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Development of Interactive Media Articulate Storyline 3 on Earth Structure Material to Improve Elementary School Students' Science Learning Outcomes

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Abstract: This study aims to develop, test the feasibility and effectiveness of interactive learning media Articulate Storyline 3 to improve learning outcomes in grade V students at SDN Sembaturagung 02 Pati Regency. This type of research is development research (R&D) using the Borg and Gall model. The subjects of this study were grade V students of SDN Sembaturagung 02 totaling 29 students in the 2024/2025 academic year. Data collection techniques used test techniques (pretest-posttest) and non-tests in the form of observation, interviews, questionnaires, and documentation. The results of this study indicate that the development of interactive media Articulate Storyline 3 is effective in improving the science learning outcomes of grade V students of SDN Sembaturagung 02 Pati Regency. This is evident from the results of the feasibility test obtained by the percentage of assessment by material experts, namely 90.20% and media experts 92.50% with the criteria "very feasible". The effectiveness of the Articulate Storyline 3 media is proven by the average increase in posttest results with the results of the N-gain test of 0.50 which is in the moderate category. Teachers and students gave very positive responses to the distributed questionnaire. Based on these results, it shows that the interactive media Articulate Storyline 3 is effective in improving student learning outcomes and is feasible and useful for use in science learning on the material of the structure of the earth's layers in class V SDN Sembaturagung 02.

Keywords: Articulate storyline 3; HTML5; Interactive media; IPAS

Introduction

The standard of the education system is one of the determining factors of a country's success that must be considered by every country (Kurniawati, 2022). In order to build a dignified, quality, and noble-character generation, high-quality education will have a positive impact on various fields (Adhana & Andriani, 2024). This is in line with the mandate of the fourth paragraph of the 1945 Constitution which emphasizes the importance of educating the nation's life as a foundation for achieving progress and shared prosperity. Rapid technological advances and globalization in 21st century learning, the education system is required to continue to adapt to meet the needs of the times. Digital technology provides opportunities to create interesting teaching and learning activities by creating direct interaction with learning applications and can improve students' cognitive values (Skulmowski & Xu, 2022). Rapid technological advances create new opportunities and have a major impact on learning in schools, one of which is through curriculum adaptation. The Merdeka Curriculum, which is currently being implemented, provides flexibility for teachers to choose and provide

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learning materials that are in accordance with students' needs and interests (Cholilah et al., 2023). The concept of independent learning in the independent curriculum expects teachers to create enjoyable learning by paying attention to students' needs and potential (Jannati et al., 2023).

The integration of Natural Sciences (IPA) and Social Sciences (IPS) in the IPAS (Natural and Social Sciences) subject is an update of the Merdeka curriculum, through this integration, it is hoped that students can be motivated to manage the natural and social environment holistically, as an interrelated unit (Sugih et al., 2023; Dewi & Setyasto, 2024). Students start learning about the IPAS subject in the third grade of elementary school (Ismiyah et al., 2024). The integration of these subjects is based on the observation that elementary school-age students usually see the world as something integrated and whole. In addition, they are still in the stage of thinking that is concrete or simple, broad, and holistic but not detailed. According to Nurmala et al. (2021), IPS is based on natural phenomena that are analyzed with a scientific approach and through the application of scientific processes, can produce knowledge. IPS learning not only aims to convey theoretical information, but also to develop critical thinking skills, problem-solving skills, and scientific mindsets in students. However, in practice, teachers still experience various difficulties when implementing IPS learning (Alfiana & Fathoni, 2022).

The results of the 2019 Program for International Student Assessment (PISA) study showed that Indonesia was only in the bottom six. Previous research also revealed that one of the main obstacles in the learning process in schools is the lack of variation and use of media in learning (Ramdani & Artayasa, 2020). Other studies also state that teachers' limitations in creating innovations in the use of technology-based media cause low student science learning outcomes due to lack of student interest and activity (Zulfa et al., 2023; Gulo, 2022). One of the main forces that drives student learning motivation is the presence of information technology, which plays an important role in disseminating knowledge more widely and easily accessible (Haleem et al., 2022). The use of appropriate media is expected to improve students' learning abilities. One strategy that teachers can use is to select and integrate appropriate learning media (Wahyuni et al., 2024). The results of observations and interviews conducted at SDN Sembaturagung 02 with grade V teachers also found several problems, namely that teaching materials as learning resources used by teachers and students are still limited, namely using textbooks and LKS.

In addition, the use of learning media used is also still less varied and has not utilized technology as an innovation in learning media. The results of the questionnaire distributed to grade V students showed that some students still had difficulty understanding the science and science material because students tended to only memorize the material. Based on the number of grade V students, namely 29 consisting of 15 male students and 15 female students, it was found that 17 students (60%) did not meet the Learning Objective Achievement Criteria (KKTP) and 12 students (40%) met the Learning Objective Achievement Criteria (KKTP) which had been set, namely 75. From the results of student learning, it can be seen that the learning carried out cannot be said to be successful because the number of students who meet the KTTP has not reached 75% of the total number of students, so learning improvements are needed. The solution to improve student learning outcomes is to develop technology-based media that can be used as interactive learning media to support the learning process (Ananda et al., 2023). An interesting learning tool that can attract students' attention and give them direct experience with the learning process is interactive media. This is in line with the opinion of (Majid & Kawuryana, 2024), who stated that the development of interesting learning media and encouraging student activity. Its use also helps students to better understand the concepts taught and see the visualization of the subject matter more clearly (Manurung, 2021).

Articulate Storyline 3 media is one of the technology-based interactive learning media that can be used as an innovation in learning media (Yolanda et al., 2022). Articulate Storyline 3 is software used to design more comprehensive and creative presentations, especially in the context of interactive learning (Sindu et al., 2020). The developed Articulate Storyline 3 media will be published in the form of web-based media or page 5. Website-based learning media can create interesting, interactive learning, and make it easier for students to understand, remember, and re-express material more meaningfully (Novialdi et al., 2020). Previous research conducted by Auvisena & Fathurrahman (2024) revealed that the use of Articulate Storyline 3 is an ideal and effective media for interactive learning. Another similar study was conducted by Sofiantari & Astuti (2024), which stated that Articulate Storyline 3 media is effective for improving student learning outcomes. Based on this background, the researcher will conduct a development research entitled "Development of Interactive Media Articulate Storyline 3 to Improve the Science Learning Outcomes of Class V Students of SDN Sembaturagung 02". This research was conducted with the aim of testing the feasibility,

effectiveness, and user responses to the products that have been developed.

Method

This study uses the type of Research and Development (R&D) research. Development research in the field of education aims to create products that can support the learning or education process. This study uses the Borg and Gall development model which consists of 10 steps. In the research and development of interactive media Articulate Storyline 3 in the subject of science, due to time and cost constraints, the researcher only conducted research up to step 8. So the steps applied by the study are: Identification of Potential and Problems, Data Collection, Product Design, Design Validation, Design Revision, Small-Scale Trial, Large-Scale Trial, and Final Product Development. The schematic image of this research can be seen in Figure 1.

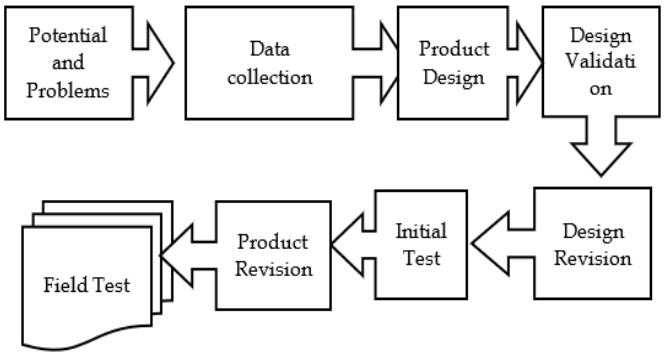

Figure 1. Modification of the Borg and Gall model

The first stage is the identification of potential and problems carried out to determine the needs, characteristics of students, and technology by conducting observations, interviews, and documentation in the form of learning outcome data of grade V students of SDN Sembaturagung 02. The next stage is data collection carried out by distributing questionnaires on student and teacher needs for learning media that will be used as a basic reference for planning products to be developed. At the product design stage, researchers design products that are adjusted to the Learning Outcomes (CP) on the material on the structure of the earth's layers. The products designed are media that are adjusted based on the results of the analysis of student and teacher needs questionnaire data. The next step is the design validation process by experts who have expertise in their fields, namely media experts and material experts. Expert validators fill out the validation assessment instrument sheet prepared by researchers with a Likert scale format of 1-4.

Design revision stage, namely by revising the product based on input from expert validators so that the product is ready to be tested, if it has met the category and does not need to be revised, the learning media is ready to be tested. In the first trial stage conducted on a small scale on 6 fifth grade students of SDN Sembaturagung 02 in the 2024/2025 academic year. The selection of students was based on variations in their cognitive ability levels, namely the average learning outcomes of low, medium, and high students. In the product trial stage, learning was carried out using the Problem Based Learning (PBL) model and using Articulate Storyline 3 media on the material on the structure of the earth's layers. The data from the teacher and student response questionnaires were analyzed using descriptive statistical methods, the results of which will be used as the basis for revising the products that have been tested. The last stage is the large-scale trial stage involving 29 fifth grade students of SDN Sembaturagung 02. At this stage, the effectiveness of the product being developed can be determined. The type of data in this study is primary data collected directly during the research process. The data obtained includes qualitative and quantitative data.

Qualitative data was obtained through distributing questionnaires to students, interviews with teachers, and observations at SDN Sembaturagung 02. Meanwhile, quantitative data was obtained from the learning scores of fifth grade students in the science subject regarding the structure of the earth's layers, as well as the results of the pretest and posttest. Test and non-test techniques were used in collecting data for this study. Test techniques were conducted through pretest and posttest, while non-test techniques were conducted through observation, interviews, and questionnaires. The test technique used was 25 multiple-choice questions, which were used in the pretest and posttest. All questions have gone through the process of validity, reliability, discriminatory power, and difficulty testing which were analyzed with the help of the IBM SPSS Statistics 30 application. While the non-test technique used was the assessment of the feasibility of the product in learning which was conducted through data analysis based on assessments by material and media experts. The assessment of data analysis of teacher and student responses related to the use of Articulate Storyline 3 media during the learning process aims to determine the level of acceptance and response of teachers and students to the product in supporting learning. Data analysis from the results of the pretest and posttest was used to determine the effectiveness of the learning media product.

To ensure that the data is in accordance with the normal distribution, the analysis procedure begins with a data normality test using SPSS software and the Shapiro-Wilk method. To find out whether the pretest and posttest results differ significantly, further analysis

was carried out using the Paired Samples Test (t-test). To assess the effectiveness of the product based on changes in student scores during the large-scale trial period, the N-Gain test was used to measure the degree of increase in scores from pretest to posttest.

Result and Discussion

Potential and Problems

Based on the results of observations and interviews at SDN Sembaturagung 02, several problems were found, including the lack of student interest in science subjects and considering science lessons on the structure of the earth's layers difficult. Teachers have not utilized technology as a support for learning media optimally, resulting in a lack of variety in the learning media used. The media used by teachers has not been innovated or modified and only relies on learning videos from YouTube, due to time constraints, teachers also only occasionally make power point presentations as learning media. The absence of innovation in learning media that involves direct student activity makes student activity low. The learning method used by teachers who use the expository or lecture model and low student participation in asking and answering questions. This resulted in the student learning outcomes in the science subject of the structure of the earth's layers of class V SDN Sembaturagung 02 in the 2024/2025 academic year found that out of 29 students, 17 students (60%) did not meet the Learning Objective Achievement Criteria (KKTP) and 12 students (40%) met the Learning Objective Achievement Criteria (KKTP) that had been set, namely 75.

Data Collection

Data collection was carried out by conducting interviews with class V teachers and distributing questionnaires on student needs for learning media. Based on the results of initial data collection, it was found that the learning media used were less varied and there were no recent innovations based on technology that were adjusted to the needs and characteristics of students. Teachers only use YouTube learning videos as a supporting medium for students' understanding of the material, besides occasionally using power point. So there has been no innovation in learning media because teachers have not optimally utilized the technology available at school. Although the facilities and infrastructure at school are quite adequate, such as class wifi and LCD projectors in each class. This condition makes learning media an important problem that needs to be studied further.

Based on the results of the distribution of student needs analysis questionnaires, as many as 28 out of 29 (96%) fifth grade students of SDN Sembaturagung 02 have their own android that can be used to access the internet. As many as 25 students out of 29 (86%) like learning presented with images and videos. In addition, as many as 27 out of 29 students (93%) stated that they were interested in using android as a learning medium to help understand the material on the structure of the earth's layers. And 27 out of 29 students (93%) were interested and enthusiastic about using web-based media or html5. These data indicate the need for steps to utilize learning media using android as an effective learning medium. Therefore, the development of interactive media connected to technology is a solution to overcome this problem. Web-based interactive media or html5 makes it easier for teachers and students to access learning materials, present more interesting materials, and provide new learning experiences for students.

Product Design

At the product design stage, the material on the media is designed according to the Learning Outcomes (CP) to be achieved in the material on the structure of the earth's layers. Articulate Storyline 3 Interactive Media has a main menu, which includes Learning Outcomes (CP) and Learning Objectives (TP), materials, games, quizzes, developer profiles, instructions for use and library references as seen in the picture. To help the learning process, researchers created a learning module that integrates a problem-based learning model or Problem Based Learning (PBL). This strategy encourages students to understand problems, organize their learning, support personal or group research, create and present work results, and assess and evaluate the problem-solving process.

Articulate Storyline 3 interactive media is created with the initial step of preparing the design and elements and creating a layout or storyboard that will be used. After the initial steps are completed, the product creation stage is continued using the Articulate Storyline 3 application. The background design and elements on this media are made using Canva, while the images are obtained from Google Photos, and the learning videos are made with references from YouTube. The final stage is the process of creating interactive media in the Articulate Storyline 3 application which is then published as a web or html5 and integrated into a qr code that can be moved using Google Lens or the default scanner application from Android. The media that has been created can be accessed via an Android device or computer, so that students can learn flexibly without being bound by time and location. The sections of the Articulate Storyline 3 interactive media consist of the following menus:

Figure 2. Cover

Figure 3. Login page

Figure 4. Instructions for use

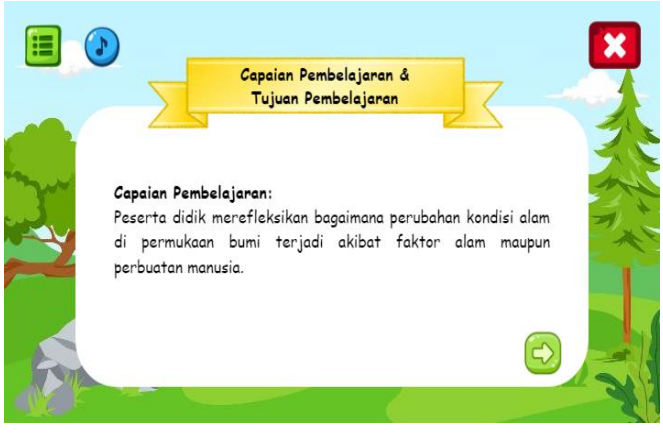

Figure 5. Learning achievements and objectives

Figure 6. Main menu

Figure 7. Material menu

Figure 8. Earth structure material menu

Figure 9. Game

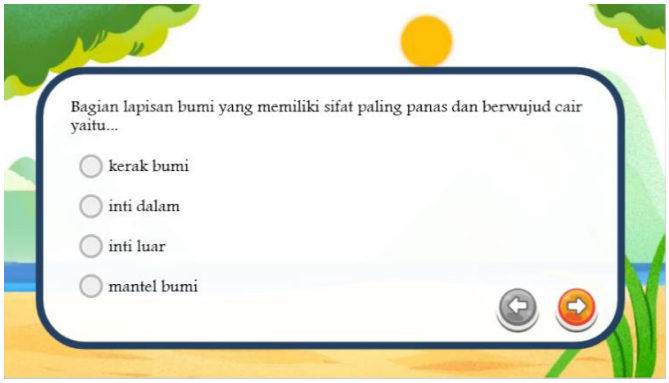

Figure 10. Quiz questions

Validation of Articulate Storyline 3 Media Product Design

At this stage, the media that has been created is assessed by media and material experts using validation instruments to determine whether the product is in accordance with the needs. After the product is assessed by expert validators, the researcher makes product revisions according to the suggestions and input given by the expert validators. Learning media will be included in the very feasible criteria if it gets a score of 86-100%, feasible criteria if it gets a score of 71-85%, quite feasible criteria if it gets a score of 56-70%, less feasible criteria if it gets a score of 41-55%, and not feasible criteria if it gets a score of 25-40%. The recapitulation of the product validation results for each expert validator is presented in Table 1.

Table 1. Results of expert validator assessment of articulate storyline 3 media

Indicator	Material Validation	Media Validation
Total Score	65	37
Maximum Score	72	40
Percentage (%)	90.20	92.50
Criteria	Very Worth It	Very Worth It

Design Revision

At the design revision stage of media development using Articulate Storyline 3, based on the assessment results of expert validators on the media, no design revision is needed because the media that has been created is functioning according to the desired objectives. All design elements, interactivity, and presentation of materials have been adjusted to learning needs. Therefore, this media is ready to be tested because it is not only visually appealing, but also able to support learning to be more interactive. To ensure that teachers and students can easily access this media both inside and outside the classroom, a product trial was conducted. In addition, the test also aims to assess how students respond to this media in the context of learning, and to what extent the media can help them understand the material better. The results of this trial will be the basis for further use and future evaluation, although at this stage, the media is ready to use without the need for further revision.

Product Trial

The next implementation stage is a small-scale and large-scale product trial. In the small-scale trial of class V SDN Sembaturagung 02 in the 2024/2025 academic year. Students were selected based on their ability levels consisting of 2 students with a high average level of learning outcomes, 2 students with a medium average level of learning outcomes, and 2 students with a low average level of learning outcomes. After learning using the Articulate Storyline 3 media was completed, teachers and students were given a response questionnaire related to the use of the interactive media Articulate Storyline 3, each questionnaire containing 18 questions. This questionnaire uses a Likert scale of 1-4 which is filled in by students and teachers according to their experience using the product developed by the researcher. The questionnaire has the following assessment criteria: Very positive if the score is 76-100%, Positive if the score is 51-75%, Quite positive if the score is 26-50%, and Less positive if the score is 0-25%.

Table 2. Teacher and student responses to the interactive media articulate storyline 3 on a small scale

Respondent Assessment	Percentage (%)	Criteria
Teacher	89.12	Very Positive
Students	95.80	Very Positive

No product revision was required in the small-scale trial because the data in Table 2 shows that teachers and students in small-scale classes have a very positive response to the use of the interactive media Articulate Storyline 3, as evidenced by a score exceeding 76%. This shows that the interactive media Articulate Storyline 3 is considered very good and can be used practically. This is also reinforced by the results of previous research by (Husna & Fajar, 2022), which stated that in the teaching process, Articulate Storyline 3 is very effective and interesting, so that it elicits a positive response from students because it can improve their understanding of the material being taught. It is further explained that because it involves students directly in the learning process, the creation of Articulate Storyline 3 media is interesting and effective (Simatupang & Napitupulu, 2023).

Table 3. Teacher and student responses to interactive media articulate storyline 3 on a large scale

Respondent Assessment	Percentage (%)	Criteria
Teacher	92	Very Positive
Students	95.80	Very Positive

Furthermore, the results of the large-scale trial responses in table 3 also show that the interactive media Articulate Storyline 3 was stated to be very positive and practical with a score of 92% from teachers and 95.8% from students in the large-scale trial. This assessment is based on 18 questions contained in the questionnaire using a Likert scale of 1-4. Thus, the interactive media Articulate storyline 3 can be stated to be practical and feasible for use in learning activities.

Effectiveness of Articulate Storyline 3 Media to Improve Student Learning Outcomes

To measure the effectiveness of the developed product, a large-scale trial was conducted on grade V students of SDN Sembaturagung 02 in the 2024/2025 academic year, involving 29 students. The interactive media Articulate Storyline 3 was used in science subjects with the material on the structure of the earth's layers. The assessment was carried out by comparing student learning outcomes before and after using the interactive media. Data analysis was carried out by applying the Paired Sample T-test to assess changes in science learning outcomes. Before carrying out the main analysis, a normality test was first carried out to ensure that the data was normally distributed. Decisions are made based on the significance value: if the significance value < 0.05, the data is considered not normally distributed, while if the significance value > 0.05, the data is categorized as normally distributed. The results of the normality test can be seen in Table 4.

Table 4. Results of data normality test

	Shapiro-Wilk		
	Statistic	Df	Sig.
Pretest Score	.952	29	.205
Posttest Score	.949	29	.175

Based on the analysis results in table 4, the data shows a normal distribution because the significance value is > 0.05. The next test conducted is the Paired Sample T-test. Decision making in this t-test is based on the significance value (2-tailed). If the significance value is < 0.05, then there is a difference in the average learning outcomes of grade V students between the pretest and posttest. Conversely, if the significance value is > 0.05, then there is no significant difference in the average learning outcomes. Paired Sample T-test analysis results.

Table 5. Paired sample t-test results

	Paired Sample Test		
	T-statistic	Degree of freedom	Sig. (2-tailed)
Pretest-Posttest Values	.687	29	<.001

Based on the analysis results in Table 5, the data shows a significance value (2-tailed) of 0.001 < 0.05, so it can be concluded that there is a significant difference between the pretest and posttest results with the use of interactive media Articulate Storyline 3. In addition, this is also proven through the average increase test (N-gain) by comparing the increase in pretest and posttest results calculated using the N-gain index analysis in Table 6.

Table 6. N-Gain test results

Learning Outcomes	Average	Average Difference	N-gain	Category
Pretest	51	24	.5035	Medium
Posttest	75			

Based on Table 6 from the results of the N-gain analysis, it is known that the average difference in large-scale product trials is 24 and the N-gain value is 0.50. This shows that the learning outcomes of grade V students of SDN Sembaturagung 02 have increased with an average of 0.50 and are included in the "moderate" criteria. The increase in the average learning outcomes shows that the interactive media Articulate Storyline 3 in the science subject on the structure of the earth's layers of grade V SDN Sembaturagung 02 is effective in improving student learning outcomes. This is supported by Leztiyani (2021), who stated that Articulate Storyline 3 as an interactive media can increase student enthusiasm with various practical menus and facilities that support the learning process to make it more enjoyable. Furthermore, this is in line with the selection of HTML5 as a platform for publishing the learning media, because HTML5 allows the integration of richer multimedia elements, such as audio, video, and animation, which will further enrich the interactive experience in Articulate Storyline 3 (Mayrita et al., 2024; Anggriani et al., 2022; Moriska & Hanif, 2024).

This media can be used by teachers to train students' problem-solving skills, and can help teachers in delivering difficult-to-explain material with more effective and enjoyable learning (Nissa et al., 2021; Tong et al., 2022; Ling & Mahmud, 2023). The use of Articulate Storyline 3 media also improves the mastery of 21st-century skills by integrating games that are tailored to students' emotional health needs (Heliawati et al., 2022; Milenia & Nurharini, 2024). In its use using Android, this technology-based interactive media can also encourage independent learning, which invites students to be more actively involved in their learning process directly (Criollo-C et al., 2021; Almulla, 2020; Inguva et al., 2018). The advantage of this media is that teachers and students learn the material without being hindered by space and time, because it can be accessed anytime and anywhere (Aspahani et al., 2020; Hastuti et al., 2021). This study shows that the interactive media Articulate Storyline 3 can be used as a learning medium that can be

utilized by teachers and students to improve the learning outcomes of students in science on the material of the earth's layers of class V of elementary school. The analysis and results of the study prove that this media is feasible and effective for use in science learning for class V of elementary school (Repelita et al., 2023).

Conclusion

The results of this study indicate that the interactive media Articulate Storyline 3 in the subject of science on the material of the structure of the earth's layers is proven to be able to improve the learning outcomes of grade V students of SDN Sembaturagung 02. In the Development of Articulate Storyline 3 Media, there are several menus including the home page, login menu, CP and TP, instructions for use, materials, games, quizzes, developer profiles, and bibliographies. This is evidenced by the results of the feasibility test based on the validation results by material experts and media experts which show that the interactive media Articulate Storyline 3 is declared "very feasible". The percentage of scores from each validator is 90.20% for material experts and 92.50% for media experts. The practicality of the product is shown by the results of the questionnaire responses of teachers and students to the interactive media Articulate Storyline 3, the percentage of teacher responses is 92% and the percentage of students is 95.8% with very positive criteria. The effectiveness of interactive media Articulate Storyline 3 in science learning is also stated to be effective as proven by the results of the t-test with a significance value of 0.001 < 0.05, so it can be concluded that there is a significant difference between the pretest and posttest results and the N-gain value of 0.50 which is included in the "moderate" category. The results show that the interactive media Articulate Storyline 3 meets the criteria of feasibility, practicality, and effectiveness to improve the learning outcomes of fifth grade elementary school students in the science subject of the structure of the earth's layers.

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S.N. contributed to the research, product development, data analysis, and writing of the article; S.Y. acted as a supervisor during the research process, providing support from the beginning to the end of writing this article.

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Conflicts of Interest
The author declares that he has no conflict of interest.

References

Adhana, H. M., & Andriani, A. E. (2024). Development of Interactive Multimedia Based on Problem-Based Learning to Improve IPAS Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, *10*(9), 6737–6745. https://doi.org/10.29303/jppipa.v10i9.7588

Alfiana, A., & Fathoni, A. (2022). Kesulitan Guru dalam Menerapkan Pembelajaran IPA Berbasis Etnosains di Sekolah Dasar. *Jurnal Basicedu*, *6*(4), 5721–5727. https://doi.org/10.31004/basicedu.v6i4.3123

Almulla, M. A. (2020). The Effectiveness of the Project-Based Learning (PBL) Approach as a Way to Engage Students in Learning. *Sage Open*, *10*(3), 2158244020938702. https://doi.org/10.1177/2158244020938702

Ananda, R., Hadiyanto, H., Erita, Y., & Karneli, Y. (2023). Development of Android-Based Interactive Media Articulate Storyline 3 in the Merdeka Curriculum. *Jurnal Penelitian Pendidikan IPA*, *9*(9), 6819–6827. https://doi.org/10.29303/jppipa.v9i9.5393

Anggriani, M. D., Haryanto, H., & Atmojo, S. E. (2022). The Impact of Problem-Based Learning Model Assisted by Mentimeter Media in Science Learning on Students' Critical Thinking and Collaboration Skills. *International Journal of Elementary Education*, *6*(2), 350–359. https://doi.org/10.23887/ijee.v6i2.46837

Aspahani, E. L., Nugraha, A., & Giyartini, R. (2020). Rancangan Media E-Poster Berbasis Website pada Pembelajaran IPA di Sekolah Dasar. *PEDADIDAKTIKA: Jurnal Ilmiah Pendidikan Guru Sekolah Dasar*, *7*(2), 158–167. https://doi.org/10.17509/pedadidaktika.v7i2.25458

Auvisena, A. U., & Fathurrahman, M. (2024). Development of Android-Based Interactive Media Articulate Storyline 3 in IPAS Subjects Fourth Grade. *Jurnal Penelitian Pendidikan IPA*, *10*(7), 4040–4047. https://doi.org/10.29303/jppipa.v10i7.7487

Cholilah, M., Tatuwo, A. G. P., Komariah, K., & Rosdiana, S. P. (2023). Pengembangan Kurikulum Merdeka dalam Satuan Pendidikan serta Implementasi Kurikulum Merdeka pada

Pembelajaran Abad 21. *Sanskara Pendidikan dan Pengajaran*, *1*(02), 56–67. https://doi.org/10.58812/spp.v1i02.110

Criollo-C, S., Guerrero-Arias, A., Jaramillo-Alcázar, Á., & Luján-Mora, S. (2021). Mobile Learning Technologies for Education: Benefits and Pending Issues. *Applied Sciences*, *11*(9), 4111. https://doi.org/10.3390/app11094111

Dewi, I. M., & Setyasto, N. (2024). Pengembangan Media Pembelajaran Digital Flipbook Berbasis Canva pada Mata Pelajaran IPAS Materi Sistem Pernapasan Kelas V di Sekolah Dasar. *Jurnal Penelitian Pendidikan IPA*, *10*(5), 2300–2308. https://doi.org/10.29303/jppipa.v10i5.7030

Gulo, A. (2022). Penerapan Model Pembelajaran Problem Based Learning dalam Meningkatkan Motivasi dan Hasil Belajar IPA. *Educativo: Jurnal Pendidikan*, *1*(1), 334–341. https://doi.org/10.56248/educativo.v1i1.58

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the Role of Digital Technologies in Education: A Review. *Sustainable Operations and Computers*, *3*, 275–285. https://doi.org/10.1016/j.susoc.2022.05.004

Hastuti, K. P., Angriani, P., Alviawati, E., & Arisanty, D. (2021). The Perspective of Geography Education Students on the Implementation of Online Learning During Covid-19 Pandemic. *IOP Conference Series: Earth and Environmental Science*, *747*(1), 012012. https://doi.org/10.1088/1755-1315/747/1/012012

Heliawati, L., Lidiawati, L., & Pursitasari, I. D. (2022). Articulate Storyline 3 Multimedia Based on Gamification to Improve Critical Thinking Skills and Self-Regulated Learning. *International Journal of Evaluation and Research in Education (IJERE)*, *11*(3), 1435. https://doi.org/10.11591/ijere.v11i3.22168

Husna, A., & Fajar, D. M. (2022). Development of Interactive Learning Media Based on Articulate Storyline 3 on Newton's Law Material with a Contextual Approach at the Junior High School Level. *IJIS Edu: Indonesian Journal of Integrated Science Education*, *4*(1), 17. https://doi.org/10.29300/ijisedu.v4i1.5857

Inguva, P., Lee-Lane, D., Teck, A., Anabaraonye, B., Chen, W., Shah, U. V., & Brechtelsbauer, C. (2018). Advancing Experiential Learning Through Participatory Design. *Education for Chemical Engineers*, *25*, 16–21. https://doi.org/10.1016/j.ece.2018.10.001

Ismiyah, K. N., Mahmudah, R., & Nurulqolbi, S. (2024). Kreativitas Guru dalam Mengimplementasikan Kurikulum Merdeka pada Mata Pelajaran IPAS Jenjang Sekolah Dasar. *Jurnal Basicedu*, *8*(1), 762–767. https://doi.org/10.31004/basicedu.v8i1.6559

Jannati, P., Ramadhan, F. A., & Rohimawan, M. A. (2023). Peran Guru Penggerak dalam Implementasi Kurikulum Merdeka di Sekolah Dasar. *Al-Madrasah: Jurnal Pendidikan Madrasah Ibtidaiyah*, *7*(1), 330. https://doi.org/10.35931/am.v7i1.1714

Kurniawati, F. N. A. (2022). Meninjau Permasalahan Rendahnya Kualitas Pendidikan di Indonesia dan Solusi. *Academy of Education Journal*, *13*(1), 1–13. https://doi.org/10.47200/aoej.v13i1.765

Leztiyani, I. (2021). Optimalisasi Penggunaan Articulate Storyline 3 dalam Pembelajaran Bahasa dan Sastra Indonesia. *Jurnal Pendidikan Indonesia*, *2*(01), 24–35. https://doi.org/10.59141/japendi.v2i01.63

Ling, A. N. B., & Mahmud, M. S. (2023). Challenges of Teachers When Teaching Sentence-Based Mathematics Problem-Solving Skills. *Frontiers in Psychology*, *13*, 1074202. https://doi.org/10.3389/fpsyg.2022.1074202

Majid, A. F., & Kawuryana, S. P. (2024). Articulate Storyline 3 Interactive Media to Increase Learning Interest and Activeness of Fifth Grade Elementary School Students. *Jurnal Ilmiah Sekolah Dasar*, *7*(4), 740–751. https://doi.org/10.23887/jisd.v7i4.61517

Manurung, P. (2021). Multimedia Interaktif sebagai Media Pembelajaran pada Masa Pandemi Covid 19. *Al-Fikru: Jurnal Ilmiah*, *14*(1), 1–12. https://doi.org/10.51672/alfikru.v14i1.33

Mayrita, H., Sahfitri, V., Aprilia, F., Abdillah, L. A., & Saputra, H. (2024). Design of an Interactive Digital Encyclopedia of Palembang Urban Culture on a Web-Based HTML5 Platform as an Implication for BIPA Learning. *Edelweiss Applied Science and Technology*, *8*(5), 633–647. https://doi.org/10.55214/25768484.v8i5.1728

Milenia, R., & Nurharini, A. (2024). Interactive Media Articulate Storyline to Improving Students' Learning Outcomes on Traditional Engklek Games Material. *Journal of Education Technology*, *7*(4), 707–714. https://doi.org/10.23887/jet.v7i4.69268

Moriska, A., & Hanif, M. (2024). Interactive Learning Multimedia Articulate Storyline as an Alternative Media to Improve Elementary Students' Critical Thinking Skills. *Jurnal Ilmiah Sekolah Dasar*, *8*(2), 258–269. https://doi.org/10.23887/jisd.v8i2.65310

Nissa, A. D. A., Toyib, M., Sutarni, S., Akip, E., Kadir, S., Ahmad, A., & Solikin, A. (2021). Development of Learning Media Using Android-Based Articulate Storyline Software for Teaching Algebra in Junior High School. *Journal of Physics: Conference Series*, *1720*(1), 012011. https://doi.org/10.1088/1742-6596/1720/1/012011

Novialdi, N., Mz, Z. A., & Thahir, M. (2020). Pengembangan Media Pembelajaran Berbasis Website untuk Memfasilitasi Pemahaman Konsep

Siswa SMK Negeri 5 Pekanbaru. *Milenial: Journal for Teachers and Learning*, *1*(1), 25–33. https://doi.org/10.55748/mjtl.v1i1.18

Nurmala, S., Triwoelandari, R., & Fahri, M. (2021). Pengembangan Media Articulate Storyline 3 pada Pembelajaran IPA Berbasis STEM untuk Mengembangkan Kreativitas Siswa SD/MI. *Jurnal Basicedu*, *5*(6), 5024–5034. https://doi.org/10.31004/basicedu.v5i6.1546

Ramdani, A., & Artayasa, I. P. (2020). Keterampilan Berpikir Kreatif Mahasiswa dalam Pembelajaran IPA Menggunakan Model Inkuiri Terbuka. *Jurnal Pendidikan Sains Indonesia*, *8*(1), 1–9. https://doi.org/10.24815/jpsi.v8i1.15394

Repelita, T., Sadiah, T. L., & Prihamdan, D. (2023). Development of Science Learning Video Media to Increase Elementary School Students' Interest in Learning. *Jurnal Penelitian Pendidikan IPA*, *9*(9), 7367–7372. https://doi.org/10.29303/jppipa.v9i9.4391

Simatupang, N. A., & Napitupulu, S. (2023). Development of Interactive Learning Media Based on Articulate Storyline 3 Theme 5 My Heroes on Student Learning Interest Grade IV Elementary School. *International Journal of Educational Research Excellence (IJERE)*, *2*(2), 155–165. https://doi.org/10.55299/ijere.v2i2.455

Sindu, I. G. P., Santyadiputra, G. S., & Permana, A. A. J. (2020). The Effectiveness of the Application of Articulate Storyline 3 Learning Object on Student Cognitive on Basic Computer System Courses. *Jurnal Pendidikan Vokasi*, *10*(3). https://doi.org/10.21831/jpv.v10i3.36094

Skulmowski, A., & Xu, K. M. (2022). Understanding Cognitive Load in Digital and Online Learning: A New Perspective on Extraneous Cognitive Load. *Educational Psychology Review*, *34*(1), 171–196. https://doi.org/10.1007/s10648-021-09624-7

Sofiantari, A. R. S., & Astuti, T. (2024). Development of Android-Based Digital Teaching Materials Using Articulate Storyline 3 to Increase Student Motivation and Learning Outcomes in Natural and Social Science Subjects. *Jurnal Penelitian Pendidikan IPA*, *10*(6), 3501–3510. https://doi.org/10.29303/jppipa.v10i6.7690

Sugih, S. N., Maula, L. H., & Nurmeta, I. K. (2023). Implementasi Kurikulum Merdeka dalam Pembelajaran IPAS di Sekolah Dasar. *Jurnal Pendidikan Dasar Flobamorata*, *4*(2), 599–603. https://doi.org/10.51494/jpdf.v4i2.952

Tong, D. H., Uyen, B. P., & Ngan, L. K. (2022). The Effectiveness of Blended Learning on Students' Academic Achievement, Self-Study Skills and Learning Attitudes: A Quasi-Experiment Study in Teaching the Conventions for Coordinates in the Plane. *Heliyon*, *8*(12), e12657. https://doi.org/10.1016/j.heliyon.2022.e12657

Wahyuni, M., Medriati, R., & Setiawan, I. (2024). Development of Interactive Learning Media Assisted by Articulate Storyline 3 to Train High School Students' Problem-Solving Skills. *Asian Journal of Science Education*, *6*(1), 95–107. https://doi.org/10.24815/ajse.v6i1.36356

Yolanda, S., Winarni, R., & Yulisetiani, S. (2022). The New Way Improve Learners' Speaking Skills: Picture and Picture Learning Media Based on Articulate Storyline. *Journal of Education Technology*, *6*(1), 173–181. https://doi.org/10.23887/jet.v6i1.41452

Zulfa, P. I., Ni'mah, M., & Amalia, N. F. (2023). Implementasi Media Pembelajaran Berbasis Teknologi IT dalam Mengatasi Keterbatasan Pendidikan di Era 5.0 pada Sekolah Dasar. *eL Bidayah: Journal of Islamic Elementary Education*, *5*(1), 1–15. https://doi.org/10.33367/jiee.v5i1.3533