42. Developing AI-Based Teaching Materials with Solar System Scope for Elementary Education.pdf

by specialgra2025_4 specialgra2025_4

Submission date: 27-Jul-2025 02:42PM (UTC+0300)
Submission ID: 2680703851
File name: 42._Developing_AI-Based_Teaching_Materials_with_Solar_System_Scope_for_Elementary_Education.pdf (514.13K)
Word count: 5927
Character count: 33350

IJE
Interdiciplinary Journal of Education
https://skillerindonesia.id/index.php/ije/index

Vol. 3, No 2: July 2025
E-ISSN: 2988-7798
pp. 100-112
Email:ije@skillerindonesia.com

Developing AI-Based Teaching Materials with Solar System Scope for Elementary Education

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Abstract: The development of teaching materials based on Artificial Intelligence assisted by the Solar System Scope application for the solar system topic in Grade VI at SDN 05 Indralaya uses the ADDIE model. It aims to develop teaching materials on the solar system topic by achieving valid and practical levels of the developed materials. Data were collected through interviews, observations, documentation, and questionnaires. The research results show that the material validity reached 97.22%, categorized as very valid, and the media validity reached 95%, also categorized as very valid. The assessment from the trial of the developed teaching materials obtained an average of 95.5%, falling into the very valid category. The high scores from expert evaluations and trials indicate that the developed teaching materials are feasible and can be applied in school learning.

Article History
Received: 10-06-2025
Revised: 20-06-2025
Published: 16-07-2025

Key Words :
Development, Teaching Materials, Artificial intelligence, Solar System.

How to Cite: Saputra, M. A., Suratmi, & Susiloningsih , E. (2024). Developing AI-Based Teaching Materials with Solar System Scope for Elementary Education . *IJE : Interdisciplinary Journal of Education*, *3*(2), 100–112. https://doi.org/10.61277/ije.v3i2.209
https://doi.org/10.61277/ije.v3i2.209

Introduction

Indonesia is obligated to fund basic education for all citizens, as stated in Article 31 of the 1945 Constitution. This affirms every citizen's right to education and underscores the government's responsibility in realizing national ideals. Teachers, as professional educators, are tasked with educating, teaching, guiding, and evaluating students in accordance with Law No. 14 of 2005. Teachers are also required to design and implement quality learning, including the preparation of learning tools such as lesson plans or teaching modules, teaching materials, media, and evaluation instruments. All these components must align with students' needs, technological developments, and the applicable curriculum (Been, 2021).

The curriculum currently used in Indonesia is the *Merdeka Curriculum*. The Merdeka Curriculum is designed to give students the freedom to learn in a way that allows them to express their natural talents, in an enjoyable, calm, and relaxed atmosphere, and allows them to think creatively (Fauzi, 2022). One characteristic of the Merdeka Curriculum is the integration of Natural Sciences (IPA) and Social Sciences (IPS) into IPAS (Natural and Social Sciences) at the elementary school level, with the aim of helping students recognize and develop curiosity and sensitivity to natural and social phenomena in their surroundings (Rahman & Fuad, 2023). High curiosity toward natural and social phenomena encourages

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students to think critically and analytically, leading to an understanding that can help them solve problems and find appropriate solutions.

The selection of engaging teaching materials in learning helps students understand natural and social phenomena, which becomes a teacher's responsibility (Utami & Atmojo, 2021). Teachers are expected to simplify the understanding of learning concepts using intermediaries such as teaching materials (Trinaldi et al., 2022). Teaching materials are recommended to have an interactive design, meaning they can be used by teachers and help students actively participate in the learning process to achieve effective learning (Fanani et al., 2022). One option for interactive teaching materials is digital teaching materials, which involve electronic devices such as computers, laptops, projectors, smartphones, and tablets, presented in the form of images, audio, and video (Mella et al., 2022). The use of digital teaching materials as a learning resource for students has the potential to improve the quality of learning (Syifah et a., 2025). Developing digital teaching materials can take advantage of technological advancements (Naresti et al., 2024). Technology in education helps students understand abstract concepts more effectively (Utami & Atmojo, 2021). One advantage of digital teaching materials is that they can be accessed anytime and anywhere, provided students have the devices and internet connection. Since there are many available technologies for learning, teachers are required to be tech-savvy and follow the latest developments in science and technology.

One technological advancement currently gaining widespread attention is Artificial Intelligence (AI) (Gusli et al., 2023). AI is designed to replicate human-like thinking models, with machines capable of recording, mimicking, and transforming information automatically, and it is predicted to potentially replace human roles in computer science (Supriadi et al., 2022). AI development greatly supports global activities, including education, by enabling teaching and learning experiences to become more interactive and engaging. AI can analyze data and gather information about the curriculum and learning needs of students, and produce appealing products such as teaching materials in the form of images, audio, and video, or even a combination of all three (Gusli et al., 2023). One type of AI that is free and easy to use to create digital teaching materials is the website Gamma.app, which can instantly generate content on any topic simply by entering the desired learning theme. Gamma.app allows reviewing and customizing material to meet student needs and achieve learning outcomes. The website also features the ability to add images and videos from various sources via link insertion. Teaching materials created with Gamma.app are digital and can be shared via link through WhatsApp groups or other digital communication tools. This demonstrates that AI-based technology can replace abstract textbook materials with digital alternatives that are more engaging and easier for students to understand.

The use of technology in learning at SDN 05 Indralaya has not been fully implemented, and the concept of Artificial Intelligence (AI) is not yet widely known. The teaching and learning process still relies on materials such as student and teacher textbooks and utilizes limited conventional media. Textbooks often fail to help students fully understand the subject matter, especially abstract topics, which require digital teaching materials or media (Nugraha, 2022). According to the Grade VI.A teacher at SDN 05 Indralaya, problems arising from the use of printed textbooks include students being less interested and having difficulty

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understanding the material. This leads to boredom during learning, resulting in a lack of focus and suboptimal understanding—especially when it comes to abstract concepts. Therefore, there is a need for innovative teaching materials based on technology that combine visual, audio, and audio-visual elements (Wu, 2024). Teachers must make extra efforts to meet students' learning needs and help them understand the lessons. Such innovative teaching materials can be created easily using AI-powered platforms like Gamma.app, providing a more engaging learning experience. According to Wijayanti and Sulastri (2021), in line with the opinion of the Grade VI.A teacher at SDN 05 Indralaya, one subject that requires digital teaching material innovation supported by technological advancement is the IPAS subject in Grade VI, especially the solar system topic.

The issues at SDN 05 Indralaya align with previous research that addressed similar problems in teaching the solar system topic. One such study by Putri and Kelana (2022), titled "Development of Teaching Materials on the Solar System Topic Using the Student Teams Achievement Division Model Assisted by Solar System Scope and Book Creator Applications to Improve Conceptual Understanding in Grade VI Science at Elementary School," showed that digital teaching materials can significantly enhance students' understanding. The use of the Solar System Scope application as a supporting medium in the learning process helped students identify the characteristics of each planet, especially Venus, which rotates clockwise, and Uranus, which rolls forward in its rotation (Putri & Kelana, 2022). Another study by Supriadi et al., (2023), titled "Technology-Based Learning Innovation Using Artificial Intelligence in Education in the Era of Industry 4.0 and Society 5.0," positioned Artificial Intelligence (AI) as a favored tool in learning due to its ability to simplify both learning and the design of learning tools, including teaching materials. The convenience of AI in creating instructional materials helps teachers in preparation, while the Solar System Scope application plays a valuable role as a learning medium for the solar system topic in Grade VI.

The ease of using AI to develop teaching materials and the effectiveness of the Solar System Scope application are the primary reasons the researcher is motivated to develop AI-based teaching materials assisted by the Solar System Scope application for Grade VI at SDN 05 Indralaya. The teaching materials to be developed are expected to support students' learning and meet their needs for audio, visual, and audio-visual resources. This research aims to determine the validity and practicality levels of the developed teaching materials.

Research Method

The researcher employed the Research and Development (R&D) method. The aim was to develop an instructional material product based on Artificial Intelligence for the Solar System topic, utilizing the Solar System Scope application as a supplementary learning media for sixth-grade students at SDN 05 Indralaya. The researcher adopted the ADDIE development model (Analyze, Design, Development, Implementation, Evaluation), as each stage includes revision activities that benefit the researcher in improving the quality of the instructional material being developed. This research was carried out through all stages of the ADDIE development model up to the Evaluation phase, as the study focused on the validity and practicality levels of the product, and on evaluating all stages from beginning to end within the Evaluation phase to optimize the developed product (Iskandar et al., 2022). The chosen

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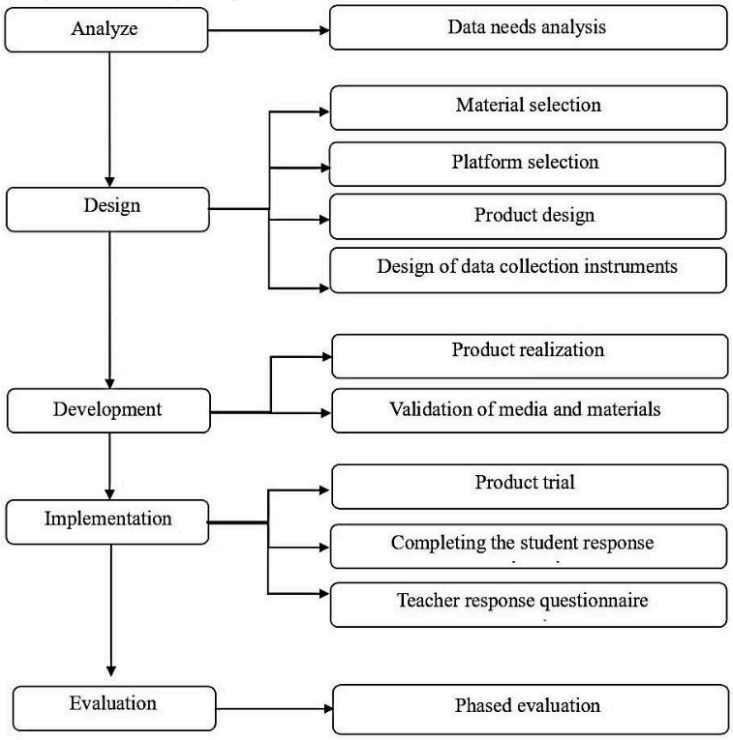
research site was SDN 05 Indralaya, located at Jln. Lintas Timur KM.37 RT.07 Indralaya Mulya, Indralaya District, Ogan Ilir Regency, South Sumatra Province. The study was conducted during the odd semester of the 2024/2025 academic year. The subjects of the research were the teacher and sixth-grade students of class VI.A at SDN 05 Indralaya.

The product testing was conducted in three stages: the first stage involved 3 individual students, the second stage involved 6 students (small group), and the third stage involved 10 students (large group). The research subjects were selected using purposive sampling. The following are the development procedures.



Pictures 1. Development Stages

The data collection methods used in this study included teacher and student observations, interviews, documentation, and validation questionnaires for experts, teachers, and students.

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Observations and interviews with teachers and students were conducted during the analysis stage to obtain needs analysis data, including curriculum and material analysis. The expert validation questionnaire served as an indicator to measure the validity level of the product during the development stage. The teacher and student response questionnaires were used to measure the practicality level of the product during the implementation stage. The following are the scoring guidelines for the expert validation questionnaire, the teacher response questionnaire, and the student response questionnaire.

Table 1. Scoring Guidelines for the Expert Validator Questionnaire

Category	Scale
Strongly Agree	4
Agree	3
Disagree	2
Strongly Disagree	1

(Sugiyono, 2019)

Table 2. Scoring Guidelines for the Teacher and Student Response Questionnaires

Response	**Scale**
Ya	1
Tidak	0

(Sugiyono, 2019)

Table 3. Validity and Practicality Criteria

Scale (%)	Practicality/Validity Category
81 – 100	Very Valid/Practical
61 – 80	Valid/Practical
41 – 60	Quite Valid/Practical
21 – 40	Less Valid/Practical
< 20	Invalid/Impractical

(Heryadi, dkk., 2023)

The assessment results from the expert validator questionnaire, the teacher response questionnaire, and the student response questionnaire are calculated into percentage scores using the following formula:

$$\text{Rating score value} = \frac{Score}{Score\ maximum} \times 100\%$$

Then, the percentage assessment results are categorized based on Table 3. Table 3 presents the validity and practicality criteria based on the assessment results from expert validators and the questionnaire responses from teachers and students. The instructional material developed by the researcher can be considered valid if it obtains a percentage of 61% ≤ x ≤ 80%, and it can be considered highly valid if it obtains a percentage of 81% ≤ x ≤

Result and Discussion

This study is a research and development (R&D) study aimed at developing digital teaching materials based on Artificial Intelligence for the solar system topic in Phase C. The model used in this research is the ADDIE model, which includes five stages: Analyze, Design,

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Development, Implementation, and Evaluation. The Evaluation stage is applied throughout all stages to detect errors in each phase.

The analysis process in the Analyze stage (the first stage) aims to identify student needs and existing problems in current learning. At SDN 05 Indralaya, interview results show that learning is still dominated by printed materials, which are less engaging for students in understanding the abstract solar system content (Nugraha, 2022). This issue often hinders students from connecting theoretical concepts to real-life applications. Proper needs analysis helps teachers design more effective learning interventions, especially by utilizing technology (Hidayat & Nizar, 2021). Here are the interview results:

Table 4. Interview Results

No.	Interview Quetions	Answer
1	What kind of obstacles do you encounter when students learn in class using the teaching materials and media that you usually use?	If the first obstacle is the teaching material, students get bored if we are not good at making variations in learning if we only use books because books are abstract and difficult for students to understand if we do not take the initiative. Then students will definitely get bored and lack focus, some do not pay attention, this is it, that is it. Finally, students' understanding is lacking. Well, if it is media, it depends. If it is direct media, it is limited because this school does not provide all the media needs.
2	Are the teaching materials you use in teaching able to meet the needs of students?	No, for example about ASEAN countries, in the book there are 10 while now there are 11. Then the solar system, in the book there is only one poster and there is little information. So I have to prepare from other sources and then print it later.
3	In your opinion, are the needs of students in science learning in grade VI met by books as teaching materials?	No, because in the book the language may be understandable but it cannot be imagined, oh it turns out the earth revolves around the earth, oh this is how rotation works, oh this is how revolution works. If there is an explanation in the book, but he cannot see it directly. If it is only in the book, I think it is lacking.
4	What is the level of students' skills in utilizing technology such as mobile phones and laptops?	If today's children are probably more up to date. If the use of technology today, children can no longer be avoided, they are all smart, especially cellphones. We even learn from them. Moreover, most of them in grade 6 already have cellphones.
5	Have you or your school ever developed teaching materials using Artificial Intelligence?	Personally, I have learned to make teaching materials from AI because of the learning needs in college. But teachers here have never done it, but they know that AI can do this and that.

Interviews with sixth-grade teachers revealed that students often lose focus when learning with printed books. Teachers also find it difficult to explain materials that require visualization. This is consistent with research by Rahman and Fuad (2023), which found that

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text-based media can cause boredom and reduce student engagement. This analysis is a crucial foundation for determining the need for AI-based digital teaching materials.

The second stage, the design stage, focuses on planning teaching materials, including selecting development platforms and organizing the content delivery sequence. Gamma.app was chosen as the main platform due to its ability to produce digital teaching materials quickly and flexibly (Anas, 2024). This platform supports the integration of various media formats, such as text, images, and videos. A flowchart and storyboard were created to ensure systematic content delivery. The flowchart illustrates the learning sequence, while the storyboard provides a preliminary visualization of the teaching material to be developed. Using a storyboard in teaching material design helps organize information so it is easier for students to understand (Fanani et al., 2022). This design aligns with learning outcomes, such as students' ability to analyze the relationship between a planet's distance and its rotation and revolution periods. The choice of visual elements also considered student engagement. Visuals like planet animations and revolution simulations were designed to support students' independent exploration. Research by Amalia et al. (2022) shows that attractive visuals can increase student attention and motivation. Besides designing the teaching material, the researcher also designed instruments used to collect data, including validation sheets from subject matter and media experts to measure the validity level of the developed material, as well as student response questionnaires to assess the practicality level.

The next stage, development, involves realizing the teaching material based on the existing design. Gamma.app was used to integrate visual and audiovisual elements into the material. The initial prototype was then validated by subject matter and media experts. Here are the validation results:

Table 5. Expert Validation Recapitulation

Aspects Assessed	Score	Score Maximum	Percentage(%)	Category
Curriculum	12	12	100	Very Valid
Material	12	12	100	Very Valid
Linguistics	11	12	91,66	Very Valid
Appearance	22	24	91,66	Very Valid
Operation	16	16	100	Very Valid

Validation results showed that the teaching material had a high level of validity, with an average validation score of over 96.05%, along with some suggestions from validators. Subject experts suggested using simpler terms for better student understanding, while media experts recommended adding greetings or prompts to stimulate students' motivation and interest. The researcher revised the material based on these suggestions and consulted again with the validators. The next stage was conducted after the validation process was completed.

The implementation stage is a crucial part of this study, aiming to test the practicality of the AI-based teaching material using the Solar System Scope application. The trial was conducted after incorporating expert suggestions. The study was held at SDN 05 Indralaya from November 25 to December 2, 2024, with one teacher and 19 sixth-grade students as subjects.

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The trial was conducted in three phases: individual, small group, and large group. In the individual phase, three students were purposively selected based on teacher recommendations to test their initial understanding. The small group trial involved six additional students to assess the material's effectiveness and practicality. Finally, the large group trial involved ten students to observe its effectiveness in a broader classroom setting.

After the trial, teachers and students filled out questionnaires to evaluate the material. The following are the results of data processing from the teacher response questionnaire and the student response questionnaire.

Table 6. Results of the Teacher Response Questionnaire

Aspects	Score	Score Maximum	Percentage(%)	Category
Curriculum	3	3	100	Very Practical
Material	3	3	100	Very Practical
Linguistics	3	3	100	Very Practical
Appearance	2	2	100	Very Practical
Operation	4	4	100	Very Practical
Total	15	15	100	Very Practical

Table 7. Processed Data Results of Student Responses in Individual Trials

Aspects	Score	Score Maximum	Percentage(%)	Category
Appearance	15	15	100	Very Practical
interest	9	9	100	Very Practical
Material	6	6	100	Very Practical
Total	30	30	100	Very Practical

Table 8. Processed Data Results of Student Responses in Small Group Trials

Aspects	Score	Score Maximum	Percentage(%)	Category
Appearance	30	30	100	Very Practical
interest	18	18	100	Very Practical
Material	12	12	100	Very Practical
Total	60	60	100	Very Practical

Table 9. Processed Data Results of Student Responses in Small Group Trials

Aspects	Score	Score Maximum	Percentage(%)	Category
Appearance	42	50	84	Very Practical
interest	21	30	70	Practical
Material	19	20	95	Very Practical
Total	82	100	82	Very Practical

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The trial results of the Artificial Intelligence-based teaching materials developed in this study not only show high scores, they prove that these materials represent an extraordinary breakthrough in elementary education. From the moment they were first introduced to Grade VI students at SDN 05 Indralaya, the students' attention was instantly captivated and could not be diverted. The classroom, which was usually quiet and flat, transformed into a stage for vibrant, interactive scientific exploration filled with awe and curiosity. Students were not just sitting and reading, they were immersed in the universe, as if they were boarding a spaceship and touring from Mercury to Neptune. When the Solar System Scope application was launched, the children's eyes lit up, and their hands instinctively pointed at the screen while asking questions with a level of excitement rarely seen in conventional learning. They were no longer just learning, they were experiencing.

The practicality scores achieved during the trials were far from ordinary. The 100% practicality rating in individual and small group trials was not just validation, it was an undeniable recognition that these teaching materials had shattered the walls of boredom that have long hindered students' understanding. Even in the large group trial, despite the complex classroom dynamics, the 82% score still affirmed that the materials were effective on a real-world scale.

Even more remarkably, students didn't just enjoy the lessons, they became curious, critical, and even hungry for further knowledge. One student, identified as AS, not only showed interest in the content but also explored deeper into AI technology and asked about how the ElevenLabs.io application works. This proves that the developed teaching materials go beyond delivering content, they ignite a spark of curiosity that could fuel long-term learning motivation. These materials truly become a bridge connecting students with abstract concepts that were previously out of reach. The integrated simulations, audio, and visuals bring the solar system to life before their eyes, turning each planet from just a name in a textbook into a real, observable, and manipulatable object.

In short, these teaching materials are not just worthy, they are essential for 21st-century learning. They have demonstrated that when technology is combined with teacher creativity and a deep understanding of student needs, the result is not merely better scores,but a complete transformation in how students learn and understand the world.

At the end of this stage, the researcher evaluated the product after the trials. Based on the consistently high ratings from all test phases, the researcher deemed no further revisions necessary during the Implementation stage. The developed teaching material can be accessed through the following QR code:

Picture 2. QR Code of the Teaching Material Product

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In conclusion, the implementation stage showed that the developed teaching material met the criteria for being very practical and suitable for use in learning. With a high level of practicality, this material can serve as an effective supplementary learning resource in elementary schools. The study also indicates that using technology in science learning can significantly enhance students' understanding and engagement. Nevertheless, there were several challenges faced by the researcher during the implementation of learning using the developed teaching materials. The first and foremost challenge was the limited access to technology at school, such as the availability of projectors, laptops, or any tools that support technology-based learning activities. The practicality of these teaching materials proves that the development of AI-based digital teaching materials can be an effective solution for abstract topics like the solar system. However, to promote implementation across various schools, support from both local and central governments is needed in the form of infrastructure provision and teacher training.

AI-based digital teaching materials allow students to learn independently. They can access interactive simulations of planetary rotation and revolution through the Solar System Scope application. This application offers a more in-depth learning experience because students can directly visualize the concepts being taught (Putri & Kelana, 2022).

The provided website focuses on solar system learning. Users are invited to watch videos, read material, and listen to audio to improve their understanding of complex concepts. This method aligns with studies showing that multisensory learning increases information retention and student engagement (Hidayat & Nizar, 2021). The materials include in-depth information about each planet and the unique characteristics of the solar system. The videos and simulations from the Solar System Scope website enable students to explore the solar system virtually, facilitating richer learning experiences. Previous research has shown that technology use in science education stimulates student interest and understanding (Putri & Kelana, 2022). After completing the material, students are encouraged to test their understanding through games available at the bottom of the website. This activity aims to make learning more enjoyable and interactive. Recent studies show that gamification in education increases student motivation and engagement, making them more active learners (Supriadi et al., 2022). The website also provides navigation guides, allowing students to easily return to previous pages if needed. With its responsive design, the teaching material can be accessed via both mobile and desktop devices. This is important, as studies have shown that digital accessibility contributes to students' academic success (Hidayat & Nizar, 2021).

The development of AI-based digital teaching materials through the Analyze, Design, Development, and Implementation stages resulted in a valid and practical product. This material provides a solution to the problems of solar system learning at SDN 05 Indralaya. In addition to enhancing students' understanding, it encourages the integration of technology in learning, relevant to 21st-century education challenges.

This study has implications for digital teaching material development. Teachers can utilize technology to create more engaging and relevant learning experiences (Hidayat & Nizar, 2021). Future research can focus on developing teaching materials for other subjects, considering students' unique needs at each educational level.

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Conclusion

This study developed Artificial Intelligence-based teaching materials using the Solar System Scope application for the solar system topic in Grade VI at SDN 05 Indralaya, employing the ADDIE model. Validation by subject matter and media experts indicated that the developed teaching material is highly valid, with a validity percentage of 97.22% (very valid) for the content and 95% (very valid) for the media, resulting in an average of 96.05%. These results show that the teaching material is feasible for use in learning trials.

The practicality of the teaching material was evaluated through trial data analysis and questionnaires filled out by teachers and students. The teacher rated the practicality at 100%, categorized as very practical. Student trials were conducted in three stages: individual (100% very practical), small group (100% very practical), and large group (82% – very practical), with an average practicality score of 91.21%. This proves that the teaching material is highly practical and suitable for use in classroom learning.

The use of Artificial Intelligence (AI) in the development of teaching materials has proven to have a significant positive impact on both the learning process and outcomes of students. This study demonstrates that the integration of AI particularly through platforms such as Gamma.app and the Solar System Scope application not only enhances the practicality of the teaching materials but also creates a more interactive, visual, and meaningful learning experience. The enthusiasm and active engagement of students in understanding the solar system topic prove that AI has great potential to support the transformation of education in Indonesia toward a more modern, adaptive, and enjoyable direction. The researcher also recommends that future researchers actively involve teachers in the creation of AI-based learning tools in order to build technological capacity within the school ecosystem.

Recommendation

This study only describes the validity and practicality levels of the developed teaching material. Therefore, future researchers are encouraged to continue by examining the effectiveness level of the teaching material developed in this study.

Acknowledgment

The researcher extends sincere gratitude to all parties who have provided support and participation throughout the course of this research. It is hoped that this study will contribute positively to the field of education and serve as a reference for future research.

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E-ISSN: 2988-7798
pp. 100-112
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