# DEVELOPMENT OF AUGMENTED REALITY-BASED LEARNING MEDIA IN GRADE II ELEMENTARY SCHOOL

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**Abstract**

This research uses the R&D (Research and Development) method. The application development process uses the ADDIE development model. Data collection techniques use observation techniques, interviews, questionnaires, and pretest-posttest questions. After media product development, validation tests by media and material experts, and product implementation in the implementation of learning in grade II SD N Nirmala, the results showed that Augmented Reality-based fractional learning media in grade 2 elementary school material developed was suitable for use as learning media. This learning media can increase the understanding of grade 2 elementary school students about the basic concept of fractions. With this media, students become more enthusiastic in participating in learning activities.

**Keywords:** Augmented Reality, Learning Media, Math, Fractions

# PENGEMBANGAN MEDIA PEMBELAJARAN BERBASIS AUGMENTED REALITY PADA MATERI PECAHAN KELAS II SEKOLAH DASAR

**Abstrak**

Penelitian ini menggunakan metode R&D (Research and Development). Proses pengembangan aplikasi menggunakan model pengembangan ADDIE. Teknik pengumpulan data menggunakan teknik observasi, wawancara, angket, dan pengerjaan soal *pretest posttest*. Setelah dilakukan pengembangan produk media, uji validasi oleh ahli media dan materi, implementasi produk pada pelaksanaan pembelajaran di kelas II SD N Nirmala, hasil penelitian menunjukkan bahwa media pembelajaran pecahan berbasis *Augmented Reality* pada materi kelas 2 SD yang dikembangkan telah layak digunakan sebagai media pembelajaran. Media pembelajaran ini mampu meningkatkan pemahaman siswa kelas 2 sekolah dasar tentang konsep dasar pecahan. Dengan adanya media ini siswa menjadi lebih antusias dalam mengikuti kegiatan pembelajaran.

**Kata Kunci:** *Augmented Reality*, Media Pembelajaran, Matematika, Pecahan

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**INTRODUCTION**

Active and engaging learning is a desire for all educators, and one of the steps that can be taken is to integrate instructional tools into the teaching and learning process. Instructional media is an example of instructional tools in the form of physical facilities used to deliver course material. The purpose of instructional media is to facilitate the teaching and learning process, increase the efficiency of teaching and learning, and help students concentrate on the learning process (Astuti, et al., 2017). Therefore, educators must use instructional media to support the learning activities for higher quality and effective facilitation of students.

The selection of appropriate media should be done in a manner that is appropriate. Educators should be more selective in choosing media for use during teaching and learning, as stated by (Miarso, et al., as cited in Fatikh, 2019). To use media effectively, educators must find and select media that meet the learning needs, attract students' interest, and align with their developmental stages, experiences, and unique characteristics. In the modern era, there is an increasing variety of media, especially those involving digital devices. Augmented reality is a technology that has emerged recently and is believed to enhance student motivation and learning enthusiasm (Setyawan et al., 2019). Using augmented reality as an instructional medium can introduce digital technology to students and deliver learning materials engagingly and interactively.

Augmented reality as an instructional medium is employed to explain information about the learning materials. This technology allows educators to present the learning materials more easily, as students can realistically see objects. AR technology makes abstract or virtual concepts appear real (Mahendra, 2021). This media can be implemented for various subjects, including mathematical concepts such as fractions.

Mathematics, being abstract, can be challenging for students to grasp basic concepts. Thus, augmented reality can provide students with a more enjoyable learning experience through visual representations. Additionally, students can better understand and relate to fractions in their daily lives. In creating augmented reality-based instructional media, Unity is a useful application for developing 3D objects (Nugroho & Pramono, 2017), which can be utilized in the development of augmented reality-based educational applications. Numerous studies have explored the development of instructional media for teaching fractions. For instance, Pujianingtyas (2019) developed a fraction learning media as a magazine with visuals and a set of related questions. Furthermore, Purnama (2021) researched the development of interactive instructional media based on Google Slides for teaching simple fractions in elementary schools, including explanations through images, text, and videos.

Another study by Asyaroh (2021) titled "Development of an Augmented Reality-Based Educational Game for Fraction Learning in Primary School Mathematics Grade III" focused on the development of instructional media using augmented reality technology to present concrete objects and make learning more engaging for students.

Based on the abovementioned research, the researcher aims to create augmented reality-based instructional media for second-grade elementary school students. This media is intended to be an engaging and non-boring learning aid that provides education and entertainment for students. Educators should monitor students' use of educational media to enhance their understanding. In understanding the concept of fractions in second-grade elementary school, challenges arise, including students' need for help comprehending the concepts and components of fractions. Therefore, the researcher intends to study the "Development of Augmented Reality-Based Instructional Media for Second-Grade Elementary School."

**METHODS**

This study falls under the category of Research and Development (R&D) and follows the five stages outlined by Branch (2009), known as the ADDIE model. ADDIE comprises Analysis, Design, Development, Implementation, and Evaluation. The research begins with an analysis of the learning problems and the need for media at Nirmala Elementary School. This is followed by the design of a guidebook and application using Unity. The product design is then developed and subjected to validation by subject matter and media experts. Subsequently, the media product is implemented in actual lessons for second-grade students at Nirmala Elementary School. During the implementation phase, pretests and posttests are administered to measure students' comprehension levels. The research concludes with an evaluation to identify the strengths and weaknesses of the developed media product.

Overall, this research took place at Nirmala Elementary School over two days on February 8, 2023, and May 30, 2023. The study population consisted of elementary school students in Bantul, Yogyakarta. The sample used for this research included all ten second-grade students at Nirmala Elementary School. Data were collected using observation, interviews, questionnaires, and testing techniques, which were subsequently analyzed using a Likert scale

**FINDINGS AND DISCUSSION**

In this chapter, the process and results of data analysis of the product developed by the researcher, an Augmented Reality-based instructional media on fractions for second-grade students, are explained. This research utilized the ADDIE model for its development. The steps, processes, and outcomes are as follows.

1. Analyze

    This stage involves generating a conceptual framework. The analysis includes a) content analysis of the material, b) the assessment of students' needs, c) the preparation of questions, and d) the arrangement of tools and materials, which includes using the Unity application to create 3D objects and the Canva application for the design of the guidebook.

2. Design

    The design and construction stage is aimed at creating a solution to address the previously discussed and analyzed problems. The design comprises an augmented reality-based educational application for fractions developed using Unity. The instructional media is tailored to match the content of the mathematics curriculum regarding fractions. Additionally, Canva is used to design the application's background and the guidebook.



Figure 1. AR Application Design

Figure 2. Example of a guidebook design

3. Development

In this stage, the researcher creates the guidebook and the designed application. The guidebook is printed in A5 size with a spiral finish. The application can be downloaded on all devices running the Android operating system. Furthermore, the instructional media is subjected to validation by subject matter experts and media experts. The validation aims to assess the suitability of the media before it is used in the field. Feedback from the subject matter and media experts is essential for improving the media to make it more suitable. The assessment instrument consists of a closed-ended questionnaire with predetermined answer choices.

Matter validation assesses the quality of the material used in creating the media. The material assessment instrument includes 20 statements with four criteria aspects. The total score obtained from the assessment instrument validated by the subject matter expert is 97. The average total score is calculated :: X = 97/20 = 4.85

The result obtained from the subject matter expert is 4.85, which falls into the "very good" category because the value of x is in the range of 4.20 ≤ x < 5.00. Based on this result, the augmented reality-based instructional media for fractions in second-grade elementary school is considered suitable for use in terms of content.

Media validation assesses the quality of the media developed. The media validation instrument consists of 15 statements with three criteria aspects. Feedback from the media expert is crucial for revising and improving the media. Media validation is conducted twice, first before revision and then after revision.

a.  Before revision:

The total score obtained after testing by the media expert is 54. The average score is calculated as follows: ( X = 54/15 = 3.6 )

Based on the media expert's assessment, the average score is 3.6, which falls into the "good" category. However, the media expert provided feedback and suggestions for improvement to make the media better and more suitable. As a result, the augmented reality-based instructional media for fractions in second-grade elementary school is considered suitable for product testing with revisions.

b.  After revision:

The total score obtained from the second validation test is 74. The average score for media validation is calculated as follows: ( X = 74/15 = 4.93)

Based on the media expert's evaluation, the average score is 4.93, which falls into the "excellent" category because it is in the range of 4.20 ≤ x < 5.00. The feedback from the media expert was "It's already excellent." Based on the average score and feedback from the media expert, the augmented reality-based instructional media for fractions in second-grade elementary school is considered suitable for field testing.Sds

4. Implementation

The implementation stage involves applying the developed product. This research was conducted in a second-grade class at Nirmala Elementary School with ten students on May 30, 2023. The product testing aims to assess the effectiveness of the media on students. To determine the media's effectiveness, the researcher collected data through pre-tests and post-tests with the same set of questions. These questions consisted of four story-based problems that required students to depict fractions. The implementation steps included pre-testing, using the AR Fractions media, post-testing, and final evaluation. The results of the pre-test and post-test are as follows:

Table 1. Pre-test and Post-test Results

| NAME | Pre-test | Post-test |
|---|---|---|
| SN-1 | 50 | 100 |
| SN-2 | 50 | 100 |
| SN-3 | 75 | 100 |
| SN-4 | 50 | 100 |
| SN-5 | 0 | 50 |
| SN-6 | 50 | 100 |
| SN-7 | 25 | 100 |
| SN-8 | 50 | 100 |
| SN-9 | 50 | 100 |
| SN-10 | 50 | 100 |
| **Total** | 450 | 950 |
| **AVERAGE** | 45 | 95 |

From the table above, it is evident that the average pre-test score was 45, and the average post-test score was 95. The increase from the pre-test to the post-test was 50, indicating a significant improvement after using the developed media. To provide more accurate results, the classical completeness is calculated as Classical Completeness = 950/10x 100% = 95%

Based on the data processing, the result falls into the "very effective" category with a score of 95%. Therefore, augmented reality-based instructional media is considered effective for use.

In addition to the data above, there were also student comments regarding the media developed by the researcher:

- "Wow, it's great! The images can appear!"
- "I want to go home and see the pizza fractions again."

5. Evaluation

In the evaluation stage, the researcher analyzes the shortcomings and strengths of the research process that was previously carried out. Implementing learning with the AR Fractions media created an active and enjoyable classroom atmosphere while providing valuable information to enrich students' knowledge and exercise questions to test their understanding after using the media. Despite its advantages, there were several drawbacks. Using media requiring smartphones hindered the learning process

because only the researcher's smartphone was used during the implementation, causing students to take turns using the media.

## DISCUSSION

The AR Fractions media was developed following the procedures and steps of the ADDIE model. The development of AR Fractions media took approximately three months, starting in mid-March 2023 and concluding at the end of June 2023. The development process commenced with an analysis of issues in mathematics education. In this context, the school played a significant role in the development process, particularly during the observation and interviews conducted by the researcher in the second-grade class at SD Negeri Nirmala to gain deeper insights and analyze the media needs at that school.

The results obtained from observations and interviews revealed that students lacked enthusiasm during their learning sessions. Students tended to be preoccupied with their own activities during lessons. According to the teachers, engaging media might help enhance the students' enthusiasm, especially in the subject of Mathematics. The Fractions topic was selected because it typically requires a concrete understanding for students. Therefore, this media was suitable for delivering the Fractions content.

Before implementing the media at the school, it underwent validation by two experts, namely a subject matter expert, and a media expert, to assess its suitability and practicality. The validation revealed that the material contained in the media was valid, and the media created fell into the valid and appropriate category. However, to reach the "appropriate" status, the researcher had to go through a media revision phase in several areas.

After conducting product validation with the media and subject matter experts, the researcher piloted the product during classroom instruction. The implementation of the AR Fractions media went smoothly. Due to the limitations of smartphones, the class was divided into three groups, each supervised by one researcher. Subsequently, students used the application according to the available guidebook. They concluded by working on a post-test, previously administered as a pre-test, related to the Fractions content as presented in the media.

The results obtained from solving the test questions showed improved scores following the use of AR Fractions media. Based on observations during the teaching process, it was found that students were more enthusiastic about their learning and were less distracted. Thus, by the earlier presentation, it can be concluded that AR Fractions media is effective in imparting a comprehensive understanding of the Fractions topic, as indicated by the score improvement following media usage, and it can enhance the interest and enthusiasm of the students, as observed by the researcher.

These findings align with the views of (Indaryati & Jailani, 2015), who suggested that the use of instructional media is a significant factor in improving the enthusiasm and learning outcomes of students, in line with the research results showing an increase in scores and increased enthusiasm among students when using AR Fractions media during instruction. Therefore, it can be inferred that mathematics, especially the Fractions topic, is suitable for teaching using AR Fractions media.

## CONCLUSION

Based on the research and development results, it can be concluded that the Augmented Reality-based Fractions instructional media developed for second-grade elementary school students is suitable for use as an instructional tool. This instructional media enhances the understanding of basic fractions concepts for second-grade students. With this media, students become more enthusiastic about participating in learning activities. The learning process becomes more interactive and less monotonous. However, it's important to note that the developed instructional media is limited to introducing

basic fractions concepts. It is hoped that future research can refine this work to achieve a more comprehensive development of Augmented Reality-based media.

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