Articulate Storyline Interactive Learning Media on the Topic of Plant Anatomy

M. Rizal Fatoni [1*], K. Bektiningsih [2] (iD)

[1,2] Pendidikan Guru Sekolah Dasar, Universitas Negeri Semarang, Semarang, Indonesia

A R T I C L E   I N F O

A B S T R A K

Kurangnya keberagaman media pembelajaran yang digunakan untuk menunjang pembelajaran IPAS dan kurangnya penggunaan media inovatif khususnya media berbasis IT mengakibatkan rendahnya pemahaman siswa terhadap materi. Tujuan penelitian ini yaitu mengembangkan media pembelajaran interaktif berbasis Articulate Storyline untuk meningkatkan pemahaman siswa. Jenis penelitian ini yaitu pengembangan (Research and Development) dengan model penelitian Borg and Gall. Metode pengumpulan data menggunakan observasi, wawancara dan kuisioner. Instrumen pengumpulan data menggunakan lembar kuesioner. Menguji rancangan produk dilakukan oleh ahli materi, ahli media, dan peserta didik. Para ahli memberikan penilaian uji kelayakan terhadap media, sedangkan beberapa peserta didik akan melakukan uji coba skala kecil. Teknik analisis yang digunakan yaitu kualitatif dan kuantitatif. Hasil penelitian menunjukan penilaian dari ahli materi sebesar 88,7%, dan penilaian dari ahli media sebesar 85%. Hasil penilaian uji N-Gain yang diperoleh score 0,58. Disimpulkan bahwa media pembelajaran interaktif berbasis Articulate Storyline layak dan efektif digunakan dalam meningkatkan hasil belajar siswa kelas IV Sekolah Dasar.

A B S T R A C T

The lack of diversity in learning media used to support science and science learning and the lack of innovative media, especially IT-based media, result in students' low understanding of the material. This research aims to develop interactive learning media based on Articulate Storyline to improve students' understanding. This type of research is development (Research and Development) with the Borg and Gall research model. Data collection methods use observation, interviews, and questionnaires. The data collection instrument uses a questionnaire sheet. Testing product designs is conducted by material experts, media experts, and students. Experts provide a feasibility test assessment of the media, while some students will conduct small-scale trials. The analysis techniques used are qualitative and quantitative. The research results showed that the assessment of material experts was 88.7%, and the assessment of media experts was 85%. The results of the N-Gain test assessment obtained a score of 0.58. It was concluded that interactive learning media based on Articulate Storylines is feasible and effective in improving the learning outcomes of fourth-grade elementary school students.

1. INTRODUCTION

Natural and social sciences blend science and social studies to help students develop critical and rational thinking skills. Natural and Social Sciences have a concept with learning objectives to provide experience and improve skills. In the independent curriculum, science lesson content and social studies lesson content are integrated into natural and social science subjects (Agustina et al., 2022; Surya et al., 2023). The purpose of learning Natural and Social Sciences in the independent curriculum is to develop a sense of interest, curiosity, active participation, and the ability to develop knowledge and skills (Agustina et al., 2022; Muhardini et al., 2023; Wanti & Chastanti, 2023). Students view elementary school science as a subject that is fun and easy to understand. This is because the content of science is taught through daily experiences, and if students have a strong interest in learning science, they will achieve good learning outcomes (Adnyani et al., 2020; Ayuni et al., 2017; Devi & Bayu, 2020; Pramita et al., 2019). Students can develop their curiosity about the phenomena around them through learning Natural and Social Sciences. This curiosity helps students understand how the universe works and interacts with life. Primary school

Corresponding author
E-mail addresses: rizalfatoni32@students.unnes.ac.id (M. Rizal Fatoni)

education should provide opportunities for students to explore, deepen, and the environment (Aini & Winahyu, 2021; Alawiyah & Sopandi, 2016; Maula & Fatmawati, 2022).

However, the current problem is the need for more technology-based learning media to facilitate student learning. Previous research findings also revealed teachers' difficulties developing technology-based learning media to support learning (Dewi & Sujana, 2021; Dinayusadewi et al., 2020; Siregar & Kurniati, 2022). Other findings also confirm that the lack of learning media that facilitates students impacts low student learning outcomes (Filivani & Agung, 2021; Pramestika et al., 2020; Yolanda et al., 2022). The results of interviews with Class IV A SD Labschool UNNES teachers found a need for more variety in the learning media used to support learning in Natural and Social Sciences. Another problem is the need for more innovative media, especially IT-based media, which makes students understand the material less. Teachers still use material texts, images, and videos from YouTube. In the learning process, teachers only use learning media in textbooks provided by the government and use simple pictures, making it easier for students to understand the learning material and get bored easily. Students become passive when carrying out learning activities. A more-than-optimal learning process causes a lack of learning success (Alshawabkeh et al., 2021; Dewi, M. D., & Izzati, 2020).

Based on these problems, teachers need to be able to develop interactive and innovative learning media in the learning process (Megawati & Utami, 2020; Zaenal Fais et al., 2019). Technology is utilized in learning, including learning principles. ICT can be utilized to develop learning media (Alqahtani, 2019; Erdemir & Yangın Ekşi, 2019; Roemintoyo & Budiarto, 2021). Therefore, it is ideal to use this technology to achieve learning objectives. The development of this technology is expected to produce learners with competencies called 4C. 4C skills (collaborative communicative, critical, creative, innovative) that students in 21st-century learning must possess (Astuti et al., 2022; Meilani et al., 2020; Widodo & Wardani, 2020). Advances in technology bring many conveniences, including software applications that can be used to create learning media. With the advancement of technology, learning media is also advancing (Li et al., 2019; Surma & Kirschner, 2020).

One of the digital-based learning media that can be used is Articulate Storyline-based interactive learning media. Interactive learning media can be used to achieve maximum learning objectives. It is also supported by previous findings stating that interactive media can help students learn (Hendi et al., 2020; Herdiyanto et al., 2020; Putra et al., 2020). The purpose of using media is to encourage students to think intensively in the form of their attention and interest and help them understand more deeply what has been learned (Andari, 2020; Febiharsa & Djuniadi, 2018; Santoso, 2019). One software that can be used to develop interactive media is Articulate Storyline. Learning media with an Articulate Storyline can provide a new and interesting learning atmosphere and become an alternative learning media that helps educators teach difficult material (Darnawati et al., 2019; Yasin & Ducha, 2017). Learning Media with Articulate Storyline creates learning media that provides learning materials that combine images, animations, videos, and accompanying music to make learning innovative and interactive in quizzes (Arwanda et al., 2020; Sari & Harjono, 2021). Articulate Storyline is an interactive learning media creation software launched by Global Incorporation in 2014. It can combine slides, Flash (SWF), videos, and animated characters into one. The format provided is .exe so you can use it directly on your PC/laptop. This software can run on Windows 7, 8, and 10 (Agustina et al., 2022; Rafmana & Chotimah, 2018).

The advantage of Articulate Storyline is that it is an interactive multimedia application that teachers and students can use (Anitasari & Dyah Utami, 2022; Nugroho & Arrosyad, 2020). This software is similar to PowerPoint in that it is easy to use. Users can use Articulate Storyline for the public as they wish. The results of Articulate Storyline can be accessed without the Internet. Even without the Internet, the results of this file are also supported in HTML5 format so that it can be accessed from a computer or smartphone. In addition, learning media using Articulate Storyline has several advantages: 1) The results of Articulate Storyline can be published on Playstore, 2) Has an interactive and attractive appearance, and 3) Learning media that can be used anytime and anywhere, 4) online or offline, and 5) Can be used at home (Farida et al., 2019; Rafmana & Chotimah, 2018). This interactive media based on Articulate Storyline is expected to increase students' learning motivation in learning activities (Arwanda et al., 2020; Rohmah & Bukhori, 2020). This learning media is made to package interesting learning. Interactive media based on Articulate Storylines involves students directly and will be actively involved in learning activities (Arwanda et al., 2020; Sari & Harjono, 2021).

Previous research findings also reveal that interactive media can facilitate students' learning (Buchori, 2019; Permana & Nourmavita, 2017; Shalikhah, 2017). Other research also states that interactive media can improve student learning outcomes (Buchori, 2019; Oktafiani et al., 2020). Based on this, the Articulate Storyline interactive media can assist students in learning. The combination of learning multimedia and the Articulate Storyline application increases student involvement in learning so that learning becomes more effective and efficient. The Articulate Storyline software was chosen because it is

very interesting, has functions like Adobe Flashin, creates animation, and has a simple appearance. There has yet to be a study of interactive learning media articulate storyline material plant body parts. Based on this, this study aims to develop interactive learning media to articulate storyline material plant body parts.

2. METHOD

This type of research is Research and Development (RnD) in the research and development of interactive media learning. It is called Articulate Storyline. A model from Borg and Gall, with only eight out of ten stages, was used because it was adjusted with needs and time research. So only adapted the steps which include: (1) Potential and Problems, (2) Collection Data, (3) Design Product, (4) Design validation, (5) Design revision, (6) Small Scale Trial, (7) Large Scale Trial, and (8) Operational Testing (Borg, W R & Gall, 2003). The research was conducted in class IV A of LabSchool UNNES Elementary School. The research was conducted on 15 students. The method used in this study was data collection using test and non-test techniques. Test techniques were carried out through pre-test and post-test, while non-test techniques were carried out through observation, interviews, documentary data, and questionnaires. /observation was carried out by observing and paying attention to school facilities and seeing the learning activity process directly. Researchers conducted interviews with the fourth-grade teacher of LabSchool UNNES Elementary School to obtain data and information related to the learning process. Teachers and fourth-grade students were given a questionnaire of media needs and responses. Furthermore, media and material experts were given an assessment instrument to assess whether the learning media was worth testing. The grids of the material expert and media expert assessment instruments are shown in Table 1, Table 2, and Table 3.

Table 1. Material Expert Assessment Instrument Grid

No	Aspect	Indicator
1.	Competence	Suitability of Natural and Social Sciences subject matter with the competencies achieved
2.	Conformity Aspect	Suitability of Natural and Social Sciences subject matter with learning media
		Suitability of Natural and Social Sciences lesson content with learning evaluation
3.	Language Aspects	Clarity of language use

Table 2. Media Expert Assessment Instrument Grid

No	Aspect	Indicator
1.	Suitability	Suitability of learning media to learning topics
2.	Appearance	Attractive design appearance
		The quality or display quality of learning media
3.	Language Aspects	Learning media is easy for students and teachers to use.
4.	Superiority	Users can understand learning media.

Table 3. Questionnaire Instrument Grid for Teacher and Student Responses to the Media

No	Aspect	Indicator
1.	Technical quality and media presentation	Display of interactive learning media
		Instructions for use
2.	Language Aspects	The influence of material in the media on students
		Presentation of material content

Qualitative and quantitative data analysis is the data analysis method used in this research. Data analysis techniques were obtained from interviews and observations. In contrast, quantitative data was obtained from the results of media feasibility tests by material experts and media experts, questionnaires filled out by teachers and students, and pre-test and post-test results. This research analyzes data using the Excel program.

3. RESULT AND DISCUSSION
Result

The results of this research are available in the form of interactive learning media, Articulate Storyline science lesson content, and science education content of plant body parts for class IV A at Labschool UNNES Elementary School. Researchers used the development model of the Borg and Gall model.

To find out the learning problems that occur at LabSchool UNNES Elementary School. The first stage begins with the potential and problem stage. At this stage, observations were made through interviews, documentation, and data in the form of student learning outcomes in class IV A SD LabSchool UNNES. The information results show that the limited learning resources and lack of interactive learning media affect student learning outcomes in learning Natural and Social Sciences. Researchers developed a product to overcome the problems of learning Natural and Social Sciences caused by limited learning resources and a need for learning media for Natural and Social Sciences.

In the second stage, data is collected after finding problems in the field. The next step is to find the cause of learning problems. The required data collection is student learning outcomes, teaching materials, and teacher and student needs surveys. Then, determine the theme and scope of interactive media Articulate Storyline and develop learning media in the form of interactive media Articulate Storyline. Researchers must ensure that students in grade IV A of LabSchool UNNES Elementary School can operate interactive learning media Articulate Storyline. Based on observations, grade IV A students can operate interactive media that can be implemented in the Computer Lab for learning.

The third stage is product design. The first process is to compile a storyboard to create outline content. Product designs are charts or images that can be used as guidelines for assessing and making media. The developed product results from data collection based on teacher and student needs. According to the storyboard, the designed product is developed into an actual product. Interactive learning media components include text, animation, images, videos, and accompanying music. Articulate Storyline software becomes the main program in making products of files as HTML5 links. The results of media development are presented in Figure 1.

Figure 1. Articulate Storyline Interactive Learning Media

The fourth stage is design validation. Design validation evaluates a product to see if a rational product design will be more effective. Material and media experts conduct the feasibility test of interactive learning media based on Articulate Storyline. It is necessary to evaluate each expert using a validation tool to determine the feasibility of interactive learning media design based on the Articulate Storyline. Besides further improvements and expert feedback, the researcher conducted a small group test with six students to get feedback and create an evaluation rubric to serve as a reference for product assessment. The results of the analysis contained revisions from material experts and media experts. Input from material experts is a revision to add pictures of real plants so students can easily understand the material. The revision from the media expert is to complete the menu bar section for each slide. The revised results are presented in Figure 2.

Figure 2. Results of Revision of Articulate Storyline Interactive Learning Media

In the fifth stage, namely design revision, researchers refined the design based on input from material and media experts. The product was revised and discussed again with material and media experts until the product was deemed suitable for testing. The results of the media feasibility test are presented in Table 4**.**

Table 4. Media Feasibility Test

Respondent	Percentage	Description
Materials Expert	88.7%	Workable
Media Expert	85%	Workable

Based on the results of Table 4, the evaluation of interactive learning media Articulate Storyline conducted by material experts is classified as feasible because it reaches a percentage value of 88.7% from 86% -100%. With the meaning of learning media, this is workable for learning, and there is input to adjust the lesson plan to the basic school. Evaluation of interactive learning media Articulate Storyline conducted by media experts is classified as very feasible to apply with a percentage of 85% and 86% -100%. It is concluded that this learning media is feasible to use for learning. The sixth stage is product testing. Testing was conducted in small groups to obtain feedback on the effectiveness of interactive learning media based on Articulate Storyline. An experiment with six students showed interactive learning media based on Articulate Storyline. After the experiment, researchers distributed questionnaires to teachers and students to find out the responses of students and teachers to interactive learning media based on Articulate Storylines, scientific content, and plant material. From the results of teacher and student responses, there were no revisions because they were appropriate.

The seventh stage is product revision. The product's shortcomings identified in the previous trials were corrected during this stage. The researcher refined the product based on the questionnaire to be used more effectively. Researchers improved the shortcomings of the Articulate Storyline interactive media tested in small groups to have the best performance when tested in large groups. The eighth stage is the usage test. The product has been improved based on small group trials, and then, at this stage, it is tested for use. All fourth-grade students of LabSchool UNNES Elementary School, as many as 15 students, are the object of research with the saturated sampling technique in this study. To determine the effectiveness of the media on student learning outcomes, researchers conducted experiments using interactive learning media, such as Articulate Storyline, on the subject matter of Natural and Social Sciences Plant Body Parts. The design applied was a pre-experimental design with a one-group pre-test post-test design model. A pre-test was conducted before and after learning to compare learning outcomes between pre-treatment and post-treatment conditions. Based on material and media experts' evaluation results, interactive learning based on Articulate Storyline is considered feasible to use in the learning process. The results of the large group test on interactive learning media Articulate Storyline are presented in Table 5**.**

Table 5. Large Group Cognitive Learning Outcomes

Action	Average	Highest Score	Lowest Score	Difference Average
Pre-test	51.25	60	40	27.81
Post-test	79.06	90	55	

Based on the assessment results contained in Table 5, it can be seen that the average student learning outcomes increased from 51.25 to 79.06, with an average difference of 27.81. It shows the difference between the conditions before and after students use Articulate Storyline media as learning media. The following N-gain test results are presented in Table 6**.**

Table 6. N-gain Test Results

Action	Average	Average Difference	N-Gain	Category
Pre-test	51.25	27.81	0.58	Effective enough
Post-test	79.06			

Based on the N-Gain test results in Table 6, it can be seen that the interactive learning media based on Articulate Storyline, with an N-Gain score of 0.58, is said to be quite effective in improving student understanding. Researchers used the response results by collecting student response data to improve the achievement of goals in developing Articulate-based interactive learning media. The results of the student response questionnaire showed a positive response to the interactive learning media based on the

Articulate Storyline content of Natural and Social Sciences lessons on Plant Body Parts material. The calculation results reached 93% of the total score of 100%. From these results, it can be concluded that using interactive learning media based on Articulate Storyline is effective in learning.

Discussion

The results of the data analysis showed that interactive learning media based on Articulate Storylines is suitable for use in learning. This is due to several factors. First, interactive learning media based on Articulate Storylines is suitable for learning because it can make learning easier for students. The development of interactive learning media based on Articulate Storylines makes it easier for students to learn because this media is packaged interestingly and creatively so that students will be interested when applied in class (Arwanda et al., 2020; Yasin & Ducha, 2017). It is reinforced by the findings that learning media is a tool that can support the learning process and clarify the learning material delivered by the teacher so that students can understand and achieve learning objectives (Anitasari & Dyah Utami, 2022; Rafmana & Chotimah, 2018; Sari & Harjono, 2021). Technology development is a tool that helps teachers create a learning media (Agustien et al., 2018; Hidayati & Astuti, 2020; Shalikhah, 2017). This learning media can help students more easily understand the subject matter of Plant Body Parts in the Natural and Social Sciences content in grade four elementary school. Using this learning media to support the learning outcomes of fourth-grade Natural and Social Sciences of Plant Body Parts material both classically and independently can be considered appropriate and able to overcome existing problems. Students are now clear about using too many learning resources when no parents help accompany learning. Pictures, schemes, and models are used so that students can understand abstract concepts (Aeni & Yusupa, 2018; Kurniawan et al., 2018). The material displayed is interactive, so students can see the learning material that is not understood (Arina et al., 2020; Permana & Nourmavita, 2017). This media also provides practice questions (quizzes), the learning indicators for concept understanding.

Second, interactive learning media based on Articulate Storyline is appropriate for learning because it increases students' enthusiasm. Using technology in learning activities increases student enthusiasm, and transferring knowledge will be accepted more easily, comfortably, and effectively (Arina et al., 2020; Ayu et al., 2015; Permana & Nourmavita, 2017; Yasa et al., 2021). The role of technology-based learning media is to provide learning materials that attract students' attention and keep them engaged in learning (Arwanda et al., 2020; Rafmana & Chotimah, 2018; Sari & Harjono, 2021; Yasin & Ducha, 2017). This interactive learning media based on Articulate Storyline facilitates student engagement with the material's content and can be adapted to students and teachers to increase motivation in the learning process. The choice of learning media must consider the criteria to suit the needs and learning objectives (Diyana et al., 2020; Putera et al., 2020). In choosing learning media, you should consider needs and learning objectives criteria. Choosing the right text, image, audio, and video content can attract students' attention and expand their knowledge while learning (Herdiyanto et al., 2020; Khamzawi & Wiyono, 2015). Interactive learning media based on Articulate Storyline is practical and does not require an internet connection so that students can use it anytime and anywhere.

Third, interactive learning media based on Articulate Storyline is feasible to use in learning because it improves a pleasant learning atmosphere. This learning media's development helps teachers provide learning materials (Herdiyanto et al., 2020; Sari & Harjono, 2021). Motivates students to learn, encourages students to be active, and allows students to understand learning materials and achieve learning goals optimally easily (Ayu et al., 2015; Permana & Nourmavita, 2017). In addition, interactive learning media based on Articulate Storyline can introduce students and teachers to information and communication technology devices, increase teacher creativity, and expand knowledge of science and technology. As for schools, the development of interactive learning media based on Articulate Storylines can contribute to improving the learning system at school and improving school quality, especially in using learning media through the utilization of Information Technology.

Previous findings also explain that interactive media is appropriate for improving students' understanding (Buchori, 2019; Permana & Nourmavita, 2017). Interactive media can help students learn and improve learning outcomes (Hakim et al., 2018; Supardi, 2014). Interactive learning media based on Articulate Storyline is suitable for use in the learning process. Using innovative media makes learning effective and efficient (Febriyandani, 2021). The results and discussion above show that interactive learning media based on an Articulate Storyline is effective and feasible for learning activities, so using interactive learning media can create an effective learning atmosphere and become an alternative to assist learning activities. Using interactive learning media based on Articulate Storyline is an alternative to creating an effective learning environment and supporting learning activities.

4. CONCLUSION

Developing interactive learning media based on Articulate Storyline received very feasible assessment criteria from experts. This media is declared effective for use in learning activities and is indicated by increased assessment scores before and after the test. It is concluded that the interactive media based on Articulate Storyline helps students better understand the previously unclear material. This learning media can also explain complex concepts, so it is explained by using interesting visualizations and interactions in the media to help explain complex concepts. Therefore, interactive learning media based on Articulate Storylines can improve the quality of learning and understanding of student material.

5. REFERENCES

Adnyani, N. K. M., Pudjawan, K., & Japa, I. G. N. (2020). Motivasi dan Hasil Belajar IPA dalam Pembelajaran Scramble Berbantuan Kartu Pertanyaan. *Jurnal Ilmiah Sekolah Dasar*, *4*(2), 270. https://doi.org/10.23887/jisd.v4i2.25622.

Aeni, W. A., & Yusupa, A. (2018). Model Media Pembelajaran E-Komik Untuk Sma. *Jurnal Kwangsan*, *6*(1), 1. https://doi.org/10.31800/jtpk.v6n1.p1--12.

Agustien, R., Umamah, N., & Sumarno, S. (2018). Pengembangan Media Pembelajaran Video Animasi Dua Dimensi Situs Pekauman di Bondowoso Dengan Model Addie Mata Pelajaran Sejarah Kelas X IPS. *Jurnal Edukasi*, *5*(1), 19. https://doi.org/10.19184/jukasi.v5i1.8010.

Agustina, N. S., Robandi, B., Rosmiati, I., & Maulana, Y. (2022). Analisis Pedagogical Content Knowledge terhadap Buku Guru IPAS pada Muatan IPA Sekolah Dasar Kurikulum Merdeka. *Jurnal Basicedu*, *6*(5), 9180–9187. https://doi.org/10.31004/basicedu.v6i5.3662.

Aini, T. N., & Winahyu, S. E. (2021). Implementasi Program Adiwiyata Berbasis Partisipatif Dalam Menumbuhkan Nilai-Nilai Karakter di Sekolah Dasar. *Sekolah Dasar: Kajian Teori Dan Praktik Pendidikan*, *1*, 57–70. https://doi.org/10.17977/um009v39i12021p057.

Alawiyah, I., & Sopandi, W. (2016). Pembelajaran Berbasis Proyek Untuk Meningkatkan Sikap Ilmiah Siswa Sekolah Dasar Pada Materi Peristiwa Alam. *Jurnal Penelitian Pendidikan*. https://doi.org/10.17509/jpp.v16i2.4241.

Alqahtani, A. S. (2019). The use of Edmodo: Its impact on learning and students' attitudes toward it. *Journal of Information Technology Education: Research*, *18*, 319–330. https://doi.org/10.28945/4389.

Alshawabkeh, A. A., Woolsey, M. L., & Kharbat, F. F. (2021). Using online information technology for deaf students during COVID-19: A closer look from experience. *Heliyon*, *7*(5), e06915. https://doi.org/10.1016/j.heliyon.2021.e06915.

Andari, R. (2020). Pemanfaatan Media Pembelajaran Berbasis Game Edukasi Kahoot! Pada Pembelajaran Fisika. *ORBITA: Jurnal Kajian, Inovasi Dan Aplikasi Pendidikan Fisika*, *6*(1), 135. https://doi.org/10.31764/orbita.v6i1.2069.

Anitasari, W. R., & Dyah Utami, R. (2022). Implementasi Media Articulate Storyline dalam Pembelajaran sebagai Penunjang Pelaksanaan Kurikulum 2013 di Sekolah Dasar. *Jurnal Basicedu*, *6*(4), 5926–5935. https://doi.org/10.31004/BASICEDU.V6I4.3167.

Arina, D., Mujiwati, E. S., & Kurnia, I. (2020). Pengembangan Multimedia Interaktif Untuk Pebelajaran Volume Bangun Ruang Di Kelas V Sekolah Dasar. *Prima Magistra: Jurnal Ilmiah Kependidikan*, *1*(2), 168–175. https://doi.org/10.37478/jpm.v1i2.615.

Arwanda, P., Irianto, S., & Andriani, A. (2020). Pengembangan Media Pembelajaran Articulate Storyline Kurikulum 2013 Berbasis Kompetensi Peserta Didik Abad 21 Tema 7 Kelas Iv Sekolah Dasar. *Al-Madrasah: Jurnal Pendidikan Madrasah Ibtidaiyah*, *4*(2), 193. https://doi.org/10.35931/am.v4i2.331.

Astuti, W., Nur'Aini, D. E., & Sangadah, L. (2022). Pengembangan Open Ended Play Untuk Meningkatkan Kompetensi Abad 21 (4cs) Pada Anak Usia 4-6 Tahun. *Jurnal Graha Pengabdian*, *4*(3), 223–236. https://doi.org/10.17977/um078v4i32022p223-236.

Ayu, G., Mega, M., Sudhita, I. W. R., & Suwatra, I. I. W. (2015). Pengembangan Multimedia Pembelajaran Interaktif Agama Hindu Dengan Model ADDIE untuk Siswa Kelas VIII SMP. *Jurnal Eductech Undiksha*, *3*(1), 1–11. https://doi.org/10.23887/jeu.v3i1.5869.

Ayuni, I. G. A. P. A. S., Kusmariyatni, N., & Japa, I. G. N. (2017). Pengaruh Model Pembelajaran Talking Stick Berbantuan Media Question Box terhadap Hasil Belajar IPA Kelas V. *Journal of Education Technology*, *1*(3), 183–190. https://doi.org/http://dx.doi.org/10.23887/jet.v1i3.12503.

Borg, W R & Gall, M. D. (2003). *Educational research: an Introduction (7th. ed)*. New York: Logman Inc.

Buchori, A. (2019). Pengembangan multimedia interaktif dengan pendekatan kontekstual untuk meningkatkan pemecahan masalah kemampuan matematika. *Jurnal Inovasi Teknologi Pendidikan*, *6*(1), 104–115. https://doi.org/10.21831/jitp.v6i1.20094.

Darnawati, D., Jamiludin, J., Batia, L., Irawaty, I., & Salim, S. (2019). Pemberdayaan Guru Melalui Pengembangan Multimedia Pembelajaran Interaktif Dengan Aplikasi Articulate Storyline. *Amal Ilmiah : Jurnal Pengabdian Kepada Masyarakat*, *1*(1). https://doi.org/10.36709/amalilmiah.v1i1.8780.

Devi, P. S., & Bayu, G. W. (2020). Berpikir Kritis dan Hasil Belajar IPA Melalui Pembelajaran Problem Based Learning Berbantuan Media Visual. *Mimbar PGSD Undiksha*, *8*(2), 238–252. https://doi.org/10.23887/jjpgsd.v8i2.26525.

Dewi, M. D., & Izzati, N. (2020). Pengembangan Media Pembelajaran PowerPoint Interaktif Berbasis RME Materi Aljabar Kelas VII SMP. *Delta: Jurnal Ilmiah Pendidikan Matematika*, *8*(2), 217. https://doi.org/10.31941/delta.v8i2.1039.

Dewi, N. L. P. J., & Sujana, I. W. (2021). Learning Multimedia Based on RPG Maker MV Material for Circumference and Area of Flat Shapes for Elementary School Students. *Journal of Education Technology*, *5*(3), 365. https://doi.org/10.23887/jet.v5i2.34462.

Dinayusadewi, N. P., Ngurah, G., & Agustika, S. (2020). Development Of Augmented Reality Application As A Mathematics Learning Media In Elementary School Geometry Materials. *Journal of Education Technology*, *4*(2), 204–210. https://doi.org/10.23887/jet.v4i2.25372.

Diyana, T. N., Supriana, E., & Kusairi, S. (2020). Pengembangan multimedia interaktif topik prinsip Archimedes untuk mengoptimalkan student centered learning. *Jurnal Inovasi Teknologi Pendidikan*, *6*(2), 171–182. https://doi.org/10.21831/jitp.v6i2.27672.

Erdemir, N., & Yangın Ekşi, G. (2019). The Perceptions of Student Teachers About Using an Online Learning Environment 'Edmodo' in a 'Flipped Classroom.' *SDU International Journal of Educational Studies*, *6*(2), 174–186. https://doi.org/10.33710/sduijes.638795.

Farida, F., Suherman, S., & Zulfikar, S. (2019). Peningkatan Kemampuan Pemahaman Konsep Himpunan Melalui Pembelajaran Matematika dengan Media Articulate Studio'13. *JSHP : Jurnal Sosial Humaniora Dan Pendidikan*, *3*(1), 20–28. https://doi.org/10.32487/JSHP.V3I1.536.

Febiharsa, D., & Djuniadi, D. (2018). Pengembangan Media Pembelajaran Interaktif 3 Dimensi untuk Pembelajaran Materi Pengenalan Lingkungan Pada Anak Usia Dini di Indonesia. *Journal of Studies in Early Childhood Education (J-SECE)*, *1*(1). https://doi.org/10.31331/sece.v1i1.590.

Febriyandani, R. (2021). Pengembangan Media Komik dalam Pembelajaran Matematika Materi Pecahan Kelas IV Sekolah Dasar. *Jurnal Pedagogi Dan Pembelajaran*, *4*(2), 323–330. https://doi.org/10.23887/jp2.v4i2.37447.

Filivani, P. N., & Agung, A. A. G. (2021). Developing E-Book Contained Character Values in PPKn Lesson Content Grade V Elementary School. *Journal of Education Technology*, *1*(1), 60–69. https://doi.org/10.23887/jet.v5i1.32047.

Hakim, M. L., Asrowi, & Akhyar, M. (2018). Pengembangan Multimedia Interaktif Mata Pelajaran Bahasa Arab Materi Profesi bagi Siswa Kelas VIII SMP IT Al-Huda Wonogiri. *JTP - Jurnal Teknologi Pendidikan*, *20*(3), 249–263. https://doi.org/10.21009/jtp.v20i3.9537.

Hendi, A., Caswita, C., & Haenilah, E. Y. (2020). Pengembangan Media Pembelajaran Interaktif Berbasis Strategi Metakognitif untuk Meningkatkan Kemampuan Berpikir Kritis siswa. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *4*(2), 823–834. https://doi.org/10.31004/cendekia.v4i2.310.

Herdiyanto, D. M., Sulton, & Praherdhiono, H. (2020). Pengembangan Multimedia Pembelajaran Interaktif Pada Materi Tema Tanah Bagi Siswa Tunagrahita. *JKTP Jurnal Kajian Teknologi Pendidikan*, *3*(1), 88–96. https://doi.org/10.17977/um038v3i12019p088.

Hidayati, A., & Astuti, S. (2020). Pengembangan Media Pembelajaran Buku Kata Bergambar Berbasis Android Untuk Meningkatkan Kemampuan Menulis. *Journal for Lesson and Learning Studies*, *3*(2). https://doi.org/10.23887/jlls.v3i2.27446.

Khamzawi, S., & Wiyono, K. (2015). Pengembangan Multimedia Interaktif Berbasis Model Pembelajaran Problem Based Leaning Pada Mata Pelajaran Fisika Pokok Bahasan Fuida Dinamis Untuk SMA Kelas XI. *Jurnal Inovasi Dan Pembelajaran Fisika*, *2*(1), 100–108. https://doi.org/10.36706/jipf.v2i1.2594.

Kurniawan, D., Kuswandi, D., & Husna, A. (2018). Pengembangan Media Video Pembelajaran Pada Mata Pelajaran Ipa Tentang Sifat Dan Perubahan Wujud Benda Kelas Iv Sdn Merjosari 5 Malang. *JINOTEP (Jurnal Inovasi Dan Teknologi Pembelajaran) Kajian Dan Riset Dalam Teknologi Pembelajaran*, *4*(2), 119–125. https://doi.org/10.17977/um031v4i22018p119.

Li, Y., Garza, V., Keicher, A., & Popov, V. (2019). Predicting High School Teacher Use of Technology: Pedagogical Beliefs, Technological Beliefs and Attitudes, and Teacher Training. *Technology, Knowledge and Learning*, *24*(3), 501–518. https://doi.org/10.1007/S10758-018-9355-2/TABLES/3.

Maula, N. R., & Fatmawati, L. (2022). Pengembangan Media Pembelajaran Kayaku (Kayanya Alam Negeriku)

Berbasis STEM Kelas IV Sekolah Dasar. *Jurnal Ilmiah Sekolah Dasar*, *4*(1), 97. https://doi.org/10.23887/jisd.v4i1.22351.

Megawati, & Utami. (2020). English Learning with Powtoon Animation Video. *Journal of Education Technology*, *4*(2), 110. https://doi.org/10.23887/jet.v4i2.25096.

Meilani, D., Dantes, N., & Tika, I. N. (2020). Pengaruh Implementasi Pembelajaran Saintifik Berbasis Keterampilan Belajar dan Berinovasi 4C terhadap Hasil Belajar IPA dengan Kovariabel Sikap Ilmiah pada Peserta Didik Kelas V SD Gugus 15 Kecamatan Buleleng. *Jurnal Elementary: Kajian Teori Dan Hasil Penelitian Pendidikan Sekolah Dasar*, *3*(1), 1–5. https://doi.org/10.31764/elementary.v3i1.1412.

Muhardini, S., Haifaturrahmah, H., Sudarwo, R., Kartiani, B. S., Anam, K., Mahsup, M., Khosiah, K., Ibrahim, I., & Herianto, A. (2023). Pengembangan Modul Ajar Ilmu Pengetahuan Alam Dan Sosial (Ipas) Bagi Siswa Sekolah Dasar Kelas Iv Dalam Kerangka Kurikulum Merdeka. *ORBITA: Jurnal Kajian, Inovasi, Dan Aplikasi Pendidikan Fisika*, *9*(1). https://doi.org/10.31764/orbita.v9i1.14742.

Nugroho, F., & Arrosyad, M. I. (2020). Learning Multimedia Development Using Articulate Storyline for Students. *International Journal of Elementary Education*, *4*(4), 575–579. https://doi.org/10.23887/ijee.v4i4.27763.

Oktafiani, D., Nulhakim, L., & Alamsyah, T. P. (2020). Pengembangan Media Pembelajaran IPA Berbasis Multimedia Interaktif Menggunakan Adobe Flash Pada Kelas IV. *Mimbar PGSD Undiksha*, *8*(3), 527–540. https://doi.org/10.23887/jjpgsd.v8i3.29261.

Permana, E. P., & Nourmavita, D. (2017). Pengembangan Multimedia Interaktif Pada Mata Pelajaran Ipa Materi Mendeskripsikan Daur Hidup Hewan Di Lingkungan Sekitar Siswa Kelas Iv Sekolah Dasar. *Jurnal PGSD*, *10*(2), 79–85. https://doi.org/10.33369/pgsd.10.2.79-85.

Pramestika, N. P. D., Wulandari, I. G. A. A., & Sujana, I. W. (2020). Enhancement of Mathematics Critical Thinking Skills through Problem Based Learning Assisted with Concrete Media. *Journal of Education Technology*, *4*(3), 254. https://doi.org/10.23887/jet.v4i3.25552.

Pramita, P. A., Sudarma, I. K., & Murda, I. N. (2019). Pengaruh Model Pembelajaran Scramble Berbantuan Media Gambar terhadap Hasil Belajar IPA. *Jurnal Pedagogi Dan Pembelajaran*, *2*(2), 186. https://doi.org/10.23887/jp2.v2i2.17907.

Putera, I. K. A., Ardyanti, A. A. A. P., Fredlina, K. Q., Sujarwo, W., Satwika, I. P., & Pharmawati, M. (2020). Perancangan Aplikasi Media Interaktif Berbasis Mobile sebagai Pengenalan Artefak Museum. *ANDHARUPA: Jurnal Desain Komunikasi Visual & Multimedia*, *6*(1), 43–62. https://doi.org/10.33633/andharupa.v6i1.2794.

Putra, I. N. T. A., Kartini, K. S., & Widiyaningsih, N. N. (2020). Implementasi Media Pembelajaran Interaktif Berbasis Mobile pada Materi Hidrokarbon. *Jurnal Pendidikan Kimia Indonesia*, *4*(2), 43–52. https://doi.org/10.23887/jpk.v4i2.28536.

Rafmana, H., & Chotimah, U. (2018). Pengembangan Multimedia Interaktif Berbasis Articulate Storyline untuk Meningkatkan Motivasi SMA Srijaya Negara Palembang. *Jurnal Bhinneka Tunggal Ika*, *5*(1). https://doi.org/10.36706/jbti.v5i1.7898.

Roemintoyo, R., & Budiarto, M. K. (2021). Flipbook as Innovation of Digital Learning Media: Preparing Education for Facing and Facilitating 21st Century Learning. *Journal of Education Technology*, *5*(1), 8. https://doi.org/10.23887/jet.v5i1.32362.

Rohmah, F. N., & Bukhori, I. (2020). Pengembangan Media Pembelajaran Interaktif Mata Pelajaran Korespondensi Berbasis Android Menggunakan Articulate Storyline 3. *ECOEDUCATION (Economic & Education Journal)*, *2*(2), 169–182. https://doi.org/10.33503/ecoducation.v2i2.892.

Santoso, P. (2019). Pengembangan Media Interaktif Menggunakan Model Assure Untuk Membantu Guru Dalam Pembelajaran Fisika Tentang Alat Ukur Listrik. *Briliant: Jurnal Riset Dan Konseptual*, *4*(2). https://doi.org/10.28926/briliant.v4i2.319.

Sari, R. K., & Harjono, N. (2021). Pengembangan Media Pembelajaran Interaktif Berbasis Articulate Storyline Tematik Terhadap Minat Belajar Siswa Kelas 4 SD. *Jurnal Pedagogi Dan Pembelajaran*, *4*(1), 122. https://doi.org/10.23887/jp2.v4i1.33356.

Shalikhah, N. D. (2017). Media Pembelajaran Interaktif Lectora Inspire sebagai Inovasi Pembelajaran. *Warta LPM*, *20*(1), 9–16. https://doi.org/10.23917/warta.v19i3.2842.

Siregar, E. S., & Kurniati, R. (2022). Multimedia as a Learning Tool in Training Reading Skills of Elementary Schools Students. *Journal of Educational Technology*, *6*(2), 299–307. https://doi.org/10.23887/jet.v6i2.44601.

Supardi, A. (2014). Penggunaan Multimedia Interaktif Sebagai Bahan Ajar Suplemen Dalam Peningkatan Minat Belajar. *Jurnal Ilmu Penddikan Dasar*, *1*(2), 161–167. https://doi.org/10.30659/pendas.1.2.161=167.

Surma, T., & Kirschner, P. A. (2020). Virtual Special Issue Computers in Human Behavior Technology

Enhanced Distance Learning Should Not Forget How Learning Happens. *Computers in Human Behavior*, *110*. https://doi.org/10.1016/j.chb.2020.106390.

Surya, A. D., Sumarno, S., & Muhtarom, M. (2023). Analisis Kualitas Instrumen Tes Hasil Belajar IPAS Materi Wujud Zat dan Perubahannya. *Fondatia : Jurnal Pendidikan Dasar*, *7*(2). https://doi.org/10.36088/fondatia.v7i2.3190.

Wanti, L., & Chastanti, I. (2023). Analysis of preparation in the independent curriculum implementation: Case study on IPAS learning. *Bio-Inoved: Jurnal Biologi-Inovasi Pendidikan*, *5*(2). https://doi.org/10.20527/bino.v5i2.15493.

Widodo, S., & Wardani, R. K. (2020). Mengajarkan Keterampilan Abad 21 4C (Communication, Collaboration, Critical Thinking And Problem Solving, Creativity And Innovation) Di Sekolah Dasar. *MODELING: Jurnal Program Studi PGMI*, *7*(2), 185–197. https://doi.org/10.36835/modeling.v7i2.665.

Yasa, I. K. D. C. A., Agung, A. A. G., & Simamora, A. H. (2021). Meningkatkan Semangat Belajar Siswa melalui Multimedia Interaktif pada Mata Pelajaran IPA. *Jurnal Edutech Undiksha*, *8*(1), 104–112. https://doi.org/10.23887/jeu.v9i1.32523.

Yasin, A. N., & Ducha, N. (2017). Kelayakan Teoritis Multimedia Interaktif Berbasis Articulate Storyline Materi Sistem Reproduksi Manusia Kelas XI SMA. *Jurnal Bioedukatika*, *6*(2). https://ejournal.unesa.ac.id/index.php/bioedu/article/view/20868.

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. https://doi.org/10.23887/jet.v6i1.41452.

Zaenal Fais, M., Listyarini, I., & Nashir Tsalatsa, A. (2019). Pengembangan Media Papin dan Koja (Papan Pintar dan Kotak Ajaib) Sebagai Media Pembelajaran Matematika. *Jurnal Penelitian Dan Pengembangan Pendidikan*, *3*(1). https://doi.org/10.23887/jppp.v3i1.17097.