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Development of Augmented Reality (AR) Based Minibook Media on Solar System Material for Grade VI Elementary School

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Abstract: This research is motivated by the challenges in learning the Solar System at SD Negeri 2 Gedangalas. These learning students' difficulties in understanding science learning about the Solar System in class VI, the lack of use of technology-based learning media, limitations in learning media that can support learning, as well as the lack of application of active and innovative learning in science learning about the Solar System in class VI. Therefore, the aim of this research is to develop Minibook Learning Media Based on Augmented Reality (AR) as an effort to overcom the challenges of learning the Solar System at SD Negeri 2 Gedangalas. This research is included in the Research and Development (R&D) category. Validation is carried out by material experts and media experts. The subjects of this research were students at SD Negeri 2 Gedangalas, with a small-scale trial involving 16 students and a large-scale trial involving 30 students . Data collection used an instrument in the form of a questionnaire. Data analysis was carried out descriptively qualitatively and descriptively quantitatively in the form of percentages. The research results showed that the validation of material experts in all aspects was rated "Very Good" with an average score of 93,35%. Media experts also gave a rating of "Very Good" with an average score of 95,37%. Small group testing showed student ratings of “Very Good” with an average score of 87,75. Thus, it can be concluded that the results of this research have produced an Augmented Reality (AR)-based Minibook learning media product that is effectively used by elementary school students.

Keywords: Solar system, Augmented Reality, Minibook.

PRELIMINARY

The solar system material is very important in elementary school education for grade VI because of its relevance to natural sciences and the abstract nature of its concepts, making it difficult for students to understand without the right teaching aids (Astuti & Athaya, 2023; Nugraha, 2022; Ula & Setyawan, 2022). The solar system is one of the science subjects that must be taught to every elementary school student. Based on the Core Competencies of Elementary School Science Subjects for Grade VI of the 2013 Curriculum, teachers can explain the characteristics of the solar system and the

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characteristics of its members. In the solar system there are celestial bodies consisting of the Sun as the center of the solar system and all objects that revolve around it, these objects include eight planets, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune (Anggraini & Sutama, 2023). Traditional learning methods often fail to engage students with the complexity of the solar system, which results in low student learning outcomes and a lack of interest in the material (Ula & Setyawan, 2022). To address this, innovative approaches such as multimedia applications, educational games, and virtual reality simulations have been developed to enhance students' understanding and engagement with solar system material, resulting in improved learning outcomes and increased student interest in the topic (Astuti & Athaya, 2023; Eryanto & Prestiliano, 2017; Nugraha, 2022).

The application of technology changes traditional learning methods, provides access to digital resources, distance learning opportunities, and interactive media, and enriches students' learning experiences (Mubaroq & Ilham, 2023). Augmented Reality (AR) has great potential to revolutionize education by increasing student engagement, meaningful learning, and personalizing educational experiences. AR technology, as highlighted in various studies (Brizar & Kažović, 2023; Kibat et al., 2023; Shaukat, 2023), facilitates the integration of digital content into the real world, encouraging collaboration, accessibility, and creativity among students. In addition, AR facilitates independent learning, as evidenced by the increase in results in independent studies compared to traditional face-to-face learning (Anggrawan et al., 2023). In this development, AR has been widely used in various fields, especially in the fields of games, entertainment, and education (Kamelia, 2015). The urgency of developing AR-based minibook media lies in its effectiveness in improving learning outcomes and addressing the ever-growing educational needs of students. Research has shown that AR-assisted textbooks and applications are not only feasible but also practical and valid for educational settings, offering interactive, colorful, and engaging content that caters to modern learning preferences (Sartono & Laisaroh, 2022; Tri Wibowo et al., 2023). Therefore, the development of AR-based minibook media is essential to foster effective learning experiences and meet the diverse needs of contemporary learners.

Based on the results of interviews conducted by researchers with grade VI teachers at SD Negeri 2 Gedangalas, data obtained showed that there was a lack of use of

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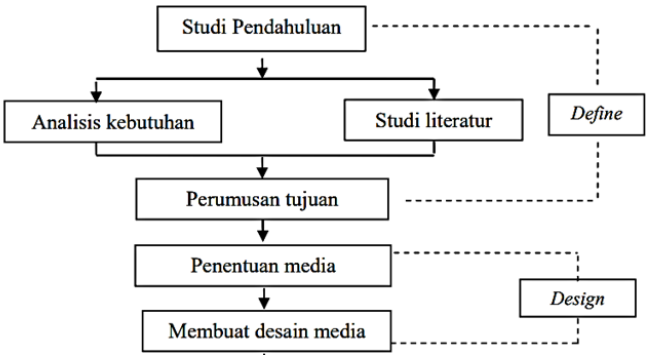
technology-based learning media in science learning in grade VI, limited learning media that could support science learning of solar system material in grade VI, lack of application of active and innovative learning in science learning of solar system material in grade VI, students' difficulties in understanding science learning of solar system material in grade VI. Based on the background of the problem and the results of interviews conducted by researchers, the development of AR-based minibook media is important as one of the solutions to overcome students' learning difficulties in science subjects of solar system material in grade VI of elementary school. Therefore, the purpose of this study is to develop Augmented Reality (AR)-based Minibook Learning Media as an effort to overcome the challenges of learning the Solar System at SD Negeri 2 Gedangalas which was chosen by the researcher which is expected to be able to solve problems in learning, especially the Science subject of the Solar System material in class VI.

METHOD

This study adopts the research and development method. Research and Development (R&D) in education plays an important role in improving the quality of education by identifying problems, developing innovative solutions, and implementing new educational approaches (Sri-gran et al., 2024; Torang Siregar, 2023). The research model used in this study is the 4D model. This 4D model consists of four stages, namely define, design, develop, and disseminate. This research stage is carried out until the develop stage so that the research and development model has been modified. The stages of developing the 4-D model according to (Iwan & others, 2018) in Figure 1



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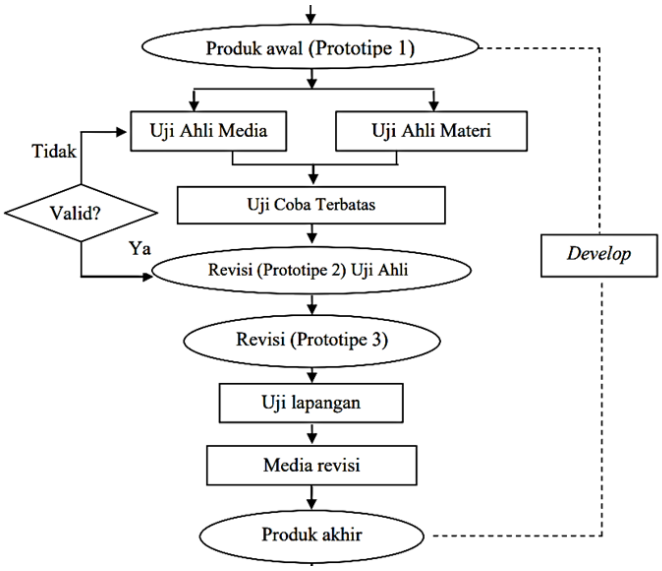

Figure 1. 4D Model Development Procedure Diagram

The subject group of this research consists of 2 material experts and 2 media experts, the trial was conducted on students of Class VI of SD Negeri 2 Gedangalas. The trial was conducted in class VI A, involving 16 students. This research technique was conducted to collect data that became the basis for determining the feasibility of the product developed by the researcher. The stages in the product trial include: (1) Interview (2) Questionnaire. The instrument in this study involved the use of interview guides and questionnaires. The researcher prepared a research instrument with an interview guide containing written questions by giving respondents the same questions. In this study, the researcher used an instrument in the form of a questionnaire to collect data on teacher responses or responses to media development.

Data analysis activities are carried out after the data is collected. Data generated from the trial activities are divided into two categories, namely quantitative data and qualitative data. The assessment sheet uses a Likert scale with the provisions of 4 = very relevant, 3 = relevant, 2 = less relevant, 1 = not relevant. The data is then analyzed to determine the quality of the learning media. Data analysis from the questionnaire sheet with a Likert scale in the form of a Checklist (✓) with the following steps:

a) The researcher calculates the score for each answer
b) Calculates the total score obtained from the research
c) Adds up the ideal scores obtained for all items

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d) Divides the total score by the ideal score

e) Then multiplied by 100%

These steps can be written in the following formula:

Percentage= $\frac{Total\ score}{Total\ ideal\ score}$ X 100 %

The percentage obtained is then changed into a qualitative sentence by looking at the details in the following table :

Table 1. Assessment Guidelines

Range (%)	Qualitative Criteria
0 – 55%	Very Poor
56 – 65 %	Poor
66 – 80 %	Good
81 – 100%	Very Good

RESULTS

The results of data analysis from the evaluation of material experts and media experts showed that the average percentage of material validation was 93.3%, while media experts gave a percentage of 95.37%. Based on the established criteria, it can be concluded that the Augmented Reality (AR) Based Minibook learning media product has met the established standards and is considered suitable for use by elementary school students. The factor that supports the acceptance of this model by elementary school students is the quality of the application which is assessed by material experts to reach the criteria of "very good." The data can be seen in detail in table 2 below :

Tabel 2. Expert Evaluation Result Data

	Media Expert	Subject Matter Expert
Expert 1	96,5	95
Expert 2	94,25	91,66
Average	95,37	93,3

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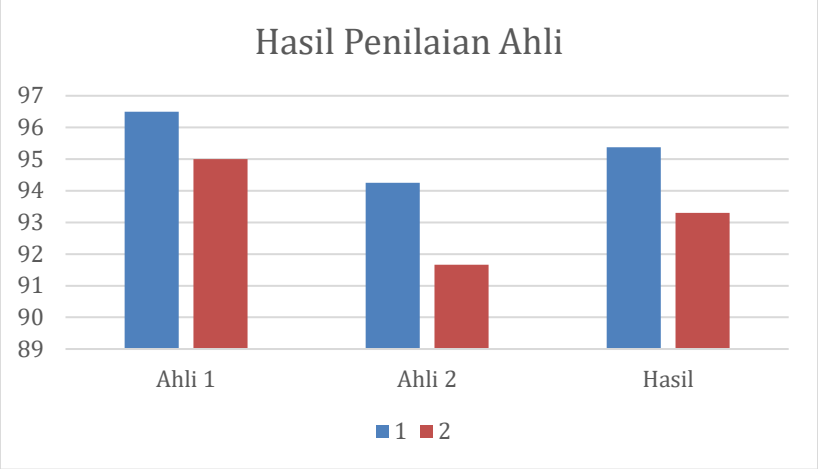

Figure 2. Member Evaluation Results Diagram

The results of data analysis from the field trial showed a percentage of 87.75%. Based on the established criteria, it can be concluded that the learning media "Minibook Based on Augmented Reality (AR)" has met the criteria of "very good". Therefore, based on the field trial, the product developed is considered suitable for use by elementary school students. The factor that supports the acceptance of this product by students of SD Negeri 2 Gedangalas is the students' ability to use the application well in all aspects tested. Overall, the learning media "Minibook Based on Augmented Reality (AR)" can be well received by elementary school students, so the results of this field trial can be used as a reference for the use of this model in students of SD Negeri 2 Gedangalas.

DISCUSSION

The results of the trial showed that the Augmented Reality (AR) Based Minibook is suitable for use in the learning process. The results of data analysis from the evaluation of material experts and media experts showed that the average percentage of material validation was 93.3%, while media experts gave a percentage of 95.37%. Meanwhile, the results of data analysis from the field trial showed a percentage of 87.75%. The results of the study that are in line with this study are studies conducted by (Supriadi & Hignasari, 2019), it is known that students feel bored with the learning media used by teachers. Students feel that visual media is no longer interesting as a learning aid. So this has an impact on the academic success of students. Students also think that the learning materials they previously received with the media used by educators or teachers tend to disappear quickly.

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According to the study (Matin & Utomo, 2023), it is necessary to develop creative ideas and more interactive learning methods to increase student interest in teaching and learning activities regarding the Solar System. Currently, learning methods that are less interactive and not fun enough for students cause a lack of exploration in learning. Based on research conducted by (Dafitri et al., 2021) entitled The Role of Augmented Reality Technology as a Learning Medium during the Covid-19 Pandemic, it was found that the role of augmented reality technology can reach a value of 89.5%, which is called effective as a learning medium. Therefore, one alternative to increase interaction in learning methods is to use Augmented Reality or AR technology. The next study conducted by (Putra & Negara, 2021) entitled Development of Solar System Multimedia in Science Content for Class VI of SD Negeri 3 Melinggih with the aim of finding out the results of the validation of solar system multimedia, the results showed that the feasibility of the product developed obtained a score of 87.50 with a good category. The effectiveness and increased student involvement are indicators of the success of this media, the product of developing Augmented Reality (AR) Based Minibook media on Class VI Solar System material has been successfully created. This product is considered suitable for use as a learning resource for Elementary School (SD) students. Because in each test it gets a "Very Good" score.

CONCLUSION

The conclusion of this study based on the results and discussion regarding the development of Augmented Reality-Based Minibook learning media at SDN 2 Gedangalas, Demak Regency, several conclusions can be drawn as follows. From the results of the validation of material experts by 93.3% and media experts by 95.37%, and the results of the questionnaire in the field trial obtained a score of 87.75%. Based on the results of the data analysis, it can be concluded that the Augmented Reality (AR)-Based Minibook learning media has received a good assessment and is worthy of use. There is high interest from teachers and students in the Augmented Reality (AR)-Based Minibook learning media from the results of the product assessment. Material experts and media experts gave a rating of "very good" while students gave a rating of "very good." This shows a positive acceptance of the learning media from both parties, which is an indication that this application meets their expectations and needs.

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