JPPIPA 10(11) (2024)

Jurnal Penelitian Pendidikan IPA

*Journal of Research in Science Education*

http://jppipa.unram.ac.id/index.php/jppipa/index

# Science Learning Media for Elementary School Students

Nirwana Anas[1*], Adi Hartono[2]

[1]Madrasah Ibtidaiyah Teacher Study Program, Faculty of Tarbiyah and Teachers Training, Universitas Islam Negeri Sumatera Utara, Medan, Indonesia
[2]Tadris Biology Study Program, Faculty of Tarbiyah and Teachers Training, Universitas Islam Negeri Sumatera Utara, Medan, Indonesia

Received: September 22, 2024
Revised: November 11, 2024
Accepted: November 25, 2024
Published: November 30, 2024

Corresponding Author: Nirwana Anas
Nirwana Anas
nirwanaanas@uinsu.ac.id

DOI: 10.29303/jppipa.v10i11.9227



**Abstract:** The use of media in learning will provide a learning experience for students because it can involve more senses and give them the freedom to interpret. This study aims to: develop android-based science learning media for elementary school students, obtain android-based science learning media suitable for elementary school students, and determine the response of elementary school students to android-based science learning media. This research is a Research and Development (R&D) study. The development procedure consists of six steps, namely: analysis of potential problems, data collection, product design, design validation, design revision, and product testing. The assessment instrument used is a questionnaire sheet to test the quality of Android-based science learning media products. The assessment of the quality of Android-based science learning media products is conducted by reviewers, peer reviewers, elementary school (SD/MI) teachers, and the response of sixth-grade students. The results of this development research are as follows: 1) Android-based science learning media products on the topic of living organism reproduction for sixth-grade students of SD/MI have been developed, 2) the Android-based science learning media for sixth-grade students of SD/MI on the topic of living organism reproduction has been assessed by reviewers, peer reviewers, and SD/MI teachers with a rating of "Very Good" (SB) with a score of 631 and a percentage rating of 86.85%, and 3) the response of sixth grade students of SD/MI to the Android-based science learning media falls within the "Agree and Strongly Agree" interval, resulting in a score of 635 with a rating percentage of 88.23%.

**Keywords:** Android; Developmen; Science Learning in Elementary/Madrasah Ibtidaiyah.

## Introduction

Science education in schools or madrasas must be able to provide students with the skills they need to live in harmony with the developments of their time (Arief, 2021). The reason why, all educators need to constantly strive to organize the learning process of students and the teaching material presented, in order to realize Indonesians that are in line with the national education goals stated in the Indonesian Law No. In 2003, the National Education System Law aimed to develop the potential of students to become faithful and devoted individuals to the Almighty God, have noble character, be healthy, knowledgeable, skilled, creative, independent, and be responsible democratic citizens (Depdiknas Law No. 20 of 2003). 20 Years 2003) (Wulandari et al., 2022).

At the elementary school (SD) or Madrasah Ibtidaiyah (MI) level, students' mindset about knowledge will be carried to higher levels or stages. This is because the level of elementary school is where the basic knowledge is implanted in the students, especially in the subject of science (Wijayanti & Ekantini, 2023). The teaching of science as one of the important components in education is often criticized by various parties considering the learning outcomes obtained by elementary students for science subjects tend to be lower compared to other subjects (Mawaddah et al., 2022). This has led to the continuous blaming of the quality of

**How to Cite:**
Anas, N., & Hartono, A. (2024). Science Learning Media for Elementary School Students. *Jurnal Penelitian Pendidikan IPA*, *10*(11), 9020–9026. https://doi.org/10.29303/jppipa.v10i11.9227

science education as the main cause of low science learning achievement of primary school students.

The most commonly perceived cause of the low quality of science education is attributed to the teaching of science, in which the science teacher plays a major role, as believed by many people (Khasanah et al., 2019). In the process of learning science, a teacher is an essential and strategic factor in determining the success of its learning goals. Therefore, a teacher's knowledge and skills in mastering scientific concepts are crucial (Nurmala et al., 2021).

The current issue in Indonesia is how the science learning process that takes place in the classroom can provide opportunities for students' creativity to develop. Based on the current situation, the process of learning Science in elementary/madrasah schools does not or has not yet provided the maximum opportunity for students to develop their creativity (Azis & Febriana, 2023). This can be seen from several points below: Teaching style of teachers who always drill students to memorize various concepts without understanding the concepts themselves, Science teaching is generally only learned by memorization without accompanying laboratory work, Generally teachers still believe that teaching is an activity of explaining and delivering information about concepts, and School facilities to support students in developing their creativity, especially related to the development of science and technology, are generally inadequate (Hardiansyah, 2022; Nurhayati & Aswarliansyah, 2022).

Several issues need to be reflected upon and improved in order for the school to function effectively as an institution that supplies human resources capable of supporting the progress of development, especially in the development of science and technology for human welfare (Triwoelandari, et al., 2023). Recognizing the importance of science education at the elementary level, many efforts have been made to improve the quality of science learning at the elementary level (Aliyah et al., 2024). This effort can be seen through the continuous refinement of the curriculum, improvement in the quality of subject teachers, provision and updating of textbooks, provision and equipping of science laboratory equipment, development of more relevant and effective approaches to achieve science learning goals, and many other efforts being made to improve the achievement of science learning outcomes for students in schools (Miah, 2022).

This research article will discuss the "Science Learning Media for Elementary School Students". This research is very necessary considering the low creativity of elementary school teachers in mastering technology-based learning media. This is done to support the improvement of the quality of elementary school teachers in teaching science. The objectives of this research are: 1) to develop android-based science learning media for elementary school students, 2) to obtain android-based science learning media that is suitable for elementary school students, and 3) to determine the response of elementary school students to android-based science learning media (Alika & Radia, 2021).

## Method

This study is a Research and Development study using a procedural model. Research and development is a process used to develop and validate products in research (Silfiani, at al., 2022). The research steps were carried out according to the research flow in Figure 1.

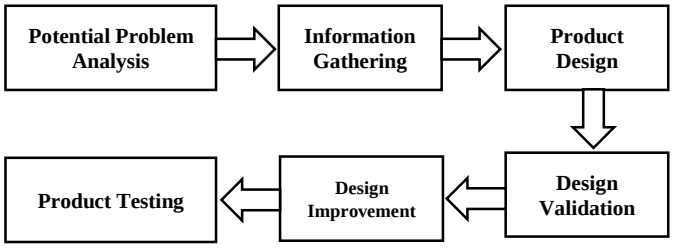


**Figure 1.** Research Steps

The steps of research and development include identifying potential and problems, data collection, product design, design validation, design revision, product testing, product revision, usage testing, product revision, and mass production. As a result, the product produced is in the form of Android-based learning media for science subjects on the topic of reproduction in living organisms in the first semester of grade VI as a science learning media in elementary/primary schools. Research design and method should be clearly defined.

The tool used to gather data on product quality is a checklist questionnaire used to obtain ratings from reviewers, including peer reviewers and teachers. In this research, the criteria for evaluating android-based learning media include: the presentation aspect of science material, curriculum aspect, activities or experiments aspect, learning evaluation aspect, implementation aspect, display quality aspect, language aspect, and sentence clarity aspect. The instrument used to collect data for product testing is in the form of a questionnaire. This questionnaire is used to gather students' assessments of their ease of understanding the lessons, study independence, active participation in learning, interest in android-based learning media, the presentation of android-based learning media, and the use of android-based learning media (Hariana et al., 2023).

The purpose of the data analysis on product quality testing is to determine the quality of learning media

using android-based learning media based on feedback from a group of reviewers consisting of 2 peers and 2 teachers. In addition, limited trial data analysis techniques are also conducted to determine the effectiveness of Android-based learning media. This can be obtained from the assessment or the students' response. Student assessment of android-based learning media was analyzed using descriptive analysis through the Miles and Huberman approach, namely data presentation, data reduction, and data conclusion (Sukma & Setyasto, 2024).

## Result and Discussion

The android-based learning media product is developed using the Research and Development method. This research process is only conducted up to the limited trial stage. The development process of Android-based learning media is carried out as follows:

*Potential Problem Analysis*

Research can stem from potential or problems. The potential that is being used as the basis of this research is the lack of teachers who have skills in the field of information technology and computers. Furthermore, there are still few technology-based and computer-based learning media available specifically for science subjects in elementary schools.

*Information Gathering*

At this stage, various information that can be used as material for product planning is gathered and expected to address the issues mentioned above. The information obtained is first analyzed so that the resulting product has good quality and achieves its goals.

This first step is aimed at determining the competencies that align with the curriculum so that the android-based learning media that is prepared is expected to enable students to master the predetermined competencies. This curriculum analysis takes into account five things, namely Competency Standards (SK), Basic Competencies (KD), achievement indicators, main subjects, and learning experiences.

The characteristics of children's development need to be given attention. In this study, the discussion is focused on the characteristic development of children during the particular age period of elementary school students. The opinion on the periodization of development for primary and middle school children is presented by the very popular psychology expert, Piaget, who states that children aged 7 to 12 years (MI age) are in the phase of concrete operational thinking. - Children at this stage think based on concrete or real experiences. Before being able to think abstractly, such as imagining the process of photosynthesis or the event of blood circulation, elementary school students have characteristic traits that include: (1) a strong desire to know about everything in the real world around them, (2) no longer solely dependent on older people, (3) enjoying activities that are beneficial to their environment, (4) able to compete in a healthy way, and (5) beginning to develop awareness of themselves and others. These concrete operational characteristics of elementary school students should be used as a basis for preparing and implementing teaching for them. Similar teachings should be designed and implemented in such a way that allows students to see, do, engage in the learning process, and experience firsthand what they are learning.

The analysis of learning experiences is an activity designed by educators for students to engage in so that they can master the competencies determined through the learning activities provided. So, the learning experience must be clearly and operationally organized, so that it can be immediately practiced in learning activities. Before developing android-based learning media, it is important to analyze several suitable learning activities in order to create android-based learning media. Therefore, this Android-based learning media not only contains information related to the reproduction of living things but also includes several experimental activities. It is hoped that students can gain firsthand experience in the learning activities.

The need for android-based learning media products is very essential. This begins with an analysis of the curriculum and an analysis of the existing learning resources (Rosemarry & Isdaryanti, 2024). Various learning media are analyzed and sorted according to their needs as materials for arranging Android-based learning media. In developing this android-based learning media, various learning resources were analyzed, including printed books and ebooks, research findings, interactive programs, and internet information (Huang, et al., 2020).

The title of android-based learning media is determined based on the core competencies, subject matter, or learning experiences found in the curriculum (Fauth, et al., 2019). The organized educational media is an android-based learning media containing science subjects for elementary school students, specifically the topic of reproduction in living beings (Partovi & Razavi, 2019). Once the title for the android-based learning media is established, the next step is to proceed with the writing and organization of the android-based learning media (Hanif, 2020).

*Product Design*

To design an android-based instructional media product, the following steps are taken: Formulate basic

competencies, Determine assessment tools, Compile materials, and Pay attention to the structure of android-based instructional media.

*Design Validation*

Design validation is the process of assessing and providing input on whether a product design is rational, effective, and suitable for use. This activity is carried out by experienced experts in their respective fields. The android-based learning media developed in this research was validated by two experts, namely one content expert and one media expert. Both experts have the necessary competence in their respective fields and are already qualified enough to validate android-based learning media on the topic of living creatures' reproduction in elementary school science lessons.

*Design Improvement*

The product design improvement is performed after being validated by experts. Expert inputs are utilized as material for revising the design. The final result of the next revision will be exported as an application (.apk) that can be installed on a smartphone to be evaluated for its quality and tested on a limited basis by students.

*Product Testing*

Quality testing is conducted on Android-based learning media products before they are tested with students. This quality assessment is carried out by a team of reviewers, including three peer reviewers and two MI teachers. Assessment of the quality of Android-based learning media covers several aspects, namely the aspect of presenting science materials, the aspect of curriculum, the aspect of experimental activities, the aspect of learning evaluation, the aspect of implementation, the aspect of display quality, the aspect of language, and the aspect of sentence clarity. The overall assessment conducted by the reviewer shows that the quality of android-based learning media products falls under the category of Very Good (SB) with a total score of 631, a percentage rating of 86.85%, and an average of 4.34. The category is excellent, based on the overall assessment criteria calculation results with a total score of 631 falling within the range of > 609.001.

Limited trial is conducted by observing students' responses in the form of feedback on android-based learning media products, students are given the allowed to evaluate and provide input (Sahin & Yilmaz, 2020). Students' assessment of android-based learning media products covers several aspects, namely the ease of understanding, self-learning ability, active participation in learning, interest in android-based learning media, presentation of android-based learning media, and the use of android-based learning media (Kwangmuang et al., 2021).

Based on this category, it can be determined that the value 635 falls within the range of "Agree and Strongly Agree". The quality of Android-based learning media products, based on student responses, achieved a score of 88.194% and falls within the "Agree and Strongly Agree" interval. The overall assessment of the presentation of science materials obtained a total score of 131 with an average score of 4.37 and an assessment percentage of 87.33%. According to the ideal assessment criteria, the average score of 4.37 falls within the range of scores greater than 4.201, which means Very Good (VG).

This means that the aspect of presenting science material has very good quality, with criteria including: the suitability of the science concepts described with concepts proposed by science experts, the arrangement or organization of the material on the reproductive system of plants and animals is very good, the completeness and accuracy of the table of contents is very good, the suitability of the material with the cognitive development of students is very good, the logical connection between facts, concepts, and theories is very good, and the use of examples of events from the surrounding environment is very good.

In overall assessment of the curriculum aspect, a total score of 64 was obtained with an average score of 4.27 and a percentage of 85.33%. Based on the ideal assessment criteria, the average score of 4.27 falls within a range greater than 4.201, which means it is very good. This means the curriculum aspect has very good quality with criteria such as: the alignment of concepts with the KTSP curriculum, the elaboration of material concepts and activities suitable for the students' grade level (grade VI), and emphasis on process skills (Wen, et al., 2020).

The overall assessment of the experimental activities aspect resulted in a total score of 86 with an average score of 4.30 and a percentage score of 86.00%. According to the ideal evaluation criteria, the average score of 4.30 falls within a range greater than 4.201, which means it is excellent. This means the aspect of experimental activities has good quality with criteria such as: the experiments conducted are not harmful to students, the experiments are easy to perform, the experiments are suitable for the allotted time, and the experiments can provide direct experience for students.

The overall assessment in the aspect of learning evaluation obtained a total score of 65 with an average score of 4.33 and a percentage of 86.67%. Based on the ideal assessment criteria, the average score of 4.33 falls within a range of scores greater than 4.201, which means it is excellent. This means that the aspect of learning evaluation has very high quality with criteria such as:

there are questions that are able to measure learning outcomes, there are questions that guide students to draw conclusions, and the evaluation instructions are easy to understand.

The overall assessment of the implementation aspect obtained a total score of 43 with an average score of 4.30 and a percentage rating of 86.00%. According to the ideal evaluation criteria, an average score of 4.30 falls within the range of scores above 4.201, which means it is excellent. This means that the aspect of implementation has very good quality with criteria including: the presentation of material is easily understood by students and the main material is appropriate for the time allocation in school.

The overall assessment of the display quality aspect obtained a total score of 111 with an average score of 4.44 and a rating percentage of 88.80%. Based on the ideal assessment criteria, the average score of 4.44 falls within the range of scores greater than 4.201, which means it is excellent. This means that the aspect of the display quality has a very good quality with criteria including: attractive program design, orderly page design, clear fonts and images, related and supportive images for clarity, and animations that can capture students' attention for learning.

The overall assessment of the language aspect obtained a total score of 66 with an average score of 4.40 and a percentage score of 88.00%. Based on the ideal assessment criteria, the average score of 4.40 falls within the score range of over 4.201, which means it is excellent. This means that the linguistic aspect has very good quality with criteria including: the selection of words in explaining the material very well, the language used is formal and engaging Indonesian, and the language used is by the guidelines for correct Indonesian spelling and grammar.

The overall assessment of the sentence clarity aspect obtained a total score of 65 with an average score of 4.33 and a percentage rating of 86.67%. Based on the ideal assessment criteria, the average score of 4.33 falls within the range of more than 4.201, which means excellent. This means that the clarity aspect of the sentence has very good quality with criteria such as: easy to understand sentences, accuracy and precision of the scientific terms used, and sentences that do not produce multiple meanings.

The limited trial of the quality of android-based learning media products is evaluated based on student feedback. Ten students from MIN Tempel class VI were surveyed for their response to the quality of android-based learning media products, resulting in an overall score of 635. The evaluation percentage for the android-based learning media product is 88.23% and falls within the "Agree and Strongly Agree" interval. The ease of understanding aspect obtained a score of 87.50% with a total of 105 out of a maximum score of 120. This value falls within the range between "Agree and Strongly Agree". This means that students can easily learn and understand the reproduction of living organisms, including how plants and animals reproduce.

In general, the aspect of independent learning received a 90.00% assessment percentage with a total score of 72 out of a maximum score of 80. This value falls within the range of "Agree and Strongly Agree". This means that android-based learning media products provide opportunities for students to learn according to their learning abilities. Students can independently use android-based learning media on the subject of living organism reproduction as independent learning media both in and out of school.

The percentage of active learning achievement is 89.38% with a total score of 143 out of a maximum of 160. This value falls within the range between "Agree and Strongly Agree". This means that android-based learning media can encourage students to actively participate in science learning. Students are encouraged to observe and actively participate in experimental activities. Students are encouraged to think, construct concepts, laws, facts, and draw conclusions.

The aspect of interest in android-based learning media obtained a rating percentage of 85.00% with a total score of 102 out of a maximum score of 120. This value falls within the range between "Agree and Strongly Agree". This means that the students are interested in learning science using android-based learning media. One of the enjoyable science learning media is android-based learning media, which can increase students' interest in learning science (Cheng & Tsai, 2019).

Generally, the aspect of interest in Android-based learning media received a rating of 90.00% with a total score of 108 out of a maximum score of 120. This value falls within the range between "Agree and Strongly Agree". This means that the Android-based learning media product presents text and images clearly and in an easily readable manner. The language used is simple and easily understood.

Generally, the aspect of interest in LKS obtained a rating percentage of 87.50% with a total score of 105 out of a maximum score of 120. This value falls within the range of "Agree and Strongly Agree". This means that android-based learning media is easy to use and can be used as a science learning media anywhere, making it easier for students to learn. Based on the overall calculation, the android-based learning media product has met the criteria as a science learning media in elementary schools. The assessment is based on the score obtained from the reviewer, which is 86.85%, indicating "Excellent" (SB), and the score obtained based on the

student's responses is 88.23%, falling within the "Agree and Strongly Agree" range.

## Conclusion

After conducting a theoretical study and research as well as discussions, the following conclusion can be drawn: 1) an android-based science learning media product on the topic of reproduction in living organisms has been developed for sixth grade elementary school students, covering the characteristics of the process (potential and problem analysis, data collection, product design, design validation, design revision, and product testing) and product characteristics (title, profile, introduction, material, simulation, exercises, and evaluation), 2) the android-based science learning media for sixth grade elementary school students on the topic of reproduction in living organisms is deemed suitable based on the assessment of reviewers, peer reviewers, and elementary school teachers, with a score of 631 and a rating of 86.85%, classified as Excellent (SB) category, and 3) the response or feedback from sixth grade elementary school students to the android-based science learning media falls within the "Agree and Strongly Agree" interval category, resulting in a score of 635 and a rating of 88.23%. Thus, according to the limits of the review results and student responses, the android-based learning media product in this study can be used as a science learning media in elementary schools.

**Acknowlegments**
The researcher would like to thank all those who have helped the research mechanism, especially the Department of Primary School Teacher Education and Madrasah Ibtidaiyah in supporting the research data.

**Author Contributions**
Nirwana Anas: conceptualization, methodology, validation. Adi Hartono: develop the product, and data analysis. All authors have read and approved the published version of the manuscript.

**Funding**
Funding for this research comes from the researcher's independent funds.

**Conflicts of Interest**
The authors declare that there is no conflict of interest in the publication of this article.

## References

Alika, O., & Radia, E. H. (2021). Development of Learning Media Based on Cross Puzzle Game in Science Learning to Improve Learning Outcomes. *7*(2), 2–6. https://doi.org/10.29303/jppipa.v7i2.667

Aliyah, D., Rohmah, N., Qomariyah, N., & Salsabila, Y. (2024). Implementasi Teori Pembelajaran IPA SD /MI. *Halimi: Journal of Education*, *5*(2). https://ejournal.kopertais4.or.id/madura/index.php/halimi/article/view/7462/4335

Arief, O. M. M. (2021). Media Pembelajaran Ipa Di Sd/Mi (Tujuan Penggunaan, Fungsi, Prinsip Pemilihan, Penggunaan, Dan Jenis Media Pembelajaran) *Oleh: M. Miftah Arief* . *5*(8), 13–28.

Azis, D. K., & Febriana, M. (2023). Identifikasi Tren Media Pembelajaran IPA di SD / MI Pasca Pandemi. *7*(2), 343–349.

Cheng, K. H., & Tsai, C. C. (2019). A case study of immersive virtual field trips in an elementary classroom: Students' learning experience and teacher-student interaction behaviors. Computers & Education, 140, 103600. https://doi.org/10.1016/j.compedu.2019.103600

Fauth, B., Decristan, J., Decker, A. T., Büttner, G., Hardy, I., Klieme, E., & Kunter, M. (2019). The effects of teacher competence on student outcomes in elementary science education: The mediating role of teaching quality. Teaching and teacher education, 86, 102882. https://doi.org/10.1016/j.tate.2019.102882

Hanif, M. (2020). The Development and Effectiveness of Motion Graphic Animation Videos to Improve Primary School Students ' Sciences Learning Outcomes. *13*(3), 247–266.

Hardiansyah, F. (2022). Improve science learning outcomes for elementary school students through the development of flipbook media. Jurnal Penelitian Pendidikan IPA, 8(6), 3069-3077. https://doi.org/10.29303/jppipa.v8i6.2413

Hariana, K., Lagandesa, Y. R., & Lapasere, S. (2023). Development of a Hybrid Learning Virtual Space Module Based on Local Saluan Language Wisdom in Science Education for Elementary School Students. 9(12),12309–12320. https://doi.org/10.29303/jppipa.v9i12.5470

Huang, S. Y., Kuo, Y. H., & Chen, H. C. (2020). Applying digital escape rooms infused with science teaching in elementary school: Learning performance, learning motivation, and problem-solving ability. Thinking Skills and Creativity, 37, 100681. https://doi.org/10.1016/j.tsc.2020.100681

Khasanah, B. U., Doyan, A., & Muliyadi, L. (2019). *Jurnal Penelitian Pendidikan IPA Analysis Validation of Learning Media Quantum Phenomenon*. *2014*. https://doi.org/10.29303/jppipa.v5i2.265

Kwangmuang, P., Jarutkamolpong, S., Sangboonraung, W., & Daungtod, S. (2021). Heliyon The development of learning innovation to enhance higher order thinking skills for students in Thailand junior high schools. *Heliyon*, *7*(May), e07309. https://doi.org/10.1016/j.heliyon.2021.e07309

Mawaddah, R., Triwoelandari, R., Irfani, F., Ibn, U., & Bogor, K. (2022). *Jurnal Cakrawala Pendas* Kelayakan Lks Pembelajaran Ipa Berbasis Stem Untuk Meningkatkan Keterampilan Kolaborasi Siswa SD/ MI. *8*(1), 1–14.

Miah, M. (2022). Pengembangan Soft Skill Melalui Pembelajaran IPA. 5.
https://doi.org/https://doi.org/10.58518/awwaliyah.v5i1.927

Nurhayati, N., Egok, A. S., & Aswarliansyah, A. (2022). Penerapan Model Pembelajaran Kooperatif Tipe TGT pada Pembelajaran IPA Sekolah Dasar. Jurnal Basicedu, 6(5), 9118–9126. https://doi.org/10.31004/basicedu.v6i5.3430

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

Partovi, T., & Razavi, M. R. (2019). The effect of game-based learning on academic achievement motivation of elementary school students. Learning and Motivation, 68, 101592. https://doi.org/10.1016/j.lmot.2019.101592

Rosemarry, L. A., & Isdaryanti, B. (2024). Adobe Animate-based Learning Media for IPAS Class V Elementary School Tlogosari Kulon 05 Effective and Improve Learning Outcomes. Jurnal Penelitian Pendidikan IPA, 10(8), 5953-5960. https://doi.org/10.29303/jppipa.v10i8.8268

Sahin, D., & Yilmaz, R. M. (2020). The effect of Augmented Reality Technology on middle school students' achievements and attitudes towards science education. Computers & Education, 144, 103710. https://doi.org/10.1016/j.compedu.2019.103710

Silfiani, S., Jasruddin, J., & Amin, B. D. (2022). The development of videoscribe assisted learning media to improve understanding of physics concepts. Jurnal Penelitian Pendidikan IPA, 8(6), 2995-3000. https://doi.org/10.29303/jppipa.v8i6.2064

Sukma, S. A., & Setyasto, N. (2024). Development of E-Comic Learning Media Assisted by Video in Science Learning on Human Blood Circulation Material. *Jurnal Penelitian Pendidikan IPA*, *10*(5), 2322–2330. https://doi.org/10.29303/jppipa.v10i5.7023

Triwoelandari, R., Rahmawati, P., & Gustiawati, S. (2023). Pengembangan Modul Pembelajaran IPA Berbasis Project Based Learning untuk Meningkatkan Kemampuan Kolaborasi Siswa Kelas 5 SD/MI. Attadib: Journal of Elementary Education, 7(3). https://doi.org/10.32507/attadib.v7i2.2298

Wen, C. T., Liu, C. C., Chang, H. Y., Chang, C. J., Chang, M. H., Chiang, S. H. F., ... & Hwang, F. K. (2020). Students' guided inquiry with simulation and its relation to school science achievement and scientific literacy. Computers & Education, 149, 103830. https://doi.org/10.1016/j.compedu.2020.103830

Wijayanti, I. D., & Ekantini, A. (2023). I*mplementasi Kurikulum Merdeka Pada Pembelajaran IPAS MI/SD*. *08*(September),2100–2112. https://doi.org/https://journal.unpas.ac.id/index.php/pendas/article/view/9597

Wulandari, T., Mudinillah, A., Islam, A., Batusangkar, N., Tinggi, S., & Islam, A. (2022). Efektivitas Penggunaan Aplikasi CANVA sebagai Media Pembelajaran *IPA MI / SD*. *2*(1), 102–118.