual, give sources to the definition of material, clarify questions by mentioning what must be calculated, give known or asked in the questions answered, and give conclusions to the answers.

Fukado learning media based on Augmented Realty assisted Flashcards developed by researchers shows media that is feasible to use in learning, media experts give positive responses with a total score of 53 and a percentage of 88.3%. The results show that Fukado's learning media based on Augmented Realty assisted Flashcards can be tested with a very decent predicate but revised in accordance with criticism and suggestions, namely improving the appearance of the media by giving bright colors to the media, selecting fonts that are upright, and giving decorations related to mathematics. Fukado learning media based on Augmented Realty assisted Flashcards developed by researchers showed a language that is feasible to use in learning, linguists gave positive responses with a total score of 39 and a percentage of 91%. The results show that the Fukado learning media based on Augmented Realty assisted Flashcards can be tested with a very decent predicate but revised in accordance with criticism and suggestions, namely using the use of invitation words and standardized word selection.

Table 3. Material, Media, and Language Validation Results

Validator	Validation Results			
	number of values	maximum value	percentage	criteria
Material	57	60	95%	very worthy
Media	53	60	88%	very worthy
Language	40	44	91%	very worthy

Design Revision

Media that have gone through the validation stage by experts are revised following suggestions from experts, so that the media that has been developed can be used with better effectiveness of use. Here are some revisions to the media display.
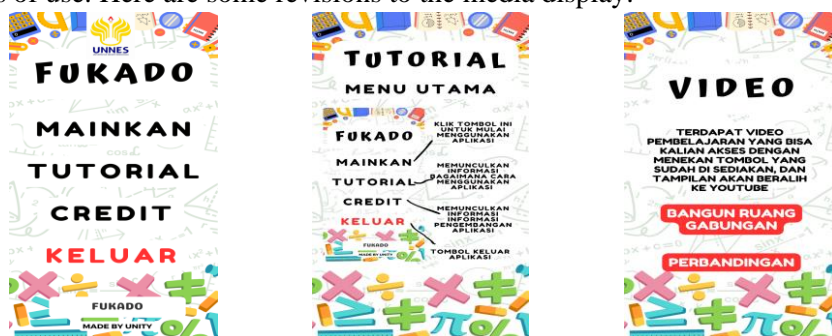

Figure 2. Main menu, tutorial, and learning video views

Product Trial (Small Scale)

The data in this study used are learning outcomes data of 6 students of grade VI SD Negeri Sadeng 01 Semarang City in a small group trial. The use of media was tested on students with

high, medium, and low cognitive levels. The pretest results obtained with an average of 37.50 with 6 students have not been able to meet the learning completeness and the posttest results obtained an average of 69.10 with 4 students have met the learning completeness and 2 students still have not met the learning completeness, but it appears that the learning outcomes in the posttest increased compared to the pretest.

The results of the small group trial showed an increase in learning outcomes marked by an increase in the average student test score which increased by 31.60. Students and teachers in the small group trial filled out a response questionnaire to determine the level of satisfaction in using the media and teachers and students provided feedback on the media to find out the shortcomings and could be input in media development in order to maximize the media so that its use in learning could be more effective. The results of responses from students and teachers stated that they agreed and were satisfied with the use of Fukado learning media with a small note or input from the teacher to improve work instructions on the student worksheet.

Table 4. Small Group Pretest and Posttest Test Results

Action	Small Group Test Results					
	Mark Average	KKM	Mark Lowest	Mark Highest	Amount Completed Students	Percentage
Pretest	37,5	70	20	50	0	0%
Posttest	69,1	70	35	85	4	66,67%

Product Revision

In its use in small group trials, in-depth analysis is needed to determine the effectiveness of the learning media that has been developed in several processes. Researchers need to analyze its use and conduct reflections for researchers and also reflections to students. Feedback from students is needed to find out the shortcomings and interests of students so that the media developed can be more helpful in increasing students' understanding in understanding abstract things in mathematics learning so that learning media can help students in learning and improve student learning outcomes which later reflection and feedback from students can maximize the function of the media and can be tested with more satisfactory product results in helping learning in large group trials. Reflection carried out together with students and teachers by providing feedback on the use of media has been improved by researchers on the developed media. The results of the reflection obtained by asking for feedback from students and teachers were found to be quite satisfactory for the media developed to be applied in learning.

Product Trial (Small Scale)

The data used in this study are learning outcomes data from 27 students of grade VI SD Negeri Sadeng 01 Semarang City. The pretest results obtained with an average of 61.00 with 7 students have met the learning completeness and the posttest results obtained an average of 76.00 with 20 students have met the learning completeness and 7 students still have not met the learning completeness, but it appears that the learning outcomes in the posttest have increased compared to the pretest. From the results of the large group trial, it can be seen that the increase in student learning outcomes can be seen by looking at the increase in the average student test score which increased by 15.00. Students and teachers in the large group trial filled out a response questionnaire to determine the level of satisfaction in using the media and the level of teacher and student satisfaction with the use of Fukado learning media.

Table 5. Large Group Pretest and Posttest Test Results

| Action | Large Group Test Results | | | | | |
	Mark Average	KKM	Mark Lowest	Mark Highest	Amount Completed Students	Percentage
Pretest	61	70	35	85	7	26%
Posttest	76	70	47,5	90	20	74%

Last Product

Products that have been evaluated by experts including material, media, and language experts are then tested on small groups, the product is revised according to recommendations, and then applied to large groups. As a result, grade VI students were asked to help in answering the questions that had been included in the response questionnaire. Based on the overall calculation of the questionnaire score in the form of responses containing questions to respond to the media developed and already used in learning got a percentage of 85.06%, which met the good criteria; the average learning score on the pretest was 61.00, and the average learning score on the posttest was 76.00. The paired t-test was used to examine the pretest and posttest values of the large group trial data to determine the significant effect of the average and indicate the conclusion on the hypothesis that the media is effective. Before testing the hypothesis, the normality test was used to be tested first. The test aims to determine whether the data is normally distributed. The results of the normality test on the data that has been collected show that the data is normally distributed so that the data can be tested for effectiveness. The data that has been tested for normality is then tested paired t-test, obtained paired t-test results with a p-value of <0.001 and these results drawn conclusions with the inference process written by Ade Setiawan (2024), if the p-value <0.05, then the change in learning outcomes after the media is tested in the learning has a significant change, so that the data shows that the use of Fukado learning media has a significant difference compared to before the use of the media. The N-gain test is the second test to determine the effectiveness of a media by calculating the difference between the pretest and posttest scores with the results of the N-gain calculation in the 6th grade treatment after the developed media has been tested. The N-Gain value in the large-scale trial received a score of 0.4078 and according to Melzer's assessment criteria, this figure falls into the criteria for moderate effectiveness. Based on the results obtained in the research that has been carried out, this study answers the questions in the formulation of the problems that have been formulated and finds that media development is declared successful marked by changes in the increase in student learning outcomes assessed using pretest and posttest question instruments. These results are in line with research that has been conducted by Muhammad Taqiyuddin, a student of Semarang State University, Krishna Huda Bagus, a student of PGRI Semarang University, Maulina Fitria Ningsih, a student of Syarif Hidayatullah State Islamic University, Valentina Rossi Wibowo, a student of Nusantara PGRI Kediri University who has examined the development of Augmented Reality media using the RnD research method successfully tested Augmented Reality media in classroom learning and the results of the study state that Augmented Reality-based media is effectively used in learning to improve student learning outcomes.

CONCLUSION

The conclusions in this study are as follows. The development of Fukado learning media through several stages of development that refer to the Borg and Gall development theory with stages from potential and problems to the final product. Based on the assessment from the media, material, and language validators, the eligibility scores were 88%, 95%, and 91% respectively. The expert assessment states that the Fukado learning media that has been developed is declared feasible to be tested in a lesson with a note of revision so that the media can be more effective when used in learning. The media that has been validated and evaluated by the validator was tested on a large group of 6th-grade students of Sadeng 01 State Elementary School in Semarang City with 27 students as the research sample, the average results of math learning outcomes have increased after using the media. The average learning outcome on the pretest was 61.00, while the average result on student learning after applying the final product of the developed media, namely on the posttest was 76.00. Based on the overall calculation of the acquisition of questionnaire scores in the form of responses containing questions to respond to the media developed and already used in learning got a percentage of 85.06%, which is in good criteria while the teacher's response got a percentage of 90.1%, which is in very good criteria.

The paired t-test is used to examine the pretest and posttest scores of a large group to determine the significant effect of the average, obtained paired t-test results with a p-value of <0.001 and these results if drawn conclusions with the inference process written by Ade Setiawan (2024), if the p-value <0.05, then the test has a significant change so that the data shows that the use of Fukado learning media has a very significant difference compared to before the use of the media.

BILIOGRAPHY

Alfitriani, N., Maula, W. A., & Hadiapurwa, A. (2021). Penggunaan Media Augmented Reality dalam Pembelajaran Mengenal Bentuk Rupa Bumi. In *JPP* (Vol. 38, Issue 1). https://doi.org/10.15294/jpp.v38i1.30698

Parsa, I Made. (2018). *Evaluasi Proses dan Hasil Belajar*. https://www.researchgate.net/publication/323986537

Elektro, J. E., Chandra Nugraha, A., Bachmid, K. H., Rahmawati, K., Putri, N., Raihan, A., Hasanah, N., & Rahmat, A. (2021). *RANCANG BANGUN MEDIA PEMBELAJARAN BERBASIS AUGMENTED REALITY UNTUK PEMBELAJARAN TEMATIK KELAS 5 SEKOLAH DASAR* (Vol. 05, Issue 2). https://journal.uny.ac.id/index.php/jee

Febriyanto, B., & Yanto, A. (2019). Penggunaan media Flash Card untuk Meningkatkan Hasil Belajar Siswa Sekolah Dasar. *Jurnal Komunikasi Pendidikan*, *3*(2), 108–116. http://journal.univetbantara.ac.id/index.php/komdik/

Hamdani, R., & Sondang Sumbawati, M. (2020). *PENGEMBANGAN MEDIA PEMBELAJARAN BERBASIS AUGMENTED REALITY PADA MATA KULIAH SISTEM DIGITAL DI JURUSAN TEKNIK INFORMATIKA UNESA*.

Huda Bagus, K. P., Buchori, A., & Nur Aini, A. (2018). Pengembangan Media Pembelajaran Berbasis Android Menggunakan Augmented Reality Pada Materi Bangun Ruang Sisi Datar. *Jurnal Pendidikan Matematika Dan Sains*, *1*, 61–69. http://journal.uny.ac.id/index.php/jpms

J., Pernanda, R., Darma, Y., Irvandi, W., Kunci, K., & Masalah, P. (2023). *Pengembangan LKPD Berbasis Problem Solving Bermuatan Ethnomatematika Terhadap Kemampuan Pemecahan Masalah Siswa*. Jurnal Dimensi Pendidikan dan Pembelajaran, *11*, 2023. http://journal.umpo.ac.id/index.php/dimensi/index

Ripai, I., Ropiah, O. (2023). *Media Pembelajaran Digital Berbasis Prezi pada Matakuliah E Commerce terhadap Hasil Belajar Mahasiswa Pendidikan Teknologi Informasi dan Komunikasi STKIP Muhammadiyah Kuningan*. Jurnal Dimensi Pendidikan dan Pembelajaran, *11*, 2023. http://journal.umpo.ac.id/index.php/dimensi/index

Agustiani, S. (2023). *Peningkatan Hasil Belajar Menerapkan Pengetikan (Keyboarding) pada Muatan pelajaran Teknologi Perkantoran Melalui Strategi Peer Lessons Siswa Kelas X OTKP 2 SMK Negeri 1 Ponorogo*. Jurnal Dimensi Pendidikan dan Pembelajaran, *11*, 2023. http://journal.umpo.ac.id/index.php/dimensi/index

Ramadhani, W. F., Pahlevi, T. (2023). *Pengaruh Model Pembelajaran Simulasi Berbantuan Media Pembelajaran Kumospace terhadap Hasil Belajar dan Motivasi Belajar Siswa Kelas XI MP di SMK Negeri 1 Ngawi*. Jurnal Dimensi Pendidikan dan Pembelajaran, *11*, 2023. http://journal.umpo.ac.id/index.php/dimensi/index

Siregar, B.V., Nugrahanta, G.A. (2022). *Permainan Daerah untuk Usia 7-9 Tahun Alamat korespondensi: Universitas Sanata Dharma* . Jurnal Dimensi Pendidikan dan Pembelajaran, *1*, 2022. http://journal.umpo.ac.id/index.php/dimensi/index

Renggani, S. A. (2023). *Pengembangan Media Pembelajaran Interaktif Berbasis Android Pada Muatan pelajaran IPAS Kelas 4 SD*. Jurnal Dimensi Pendidikan dan Pembelajaran, *11*, 2023. http://journal.umpo.ac.id/index.php/dimensi/index

Khotimah, K., Siwi Satiti, W., Matematika, P., A Wahab Hasbullah Jl Garuda No, U. K., & Jombang, T. (2019). Pengembangan Media Pembelajaran Berbasis Augmented Reality Pada Materi Bangun Ruang Sisi Datar Kelas VIII. *Seminar Nasional Multidisiplin*.

Listiawan, T., Hayuningrat, S., & Anwar, M. K. (2017). Pengembangan media pembelajaran berbasis Augmented Reality pada materi bangun ruang. *Jurnal Pendidikan Dan Pembelajaran Matematika)*, *8*(2), 1–10. https://doi.org/10.29100/jp2m.v8i2.2022

Mohd Fadzil, M. Z., & Mohd Noor, N. A. Z. (2023). Mengintegrasikan Augmented Reality dalam Pembelajaran Bentuk 2D dan 3D. *Journal of Engineering, Technology, and Applied Science (JETAS)*, *5*(1), 12–22. https://doi.org/10.36079/lamintang.jetas-0501.500

Mustaqim, I., Pd, S. T., & Kurniawan, N. (2017). *PENGEMBANGAN MEDIA PEMBELAJARAN BERBASIS AUGMENTED REALITY*. http://journal.uny.ac.id/index.php/jee/

Nasution, N., Darmayunata, Y., & Wahyuni, S. (2022). Pengembangan Media Pembelajaran Anak Usia Dini berbasis Augmented Reality. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *6*(6), 6462–6468. https://doi.org/10.31004/obsesi.v6i6.3408

Nurrita, T. (2018). *PENGEMBANGAN MEDIA PEMBELAJARAN UNTUK MENINGKATKAN HASIL BELAJAR SISWA* (Vol. 03). https://doi.org/10.33511/misykat.v3i1.52

Praptaningrum, G., Sukamti, S., & Suhartono, S. (2023). Analisis Penggunaan Media Pembelajaran pada Pembelajaran Tematik Kelas II di SD. *Jurnal Pembelajaran, Bimbingan, Dan Pengelolaan Pendidikan*, *3*(2), 124–136. https://doi.org/10.17977/um065v3i22023p124-136

Qorimah, E. N., Laksono, W. C., Hidayati, Y. M., & Desstya, A. (2022). Kebutuhan Pengembangan Media Pembelajaran Berbasis Augmented Reality (AR) pada Materi Rantai Makanan. *Jurnal Pedagogi Dan Pembelajaran*, *5*(1), 57–63. https://doi.org/10.23887/jp2.v5i1.46290

Ramdani, N. G., Fauziyyah, N., Fuadah, R., Rudiyono, S., Septiyaningrum, Y. A., Salamatussa'adah, N., & Hayani, A. (2023). Definisi Dan Teori Pendekatan, Strategi, Dan Metode Pembelajaran. *Indonesian Journal of Elementary Education and Teaching Innovation*, *2*(1), 20. https://doi.org/10.21927/ijeeti.2023.2(1).20-31

Sari, V. A., Arfuah, N., Ardiansyah, W., Syara, A., Pameila, N., & Fauziah, A. (2023). *Seminar Nasional Inovasi Pendidikan Ke-7 (SNIP 2023) SHEs: Conference Series 6 (3) (2023) 58-64 Pengembangan Media Pembelajaran Flashcard Digital Berbasis Etnomatematika untuk Pembelajaran Matematika Sekolah Dasar*. https://jurnal.uns.ac.id/shes

Seviana, R. (2022). Pengembangan Media Pembelajaran Augmented Reality pada Pembelajaran Geografi Materi Planet di Tata Surya. *Geodika: Jurnal Kajian Ilmu Dan Pendidikan Geografi*, *6*(2), 198–208. https://doi.org/10.29408/geodika.v6i2.6122

Shinta, G., Wibowo, D., Primadhany, I. C., & Meilani, P. (2023). *Pancasila sebagai Karakter Bangsa*. *2*.

Sungkono, S., Apiati, V., Santika, S., Matematika, P., Siliwangi, U., Siliwangi, J., 24, N., Tasikmalaya, J., Barat, I., & Com, S. S. (2022). *Mosharafa: Jurnal Pendidikan Matematika Media Pembelajaran Berbasis Teknologi Augmented Reality*. *11*(3). http://journal.institutpendidikan.ac.id/index.php/mosharafa

Usmaedi, U., Fatmawati, P. Y., & Karisman, A. (2020). PENGEMBANGAN MEDIA PEMBELAJARAN BERBASIS TEKNOLOGI APLIKASI AUGMENTED REALITY DALAM MENINGKATKAN PROSES PENGAJARAN SISWA SEKOLAH DASAR. *Jurnal Educatio FKIP UNMA*, *6*(2), 489–499. https://doi.org/10.31949/educatio.v6i2.595

Wibowo, V. R., Eka Putri, K., & Amirul Mukmin, B. (2022). Pengembangan Media Pembelajaran Berbasis Augmented Reality pada Materi Penggolongan Hewan Kelas V Sekolah Dasar. *PTK: Jurnal Tindakan Kelas*, *3*(1), 58–69. https://doi.org/10.53624/ptk.v3i1.119

Wijaya, C., 1, S., Gede Margunayasa, I., & Werang, B. R. (2023). Android Pada Materi Sistem Tata Surya Untuk Siswa Kelas VI Sekolah Dasar. *INNOVATIVE: Journal Of Social Science Research*, *3*, 4261–4275. https://j-innovative.org/index.php/Innovative