

Development of Articulate Storyline 360-Based Interactive Learning Media Integrated with PhET to Support the Implementation of the Merdeka Curriculum on Elements, Compounds, and Mixtures

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Abstrak

The urgency of this research is to develop interactive learning media that integrates Articulate Storyline 360 and PhET simulations to enhance students' conceptual understanding of elements, compounds, and mixtures while supporting the effective implementation of the Merdeka Curriculum. Science learning in the Merdeka Curriculum requires the use of innovative media that actively involve students, but what happens in the field, the science learning process in schools often still relies on lecture methods and textbooks only, so that students feel bored and less enthusiastic during learning. This study aims to develop interactive learning media based on Articulate Storyline 360 on the material of elements, compounds, and mixtures for grade VIII SMP/MTs students in accordance with the Merdeka Curriculum. The method used is Research and Development (R&D) with the ADDIE development model, namely analysis, design, development, implementation, evaluation. The trial subjects consisted of 32 grade 8F students at MTsN 1 Nganjuk. The study was conducted over a period of two months, namely from April to May 2025. The instruments used were interviews and questionnaires. The results showed that the developed media obtained a feasibility percentage of 87% from material experts, 87% from media experts and 90% from student trials, this value is in the highly feasible criteria. The implementation results showed a positive response from students with a percentage of 86%, indicating that the product was attractive in terms of appearance, material presentation, and ease of access. Thus, interactive learning media based on Articulate Storyline 360 was declared suitable for use in science learning because it increased student enthusiasm and engagement in the learning process.

Kata Kunci: *Articulate Storyline 360, Interactive Learning Media, Merdeka Curriculum*

Introduction

Natural Science (IPA) learning at the junior high school (SMP/MTs) level plays a highly essential role in the modern educational ecosystem. Science learning is crucial for cultivating students' understanding of basic science concepts, problem-solving skills, and critical thinking abilities to face various 21st-century challenges (Rahmaniati & Aulia, 2025). Inherently, science is not merely a collection of theories and facts to be memorized, but rather a process of scientific discovery that requires students to actively explore natural phenomena in their surroundings.

Along with the transformation of the educational paradigm in Indonesia, the implementation of the Kurikulum Merdeka (Independent Curriculum) has emerged, strongly encouraging the use of digital technology to create flexible, differentiated, and student-centered learning environments (Astri et al., 2026; Zahro et al., 2026). The integration of digital technology in the classroom is expected to accommodate students' diverse learning styles, thereby making the delivery of material more inclusive and equitable (Rosiyani et al, 2024). Furthermore, the Kurikulum Merdeka demands the use of innovative media that actively engage students; therefore, teachers must become increasingly adaptive and creative in creating learning processes that are both meaningful and enjoyable for students (Dewi et al., 2025).

Ironically, however, the situation on the ground reveals conditions that contradict the curriculum's expectations. The science learning process in various schools still frequently relies heavily on one-way lecture methods and the sole use of printed textbooks. Consequently, students quickly feel bored, passive, and lack enthusiasm during learning activities (Sulistiyono & Triyanti, 2021). Educators' reliance on these conventional instructional methods poses highly serious constraints, especially when students are faced with science materials that are invisible in nature. Lecture methods make it difficult for students to visualize abstract science materials due to a lack of concrete examples and limited visualization, particularly on the topics of elements, compounds, and mixtures (Mawaddah & Putera, 2024). In fact, elements, compounds, and mixtures are essential and crucial topics in science learning, serving as the main foundation and conceptual basis for students to understand higher and more complex chemistry concepts in subsequent educational levels.

Hemistry and science generally involve three levels of representation: macroscopic (visible to the naked eye), submicroscopic (arrangement of atomic particles and molecules), and symbolic (chemical formulas). When teachers only provide verbal explanations without adequate visual aids, students fail to fully construct an understanding of this particulate level. This inability to visualize the size, distance, and arrangement of molecules triggers misconceptions and low student learning outcomes on these fundamental chemistry topics. One solution that can be implemented to address this problem is by developing interactive learning media based on Articulate Storyline 360 (Mutia et al., 2023). This multimedia approach in education is not without reason; the selection of this application is strongly supported by the Cognitive Theory of Multimedia Learning initiated by Richard E. Mayer.

This theory asserts that the human brain processes information more optimally through two separate channels namely visual and auditory simultaneously. His aligns with several previous studies that have empirically proven that the combination of multimedia elements, including text, images, animations, video, and interactive features, is highly effective in helping students distribute their cognitive load, thereby making it easier for them to understand complex science concepts (Rusman, 2018). *The Articulate Storyline application is highly suitable and recommended for use because this software is an advanced authoring tool capable of summarizing all informative material presentations and evaluative quiz instruments into a single, cohesive, and systematic application* (Oktaviani et al., 2026). Various recent studies have also confirmed that the use of Storyline-based interactive learning media has proven to be highly practical and effective in training visual intelligence and improving conceptual understanding in junior high school science subjects (Gafelina & Subagyo, 2025; Sarah & Arwita, 2025).

In addition to facilitating visual and auditory learning styles, the utilization of Articulate Storyline 360 is also highly relevant to efforts to enhance students' independent learning, which is one of the crucial dimensions in the Profil Pelajar Pancasila (Pancasila Student Profile) under

the Kurikulum Merdeka. This interactive media allows for the implementation of adaptive formative evaluations through the provision of quizzes with immediate feedback. This direct assessment system encourages students to conduct self-reflection on their level of understanding without having to wait for manual corrections from educators. When students are able to evaluate their own achievements and freely repeat science materials they find difficult, the learning process shifts entirely from being teacher-centered to student-centered.

This is in line with research confirming that the integration of Storyline-based interactive learning media at the junior high school level is capable of increasing students' independent learning and critical thinking skills in exploring science concepts in a structured manner (Sari & Harjono, 2021; Wahyuni et al., 2022). Although interactive media like Storyline can present material in a structured manner, the characteristics of pure science materials still require experimental observation facilities so that students can prove the theories they have learned. Limitations in time, measuring instruments, and chemicals in real school laboratories often become obstacles to conducting routine science practicum activities. Therefore, the integration of simulated laboratories becomes highly essential.

The added value or novelty of the media developed in this study is the availability of a holistically integrated independent learning package (all-in-one), which includes branching scenario material presentations, evaluation quizzes with automatic feedback, and the direct embedding of virtual laboratory simulations from PhET (Physics Education Technology). The use of this virtual simulation-based inquiry approach is acknowledged to be highly crucial as it has been proven capable of transforming abstract concepts into macroscopic visualizations that can be controlled by students, thereby culminating in a significant improvement in learning outcomes (Fitriyati & Prastowo, 2022). The presence of the PhET laboratory feature integrated directly into Articulate Storyline allows students to conduct independent science practicum simulations, enabling them to visualize the particle dynamics of elements, compounds, and mixtures more realistically without having to switch between applications.

This interactive learning ecosystem is designed by utilizing the HTML5 output format, resulting in extremely high flexibility and accessibility. The media can subsequently be accessed directly via web browsers on various types of smart devices (smartphones, tablets, and laptop computers) without burdening device memory with additional application installations. Based on the background presentation and problem analysis above, this study aims to design and develop an interactive learning media instrument based on Articulate Storyline 360, integrated with PhET laboratory simulations on the material of elements, compounds, and mixtures for 8th-grade junior high school (SMP/MTs) students, specifically designed to align with the philosophy of independent learning in the Merdeka Curriculum.

Method

The research method used by the researcher is development research or Research and Development (R&D) (Sugiyono, 2019). This method is an appropriate approach for developing learning media. According to Borg and Gall, the field of education applies research and development (R&D) as a way to develop and validate educational products. In practice, this method has been widely used by educational professionals and educators when developing educational product models. The model used for this research is the ADDIE development theory. The subjects in this study were students at one of the State Islamic Junior High Schools (MTs Negeri) in Nganjuk, with the sample consisting of 32 eighth-grade students. The development

procedure in this study adapted the ADDIE model, which consists of five systematic stages, namely: Analysis, Design, Development, Implementation, and Evaluation.

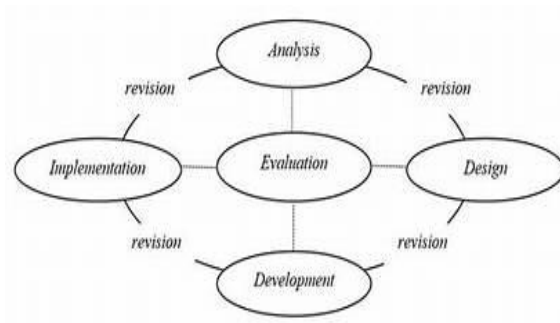


Figure 1. ADDIE Procedure

The selection of the ADDIE model was based on the characteristics of its framework, which is structured yet flexible, making it highly ideal for designing precise instructional media relevant to students' needs in the field (Debriliya et al., 2025). The following are the stages conducted by the researcher in carrying out the research using the ADDIE model. The stages of the ADDIE model are implemented as follows.

The first stage, analysis, focused on identifying instructional needs, student characteristics, as well as formulating objectives and material boundaries. Analysis is the primary stage in product development that aims to identify the root causes of performance gaps to determine appropriate solutions. Design is the stage that includes several product development plans, ranging from a rough sketch of the product to the creation of the initial product.

Development is the product design phase that includes the validation process by experts, namely material experts and media experts. After the product is revised based on expert evaluation, the next stage is a trial on a small group of students. This initial trial aims to measure the level of media practicality and collect direct feedback from users as material for final refinement before it is widely implemented.

Implementation is the stage of implementing the product developed by the researcher. The validated learning media is then tested directly in the learning process. In practice, students are directed to access the Articulate Storyline-based interactive media through a provided website to independently explore material summaries, videos, virtual laboratories (PhET), and assessments. To measure the level of practicality and user response, data collection is carried out using instruments.

Evaluation is the final stage that includes formative and summative evaluations. Formative evaluation is conducted to collect data at each stage for improvement, while summative evaluation is carried out to determine the broad impact of the learning media on the quality of learning. The instrument used in this study is a Likert scale questionnaire given to validators and users. The Likert scale is commonly used in questionnaires, and it is also the most widely used scale in various survey research. The questionnaire instruments were measured using a Likert scale modified into four response options to avoid the bias of neutral attitude tendencies from respondents.

Table 1. Questionnaire Scoring

Response Options	Score
Strongly Agree	4
Agree	3
Disagree	2
Strongly Disagree	1

The questionnaire scoring table was used to measure validator assessments and convert them into quantitative data in the form of scores. The quantitative data obtained from the questionnaire results were then analyzed. The analysis process was conducted by calculating the accumulated score, converting it into a percentage, and interpreting it into feasibility criteria to determine the validity and practicality level of the developed learning media.

Table 2. Feasibility Criteria

No.	Interval %	Criteria
1.	80,1% - 100%	Highly Feasible
2.	70,1% - 80%	Feasible
3.	50,1% - 70%	Less Feasible
4.	0% - 50%	Not Feasible

The feasibility criteria table was used as a reference in interpreting the results of validation data analysis and facilitated determining the feasibility level of the developed media based on the expert validators' assessments. The higher the percentage obtained, the better the quality and feasibility of the media for use in learning. These criteria made the research results more objective, structured, and easy to understand.

Result and Discussion

This study produced an interactive learning media based on Articulate Storyline on the material of elements, compounds, and mixtures, developed using the ADDIE model.

Analysis

Each stage in the ADDIE model generated data that was analyzed to determine the quality and feasibility of the developed media. In the analysis stage, information was obtained that learning still utilized conventional media such as student worksheets (LKS) and PowerPoint, making it less capable of creating interactive learning. The use of Articulate Storyline in learning had never been implemented; however, the teacher was highly enthusiastic about the possibility of using this media as it was considered capable of opening new insights into learning methods, fostering students' learning enthusiasm, and helping students understand the material better. Articulate Storyline media can serve as an innovation in learning; this is reinforced by previous studies who explained that Articulate Storyline-based learning media can encourage students' independent learning through its interactive features, which ultimately enhances the effectiveness and quality of education sustainably (Pratama, 2018).

Design

Following the analysis stage, the next step was designing the Articulate Storyline 360-based interactive learning media by compiling a storyboard containing the flow of material presentation, menu structure, and media components such as materials, practice questions, remedial, and enrichment. The storyboard served as a crucial guideline in developing the learning media to communicate the design framework so that the production process by the developer ran logically, systematically, and directionally (Nursetyo et al., 2021).

In the visual design stage, this product utilized the Canva tool, a graphic design platform that facilitates the creation of presentations, documents, and other visual content (Herniyastuti & Kadir, 2024). The selection of this application is highly recommended because Canva provides various free templates, a user-friendly interface, and can be accessed directly via the web (without the need to install), making it easier for developers to create high-quality designs without starting from scratch (Tanjung & Faiza, 2019). Overall, the utilization of this application

proved to be highly supportive for the developer as it could facilitate the improvement of academic needs efficiency in conveying messages better through capable visualizations.

Development

In the development stage, the learning media was developed using the Articulate Storyline 360 application. The resulting media consisted of an opening page, main menu, learning materials, evaluation questions, as well as remedial and enrichment features. This media was designed to be accessible via various devices such as laptops and smartphones; the media also contained text, videos, images, and interactive features to facilitate students in learning, aligning with Richard Mayer's multimedia theory where learning by combining various multimedia elements will create more effective learning. The display of the Articulate Storyline 360-based interactive learning media is as follows:



Figure 2. Interactive Learning Media

The cover display is the initial page of the interactive learning media that presents the material title "Elements, Compounds, and Mixtures" for 8th grade. The design was made attractive with a bright color combination and illustrations relevant to the science material. On this page, there is also a "Start" (Mulai) button that functions to direct users to the main menu section. The menu display contains a list of meetings arranged systematically, starting from meeting 1 to meeting 6. Each menu can be selected according to the user's needs, thereby making it easier for students to access learning materials gradually and in a structured manner. In this section, brief and clear explanations of the material are presented, accompanied by supporting illustrations to facilitate concept comprehension. The material was compiled in simple language to suit the characteristics of 8th-grade students.

The PhET display presents interactive simulations that students can use to explore concepts directly. With this feature, students can learn more actively through engaging and interactive virtual experiments. The remedial section contains additional questions or exercises intended for students who have not achieved learning mastery. The questions are structured to help students re-understand concepts they have not yet mastered. The enrichment display contains advanced tasks or activities for students who have understood the material. This activity aims to deepen understanding and relate concepts to everyday life through analysis and presentation activities.

After the media was completely developed, validation was conducted by material experts and media experts to assess the product's feasibility. The validation results from the material expert, media expert, and *pretest posttest expert* are as follows:

Table 3. Material Expert Validation Results

Assessment aspects	Percentage	Criteria
Material	90%	Highly Feasible
Language	85%	Highly Feasible
Question presentation	87%	Highly Feasible
Overall assessment	87%	Highly Feasible

Based on Table 3, the subject matter expert validator assessed the Articulate Storyline learning media from the aspects of content, language, and question presentation. The overall assessment by the subject matter expert obtained a percentage of 87% with a criterion of highly feasible.

Table 4. Media Expert Validation Results

Assessment aspects	Percentage	Criteria
Design	86%	Highly Feasible
Illustration	88%	Highly Feasible
Technology	86%	Highly Feasible
Overall assessment	87%	Highly Feasible

Based on Table 4, media experts validators assessed the Articulate Storyline learning media from the aspects of appearance, illustrations, and ease of access. The overall assessment by media experts obtained a percentage of 87% with the criteria of highly feasible. The validation results indicated that the Articulate Storyline 360-based interactive learning media on the material of elements, compounds, and mixtures was highly feasible to be used in learning, although it required revisions based on suggestions and comments from the validators. The following are the revisions based on the validators' suggestions and comments:

Table 5. Before and After Revision

Before Revision	Revisi	After Revision
	Changing meeting 1-6 into the material name	

Based on Tabel 5, the menu display before and after revision. Initially, the menu display used the naming of each meeting, which was then revised based on the validator's suggestion by making it more specific using naming according to the material. This change made the menu display more communicative, structured, and easier for students to study the material to be learned. These results demonstrate that the developed media had fulfilled quality aspects both in terms of material and design, making it feasible for testing on students. At the development stage, the product was tested on 5 students, the results of the student trials are as follows:

Table 6. Trial Results on Students

Assessment spectrs	Percentage	Criteria
Design	88%	Highly Feasible
Material presentation	92%	Highly Feasible
Ease of access	90%	Highly Feasible
Overall assessment	90%	Highly Feasible

Based on Table 6, the trial was conducted by students by assessing the product in terms of appearance, material presentation, and ease of access. The overall assessment of the student trial obtained a percentage of 90% with the criteria of highly feasible. During trial with students, obstacles were found in the form of limited internet access at school, therefore some students

had to share the internet network in order to access the Articulate Storyline 360-based interactive learning.

Implementation

The implementation stage was carried out through a trial with 32 8th-grade students. In this stage, the media was used directly in the learning process. Students were directed to access the media through the provided website, and they were given the opportunity to explore information within the Articulate Storyline media. Assessment by 32 students at the implementation stage is as follows:

Table 7. Student Assessment Results

Assessment aspects	Percentage	Criteria
Design	85%	Highly Feasible
Material presentation	91%	Highly Feasible
Ease of access	82%	Highly Feasible
Overall assessment	86%	Highly Feasible

Based on Table 6, students provide assessments of the product in terms of design, material presentation, and technology. The overall assessment received a percentage of 86% with the criteria of highly feasible. The interactive Articulate Storyline media contained material summaries arranged attractively, accompanied by videos, a virtual laboratory, and assessments that could train students' abilities on the materials they had learned. Students gave a positive response to the developed media, which could be seen from their enthusiasm and interest in learning, especially regarding the presented virtual laboratory/PhET; for students, using a virtual laboratory was a new experience.

The use of the virtual laboratory/PhET in the learning process can increase students' engagement in learning because it provides space for students to conduct experiments independently (Rararati et al., 2024). This indicates that the Articulate Storyline media was capable of increasing students' interest and engagement in learning. Learning interest is highly necessary in the learning process because students who have an interest in something will work on it earnestly, resulting in a positive impact on better learning outcomes (Nurhasanah & Sobandi, 2016)

Evaluation

The evaluation stage is the final stage, which aims to assess the quality of the developed product. The evaluation results indicate that the interactive articulate storyline media has met the eligibility criteria, as reviewed from the validation results of material experts and media experts, trials, and student responses as product users. The interactive articulate storyline media is very suitable for use in learning and has received a positive response from students, as evidenced by their enthusiasm and interest in learning. The use of technology-based media can be an innovation in learning that can attract student interest, thus positively impacting the quality of student learning.

Conclusion

This study aims to develop interactive learning media based on Articulate Storyline 360 on the subject of elements, compounds, and mixtures, which tests the feasibility and effectiveness of the product in science learning. The product was developed using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). Interactive learning media based on Articulate Storyline 360 obtained very feasible criteria based on assessments from media

experts with a percentage of 87%, subject matter experts 87%, and student trial results 90%. Students also showed positive responses during the learning process, as indicated by student assessments of 86% with very feasible criteria, and as shown in students' attitudes during the learning process.

This media is able to increase students' enthusiasm and engagement in learning, especially through interactive features such as videos and virtual laboratories (PhET). Thus, interactive learning media based on Articulate Storyline 360 is worthy of being used as an innovation in science learning and can become an alternative solution to improve the quality of learning in a more engaging and interactive way. The limitations of this study are that the developed product is limited to the material on elements, compounds, and mixtures, so it does not yet cover other materials in other fields of education. In addition, the implementation of the product was only carried out at MTsN 1 Nganjuk, so the generalization of the product is still limited.

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Reference

- Astri, I. P., Sulasmi, E., & Dongoran, F. R. (2026). Tantangan Dan Pendukung Integrasi Teknologi Digital Dalam Implementasi Kurikulum Merdeka: Sebuah Tinjauan Literatur Sistematis. *Pedagogi: Jurnal Ilmiah Pendidikan*, 12(1), 39–50. <https://doi.org/10.47662/pedagogi.v12i1.1348>
- Debriliya, I. F., Saidah, K., & Zaman, W. I. (2025). Pengembangan Media Web Flipbook Berbasis Augmented Reality Untuk Meningkatkan Hasil Belajar Pada Materi Keberagaman Budaya Di Provinsi Jawa Timur Bagi Siswa Kelas V Sdn Ploso. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, 10(3), 817–826. <https://doi.org/10.23969/jp.v10i3.30705>
- Dewi, C. Y., Zaiti, A., Latipah, J., & Wibisono, R. (2025). Peran Media Pembelajaran Implementasi Kurikulum Merdeka Di Sdn Kuin Cerucuk 4. *Didaktik : Jurnal Ilmiah PGSD STKIP Subang*, 11(02), 428–437. <https://doi.org/10.36989/didaktik.v11i02.6149>
- Fitriyati, I., & Prastowo, A. (2022). Pembelajaran Daring Menggunakan Phet Simulations Untuk Meningkatkan Keaktifan Dan Hasil Belajar Siswa Madrasah Ibtidaiyah. *Al-Madrasah: Jurnal Ilmiah Pendidikan Madrasah Ibtidaiyah*, 6(4), 1041–1052. <https://doi.org/10.35931/am.v6i4.1120>
- Gafelina, G., & Subagyo, A. (2025). Pengembangan Media Pembelajaran Interaktif Berbasis Articulate Storyline Pada Pembelajaran Ipa. *EDUTECH: Jurnal Inovasi Pendidikan Berbantuan Teknologi*, 5(1), 179–192. <https://doi.org/10.51878/edutech.v5i1.4813>
- Herniyastuti, & Kadir, A. (2024). Pemanfaatan Aplikasi Canva Sebagai Media Pembelajaran Dalam Upaya Meningkatkan Hasil Belajar Bahasa Indonesia Pada Siswa Kelas V Sdn 101 Pajalesang Tahun Pelajaran 2023/2024. *Jurnal PGSD Universitas Lamappapoleonro*, 2(2), 88–94. <https://doi.org/10.57093/jpgsdunipol.v2i2.39>
- Mawaddah, G. A., & Putera, D. B. R. A. (2024). Pengembangan E-Magazine Tema Lontong Kupang Sidoarjo Pada Materi Unsur, Senyawa Dan Campuran. *UNESA Journal of Chemical Education*, 13(3), 226–237. <https://doi.org/10.26740/ujced.v13n3.p226-237>

- Mutia, Istyadi, M., & Hafizah, E. (2023). Pengembangan Media Pembelajaran Interaktif Articulate Storyline Materi Zat Aditif Kelas VIII SMP. *Jurnal Pendidikan, Sains Dan Teknologi*, 2(4), 1071–1075. <https://doi.org/10.47233/jpst.v2i4.1377>
- Nurhasanah, S., & Sobandi, A. (2016). Minat Belajar Sebagai Determinan Hasil Belajar Siswa. *Jurnal Pendidikan Manajemen Perkantoran*, 1(1), 128–135. <https://doi.org/10.17509/jpm.v1i1.3264>
- Nursetyo, K. I., Ariani, D., Widyaningrum, R., & Syahyani, R. (2021). Ragam Storyboard Untuk Produksi Media Pembelajaran. *Jurnal Pembelajaran Inovatif*, 4(1), 108–120. <https://doi.org/10.21009/JPI.041.14>
- Oktaviani, L. I., Santa, & Destiana, D. (2026). Pengembangan Media Pembelajaran Berbasis Articulate Storyline 3 Pada Materi Efek Rumah Kaca. *Didaktik : Jurnal Ilmiah PGSD STKIP Subang*, 12(01), 177–190. <https://doi.org/10.36989/didaktik.v12i01.11406>
- Pratama, R. A. (2018). Media Pembelajaran Berbasis Articulate Storyline 2 Pada Materi Menggambar Grafik Fungsi Di Smp Patra Dharma 2 Balikpapan. *JURNAL DIMENSI*, 7(1), Article 1. <https://doi.org/10.33373/dms.v7i1.1631>
- Rahmaniati, R., & Aulia, N. (2025). Analisis Keterampilan Proses Sains pada Mata Kuliah Pendidikan IPA: Analysis of Science Process Skills in Science Education Subjects. *Anterior Jurnal*, 24(1), 111–116. <https://doi.org/10.33084/anterior.v24i1.9155>
- Rararati, P. A., Nuroso, H., & Kurniawan, A. F. (2024). Kajian Literatur: Penggunaan Simulasi PhET dalam Pembelajaran Fisika. *Lontar Physics Today*, 3(2), 045–054. <https://doi.org/10.26877/lpt.v3i2.21838>
- Rosiyani, A. I., Salamah, A., Lestari, C. A., Anggraini, S., & Ab, W. (2024). Penerapan Pembelajaran Berdiferensiasi dalam Kurikulum Merdeka pada Pembelajaran Ips Sekolah Dasar. *Jurnal Pendidikan Guru Sekolah Dasar*, 1(3), 10–10. <https://doi.org/10.47134/pgsd.v1i3.271>
- Rosiyanti, H., & Farahdiba, T. (2022). Pengembangan Media Pembelajaran Statistika SMA Kelas XII Menggunakan Articulate Storyline. *JNPM (Jurnal Nasional Pendidikan Matematika)*, 6(1), 169–183. <https://doi.org/10.33603/jnpm.v6i1.5905>
- Rusman. (2018). *Belajar Dan Pembelajaran Berbasis Komputer Mengembangkan Profesionalisme Guru Abad 21*. Alfabeta.
- Sarah, O. M., & Arwita, W. (2025). Analisis Keterlaksanaan Model Problem Based Learning pada Pembelajaran Biologi di Kelas X SMA Negeri 1 Medan. *Jurnal Pelita: Jurnal Pembelajaran IPA Terpadu*, 5(2), 722–740. <https://doi.org/10.54065/pelita.5.2.2025.998>
- 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), 122–130. <https://doi.org/10.23887/jp2.v4i1.33356>
- Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Alfabeta. <https://share.google/BnX4bBwpnxCcdp8as>
- Sulistiyono, S., & Triyanti, M. (2021). Pengembangan Modul Ipa Berbasis Lingkungan Untuk Meningkatkan Kemandirian Belajar Siswa Smp. *JURNAL PERSPEKTIF PENDIDIKAN*, 15(2), 214–220. <https://doi.org/10.31540/jpp.v15i2.3992>

- Tanjung, R., & Faiza, D. (2019). Canva Sebagai Media Pembelajaran Pada Mata Pelajaran Dasar Listrik Dan Elektronika. *Voteteknika (Vocational Teknik Elektronika dan Informatika)*, 7, 79. <https://doi.org/10.24036/voteteknika.v7i2.104261>
- Wahyuni, S., Ridlo, Z. R., & Rina, D. N. (2022). Pengembangan Media Pembelajaran Interaktif Berbasis Articulate Storyline Terhadap Kemampuan Berpikir Kritis Siswa SMP pada Materi Tata Surya. *JIPi (Jurnal IPA Dan Pembelajaran IPA)*, 6(2), 99–110. <https://doi.org/10.24815/jipi.v6i2.24624>
- Zahro, A. A., & Putra, P. D. A. . (2026). Pengembangan E-LKPD Berbasis STEM dalam Pembelajaran IPA Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa SMP. *Jurnal Pelita: Jurnal Pembelajaran IPA Terpadu*, 6(1), 311–321. <https://doi.org/10.54065/pelita.6.1.2026.1362>