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DEVELOPMENT OF ARTICULATE STORYLINE MEDIA FOR ENHANCING LEARNING OUTCOMES IN NATURAL AND SOCIAL SCIENCES AMONG ELEMENTARY SCHOOL STUDENTS

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ABSTRACT

Technology-based interactive media have yet to reach their full potential in elementary education, resulting in suboptimal learning outcomes in the natural and social sciences. This study aims to outline the development steps for interactive learning media using Articulate Storyline and to assess the quality and effectiveness of this media in teaching fifth-grade students about Earth and the Universe within natural and social science subjects. Employing a research and development approach, this study utilized the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The participants were fifth-grade students from the Muhammadiyah Elementary School of Karangbendo, Yogyakarta, with 28 students. Instruments used in this research are questionnaires and tests. The questionnaire was used to get data from the experts, whereas a test was used to get the data on learning outcomes. The findings suggest that the Articulate Storyline interactive learning media is suitable and effective, as evidenced by an average 'Highly Suitable' rating of 87% from experts in content knowledge, media, language, and teaching and learning in primary education and a 'Very Good' response rating of 98% from teachers and students. A significant improvement in learning outcomes was observed, with an average n-gain score of 0.73, indicating a high level of effectiveness. This media is recommended as an alternative for educational activities in schools, particularly for introducing topics related to Earth and the universe.

Keywords: articulate storyline; elementary school; interactive media; learning; natural and social sciences; outcomes

INTRODUCTION

Natural and social sciences engage learners by cultivating their curiosity about the phenomena around them, serving as a catalyst for exploring how the universe operates and interacts with human life on Earth.[1] This understanding is essential for identifying global challenges and devising solutions to achieve sustainable development goals. Applying basic scientific methodologies enhances cognitive skills within the framework of natural and social sciences education. It nurtures a scientific attitude characterized by high curiosity, critical thinking, analytical prowess, and accurate conclusion drawing.[2]

[1] Febblina Daryanes et al., "Improving Students' Critical Thinking Through the Learning Strategy 'Students as Researchers': Research Based Learning," *Jurnal Penelitian Pendidikan IPA* 9, no. 5 (2023): 2374–82, https://doi.org/10.29303/jppipa.v9i5.2345.

[2] Zacharoula Smyrnaiou, Eleni Georgakopoulou, and Sofoklis Sotiriou, "Promoting a Mixed-Design Model of Scientific Creativity through Digital Storytelling—the CCQ Model for Creativity," *International Journal of STEM Education* 7, no. 1 (2020), https://doi.org/10.1186/s40594-020-00223-6.

Particularly for fifth-grade students at a crucial developmental stage, a creative and innovative approach to teaching these subjects is vital, as it helps them develop essential analytical skills and sets a strong foundation for lifelong learning and curiosity in a broad spectrum of topics from science to social studies.

The rapid development of Information and Communication Technology (ICT) in education is critical for enhancing the quality of human resources.[3] Educators can utilize ICT effectively in their teaching methods, thereby boosting both their professional growth and the educational performance of their students.[4,5] Consequently, providing teachers with essential ICT skills is fundamental for adapting to and excelling in the increasingly digital landscape, particularly as educational frameworks evolve to accommodate the demands of Generation 4.0 students. In pursuit of innovative methods to engage students and enrich their learning experiences, integrating multimedia and technology is becoming more pivotal.

Technology integration in education can potentially enhance learning outcomes across various disciplines. Specifically, interactive media such as Articulate Storyline have become increasingly popular for their ability to engage students in a more dynamic and participatory learning process.[6] Articulate Storyline is an innovative platform that has been particularly influential in elementary education.

Firstly, a study by Saadah et al. demonstrated that using Articulate Storylines in classroom settings significantly improved students' engagement levels and academic performance in science subjects.[7] The interactive features of the platform allowed for a more hands-on learning experience that was both enjoyable and educational. Secondly, Hadianto et al. explored the specific impacts of interactive media on students'

[3] Nurul Hidayati Rofiah, Restiana Restiana, and Rahmatika Dewi, "Promoting Digital Literacy: Assessing Teachers Readiness in Utilizing Information and Communication Technology for Learning in Rural Area," *Jurnal Prima Edukasia* 12, no. 1 (2024): 41–51.

[4] Chiara Antonietti, Alberto Cattaneo, and Francesca Amenduni, "Can Teachers' Digital Competence Influence Technology Acceptance in Vocational Education?," *Computers in Human Behavior* 132, no. March (2022): 107266, https://doi.org/10.1016/j.chb.2022.107266.

[5] Elena V Frolova et al., "Digitalization of Education in Modern Scientific Discourse: New Trends and Risks Analysis," *European Journal of Contemporary Education* 9, no. 2 (2020): 313–36, https://doi.org/10.13187/ejced.2020.2.313.

[6] Josef Buchner and Michael Kerres, "Media Comparison Studies Dominate Comparative Research on Augmented Reality in Education," *Computers and Education* 195, no. November 2022 (2023): 104711, https://doi.org/10.1016/j.compedu.2022.104711.

[7] Ifanny Nurhayatus Saadah et al., "Development of Articulate Storyline Learning Media to Improve Biology Learning Outcomes for Junior High School Students," *Research and Development in Education* 2, no. 2 (2022): 51–56, https://doi.org/10.22219/raden.v2i2.23232.

understanding of complex natural science concepts.[8] Their findings indicated that interactive simulations and story-based learning scenarios could bridge the theoretical knowledge and practical application gap.

Furthermore, a comparative analysis by Daryanes et al. highlighted the superior performance of students using Articulate Storyline compared to those engaged in traditional learning methods.[9] This study underscored the importance of multimedia elements in fostering a deeper understanding of social science topics. Additionally, the research by Li and colleagues confirmed that multimedia storytelling not only enhances cognitive learning outcomes but also promotes emotional and social learning among young learners, which is crucial in social sciences education.[10]

Finally, a recent longitudinal study by Thompson et al. tracked the long-term educational development of students who regularly used Articulate Storyline in their curriculum. The results revealed sustained improvements in critical thinking and analytical skills, particularly in subjects that span the broad spectrum of natural and social sciences.[11]

The application of Articulate Storylines in elementary education, particularly within the subjects of natural and social sciences, still needs to be explored, presenting a significant opportunity to enhance educational practices.[12] This gap is especially pronounced in Earth and the Universe topics, where traditional lecture methods dominate and often fail to capture students' interest and curiosity adequately. These conventional methods, while foundational, may not fully engage young learners or encourage the depth of exploration that interactive and multimedia tools can facilitate.

[8] Daris Hadianto et al., "The Role of Multimodal Text to Develop Literacy and Change Social Behaviour Foreign Learner," *International Journal of Instruction* 14, no. 4 (2021): 85–102, https://doi.org/10.29333/iji.2021.1446a.

[9] Febblina Daryanes et al., "The Development of Articulate Storyline Interactive Learning Media Based on Case Methods to Train Student's Problem-Solving Ability," *Heliyon* 9, no. 4 (2023): e15082, https://doi.org/10.1016/j.heliyon.2023.e15082.

[10] Ming Chaun Li and Chin Chung Tsai, "Game-Based Learning in Science Education: A Review of Relevant Research," *Journal of Science Education and Technology* 22, no. 6 (2013): 877–98, https://doi.org/10.1007/s10956-013-9436-x.

[11] Meredith M. Thompson et al., "Authenticity, Interactivity, and Collaboration in VR Learning Games," *Frontiers Robotics AI* 5, no. DEC (2018): 1–7, https://doi.org/10.3389/frobt.2018.00133.

[12] Fika Ari Widyaningrum, Ika Maryani, and Rungchatchadaporn Vehachart, "Literature Study on Science Learning Media in Elementary School," *International Journal of Learning Reformation in Elementary Education* 1, no. 01 (2022): 1–11, https://doi.org/10.56741/ijlree.v1i01.51.

Articulate Storyline, capable of creating custom interactive content, offers a unique avenue for educators to develop more engaging and immersive learning experiences.[13] Teachers could significantly enhance student engagement by incorporating interactive simulations, animated storytelling, and problem-solving exercises directly related to natural and social sciences.[14] This approach makes learning more enjoyable and allows students to see the practical applications of their studies, thereby fostering a deeper understanding of complex concepts such as ecological systems, geological processes, and historical events.

Furthermore, the integration of Articulate Storyline can also promote critical thinking and analytical skills by challenging students with real-world problems and scenarios within the digital environment.[15,16] As students navigate these interactive lessons, they are encouraged to question, hypothesize, and experiment, critical components of scientific inquiry and social analysis.[17] This hands-on approach will likely result in a more dynamic educational experience, motivating students to participate actively and thus leading to better retention of knowledge and enhanced learning outcomes.[18]

In conclusion, by bridging the gap with technology like articulate storylines in teaching natural and social sciences, educators can transform passive learning into an active discovery process, ultimately cultivating a generation of learners who are knowledgeable and enthusiastic about exploring the world around them.

Furthermore, preliminary investigations indicate that learning outcomes in these science topics are suboptimal, suggesting a need for innovative teaching approaches to

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[13] Marinda Rosita Sari and Abd Qohar, "Development of Mathematics Learning Media Based on Articulate Storyline 3 on Cube Materials," *AIP Conference Proceedings* 2614, no. 1 (2023): 43–58, https://doi.org/10.1063/5.0125871.

[14] Frisya Alvita Muthiah Wandani, Gusti Yarmi, and A.R. Supriatna, "Development of Articulate Storyline Interactive Media Based on Problem Based Learning in Science Learning in Class Iv Primary School," *Educational Technology Journal* 4, no. 1 (2024): 35–41.

[15] Sucita Triana and Risda Amini, "Pengembangan Media Pembelajaran Tematik Terpadu Menggunakan Articulate Storyline Di Kelas IV Sekolah Dasar," *Jurnal Pendidikan Tambusai* 7, no. 3 (2023): 21691–96.

[16] Wandani, Yarmi, and Supriatna, "Development of Articulate Storyline Interactive Media Based on Problem Based Learning in Science Learning in Class Iv Primary School."

[17] Ulya Wati, Woro Sri Hastuti, and Ali Mustadi, "Analysis of Student Creativity in Developing Science Learning Media during the COVID-19 Pandemic," *AL-ISHLAH: Jurnal Pendidikan* 13, no. 3 (2021): 2790–99, https://doi.org/10.35445/alishlah.v13i3.612.

[18] Sabina Ndiung et al., "The Effect of Treffinger Creative Learning Model with the Use Rme Principles on Creative Thinking Skill and Mathematics Learning Outcome," *International Journal of Instruction* 14, no. 2 (2021): 873–88, https://doi.org/10.29333/iji.2021.14249a.

better cater to young students' diverse learning styles. The utilization of Articulate Storyline offers a promising avenue for this purpose, providing interactive, multimedia-rich educational experiences that could significantly enhance understanding and retention of complex scientific concepts. However, the lack of comprehensive research into its effectiveness within this specific educational setting necessitates thoroughly exploring how this technology can be best implemented to maximize educational benefits.

This project aims to develop, deploy, and evaluate an Articulate Storyline module tailored to the Earth and Universe curriculum, addressing the current educational shortcomings and paving the way for a more engaging and effective learning environment. This research focuses on developing Articulate Storyline media to enhance learning outcomes in the natural and social sciences among elementary school students. The motivation for this study is rooted in the observed effectiveness of interactive media in stimulating student engagement and comprehension, a claim supported by several prior studies.

RESEARCH METHODS

The research method employed to develop the Articulate Storyline media is Research and Development, which utilizes the ADDIE model (Figure 1). The ADDIE model is a systematic framework for developing educational interventions and consists of five stages: Analysis, Design, Development, Implementation, and Evaluation.

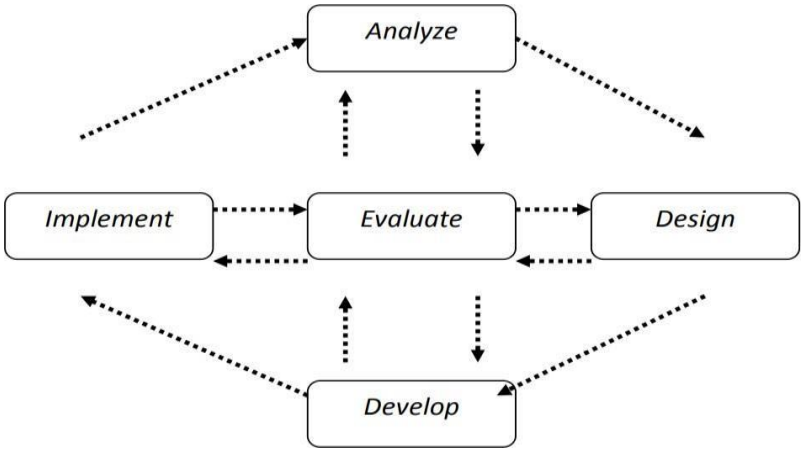

Figure 1
Flowchart ADDIE Model[19]

[19] Dalibor Drljača et al., "ADDIE Model for Development of E-Courses," no. June 2018 (2017): 242–47, https://doi.org/10.15308/sinteza-2017-242-247.

Analyze: This initial stage is crucial for identifying existing problems in the learning process. First, it includes a curriculum analysis, which involves understanding the current curriculum and assessing learning flows, outcomes, objectives, and mastery criteria. Second, the Needs Analysis determines the necessary media to address learning challenges based on classroom observations and teacher interviews. Lastly, the Learner Characteristics Analysis identifies student characteristics and behavior patterns to tailor the media appropriately.

Design: The design phase focuses on specifying and structuring the media to be developed. This includes creating flowcharts to outline the sequence of interactions, storyboarding to visualize the media content and interactions, and defining media specifications to plan the technical and content specifications that match the competencies needed for the curriculum.

Development: In this phase, the planned product is materialized. It involves instrument development, which includes creating tools to measure the feasibility of the media (see Table 1) and the effectiveness of the media for learning outcomes. Content creation follows, focusing on developing the actual learning content. Lastly, product revision refines the product based on expert feedback and preliminary testing with students and teachers.

Table 1
Instrument for Assessing Eligibility by Experts

No.	Aspects	Indicators
	Learning Media Expert	
1	Text	Suitability of text type and size.
2	Image	Suitability of image with the material. Suitability of image placement.
3	Audio	Suitability of audio with the material.
4	Video	Suitability of video with the material.
5	Animation	Suitability of the used animation
6	Layout	Harmony of text layout. Appropriateness of image proportion to text.
7	Program Operation	Ease of application use. Ease of navigation button functionality.
	Content Expert	
1	Content Quality	Relevance of the material to learning objectives. Appropriateness of the material for understanding. Ease of understanding of the material. Suitability of images with the material.

No.	Aspects	Indicators
		Pedagogy Expert
1	Material Suitability	Alignment of material with learning outcomes. Alignment of material with learning objectives.
2	Media Suitability	Suitability of media with the characteristics of the learners. Suitability of learning media with the daily experiences of the learners.
3	Ease of Use	Ease of use of the media for teachers in delivering lessons. Ease of use of the media for learners in their studies.
4	Appeal	Attractiveness of the media for learners in their studies.
5	Beneficial	The usefulness of the media for teachers in delivering material. The usefulness of the media for learners in their studies.
6	Evaluation	Appropriateness of evaluation questions with the material presented in the media.
		Language expert
1	Sentence Structure and Usage	Accuracy of sentence structure used. Effectiveness of sentence usage. Accuracy of using standard sentences. Precision in sentence interpretation. Appropriateness of sentence usage. Accuracy of sentence spelling.
2	Language Structure and Usage	Suitability of language structure to the level of thinking. Suitability of language structure to the social-emotional level. Appropriateness of everyday language usage. Accuracy of using motivating language.

Source: Personal Document

Implementation: The fourth stage involves applying the developed media in a real educational setting. Initially, it is trialed with 28 students to gauge its effectiveness. A quasi-experiment one-group pretest-posttest design is used to measure the effectiveness of the developed Articulate Storyline media in enhancing student outcomes in natural and social sciences learning. The effectiveness is analyzed using the N-gain formula, which helps to determine the extent of improvement in student learning based on pre-and post-intervention test scores.

Table 2
Assessment Grid for Learning Outcomes

Indicators	Cognitive level
Students summarize the concept of Earth.	C1
Students interpret the shape and extent of the Earth's surface.	C5
Students explain the concept of the three layers of the Earth. -	C2

Indicators	Cognitive level
Students master and provide examples of the lithosphere.	C2
Students explain parts of the Earth's atmosphere.	C2
Students compare changes in the Earth's surface conditions from the past to the present.	C2
Students explain the negative impacts of natural factors on Earth's changes.	C2
Students classify the structure of the Earth's atmosphere layers.	C2
Students explain and provide examples of natural factors affecting Earth's changes.	C2
Students summarize the process of the water cycle	C4

Source: Personal Document

Evaluation: Each stage in analysis, design, development, and implementation is evaluated to ensure that every aspect meets the established quality standards. This stage involves systematic testing of the developed Articulate Storyline media to assess whether the learning objectives are achieved.

Data collection is conducted using questionnaires and tests (see Table 2). The quality analysis of the Articulate Storyline learning media aims to measure its effectiveness. Media, content, learning, and language experts are involved in this process. The collected data will be analyzed in percentage form using the formula: $S = (B/N) \times 100\%$, where 'S' represents the score, 'B' is the number of responses, and 'N' is the total responses.

Table 3
Eligibility Criteria

Interval	Criteria	Information
86% - 100%	Very good	Very feasible/ very valid/ does not need to be revised
76% - 85%	Good	Feasible/ valid/ does not need to be revised
60% - 75%	Good enough	Inappropriate/invalid/ needs to be revised
<54%	Not good	Very inappropriate/ invalid/ needs to be revised

Source: Personal Document

Additionally, the N-Gain formula is used to evaluate instructional effectiveness further. N-Gain, or normalized gain, measures the proportion of potential improvement achieved through an educational intervention. It is particularly valuable in academic settings for quantifying students' cognitive progress after introducing new learning media. The N-Gain formula is calculated as follows:

$$\text{N-Gain} = \frac{\text{(Maximum Score} - \text{Pretest Score)}}{\text{(Posttest Score} - \text{Pretest Score)}}$$

This research has several limitations. Firstly, it focuses solely on Earth and Universe science materials for fifth-grade students. Secondly, the testing was confined to 28 students at SD Muhammadiyah Karangbendo.

RESULTS AND DISCUSSION

This study explores the development of Articulate Storyline media and the significant impacts of incorporating this media into science education for fifth graders. By employing interactive multimedia elements, educators aim to foster a more immersive and stimulating learning environment to enhance student outcomes in science.

Development of educational media using Articulate Storyline for Grade V science students involves a five-phase ADDIE model: Analysis, Design, Development, Implementation, and Evaluation.

Analysis Phase

The analysis phase at SD Muhammadiyah Karangbendo includes curriculum analysis, needs analysis, and learner characteristics analysis. The curriculum analysis reveals that the school employs the 'Kurikulum Merdeka,' which aligns with the independent and creative learning philosophy. This curriculum encompasses components such as learning objectives, achievements, and the mastery criteria of learning objectives. For example, it specifies learning goals related to Earth and Universe material, designed to enhance understanding and differentiate key concepts like the lithosphere, hydrosphere, and atmosphere.

The needs analysis identified a lack of improvement in student comprehension despite using various teaching aids, indicating that the current lecture method is monotonous and ineffective. This underscores the need for more interactive methods, such as discussions and Q&A sessions, which have proven more engaging and effective.

The learner characteristics analysis showed that Grade V students are more engaged with technology-based media, favoring visual and auditory learning styles. This suggests significant potential for implementing interactive, technology-based learning tools such as Articulate Storyline to enhance student understanding and engagement. The analysis of learning modalities indicates that students predominantly use auditory and visual learning modalities. This is based on the classroom teacher's identification and

students' learning profiles, further supporting the idea that students are more engaged when learning involves technology-based media.

Design Phase

In designing interactive learning media using Articulate Storyline for Earth and Universe topics, several critical design stages must be completed to ensure the media's effectiveness and relevance to students' learning needs. The first stage involves creating a flowchart, a diagram displaying learning steps in graphic symbols. This flowchart is very important as it provides a clear visual representation of the learning flow. It ensures that each critical module segment, such as the introduction, concept exploration, interactive activities, and evaluation, is well-structured and logical.

Next, the second stage is the creation of a storyboard. The storyboard serves as a detailed sketch of each screen or slide created in Articulate Storyline, including all elements such as text, images, videos, and interactions to be used. This process is crucial as it acts as a blueprint that helps developers visualize and plan the look and feel of the learning media before the actual development process begins, allowing for adjustments based on initial feedback.

The third stage is a media creation. At this stage, all the elements designed in the storyboard will be integrated and encoded into the Articulate Storyline platform (Figure 1). This stage requires close cooperation between instructional designers, media developers, and content experts to ensure that didactic materials, interactions, and other multimedia elements function harmoniously and effectively in supporting the learning process. The articulate storyline interactive learning media can be accessed through: https://p1nki6k4i5kjfzjjlqvi7a.on.drv.tw/MEDIA%20PEMBELAJARAN%20IPAS/story.html.

Figure 1
Some scene views of articulate storyline learning media
Source: Personal Documents

Development Phase

At this stage, the developed material addresses three main topics: natural features on Earth, Earth's weather surface, and the changing Earth's surface. The first section, 'Natural Features on Earth,' explores definitions and details of natural formations, utilizing text, images, and developer-supplied audio. The second section, 'Earth's Weather Surface,' explains weather changes and the water cycle, enriched with text, audio, images, animations, and videos. The third section, 'The Changing Earth's Surface,' examines natural factors influencing Earth's structural changes, featuring texts, images, videos, and audio. This comprehensive multimedia approach caters to diverse learning styles and is tailored to meet learning outcomes, objectives, and student needs. Additionally, audio enhancements are included to support predominantly auditory learners.

Expert validation is conducted by a diverse group of specialists—including learning media experts, content material experts, experts in primary education, and linguists—to assess the suitability of the media before its integration into student learning. After receiving validation from experts, the media is revised based on their feedback. Subsequently, the responses of teachers and students to the developed media are evaluated. This validation process ensures that the media meets the requirements of both teachers and learners, thereby enhancing the educational experience.

Table 4
Results of Expert Validation Analysis

No.	Aspects	Indicators	Score	Category
		Learning Media Expert		
1	Text	Suitability of text type and size.	4	Very good
2	Image	Suitability of image with the material.	4	
		Suitability of image placement.	4	

No.	Aspects	Indicators	Score	Category
3	Audio	Suitability of audio with the material.	5	
4	Video	Suitability of video with the material.	5	
5	Animation	Suitability of the used animation	4	
6	Layout	Harmony of text layout.	4	
		Appropriateness of image proportion to text.	4	
7	Program Operation	Ease of application use.	4	
		Ease of navigation button functionality.	5	
		Content Expert		
1	Content Quality	Relevance of the material to learning objectives.	4	Good
		Appropriateness of the material for understanding.	5	
		Ease of understanding of the material.	5	
		Suitability of images with the material.	4	
		Pedagogy Expert		
1	Material Suitability	Alignment of material with learning outcomes.	4	Very good
		Alignment of material with learning objectives.	4	
2	Media Suitability	Suitability of media with the characteristics of the learners.	4	
		Suitability of learning media with the daily experiences of the learners.	5	
3	Ease of Use	Ease of use of the media for teachers in delivering lessons.	4	
		Ease of use of the media for learners in their studies.	4	
4	Appeal	Attractiveness of the media for learners in their studies.	5	
5	Beneficial	The usefulness of the media for teachers in delivering material.	4	
		The usefulness of the media for learners in their studies.	4	
6	Evaluation	Appropriateness of evaluation questions with the material presented in the media.	3	
		Language expert		
1	Sentence Structure and Usage	Accuracy of sentence structure used.		Very good
		Effectiveness of sentence usage.		
		Accuracy of using standard sentences.		
		Precision in sentence interpretation.		
		Appropriateness of sentence usage.		
		Accuracy of sentence spelling.		

No.	Aspects	Indicators	Score	Category
2	Language Structure and Usage	Suitability of language structure to the level of thinking. Suitability of language structure to the social-emotional level. Appropriateness of everyday language usage. Accuracy of using motivating language.		

Source: Personal Document

Based on Table 4, the evaluation of the Articulate Storyline media for the Earth and Universe material in Grade V received the following scores: 86 from media experts (categorized as "Very Good"), 82 from subject matter experts (classified as "Good"), and 92 from learning experts (categorized as "Very Good"). Several comments and suggestions from media experts regarding the developed Articulate Storyline interactive media included improving the main page to facilitate user navigation. The evaluation menu should be separated from the content page, and sub-chapter pages should be added for materials with multiple discussions. Furthermore, comments from material experts emphasized the need to clarify the types of exercises or tests with the function of minimum competency assessment.

After revising the media according to expert feedback, a teacher and six students' responses to the developed Articulate Storyline media were collected. Teacher assessments were conducted by the fifth-grade teacher at SD Muhammadiyah Karangbendo (see Table 5). Qualitative data were obtained from teacher comments and suggestions. Teachers noted that the developed media is excellent and engaging for elementary school learning. The content includes explanations, audio, images, and videos. Student feedback indicated that the Articulate Storyline media is good, interesting, and makes learning enjoyable.

Table 5
The results of teacher and students' responses

No.		Teacher's response	Student's responses	Percentage
1	Clarity of the material presented in Articulate Storyline media.	1	6	100%
2	Appropriateness of the language used in the Earth and Universe material.	1	6	100%
3	Ease of understanding of the material in Articulate Storyline media.	1	6	100%

No.		Teacher's response	Student's responses	Percentage
4	Clarity of learning instructions for using Articulate Storyline media.	1	6	100%
5	The attractiveness of the presentation in Articulate Storyline learning media	1	6	100%
6	Attractiveness of the colors used in Articulate Storyline media.	1	6	100%
7	Attractiveness of the images in Articulate Storyline learning media	1	6	100%
8	Ease of use of Articulate Storyline learning media for me	1	6	100%
9	The usefulness of Articulate Storyline media in helping me understand the Earth and the Universe's material	1	6	100%
10	Attractiveness of Articulate Storyline in drawing my interest to learn	1	5	83%

Source: Personal Document

Implementation Phase

The implementation of Articulate Storyline media for teaching Earth, Nature, and the Universe aimed to enhance learning outcomes in natural and social sciences. Expert judgment, assessed through a questionnaire, deemed the media suitable for teaching. Teacher and student responses also supported this evaluation. An empirical trial was conducted with 28 fifth graders at SD Muhammadiyah Karangbendo. To determine whether the developed media is effective, the N-Gain value (Table 6).

Table 6
N-Gain Value

	N	Minimum	Maximum	Mean	Std. Deviation
N gain score	28	.00	1.00	.7351	.24851
N gain percentage	28	.00	100.00	73.5119	24.85074
Valid N (listwise)	28				

Source: Personal Document

The results showed an average increase in learning outcomes after using the Articulate Storyline learning media. Pretest scores rose from 49.28 to posttest scores of 85.71, showing an average improvement of 36.43 points. Based on the average increase test (N-Gain) calculation, the average N-Gain score obtained is 0.73. Since $0.73 \geq 0.70$, the

category obtained is high, indicating that the effectiveness of the Articulate Storyline interactive media is high.

Evaluation Phase

Each stage in analysis, design, development, and implementation is evaluated to ensure that every aspect meets the established quality standards. The interactive learning media using Articulate Storyline was implemented in learning activities for the Earth and Universe topics in elementary school classes. The learning process began with the teacher briefly introducing the topic to be studied. This introduction explained the learning objectives and how to use the Articulate Storyline interactive media. The teacher ensured that the students understood how to operate this media before they began exploring the material.

Next, the students were directed to use the Articulate Storyline media, designed with interactive content such as animations, images, videos, and quizzes. The presented material covered basic concepts about the Earth and the Universe, accompanied by easy-to-understand explanations and engaging visual illustrations. Each part of the material was designed to enhance student's understanding through a fun and interactive approach.

After completing each material section, students faced various interactive quizzes designed to test their understanding. These quizzes included multiple-choice questions, matching, and short-answer questions. Immediate feedback was provided after each answer, helping students understand their mistakes and improve their comprehension. These interactive quizzes served not only as an evaluation tool but also as an effective learning tool.

The teacher led a class discussion session to review the material learned after completing the media use. Students were allowed to ask questions, share their experiences, and reflect on their learning. This session allowed students to receive additional explanations and clarifications from the teacher if any concepts were unclear. The discussion also served to reinforce understanding and provided an opportunity for students to learn from each other.

Finally, to assess the effectiveness of the learning, students took a posttest, which was also designed using Articulate Storyline. The results from the pretest and posttest were compared to measure the improvement in students' learning outcomes. Articulate Storyline media in this learning aimed to enhance students' learning outcomes by

providing an interactive, engaging, and effective learning experience. This media helped students better understand the material and increased their involvement in learning.

Final Product Review of Articulate Storyline Media

This study aims to develop interactive, Articulate Storyline learning media for elementary school science and social studies education. Learning media facilitate communication between teachers and students, making the teaching-learning process smoother.[20] Interactive learning media, such as 3D, sound, graphics, video, and animation, enhance learning experiences and facilitate interaction.[2122] These media include resources that send messages and stimulate students' thoughts, emotions, attention, and motivation, creating a structured learning process.[23] Combining text, audio, video, and graphics makes these media crucial for improving student learning outcomes. They engage students with compelling elements, making them more enthusiastic about learning.

The developed Articulate Storyline has received very good quality ratings from expert evaluations and positive responses from teachers and students. This feedback indicates its high quality and suitability for fifth-grade natural and social science education. Nursalam mentions that Articulate Storyline is a prime example of interactive learning media, enabling content creation with images, text, sound, graphics, video, and animation. [24] Outputs from Articulate Storyline are web-based (HTML5) or application files (.exe) that run on various devices. [25]

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[20] Zsofia K. Takacs, Elise K. Swart, and Adriana G. Bus, "Benefits and Pitfalls of Multimedia and Interactive Features in Technology-Enhanced Storybooks: A Meta-Analysis," *Review of Educational Research* 85, no. 4 (2015): 698–739, https://doi.org/10.3102/0034654314566989.

[21] Muhammad Nurtanto, Herminarto Sofyan, and Pardjono Pardjono, "E-Learning Based Autocad 3d Interactive Multimedia on Vocational Education (Ve) Learning," *Journal of Engineering Education Transformations* 34, no. 4 (2021): 97–103, https://doi.org/10.16920/jeet/2021/v34i4/155014.

[22] Septian Rheno Widianto et al., "Developing Learning Material for Animation 2D Instruction in Vocational High Schools," *Jurnal Mantik* 6, no. 3 (2022): 3446–52, https://iocscience.org/ejournal/index.php/mantik/article/view/3194.

[23] Stefi Yolanda, Retno Winarni, and Septi Yulisetiani, "The New Way Improve Learners' Speaking Skills: Picture and Picture Learning Media Based on Articulate Storyline," *Journal of Education Technology* 6, no. 1 (2022): 173–81, https://doi.org/10.23887/jet.v6i1.41452.

[24] Nursalam Nursalam et al., "The Effectiveness of Articulate Storyline 3 Application-Based Interactive Learning Media in Social Studies Learning for Elementary School," *AL-ISHLAH: Jurnal Pendidikan* 15, no. 4 (2023): 5724–32, https://doi.org/10.35445/alishlah.v15i4.3061.

[25] Itsnaani Nur Halimah and Fitri Indriani, "Pengembangan Multimedia Interaktif Berbasis Articulate Storyline Pada Pembelajaran Tematik Abad 21 Bagi Siswa Sekolah Dasar," *Sekolah Dasar: Kajian Teori Dan Praktik Pendidikan* 30, no. 2 (2021): 159, https://doi.org/10.17977/um009v30i22021p159.

The results show that an Articulate Storyline enhances student learning outcomes in natural and social science subjects. This aligns with Firdaus's study, which states that an Articulate Storyline helps achieve learning objectives and improve student performance.[26] Particularly, studies confirm the effectiveness of computer-based learning media (Mumtahana et al., 2020). Articulate Storyline helps achieve learning objectives and improve student performance. For instance, Setyaningsih (2020) found it positively impacts fourth-grade students at SD Negeri Gubeng on cognitive abilities such as learning, understanding, memory, and problem-solving.

The results show that an Articulate Storyline enhances student learning outcomes in natural and social science subjects. This aligns with Firdaus's study, which states that an Articulate Storyline helps achieve learning objectives and improve student performance.[27] Setyaningsih and colleagues found that the learning media Articulate Storyline positively impacts fourth-grade students at SD Negeri Gubeng on cognitive abilities such as learning, understanding, memory, and problem-solving.[28]

CONCLUSION

The development of interactive learning media using Articulate Storyline was done through Research and Development using the ADDIE model, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation. In the planning stage, flowcharts, storyboards, and media were created. The development stage involved the creation of quality test instruments in the form of questionnaires presented to experts, as well as the development of questions and product testing. The final stage is product evaluation.

The quality of the developed Articulate Storyline products is evident from expert assessments (media, material, teaching and learning, linguists) with an average score of 87% and responses from teachers and students with an average score of 98%. Positive

[26] Fery Muhamad Firdaus et al., "The Development of Articulate Storyline-Based Learning Media to Improve 5th Grade Students' Mathematical Representation Ability," *Al Ibtida: Jurnal Pendidikan Guru MI* 9, no. 1 (2022): 55, https://doi.org/10.24235/al.ibtida.snj.v9i1.9827.

[27] Rindita Milenia and Atip Nurharini, "Interactive Media Articulate Storyline to Improving Students' Learning Outcomes on Traditional Engklek Games Material," *Journal of Education Technology* 7, no. 4 (2024): 707–14, https://doi.org/10.23887/jet.v7i4.69268.

[28] Sri Setyaningsih, Rusijono Rusijono, and Ari Wahyudi, "Pengaruh Penggunaan Media Pembelajaran Interaktif Berbasis Articulate Storyline Terhadap Motivasi Belajar Dan Hasil Belajar Siswa Pada Materi Kerajaan Hindu Budha Di Indonesia," *Didaktis: Jurnal Pendidikan Dan Ilmu Pengetahuan* 20, no. 2 (2020): 144–56, https://doi.org/10.30651/didaktis.v20i2.4772.

feedback from both groups indicates its high quality and suitability for fifth-grade natural and social science education. The media effectively improved student outcomes in Earth and Universe material, with scores increasing from 49.2 (pretest) to 85.7 (post-test) and an average n-gain of 0.73, indicating high effectiveness. The developed products can be used as an alternative in the learning process to improve elementary school students' outcomes in natural and social science subjects.

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