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Development of Interactive Augmented Reality Cards as a Learning Media for the Solar System in Space Adventure Games for Grade VI Elementary Schools

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Abstract

Elementary school children are at the concrete operational stage so they need learning media such as Augmented Reality (AR). Despite having the potential to use technology, teachers still have limitations in innovation and implementing effective learning media. This study aims to develop an interactive AR through the "Space Adventure" game method to provide a more concrete learning experience through innovative and fun learning. This research uses the research and development (R&D) method with the ADDIE development model consisting of five stages, namely analysis, design, development, implementation, and evaluation. The data in this study were collected through interviews, observation, media validation, and practicality testing media, as well as documentation, with descriptive analysis, both qualitative and quantitative. The results of the interactive AR card development research obtained a validation score of 86 percent of the material experts with a very suitable category and a score of 91,28 percent of media experts with a very suitable category. Then according to the questionnaire's responses, two teachers received a score of 86,87 percent and 94,37 percent with a very applicable category. The application of this game increases the interests and competitiveness of students in participating in learning.

Keywords: augmented reality; interactive AR card; space adventure

INTRODUCTION

Educational institutions' teaching and learning procedures need to be flexible enough to change with the times. One way to use the advancements of globalization in the realm of education is through the integrating technology-based media. According to Silmi & Hamid, (2023), technology is an important aspect in advancing education because it can facilitate the achievement of set learning goals. The application of technology through learning media can change the education system that is no longer relevant to the times. One technology that can be employed as a teaching tool is AR (Augmented Reality). The technology known as augmented reality projects three-dimensional or two-dimensional virtual objects onto a three-dimensional real-world setting, then displays these digital objects in real time (Hidayat et al., 2024). The technology known as augmented reality (AR) blends the virtual and physical worlds to give consumers an interactive experience (Indahsari & Sumirat, 2023). AR technology with a variety of visual presentations that allow interactivity can increase learning motivation and facilitate the absorption of learning materials for students (Hordiienko et al., 2020).

In *Jean Piaget's* cognitive development theory, it is known that elementary school age (SD) is a child who is at the specific cognitive development operational stage. At this stage, children are able to think systematically, but are limited to concrete objects (Marinda, 2020). Children can begin to think logically at this age, but their reasoning is still based on tangible objects (Pakpahan & Saragih, 2022). This is in accordance with what was stated by Magdalena, et al. (2023) that at the concrete operational stage, children are mature enough to use operational or logical thinking but are limited to the physical objects they encounter. Jean Piaget also emphasized in his constructivism theory, which assumes that children's knowledge is built on reality so that they use their concepts in the environment to understand it (Habsy et al., 2024). Constructivism is one of the contextual learning theories that provides real experiences and creates creative, innovative, active, cooperative, competitive, and enjoyable teaching and learning activities (Nurhuda et al., 2023). Game-based learning is one type of learning paradigm that fits the features of this theory. This learning model is suitable for application in elementary schools. Game-based learning invites students to learn while playing so that students feel happy, enthusiastic, and collaborative (Septianing et al., 2024).

Science is a learning material in schools that has objects of study that cannot be observed directly by the five senses. Teachers must teach science in a concrete way so that students can understand the concept of abstract science material (Gumilar, 2023). This is in line with what was expressed by Wulandari & Mudinillah (2022), that science material is abstract, so to adjust the cognitive abilities of students who are at the concrete operational stage in elementary schools, the utilization of educational media is crucial for science instruction. One of the learning materials in elementary schools that is abstract is the solar system material in the independent curriculum science subject. The solar system is an abstract object that cannot be seen directly by the eye because it cannot be reached. The broad scope of the study objects means that there is a need for learning media that can facilitate students in understanding the solar system material.

The use of AR in learning media can help provide concrete understanding to students. There are many innovations in the use of AR technology as a tool for education. One of them is with interactive cards. Development research on interactive AR cards has been conducted in previous research by Suhati et al. (2023), which produced SOLCAR (Solar System Card Augmented Reality) media that met the criteria of being very feasible and effective in supporting learning. Then, in a study conducted by Aminudin & Mutmainah (2024), it was found that the implementation of Android-based AR through interactive cards can significantly enhance student understanding and engagement in science learning. In addition, based on a literature study on the use of AR technology in learning in elementary schools conducted by Hidayat et al. (2024) in their research, it was found that the use of augmented reality technology can enhance student performance in more ways than one and abilities but also create a more interactive and enjoyable learning process.

These studies provide an understanding that the use of interactive augmented reality cards can support interactive learning and enhance studentsu' understanding of the subject matter being presented. However, in the reality of the learning process in schools, teachers are less able to innovate in using learning media that can provide concrete understanding to students. Considering the findings of the interviews conducted by the author with grade VI teachers at SD Negeri 01 Gumawang, the results obtained show that the learning media used by teachers in

providing solar system material are in the form of images and videos. The grade VI teacher explained the material based on books and gave examples through images and videos. According to Aini et al. (2020), in elementary schools today, solar system material is only taught using books, 2D images, or videos, which are less effective in helping students understand the material because of the limited memory of students in remembering concepts. Therefore, the learning medium must be innovative that can provide concrete understanding to students.

Then, the results of the researcher's initial observations at SD Negeri 01 Gumawang showed that this school is one of the schools that supports its students to use gadgets at school. The homeroom teacher of grade VI explained that sometimes students are asked to bring gadgets to school to support learning, such as doing quizzes and searching for information. So, according to the findings of the study, as is well known, SD Negeri 01 Gumawang has great potential to develop learning methods through technology-based interactive media. However, due to limited knowledge, teachers cannot maximize the use of gadgets as interactive and effective learning media for students. In fact, the process's utilization of technology of learning can rise creativity and effectiveness in the field of education because technology can provide new innovations (Julita & Purnasari, 2022).

Previous studies have focused heavily on the creation of learning materials for augmented reality, but there are limitations in the innovation of the application of the learning models used. According to Cadiz et al. (2023), among the models of learning that are in accordance with the theory of constructivist learning and are able to improve 21st-century skills is game-based learning. Then, Kusmiati et al. (2024) revealed that adventure games provide benefits for students' understanding and are able to increase students' interest, activity, and motivation. So based on this, researchers are interested in developing interactive AR card media as well as developing the "Space Adventure" game as a method of implementing media through the game based learning model. In this case, the researcher conducted a study entitled "Development of Interactive Augmented Reality Cards as a Learning Media for the Solar System in Space Adventure Games for Grade VI Elementary Schools.". The purpose of this study is to provide innovation in effective learning methods through the development of interactive card learning media based on augmented reality which can be applied through the “Space Adventure” game method in grade VI of SD Negeri 01 Gumawang to provide innovation in learning the solar system that can provide concrete understanding for students.

METHOD

This study uses the research and development method. Research and development (R&D) is a technique used to develop and test educational products. The products developed include media, teaching materials, questions, and systems for managing education for teachers (Umar et al., 2023). The product was developed with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The ADDIE model is an organized model in developing learning. This model was chosen because it has a systematic and structured development flow, starting from needs analysis to evaluation, thus ensuring that the product developed is in accordance with learning objectives. In addition, this model is flexible and researchers can make revisions at each stage, so that it becomes a good product result. At the stage of analysis, the author

conducted observations to ascertain the requirements of students in learning activities of solar system learning materials in elementary schools. The author conducted analytical observations at SD Negeri 01 Gumawang. In the research conducted, the author identified the problems experienced and determined solutions to these problems. Then, the design stage was in the form of designing interactive AR card media by making an initial draft through a storyboard. In addition, the researcher also created a concept for the "Space Adventure" game which will be used as a method of implementing cards in learning.

At the development stage, researchers use the *Canva Assemblr Edu* software as the software. At this point, the developed product will undergo testing for validity by media and material specialists. After the validity test and product revision according to the advice of the experts, the implementation stage will be carried out. At this stage, the product is applied to grade VI students at SD Negeri 01 Gumawang. This study has limitations in the trial stage which only involved a small group, namely 17 grade VI students, so the results obtained are limited and do not represent a wider population. After the implementation, a practicality test was carried out by teachers, principals, and students through a practicality test questionnaire to determine the response to the use of interactive AR card media. Then, the last stage is evaluation. At this stage, an evaluation will be carried out regarding the results of the product test based on the teacher and student practicality test questionnaires.

Data Acquisition Techniques

Data collection in this study was carried out using validation instruments and the practicality of learning media. The validation instrument consists of a material expert validation sheet and a validation sheet for media experts. This validation sheet is used to see the validity of a product from the perspective of material experts and media experts. Meanwhile, to determine the response to the use of media, researchers used a practicality test instrument consisting of both a teacher response survey and a student response survey. The instruments used in this study were arranged based on a Likert scale with the subsequent clauses.

Table 1. Likert Scale Assessment Categories

Criteria	Score
Strongly Agree	5
Agree	4
Neutral	3
Don’t Agree	2
Strongly Disagree	1

Source : Modification (Nengsih et al., 2023)

Data Analysis Techniques

This study uses descriptive analysis of qualitative and quantitative data. Qualitative description is done by collecting information from data via critiques and recommendations for improvement from experts related to the media. However, data from the questionnaire is processed using quantitative descriptive analysis to get a percentage. The percentage of product feasibility and practicality is calculated using the following formula (Lestari et al., 2024).

$$\rho = \frac{f}{N} \times 100\%$$

Information :
ρ : Assessment score
f : Score obtained
N : Maximum score

Following that, the percentage calculation's findings will be used to draw conclusions regarding the feasibility and practicality of the media with the following criteria.

Table 2. Interpretation of Product Suitability Criteria

Score	Criteria
86% - 100%	Very Suitable
76% - 85%	Suitable
60% - 75%	Quite Suitable
55% - 59%	Less Suitable
0% - 54%	Not Suitable

Source : Modification (Cahyaningrum & Bektiningsih, 2024)

Table 3. Interpretation of Product Applicability Criteria

Score	Criteria
81% - 100%	Very Applicable
61% - 80%	Applicable
41% - 60%	Quite Applicable
21% - 40%	Less Applicable
0% - 20%	Not Applicable

Source : Modification (Puspitasari & Afiani, 2024)

RESULTS AND DISCUSSION

Results

The ADDIE model, which stands for Analysis, Design, Development, Implementation, and Evaluation, was used in the creation of this interactive AR card medium, where the development process goes through the following stages.

Analysis

At this stage, a needs analysis was conducted through observations and initial interviews with sixth-grade teachers and the principal of SD Negeri 01 Gumawang. It was found that while students have been allowed to use gadgets for learning process since grade IV, their use has been limited to quizzes or searching for learning materials online, with teachers unable to fully utilize gadgets as effective learning media. The solar system topic, in particular, is taught using conventional methods like books, pictures, static images, and sometimes videos, making it difficult for students to grasp this abstract concept concretely. Discussions with teachers revealed the need for more innovative and interactive media to improve students' understanding and engagement. Therefore, the researcher developed an interactive AR card media, integrated with the "Space Adventure" game, to provide concrete and enjoyable learning experiences that can foster better comprehension and participation.

Design

After the needs analysis, the design of interactive AR card media was carried out in three stages. First, software selection, *Canva* was used to design the cards and AR object materials, while *Assembler Edu* was used to create the augmented reality objects. Second, collected solar system material for grade VI SD/MI. Third, compile a card concept through a storyboard. Figure 1 shows the interactive AR card storyboard design.

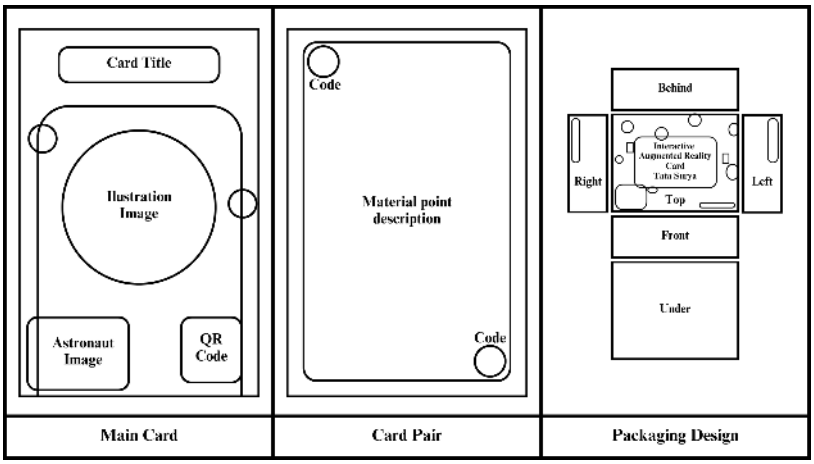

Figure 1. Interactive AR Card Storyboard Design

Besides designing the card and packaging, a user guidebook and student worksheets were created to support teaching and learning activities, adjustable to teachers' needs. In this study, the implementation used the "Space Advanture" game, with researchers also designing the procedures for the game.

Development

The development stage is the stage where the media is realized according to the media design in the previous stage. Media development is divided into 5 parts, namely making augmented reality, interactive AR cards, card packaging, usage guidelines, and student worksheets. Augmented reality content is created using *Canva* and *Assemblr Edu* software. The steps in creating augmented reality begin with preparing AR objects through the *Canva* application. AR objects are created from each element, which will later be combined through *Assemblr Edu* software. After all the elements are created, the next step is to save each element in PNG format and then combine and arrange all the elements into a 3D object through the assembler edu application. This 3D object will later become augmented reality content.

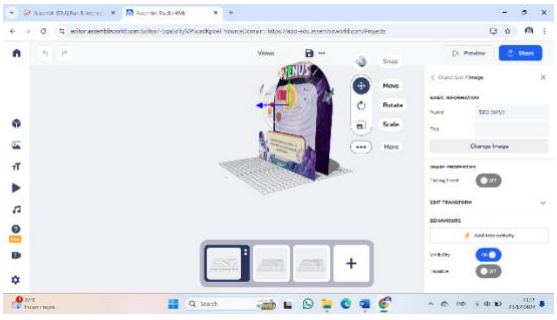

Figure 2. Arranging Each Element Into a 3D Augmented Reality Object

In addition, augmented reality objects are also created using 3D objects that are already available on *Assemblr Edu*. Researchers combine objects from *Canva* elements and 3D assets from *Assemblr Edu* to create augmented reality content. Then, researchers provide notations on AR objects as a means of placing solar system materials.

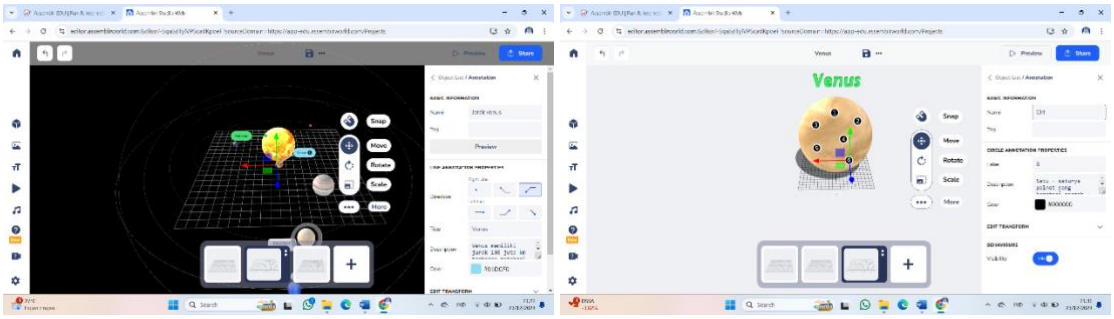

Figure 3. Adding Notations to AR Objects

After the AR object was created, the researcher saved the link from the object that had been created with Assemblr Edu to later be used to create a QR code on the card. Then, the researcher developed the card from the storyboard that had been created. These are the outcomes of creating interactive augmented reality cards using the previously prepared storyboard.

Figure 4. Results of Interactive AR Card Development Based on Storyboard

Researchers developed interactive AR cards measuring 5.7 × 8.7 cm. Interactive AR cards consist of 12 main cards with 6 partner cards each and 1 usage guide card. So that the total of one interactive AR card package is 85 cards. The main card is a search mission for students to find their partner cards. Each main card has a code A - L, while the partner card has a code according to the alphabet of the main card and is given a numeric code. For example, card A will have a partner card with the code A.1; A.2; A.3; A.4; A.5; and A.6. Here are the main cards and their codes.

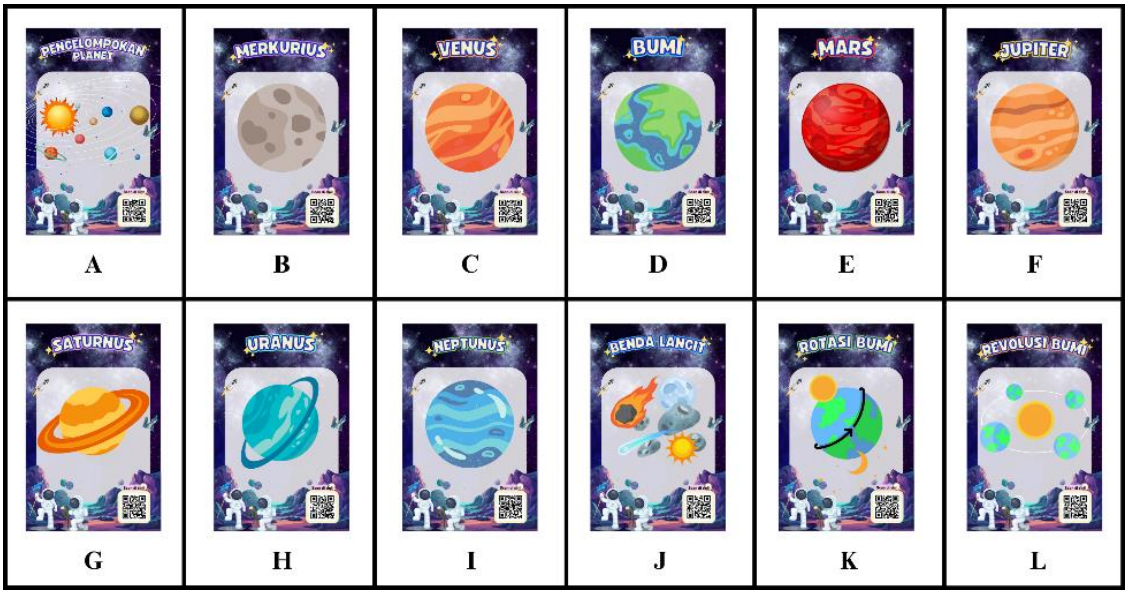

Figure 5. Main Card and its Code

Each main card has a different discussion according to the card title. Here is an example of the appearance of the augmented reality content on the card when it has been scanned.

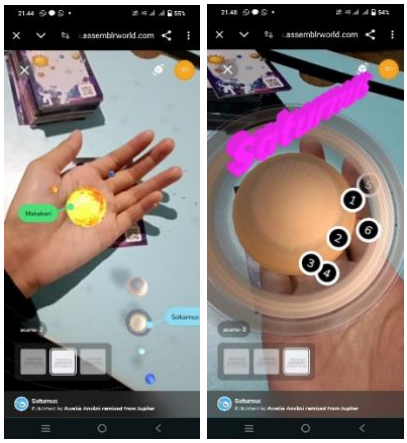

Figure 6. Example of Augmented Reality Content Display

After product development is carried out, the next step is to test the validity of the product. Validity testing is to see the viability of the product in terms of material experts and media experts. Material experts are practicing lecturers who are experts in the field of science material. Testing the viability in terms of material includes several aspects, namely the truth of the content, conceptual accuracy, up-to-dateness of the material, depth of the material, and the adequacy of the references used (Chaeruman, 2015). The following are the results of the validation of material experts.

Table 4. Results of Material Expert Validation

No	Aspect	Indicator	Maximum Score	V1	V2
1	The truth of the content of the material	The content aligns with what is being learned, outcomes, learning objectives, and curriculum and is presented systematically	20	12	17
2	Conceptual accuracy	The material is free from conceptual errors, in accordance with scientific theories and laws, and illustrations are appropriate to clarify the material.	35	25	30
3	Up-to-dateness of the material	The material is in accordance with current science.	10	8	8
4	Coverage and depth of the material	The material covers all learning outcomes of the solar system, topics, and subtopics that are relevant to the curriculum and allows students to understand the relationship between concepts.	25	19	23
5	Adequacy of the references used	The references used are relevant and directly support the content of the material presented.	10	8	8
		Amount	100	72	86
		Percentage	100%	72%	86%
		Criteria		Quite Suitable	Very Suitable

Then, the media validity The test was conducted by distributing a questionnaire to media experts. Media experts are lecturers who practice educational technology. The media validity test includes aspects of relevance to the objectives, target audience, simplicity and clarity, context and location, interactivity, visual design, and security and privacy (Maisarah & Mesra, 2023). The following are the results of the media expert validation.

Table 5. Media Expert Validation Results

No	Aspect	Indicator	Maximum Score	V1	V2
1	Relevance to purpose	Media can be a means of achieving solar system learning objectives, supporting understanding, and providing concrete understanding to students.	20	16	16
2	Target audience	Media is designed according to the characteristics of grade VI elementary school children and facilitates independent or group learning.	25	22	23
3	Simplicity and clarity	Ease of access to augmented reality features and operations	25	20	23
4	Context and location	Media is compatible on various devices and can be used in various places.	25	20	22
5	Interactivity	Availability of interactive features in AR content and ease of navigation of AR features	20	16	19
6	Visual design	Consistency of color, size, shape, suitability with the theme, object image resolution, font selection, animation, and AR visual effects	70	64	65
7	Security and privacy	Media is safe for students to use and complies with data security and privacy rules.	10	10	10
		Amount	195	168	178
		Percentage	100%	86,15%	91,28%
		Criteria		Very Suitable	Very Suitable

Implementation

After passing the validity test, the media was applied to students. This field test was conducted at SD Negeri 01 Gumawang with research subjects of 17 grade VI students, 1 class teacher, and 1 principal. The Interactive AR card media were implemented through the "Space Adventure" game, where students were divided into 6 groups, and each group was given 2 main cards as a search mission. The game "Space Adventure" was applied according to the game steps that had been designed.

Figure 7. Implementation of Interactive AR Cards Through the Game "Space Adventure"

Figure 7 illustrates this implementation. Following the activity, the researcher distributed response questionnaires to the teacher, principal, and students to assess the practicality of the learning media.

Evaluation

The evaluation phase was conducted by analyzing the results of the teacher and student response questionnaires. The teacher response questionnaire assessed practicality through aspects including appearance, curriculum relevance, effectiveness, interactivity, efficiency, creativity, and language (Sukma et al., 2023). The following table 6 presents the results of the teacher response survey.

Table 6. Results of the Teacher Response Questionnaire Regarding Applicability

No	Aspect	Indicator	Maximum Score	Teacher 1	Teacher 2
1	View	Clarity of display and design according to student age	25	23	23
2	Curriculum	Media supports learning achievement and integrates material with the curriculum.	15	15	13
3	Effectiveness	Media is used to explain material and create effective learning	25	21	25
4	Interactivity	Availability of interactive features and ease of navigation of AR features	20	16	17
5	Efficiency	Ease of using media, efficient in learning, and portable media	35	30	34
6	Creativity	Creativity in presenting material and enriching learning methods in class	20	18	19
7	Language	Use of easy-to-understand language and systematic text arrangement	20	16	20
		Pecentage	100%	86,87%	94,37%
		Criteria		Very Applicable	Very Applicable

Then, the practicality test through the student response questionnaire is seen from four aspects, namely learning interest, ease of understanding, appearance, and implementation (Mukti, 2019). The results of the student response questionnaire on the media are as follows.

Table 7. Results of Student Response Questionnaire Regarding Applicability

Number of Respondents	Score Obtained	Maximum Score	Percentage	Criteria
17	1131	1275	88,7%	Very Applicable

Discussion

Considering the research results obtained, one of the challenges in the science learning process in elementary schools is the lack of learning media that can provide concrete understanding to students. Learning media has the main function of clarifying the material given by the teacher by providing concrete experiences to students (Wulandari et al., 2023). Providing concrete experiences to students is one form of application of constructivism theory in everyday life that can help students understand learning (Nurhuda et al., 2023). The results of the researcher's interviews with teachers at SD Negeri 01 Gumawang showed that there needs to be innovation in learning media that can maximize the use of technology so that it can provide concrete understanding to students. Technology-based learning media is a new innovation that makes it easier for teachers to provide learning materials in teaching and learning activities. One of the effective technology-based learning media is augmented reality-based media (Hidayat et al., 2024). The technology known as augmented reality blends two- or three-dimensional things from computers with the real environment so that users can interact with virtual objects in real life (Sholeh et al., 2023). Augmented reality-based learning media can overcome obstacles such as conventional learning and provide in-depth understanding of abstract materials such as the solar system through meaningful learning (Putra et al., 2022).

The development of interactive AR card media was chosen as a solution to provide innovation in learning media for solar system materials at SD Negeri 01 Gumawang. This media is implemented through game-based learning with the game "Petualangan Ruang.". Game-based learning is the use of traditional or digital games to help teachers improve learning (Wahyuning, 2022). Interactive AR card media was developed with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). ADDIE is a general and universal research and development model that can be applied to various development items including instructional materials, learning media, and models (Syahid et al., 2024). At the analysis stage, it was found that there was a need for a learning design that was able to provide innovation, support the achievement of learning objectives, and provide concrete experiences to students. So the researcher planned to develop interactive AR card media that would be implemented through the game "Space Adventure," which began with the creation of a storyboard and how to play it. The development of AR cards was carried out using Canva and Assemblr Edu software. The outcomes of the creation of this media are a set of interactive cards based on augmented reality with 12 main cards, each of which has 6 partner cards.

The interactive card media was tested for validity by one material expert and one media expert. Considering the outcomes of the first material expert validation test, it got a score of

72% with a quite suitable category. In general, the assessment from the material expert was that the media could be implemented after making slight revisions related to the use of spelling and font types in certain writings. After revisions were made according to the suggestions given by the expert, the media was validated for the second time and got a score of 86% with a very suitable category. The second material validation showed that the media was very feasible and could be tested. Then, based on the first media expert test, the interactive AR card got a score of 86,15% with a very suitable category. In general, based on the confirmation of media experts, the interactive AR card was very feasible and could be implemented but needed to improve the navigation performance of its AR system. So the researcher made improvements according to the expert's suggestions and conducted a second media validation test. In light of the findings of the second media expert validation test, a score of 91,28% was obtained with a very very suitable. The findings of this validation demonstrate that using the media as a teaching tool for students is very practicable.

During the media development process, researchers faced several technical and non-technical challenges. One of the challenges faced by researchers was ensuring that the presentation of material through AR objects really looked concrete and was easy for students to understand. This requires the selection of visual designs and animations that are in accordance with the characteristics of the material, as well as adjusting the position and size of the object so that it appears optimally when scanned. In addition, researchers also had difficulty in ensuring that the markers on the cards could be read properly by the device, which affected the smoothness of the 3D object display. Researchers needed to conduct several trials to adjust the AR display so that it could provide a real learning experience and support visual understanding of concepts. However, through the revision process and consultation with experts, the media was successfully developed in accordance with learning objectives.

After the media has been validated by experts and is suitable for implementation. The interactive AR card media was tested on 17 sixth-grade students at SD Negeri 01 Gumawang. According to Wen et al. (2023), AR's ability to improve 21st-century skills is unquestionable, such as collaboration, critical thinking, and creativity, but must be implemented through good learning design. So the researcher implemented this media through game-based learning, namely the "Space Adventure" game. Game-based learning is an active learning design that supports the accomplishment of learning goals (Wahyuning, 2022). The application of game-based learning is considered the easiest approach in learning because students basically like games (Schabas, 2023). The "Space Adventure" game starts by dividing students into 6 groups. Then, each group is given 2 main cards as their search mission. Considering the findings of the observations students were excited to participate in the learning process. They are very enthusiastic about completing the missions carried out with their groups. Students work together to collect information based on the content of the augmented reality content on the cards. This game can increase students' interest in participating in learning because they have a sense of competition among groups. This is consistent with studies carried out by Widiana (2022), which shows that through her research in implementing game-based learning, there is an increase in students' interest in learning and understanding of concepts compared to conventional learning. In addition, student responses indicate the achievement of the objectives of implementing interactive learning media in accordance with what was stated by Arifannisa et al. (2023) namely increasing student interest and participation in teaching and learning activities,

deepening students' understanding of learning materials, improving students' critical and creative thinking skills, improving students' ability to use technology, and increasing learning effectiveness.

Although the implementation of interactive AR cards has been successful in increasing students' interest and understanding, there are still some challenges faced. One of these problems is that some students' devices do not support AR applications, which hinders the trial. In addition, some students need more time and guidance to operate the application, especially those who are not used to using AR-based technology. Adjusting the position of the marker so that virtual objects can appear clearly is also an obstacle in the implementation process in the classroom.

Interactive AR cards were also tested by teachers to assess their practicality. This media was tested by grade VI teachers and the principal of SD Negeri 01 Gumawang. According to the survey, the response of grade VI teachers to practicality obtained a score of 86,87% with the criteria of very applicable. The grade VI teacher also responded that the interactive AR card media is very creative and able to provide innovation in learning activities. Then, based on the questionnaire, the response to practicality by the principal received a score of 94,37% with the criteria of very applicable. The principal also responded that this media greatly supports learning because it can improve how well students learn and teach activities. Then, based on the answers to the questionnaire of 17 students to the practicality of interactive AR card media, a score of 88,7% was obtained with the category of very applicable. Most of them also responded that the learning process with the "Space Adventure" game was very fun and not boring. These results indicate that the media is easy to use by students and is able to increase student enthusiasm in learning activities. The results of this study support the findings of previous research by Aminudin & Mutmainah (2024) that the use of interactive cards based on augmented reality is an alternative in providing learning media innovation and has been proven effective in providing understanding of subject matter concepts through student interaction and involvement.

CONCLUSION

Conclusion

Interactive AR card learning media implemented through the game "Space Adventure" has proven effective in enhancing learning at SD Negeri 01 Gumawang. Based on the results of the validation test of material experts, this media scored 86% in the very feasible category, and from media experts, it scored 91.28% in the very feasible category. Through game-based learning, the application of AR card Media can boost students' enthusiasm to learn, deepen students' understanding, and enhance students' critical and creative thinking skills. The implementation of media on 17 grade VI students demonstrated how excited the students were. in participating in learning and gave rise to a sense of competitiveness among groups. This media scored 86.87% with a very practical criterion from the questionnaire for student responses on the practicality of the media. Then, based on the practicality test through the questionnaire for teacher responses, it obtained a score of 86.87% from grade VI teachers and a score of 94.37% from the principal with a very practical category. Thus, interactive AR cards

can be an innovation in learning media that can support teachers in delivering abstract learning materials so that they can increase the effectiveness of learning.

Suggestion

Interactive AR card media can be an alternative in helping teachers improve students' concrete understanding of the solar system material in elementary schools. This media can be used individually or in groups. The application of game-based learning through the "Space Adventure" game method can be an innovation in the application of interactive AR card media. However, the use of interactive AR cards can be adjusted to the learning model applied by the teacher. This study is only limited to the solar system material for grade VI elementary schools. Suggestions for further research can develop augmented reality-based media on different materials and classes to help teachers provide understanding related to abstract material for elementary school students.

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