

Utilizing Visual Teaching Materials to Assist Students in Science Subjects Improves Science Process Skills

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Received: December 1, 2023

Revised: March 15, 2024

Accepted: April 25, 2024

Published: April 30, 2024

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DOI: [10.29303/jppipa.v10i4.6815](https://doi.org/10.29303/jppipa.v10i4.6815)

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Abstract: The purpose of this study is to analyze the improvement of student's science process skills with the application of visual gaining knowledge media in science subjects. The research method used is an experiment with a quantitative approach. The research design employed in this study is true experiment. The study's target population were all students at SMP Negeri 11 Banda Aceh, while the instance selected in this research were 56 pupils making use of the non-simple random sampling method by means of proportional sampling. The instrument used was 20 items to measure science process skills with multiple choice diagnostic tests. The outcomes of research on science process skills in the experimental class for each indicator were obtained: observing by 31.76%, classifying by 39.99%, interpreting by 62.31%, predicting by 53.42%, asking questions by 27.27%, formulating hypotheses by 21.74%, designing experiments by 34.95%, using tools and materials by 25.83%, applying concepts by 15.46%, and communicating by 21.72%. The study's findings allow for the conclusion that the highest indicator of students' science process skills is in the interpretation indicator, but the least significant indication is in the communication indicator. Therefore, the implementation of visual learning media in science subjects can have a positive impact on improving students science process skills.

Keywords: Learning Media; Science Process Skills; Visual Learning

Introduction

Natural Education Science or better known as IPA is one of the contents of education that has an important role. Science is a subject that equips students with the knowledge competencies and skills needed by them to find out about nature and learn about themselves. The importance of science leads to real experience proving the need for proof through data and facts on each observed phenomenon (Asidiqi & Adiputra, 2023; Tantia, 2016).

Natural science is a collection of knowledge in the form of facts, concepts, and principles about the surrounding nature. Science learning always emphasizes the discovery process or research process so that it can foster students' scientific attitudes, and be able to improve their cognitive, psychomotor, and social thinking skills (Rofiiqoh & Qosyim, 2023). Junior high

school science curricula consists of physics and biology lessons, in this study only studied for physics lessons with material about light and optical devices (Agustin et al., 2019; Hamadi et al., 2018).

Process skills in science are the capacity to of learners to apply the scientific method in understanding, developing science and discovering science (Afsas et al., 2023; Sutiani, 2021). Science process skills are very crucial for important for every learner as a provision to use the scientific method in developing science to obtain new knowledge or develop existing knowledge (Russell & Martin, 2023). Science Process Skills is a scientific method in which the steps to discover something through experiments and experiments are practiced (Hartati & A., 2022). So it can be understood that science process skills in this study are expected that students are able to conduct an experiment or experiment to gain

How to Cite:

Maizaliani, C. R., Muhibbuddin, M., Syukri, M., Saminan, S., Nurmaliah, C., Evendi, E., & Herliana, F. (2024). Utilizing Visual Teaching Materials to Assist Students in Science Subjects Improves Science Process Skills. *Jurnal Penelitian Pendidikan IPA*, 10(4), 2162-2169. <https://doi.org/10.29303/jppipa.v10i4.6815>

knowledge during the physics process of learning (Lafifa et al., 2022).

During the process of learning, science process skills are important to be raised and developed because with that students do not just learn about what already exists but also learn about how to get new knowledge (Asriani et al., 2021), therefore with the existence of science process skills, students are asked to have greater active and creative when finding problems to be solved and linking lessons with everything that goes on in their daily lives (Yunita & Nurita, 2021). Science process skills can be instructed in pupils during the procedure of building knowledge, they create and use information, conduct procedures for research, and practice resolving environmental issues (Subeki et al., 2022).

The poor state of scientific process skills is evidenced by research conducted by Setiono & Suhendar (2020) showing that the science process skills of seventh grade students in Sukabumi City State Junior High School each indicator of science process skills, namely, predicting 54.32%, communicating 55.00%, hypothesizing 57.30%, applying concepts 45%, observing 40.51%, classifying 24.33%, designing experiments by 20.42%, and interpreting 30.00%, and the skill of using tools and materials is 64.75%. Based on this research, it can be seen that students are still low in science process skills, the percentage obtained is in the moderate and moderate categories. Based on this research, the indicator of science process skills that shows the lowest indicator is the indicator of designing experiments (Devi & Bayu, 2020).

The obstacles faced by students to have science process skills are not only influenced by the material presented, but there are fewer pupils students are less involved in learning, even though learning activities in certain subjects require students to have and develop science process skills that are already owned by students such as in Natural Science subjects which are integrated into three fields of science, namely biology, physics and chemistry (Fatayan et al., 2022). Science learning requires students to answer phenomena that occur in everyday life and prove the truth through a scientific method. The main obstacle is the selection of methods or ways of learning students in a lesson that has been designed systematically and sequentially by educators before the implementation of learning is very influential, because it requires the ability of educators to develop effective learning methods so that learning is not only a provision of information but also information processing supported by certain skills to solve any problems faced (Heryadi et al., 2023). Effective learning methods are ways done by educators in order to create conditions of activities for teaching and learning that are fun and make students straight involved in order for students to not just gain knowledge in knowledge (cognitive) only, but increase in affective (attitude) and

psychomotor (skills) as well. Different types of learning methods were developed to make science learning not only theoretical learning but also learning that uses all five senses and is assisted by using tools that make it possible to scientifically explain a natural phenomenon. Students are trained by being confronted with a phenomenon around them that is required to think at a high degree to address the issues encountered, so that when science learning occurs, students not only gain theoretical knowledge but skills and positive character development and psychomotor are also grown (Alannasir, 2020; Septaria et al., 2019; Supriady et al., 2023).

Considering the original studies and teacher conversations at SMP Negeri 11 Banda Aceh, it was found that learning was still teacher-centered, while students only heard the teacher's explanation. Thus causing students must possess no science process skills during the learning process that takes place. Whereas in science learning can do quite a lot of practicum or experiments according to the material concerned which can encourage kids to take more risks during the ongoing learning process. Therefore, the method used in the study to get better science process skills by implementing visual learning media during the ongoing learning process (Azzubairiyah et al., 2022; Tawil & Dahlan, 2021).

It is expected that by implementing visual learning media can help students become more active, learning is not teacher-centered, and students are more independent during the ongoing learning process. The visual learning media used in this study are visual learning media that can be projected in the form of power points and student worksheets related to light material and optical devices. During the learning process, researchers will also provide student worksheets that are equipped with images related to light and optical devices. The use of this student worksheet aims to guide students to become more self-sufficient in obtaining new information or knowledge with the results of group work together. The selection of this material is according to the outcomes of interviews with teachers and the lowest daily test outcomes of students (Wihartini & Suyanti, 2022).

Given the context, the issue with this study is formulated as follows: "Is the implementation of visual learning media able to improve students' science process skills in science subjects? The purpose of this study was to analyze the improvement of students' science process skills with the implementation of visual learning media in science subjects (Komisia et al., 2023).

Method

This research uses a quantitative approach with experimental research type. This research was

conducted at SMP Negeri 11 Banda Aceh with a research sample of 80 students in class VIII₁ and VIII₂ using proporsive sampling technique. The instruments used in this study were 20 items of multiple choice diagnostic tests to measure students' science process skills and interview guides as initial observations. This question instrument has been tested by experts and respondents so that it is valid and feasible to use in research (Masruhah et al., 2022).

The multiple choice diagnostic test results are based on each indicator of science process skills. The indicators of science process skills used consist of 10 namely: observing, classifying, interpreting, predicting, asking questions, formulating hypotheses, designing experiments, using tools/materials, applying concepts, and communicating. Diagnostic test data were analyzed

using descriptive statistics of the scores obtained and interpreted (Muninggar & Ramli, 2023; Nursulistiyo et al., 2023).

The research design used in this research is true experiment. This design is almost the same as the pretest-posttest control group design. In this design consists of an experimental group and a control group selected randomly. The research design used is as follows.

Table 1. Pretest-posttest control group design

Group 1	O ₁	X ₁	O ₂
Group 2	O ₁	X ₂	O ₂

The research flow used can be seen as as shown in Figure 1.

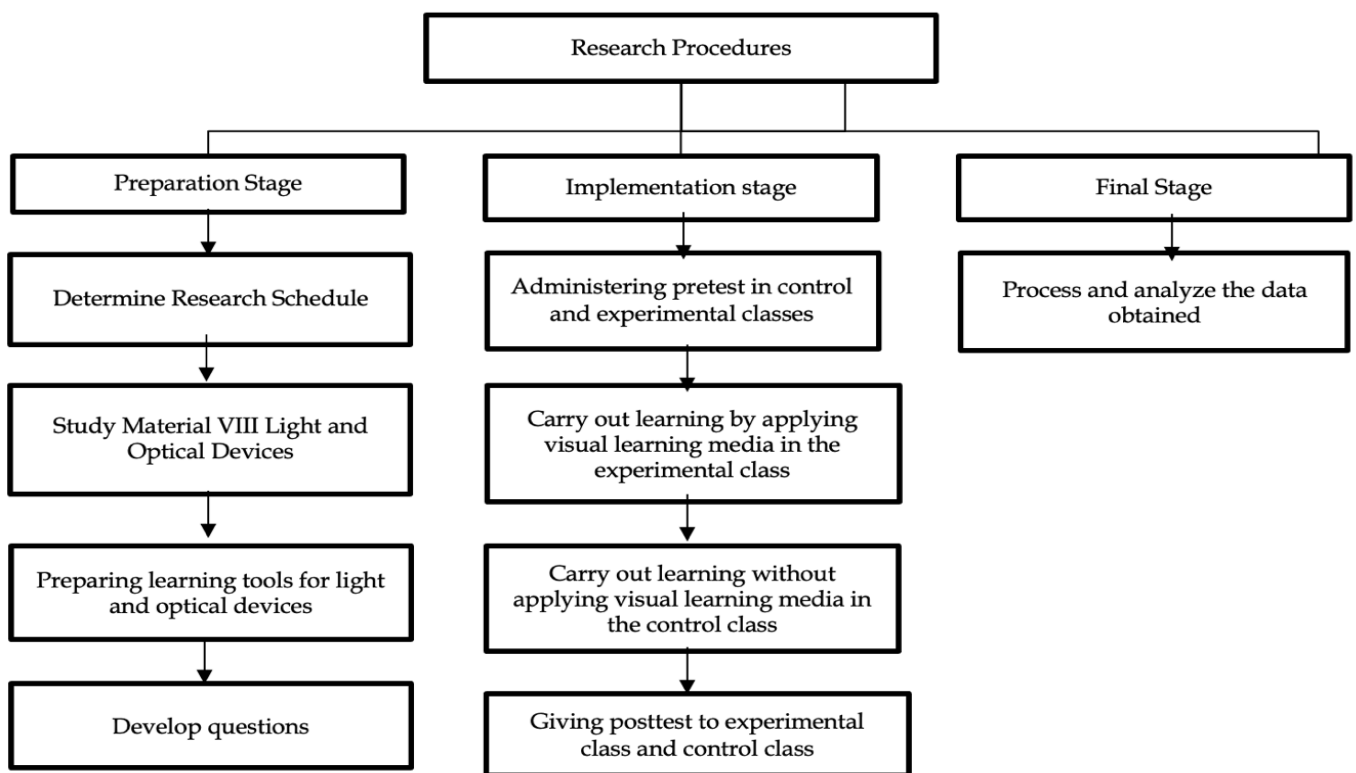


Figure 1. Research Flow

Result and Discussion

Results of Increasing Science Process Skills

Recapitulation of data on the average score of pretest science process skills, posttest and N-Gain of experimental and control class students as a whole is presented in Figure 2.

The results of the normality test and homogeneity test to determine the average difference in initial ability and final ability of students at SMP Negeri 11 Banda Aceh can be seen in Table 2.

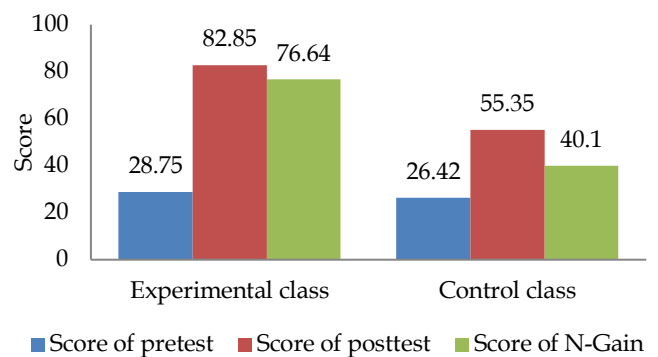


Figure 2. Comparison of average score of science process skills of experimental and control class

Table 2. Recapitulation of pretest of science process skills of students in experimental class and control class at SMP Negeri 11 banda aceh

Class	Science process skills average score	Normality	Homogeneity	Hypothesis testing t test	Information
Experimental	Pretest (28.75)	$X^2_{hit} < X^2_{tab}$ (0.83 < 16.91) Normal	$F_{hit} < F_{tab}$ (0.67 < 1.90) Homogeneous	$t_{hit} < t_{tab}$ (0.60 < 2.00)	Not really different
Control	Pretest (26.42)	$X^2_{hit} < X^2_{tab}$ (0.84 < 18.30) Normal			

From table 2 it can be concluded that the data obtained are not significantly different, this is because the initial ability of the experimental class and control class was the same before being given treatment. The experimental class was given treatment with the implementation of visual learning media to improve students' science process skills and also conducted practicum or experiments during the learning process (Nasir et al., 2023; Rahmasandi et al., 2022; Rahmawati & Atmojo, 2021), while the control class only applied a conventional learning model with the lecture method without any practicum or experiment during the learning process (Sarwinda et al., 2020; Setyani & Darmawan, 2021).

The results of the normality test and homogeneity test to determine the improvement of the initial ability and final ability of students at SMP Negeri 11 Banda Aceh can be seen in Table 3. From Table 3 it can be concluded that the data obtained are significantly

different (significant) this is because after being given the treatment of visual learning media implementation in the experimental class there is an increase in the science process skills of students, while in the control class only a conventional learning model is applied with the lecture method without being given the treatment of visual learning media implementation (Juliana et al., 2023).

The difference in N-Gain scores between the experimental class and the control class means that the improvement of students' science process skills on the material of light and optical devices at SMP Negeri 11 Banda Aceh in the experimental class is better than the control class. The material of light and optical devices is considered difficult by students, because the content is challenging students to imagine in daily existence. Therefore, the implementation of visual learning media is applied successfully to improve students' science process skills.

Table 3. Recapitulation of N-Gain of science process skills of students in experimental classes and control classes at SMP Negeri 11 banda aceh

Class	Science process skills average score	Normality	Homogeneity	Hypothesis testing t test	Information
Experimental	N-Gain (76.64)	$X^2_{hit} < X^2_{tab}$ (0.83 < 28.86) Normal	$F_{hit} < F_{tab}$ (0.64 < 1.90) Homogeneous	$t_{hit} < t_{tab}$ (8.64 < 2.00)	Really different (significant)
Control	N-Gain (40.1)	$X^2_{hit} < X^2_{tab}$ (0.91 < 35.17) Normal			

Results of the Analysis of Science Process Skills Indicators

In this study, to measure science process skills, pretests and posttests consisting of 20 questions were used. The indicators contained in the questions consist of indicators of science process skills, each indicator consisting of 2 items. When viewed based on indicators, the difference in pretest scores and science process skills of students can be seen in Table 4.

Observed

Table 4 presents the pretest value that students received on the observing indicator is 16.35, while the posttest value that they received is 41.07. This demonstrates that both before and after the implementation of visual learning materials, there's an improvement in the indicators of students' science

process skills. The N-gain test on the observing indicator, an increased category, demonstrates the increase.

Table 4. Analysis of science process skills indicators

Science process skills indicators	Pretest	Posttest	N-gain
Observed	16.35	41.07	31.76
Grouped	16.96	45.53	39.99
Interpreted	10.71	49.1	62.31
Predicted	9.82	44.64	53.42
Asked questions	17.85	39.28	27.27
Develop hypotheses	24.1	41.96	21.74
Designed experiments	17.85	43.75	34.95
Used tools and materials	19.64	40.17	25.83
Applied concepts	32.14	45.53	15.46
Communicated	22.32	40.17	21.72

Grouped

Table 4 presents the pretest value that students received on the grouping indicator is 16.96, while the posttest value that they received is 45.53. This demonstrates that both before and after the implementation of visual learning materials, there's an improvement in the indicators of students' science process skills. The N-gain test on the observing indicator, with an increased category, demonstrates the increase.

Interpreted

Table 4 presents the pretest value that students received on the interpreting indicator is 10.71, while the posttest value that they received is 49.1. This demonstrates that both before and after the implementation of visual learning materials, there's an improvement in the indicators of students' science process skills. The N-gain test on the observing indicator, which presents of 62.31 with an increased category, demonstrates the increase.

Predicted

Table 4 presents the pretest value that students received on the predicting indicator is 9.82, while the posttest value that they received is 44.64. This demonstrates that both before and after the implementation of visual learning materials, there's an improvement in the indicators of students' science process skills. The N-gain test on the observing indicator, which presents of 53.42 with an increased category, demonstrates the increase.

Asked questions

Table 4 presents the pretest value that students received on the indicator of asking questions, which is 17.85, and the posttest value that students obtained, which is 39.28. This demonstrates that both before and after the implementation of visual learning materials, there's a rise in the markers of students' science process skills. The N-gain test indicated an increase in question-asking behavior, with a low category.

Develop hypotheses

Table 4 presents the pretest value that students received on the indicator of developing hypotheses, which is 24.1, and the posttest value that students obtained, which is 41.96. This demonstrates that both before and after the implementation of visual learning materials, there's a rise in the markers of students' science process skills. The N-gain test indicated an increase in question-asking behavior, with a low category.

Designed experiments

Table 4 presents the pretest value that students received on the designing experiments indicator is 17.85, while the posttest value that they received is 43.75. This demonstrates that both before and after the implementation of visual learning materials, there's an improvement in the indicators of students' science process skills. The N-gain test on the observing indicator, with an increased category, demonstrates the increase.

Used tools and materials

Table 4 presents the pretest value that students received on the indicator of using tools and materials, which is 19.64, and the posttest value that students obtained, which is 40.17. This demonstrates that both before and after the implementation of visual learning materials, there's a rise in the markers of students' science process skills. The N-gain test indicated an increase in question-asking behavior, with a low category.

Applied concepts

Table 4 presents the pretest value that students received on the indicator of applying concepts, which is 32.14, and the posttest value that students obtained, which is 45.53. This demonstrates that both before and after the implementation of visual learning materials, there's a rise in the markers of students' science process skills. The N-gain test indicated an increase in question-asking behavior, with a low.

Communicated

Table 4 presents the pretest value that students received on the indicator of communicating, which is 22.32, and the posttest value that students obtained, which is 40.17. This demonstrates that both before and after the implementation of visual learning materials, there's a rise in the markers of students' science process skills. The N-gain test indicated an increase in question-asking behavior, with a low category.

Previous study carried out by Sopandi et al. (2022) stated that the application of visual learning media can enhance abilities, grasp of the material and inspire pupils to participate in their education. And previous study carried out by Wong et al. (2022) states that the use of visual learning media successfully facilitates both analytical and imaginative thinking, while being interesting (Fitria, 2023; Lin & Wang, 2021; Yenawine, 2013). The application of visual learning media additionally functions as a superb facilitator for conversations regarding the methodology of science, and could be more advantageous if applied early in the term of the semester. Therefore, this easy and entertaining exercise is for teachers want to incorporate

scientific method skills into their teaching (Husna & Kurniawan, 2023; Karo, 2022).

Drawing conclusions from the research findings, it can be said that the implementation of visual learning media can improve the science process skills of class VIII students in the 2023/2024 school year.

Conclusion

Based on studies carried out at SMP Negeri 11 Banda Aceh, Consequently, it may be said that it can be concluded that the implementation of visual learning media can improve students' science process skills in light and optical instruments at SMP Negeri 11 Banda Aceh. The pretest score before implementing visual learning media was 28.75%, while the posttest score after implementing visual learning media was 82.85%.

Acknowledgments

Thank you to the entire supervisory team for their guidance and assistance during this research, as well as constructive and useful suggestions so that this research can be completed.

Author Contributions

Cut Roza Maizaliani, the primary author, participated in the planning, execution, and writing of the study. The second and third author, Muhibbuddin, and M.Syukri, assisted in seeing the piece through to completion. The fourth, and fifth, sixth, and seventh authors, Saminan, Cut Nurmaliah, Evendi, and Fitriana Herliana contributed to validating the article instruments. All authors have approved the manuscript's published version.

Funding

There was no outside support for this study

Conflicts of Interest

The authors claim there are no competing interests. A few conclusions section, which can either stand alone or be a subsection of a discussion or results and discussion section, might contain the study's key findings.

References

- Afsas, S. K., Sutikno, S., & Fianti, F. (2023). Penerapan Pembelajaran Berbasis Praktikum untuk Meningkatkan Keterampilan Proses Sains Siswa SMP. *Journal on Education*, 6(1), 8913-8926. <https://doi.org/10.31004/joe.v6i1.4375>
- Agustin, N. K. T. J., Margunayasa, I. G., & Kusmariyatni, N. N. (2019). Pengaruh model pembelajaran TPS berbantuan media visual terhadap hasil belajar IPA. *Journal for Lesson and Learning Studies*, 2(2), 239-249. <https://doi.org/10.23887/jlls.v2i2.19148>
- Alannasir, W. (2020). Characteristic-based development students aspect. *International Journal of Asian Education*, 1(1), 29-36. <https://doi.org/10.46966/ijae.v1i1.18>
- Asidiqi, D. F., & Adiputra, D. K. (2023). Pengaruh Media Animasi Flash Terhadap Keterampilan Proses Sains Siswa Kelas V Sekolah Dasar. *Jurnal Basicedu*, 7(3), 1485-1492. <https://doi.org/10.31004/basicedu.v7i3.5518>
- Asriani, A., Pahriadi, P., & Sinta, S. (2021). Pengaruh Model Pembelajaran Kreatif Produktif Berbantuan Media Visual Terhadap Hasil Belajar Siswa Pada Mata Pelajaran IPA Di Kelas V. *Educate: Jurnal Teknologi Pendidikan*, 6(1), 1-8. <https://doi.org/10.32832/educate.v6i1.3939>
- Azzubairiyah, N., Erman, E., & Susiyawati, E. (2022). Examining student responses of PhET simulations after virtual laboratory practices. *Jurnal Pijar Mipa*, 17(4), 515-519. <https://doi.org/10.29303/jpm.v17i4.3624>
- 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/jjpsgd.v8i2.26525>
- Fatayan, A., Zulherman, Z., & Triannisa, S. W. (2022). Pengembangan Media Visual Flashcard Berbasis Adobe Premiere Di Sekolah Dasar. *Jurnal Eduscience (JES)*, 9(1), 28-39. <https://doi.org/10.36987/jes.v9i1.2518>
- Fitria, T. N. (2023). Augmented reality (AR) and virtual reality (VR) technology in education: Media of teaching and learning: A review. *International Journal of Computer and Information System (IJCIS)*, 4(1), 14-25. <https://doi.org/10.29040/ijcis.v4i1.102>
- Hamadi, A. A. L., Priyayi, D. F., & Astuti, S. P. (2018). Pemahaman guru terhadap keterampilan proses sains (KPS) dan penerapannya dalam pembelajaran IPA SMP di Salatiga. *Edu Sains: Jurnal Pendidikan Sains Dan Matematika*, 6(2), 42-53. <https://doi.org/10.23971/eds.v6i2.935>
- Hartati, N., & A., dan A. (2022). Keterampilan Proses Sains Siswa melalui Model Pembelajaran Problem Based Learning (PBL) pada Materi Biologi. *Jurnal Ilmiah Ilmu Pendidikan*, 5(12), 5795-5799. <https://doi.org/10.33627/es.v6i2.1574>
- Heryadi, Y., Fathurrohman, M., & Yuhana, Y. (2023). Pengembangan Bahan Ajar Komik Materi Operasi Hitung Penjumlahan dan Pengurangan Bilangan Bulat Kelas V SD. *Jurnal Basicedu*, 7(6), 4157-4163. <https://doi.org/10.31004/basicedu.v7i6.6767>
- Husna, S. M., & Kurniawan, D. A. (2023). Preliminary Study: Development of Digital Literacy Assessment Instruments and Science Process Skills on Simple Plane Material. *Jurnal IKA*, 21(2), 80-90. <https://doi.org/10.23887/ika.v21i2.59761>
- Juliana, E. N., Zainuddin, Z., & Dewantara, D. (2023). Electronic Module with Scientific Approach in Training Students' Science Process Skills on Solid

- Elasticity Learning Material. *Journal of Mathematics Science and Computer Education*, 3(1), 12–25. Retrieved from <https://ppjp.ulm.ac.id/journals/index.php/jmsc-edu/article/view/8157>
- Karo, R. K. (2022). Pengaruh Media Visual Tiga Dimensi Terhadap Hasil Belajar Ilmu Pengetahuan Alam Siswa Kelas IV SD Negeri 094132 Dolok Ulu Tahun Ajaran 2021/2022. *Management of Education: Jurnal Manajemen Pendidikan Islam*, 8(2), 196–200. <https://doi.org/10.18592/moe.v8i2.8948>
- Komisia, F., Buku, M. N. I., Tukan, M. B., Londa, D., Bubu, M. I., & Asafa, M. P. (2023). Penguatan Keterampilan Proses Sains Peserta Didik Kelas VII Smp Negeri 18 Kupang Melalui Praktikum Ipa Terpadu. *Abdimas Galuh*, 5(2), 1661–1669. <https://doi.org/10.25157/ag.v5i2.12005>
- Lafifa, F., Parno, P., Hamimi, E., & Setiawan, A. M. (2022). Development of STEM animation learning media with feedback to facilitate students' critical thinking ability on global warming materials. *Eighth Southeast Asia Design Research (SEA-DR) & the Second Science, Technology, Education, Arts, Culture, and Humanity (STEACH) International Conference (SEADR-STEACH) 2021*, 8–15. <https://doi.org/10.2991/assehr.k.211229.002>
- Lin, Y.-J., & Wang, H. (2021). Using virtual reality to facilitate learners' creative self-efficacy and intrinsic motivation in an EFL classroom. *Education and Information Technologies*, 26(4), 4487–4505. <https://doi.org/10.1007/s10639-021-10472-9>
- Masruhah, G. D., Rusdianto, R., & Wahyuni, S. (2022). Pengembangan e-LKPD berbasis inkuiri terbimbing untuk meningkatkan keterampilan proses sains siswa SMP. *SAP (Susunan Artikel Pendidikan)*, 7(1), 169–177. <https://doi.org/10.30998/sap.v7i1.12935>
- Muninggar, S., & Ramli, M. (2023). The Effectiveness of Learning Progression-based Biotechnology STEM Module to Improve Metacognitive Skills. *Journal of Education Research and Evaluation*, 7(4). <https://doi.org/10.23887/jere.v7i4.67502>
- Nasir, M., Fahrudin, F., Haljannah, M., & Nehru, N. (2023). Implementasi Model Pembelajaran Problem Based Learning untuk Meningkatkan Keterampilan Proses Sains Siswa SMAN 5 Kota Bima. *JIP-Jurnal Ilmiah Ilmu Pendidikan*, 6(1), 289–296. <https://doi.org/10.54371/jiip.v6i1.1370>
- Nursulistiyo, E., Kurniawan, D. A., Husna, S. M., & Perdana, R. (2023). The Relationship Between Digital Literacy and Students' Science Process Skills in Junior High Schools. *Journal of Education Research and Evaluation*, 7(4). <https://doi.org/10.23887/jere.v7i4.58388>
- Rahmasandi, R., Astuti, S., Azhar, A., Irfan, I., & Azmin, N. (2022). Penerapan Model Pembelajaran Kooperatif Berbantuan Kartu Bergambar Untuk Meningkatkan Hasil Belajar Siswa SMPN 1 Kota Bima. *Edu Sociata: Jurnal Pendidikan Sosiologi*, 5(2), 103–108. <https://doi.org/10.33627/es.v5i2.1023>
- Rahmawati, F., & Atmojo, I. R. W. (2021). Analisis media digital video pembelajaran abad 21 menggunakan aplikasi canva pada pembelajaran IPA. *Jurnal Basicedu*, 5(6), 6271–6279. <https://doi.org/10.31004/basicedu.v5i6.1717>
- Rofiiqoh, N., & Qosyim, A. (2023). Analisis Kemandirian Belajar Siswa SMP dalam Pembelajaran IPA Di Masa Pandemi Covid-19. *PENSA: E-JURNAL PENDIDIKAN SAINS*, 11(1), 106–115. Retrieved from <https://ejournal.unesa.ac.id/index.php/pensa/article/view/46001>
- Russell, T., & Martin, A. K. (2023). Learning to teach science. In *Handbook of research on science education*, 1162–1196. <https://doi.org/10.4324/9780367855758-42>
- Sarwinda, K., Rohaeti, E., & Fatharani, M. (2020). The development of audio-visual media with contextual teaching learning approach to improve learning motivation and critical thinking skills. *Psychology, Evaluation, and Technology in Educational Research*, 2(2), 98–114. <https://doi.org/10.33292/petier.v2i2.12>
- Septaria, K., Dewanti, B. A., & Habibulloh, M. (2019). Implementasi Metode Pembelajaran Spot Capturing Pada Materi Pemanasan Global untuk Meningkatkan Keterampilan Proses Sains. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, 7(1), 27–37. Retrieved from <http://ejournal.undikma.ac.id/index.php/prismasains/article/view/1379>
- Setiono, S., & Suhendar, S. (2020). Profil Keterampilan Proses Sains Siswa Kelas VII SMP Pada Materi Ekosistem:(Profile of Science Process Skills Class VII Junior High School Students in Ecosystem Material. *BIODIK*, 6(4), 519–525. <https://doi.org/10.22437/bio.v6i4.10295>
- Setyani, W. A., & Darmawan, A. S. (2021). The Implementation of Audio Visual Media in Problem Based Learning Model to Improve the Problem Solving Skills. In *6th International Seminar on Science Education (ISSE 2020)*, 563–568. <https://doi.org/10.2991/assehr.k.210326.081>
- Sopandi, A., Permasari, A., & Pursitasari, I. D. (2022). Improving Student's Skills and Concept Understanding in Vibration and Waves with the Use of Visual Media Concepts on Students. *JSEP (Journal of Science Education and Practice)*, 6(1), 35–50. <https://doi.org/10.33751/jsep.v6i1.5689>
- Subeki, R. S., Astriani, D., & Qosyim, A. (2022). Media Simulasi PHET Berbasis Inkuiri Terbimbing Materi

- Getaran Dan Gelombang Terhadap Peningkatan Keterampilan Proses Sains Peserta Didik. *Pensa: E-Jurnal Pendidikan Sains*, 10(1), 75–80. Retrieved from <https://ejournal.unesa.ac.id/index.php/pensa/article/view/41459>
- Supriady, F., Fadli, M., Efani, A., & Asep, I. S. (2023). The Influence Of Cognitive, Affective, Psychomotor Skills And Naval Science On Character Development Of Naval Academy Cadets. *Russian Journal of Agricultural and Socio-Economic Sciences*, 143(11), 12–23. Retrieved from <https://cyberleninka.ru/article/n/the-influence-of-cognitive-affective-psychomotor-skills-and-naval-science-on-character-development-of-naval-academy-cadets>
- Sutiani, A. (2021). Implementation of an inquiry learning model with science literacy to improve student critical thinking skills. *International Journal of Instruction*, 14(2), 117–138. Retrieved from <https://digilib.unimed.ac.id/id/eprint/42164>
- Tantia, L. I. (2016). Keterampilan proses sains siswa SMP Negeri 21 Surabaya pada materi kalor dan perpindahannya. *PENSA: E-JURNAL PENDIDIKAN SAINS*, 4(02). Retrieved from <https://ejournal.unesa.ac.id/index.php/pensa/article/view/14972>
- Tawil, M., & Dahlan, A. (2021). Application of interactive audio visual media to improve students' creative thinking skill. *Journal of Physics*, 1752(1), 12076. <https://doi.org/10.1088/1742-6596/1752/1/012076/meta>
- Wihartini, K., & Suyanti, R. D. (2022). The Influence Of Inquiry Learning Model With Audio Visual And Science Process Skills On Critical Thinking Skills In Animal And Human Breathing Materials. *Sensei International Journal of Education and Linguistic*, 2(1), 43–66. <https://doi.org/10.53768/sijel.v2i1.69>
- Wong, M., Al-Arnawoot, A., & Hass, K. (2022). Student Perception of a Visual Novel for Fostering Science Process Skills. *Teaching & Learning Inquiry*, 10. Retrieved from <https://pubs.rsc.org/en/content/articlehtml/2012/rp/c2rp20046e>
- Yenawine, P. (2013). *Visual thinking strategies: Using art to deepen learning across school disciplines*. Harvard Education Press.
- Yunita, N., & Nurita, T. (2021). Analisis Keterampilan Proses Sains Siswa Pada Pembelajaran Daring. *Pensa: E-Jurnal Pendidikan Sains*, 9(3), 378–385. Retrieved from <https://ejournal.unesa.ac.id/index.php/pensa/article/view/41088>