PROCEEDINGS
International Conference on Education
Faculty of Tarbiyah | UIN Syekh Wasil Kediri
E-ISSN: 3025-6828

Volume 3, 2025

Development of KIT-Based Learning Media to Improve Science Learning Outcomes on Light and Optics

Aziza Anggi Maiyanti[1]; Nia Ellia Malika[2]; Anis Nabil Rahmawati[3]; Yulianti Yusal[4] ; Yulisna Moryati[5]
[1,2,3] UIN Syekh Wasil Kediri, Indonesia,
[4]Universitas Negeri Makasar, Indonesia
[5] Sanggar Bimbingan Sungai Buloh, Malaysia
Correspondence e-mail: azizaanggimaiyanti@iainkediri.ac.id

Abstract:
This study aims to develop simple, effective, and feasible KIT-based learning media to improve science learning outcomes in light and optics in grade 8. The media was developed using the Research and Development (R&D) model. The media feasibility test showed that the practical KIT on the properties of light was feasible for use, with a percentage of 72.5%. The media was also highly rated by teachers and students based on the responses obtained, with 85.5% and 88.96% respectively categorizing it as highly suitable. The effectiveness of the KIT media was tested by comparing the learning outcomes of students who used the KIT media with those who used conventional methods. The hypothesis test results showed that the use of KIT media in learning could improve student learning outcomes (t-count < t-table or 0.000 < 2.039). This indicates that the KIT media can be an effective alternative in enhancing students' understanding of light and optics. This study contributes to the development of simple KIT-based learning media that can be used as an additional option in science learning. This media is expected to increase students' interest and learning outcomes, as well as help teachers deliver light and optics material in a more interesting and interactive way. The development of KIT-based learning media opens up opportunities for further research into the effectiveness of KIT media in other science subjects and at various levels of education.

Keywords: Simple Kit, Light And Optics, Science Learning Outcomes

Article History:
Received : 26 July 2025
Revised : 28 August 2025
Accepted : 15 October 2025

Introduction

Education is the ability to use available knowledge appropriately, thereby creating new knowledge (Novakovskaya 2013). Through education, individuals can learn and understand existing knowledge, enabling them to apply it in their daily lives. In addition, education encourages individuals to think critically, creatively, and innovatively, allowing them to create new knowledge that benefits society and the world. To optimally support the achievement of these competencies, it is necessary to integrate learning media that can strengthen the role of educators in the learning process.

In modern education systems, the role of educators as teachers seems to need to be supported by the use of educational media. This is aimed at improving the effectiveness and efficiency of the learning process and education as a whole. In this context, educational media is important because the learning materials to be delivered are becoming increasingly diverse and extensive, in line with the rapid development of science and technology (Isran Rasyid Karo-Karo & R. Rohani 2018). Educators are no longer the sole source of learning and conveyors of educational messages. They also develop themselves through various educational media that serve as learning aids and conveyors of educational messages (Marina n.d.). Therefore, it is important for teachers to have certain skills in classroom management, understanding concepts, using learning media, and planning learning strategies. With these skills, teachers can create a conducive and enjoyable learning environment for students.

In essence, the learning process is a process of communication and interaction between teachers and students on the one hand, and between students on the other. Teacher-student interaction is very important in the learning and education process. The patterns and styles of this interaction are determined by the educational situation, tendencies and attention, as well as educational characteristics. Classroom interaction is important and plays a major role in improving the efficiency of the learning process and increasing student achievement. The effectiveness of learning is influenced by several factors, including the interactive behavior patterns that occur in the classroom. These patterns are reflected in the activities of teachers and students during the learning process. The effectiveness of learning is also influenced by the cognitive and non-cognitive characteristics of teachers that help them achieve success, the characteristics of students, the subjects taught, and teaching methods (ElAlfi, A., ElAlami, M., & Asem 2009).

Science plays an important role in developing critical thinking skills because it can utilize innovative learning materials. In this context, science creates innovative learning materials to increase students' interest in learning science and train their critical thinking skills (Putri, A. S., & Aznam 2019). Critical thinking skills can be improved by integrating these concepts into science learning designs (Swartz 2001). However, despite these efforts, the results of the investigation show that students' critical thinking skills are still relatively low, as revealed in previous studies on college students' critical thinking skills (Y. Yusal 2021).

Based on the results of the 2018 Programme for International Student Assessment (PISA) evaluation, Indonesia showed low levels of student science proficiency. The PISA study results indicate that Indonesia still faces challenges in the field of education. In the reading proficiency category, Indonesia ranked 74th out of 79 countries, while in mathematics and science proficiency assessments, Indonesia ranked 73rd and 71st out of 79 participating countries. This means that Indonesian students' performance in these three areas remains relatively low compared to other countries (Hewi, M. & Shaleh 2020). The PISA survey results show that science literacy among students in Indonesia remains low, placing Indonesia 71st out of 79 countries. This is due to several factors, such as students' lack of understanding of the nature of science, difficulties in applying scientific

concepts in everyday life, and low ability to read and interpret data in the form of images, diagrams, and tables. Additionally, critical thinking, scientific reasoning, creative thinking, and problem-solving skills also need to be improved (Sopandi 2019). To improve students' science skills in Indonesia, comprehensive measures are needed. First, it is important to instill a strong understanding of the nature of science, not only as a collection of facts, but also as a process of investigation and understanding of the world. Second, it is important to teach students how to apply scientific concepts in everyday life, connecting theory with practice. Third, improving the ability to read and interpret data, including images, diagrams, and tables, is key to understanding scientific information. Lastly, fostering critical thinking, scientific reasoning, creativity, and problem-solving skills within a scientific context will help students tackle future challenges. With sustained efforts, it is hoped that Indonesian students' scientific abilities will improve, producing a generation with better scientific literacy and readiness to face the increasingly complex challenges of the world.

The 2013 Curriculum, also known as K-13, is an educational framework that has been implemented in Indonesia since 2013, with the main objective of developing the potential of students holistically, covering cognitive, affective, and psychomotor aspects. This curriculum adopts an active and creative learning approach that emphasizes the development of critical thinking skills, creativity, and social skills among students. The integration of subjects and a focus on character development are prominent features of the 2013 Curriculum, which aims to produce individuals with strong competencies and character, ready to face the challenges of the modern era. Additionally, the 2013 Curriculum has undergone several changes and improvements since its implementation. In 2018, revisions were made to the curriculum with a focus on enhancing students' literacy and numeracy skills (Komara Nur Ikhsan dan Supian Hadi 2018).

Cognitive learning theory explains that learning involves changes in the internal mental processes used to understand the world around us. This process can be applied at various levels, from learning simple tasks to more complex ones (J. Anidar 2017). One important aspect of cognitive learning theory is the role of media in the learning process. An example is the integrated instrument box (KIT) media, which is one type of media often used in education.

A Physics Kit is a collection of physics tools that can be used for various experiments and stored in a box. The tools in this kit are designed to support the learning of similar physics concepts. There are many types of kits available for middle school/MTs and high school levels, such as optical kits, mechanics kits, and electricity and magnetism kits. Interestingly, a single kit box can be used for a variety of experiments. For example, an optical kit box can be used to study light dispersion, the magnifying effect of a magnifying glass, and so on. Thus, a single kit box can provide numerous opportunities for learning and experimentation (Kementrian Pendidikan dan Kebudayaan. 2011).

Natural sciences or science itself is one of the subjects that is considered complex and abstract in every concept. Therefore, in the learning process, it is important to use learning media tools that can help convey the material more clearly and interestingly to students (N. Karlina & R. Setiyadi 2019). By using the right learning media, it is hoped that students will find it easier to understand and apply concepts in science subjects.

The media plays a very important role in education as an intermediary or channel of communication between teachers and students (A. Asyar 2011). Media can take the form of various tools used to convey messages and achieve teaching objectives (Djamarah 2002). Media has the ability to convey information through various means such as sound, images, movement, and color, both naturally and through manipulation. Thus, learning

media can be described as a learning aid that aims to stimulate the minds, feelings, attention, and skills of learners during the learning process. This definition encompasses a variety of resources, environments, human interactions, and methods used in the context of learning.

Learning media plays a very important role and is on par with learning methods. The application of learning media must be adapted to the methods used by teachers and the learning conditions encountered. Therefore, the importance of learning media also has an impact on the success of the learning process itself (Dr. Muhammad Hasan, S. Pd. 2021). Learning media that uses practical methods has a positive impact on improving students' ability to understand learning materials, thereby improving their learning outcomes. Practical methods are a way of presenting material where students can directly conduct experiments by experiencing and proving for themselves what they have learned. Thus, students can follow the process, do it themselves, observe objects, analyze, prove, and draw their own conclusions about certain objects, conditions, and processes.

Based on observations and interviews with teachers conducted by researchers at SMPN 1 Tarokan, two problems were found in science learning. One of them is the lack of student interest in learning and low student learning outcomes. In addition, students there rarely and almost never conduct practical work due to the lack of optimal use of facilities. This is believed to be due to the existing facilities being considered too complex and uninteresting, as well as the lack of proper lesson planning. Especially in the field of physics, particularly the topics of light and optics, many students find it difficult to understand the concepts related to light and optical instruments. Therefore, the researcher will attempt to develop a simple practical learning kit (KIT) for science education, focusing on the topics of light and optics at the junior high school/MTs/equivalent level. The objective of this development is to determine the feasibility and effectiveness of a simple KIT-based learning medium in improving the learning outcomes of students in the 8th grade at SMPN 1 Tarokan. It is hoped that with this learning media, students can easily understand and master the material on light and optics effectively and maximally, thereby improving their learning outcomes. The approach used in developing this learning media aligns with the principle that knowledge is constructed through interaction with others (A. Bandura 1999). Therefore, through interaction in practical activities, students can gain valuable learning experiences. In practical activities, students will actively interact with their classmates, while teachers act as facilitators in the learning process.

Why did researchers decide to develop simple KIT-based learning media? This is because purchasing a complete KIT is considered more expensive and some parts are not yet relevant to be introduced or taught at the junior high school level. Therefore, the creation of simple KIT-based learning media will only focus on tools that are relevant to the needs of light and optics practical work at the junior high school/MTs/equivalent level.

Methods

This researcher used the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) research and development model introduced by Robert Maribe Brach in 2009. The purpose of this development was to determine the feasibility and effectiveness of simple KIT-based learning media in improving the learning outcomes of eighth-grade students at SMPN 1 Tarokan, particularly in the subject of light and optics. It is hoped that with this learning media, students will be able to understand and master the material more easily and effectively, thereby improving their learning outcomes. The development of this simple KIT is based on the consideration that purchasing a complete KIT is deemed

more expensive and contains some components that are not yet relevant to introduce or teach at the junior high school level. Therefore, the development of the learning media is focused solely on tools appropriate for light and optics experiments at the junior high school/MTs/equivalent level.

The type of data used in this study is mixed methods data, which consists of quantitative and qualitative data. Quantitative data was obtained through validation questionnaires from subject matter experts, media experts, learning experts, and students, as well as pretest and posttest results to determine the effectiveness of the developed media. The validation questionnaire was analyzed using a percentage formula to determine the level of media validity, with interpretations based on the following five categories.

Table 1. Product Validation Criteria

No	Category	Assessment
1.	Very valid, no revision needed	84%-100%
2.	Valid, no revision needed	71%-83%
3.	Sufficiently valid, minor revision needed	61%-70%
4.	Insufficiently valid, major revision needed	41%-60%
5.	Not valid, complete revision needed	0%-40%

(adapted from UM Education Guidelines in Jauhari, 2011)

In this study, a t-test was conducted to determine the difference in mean scores between the pre-test and post-test results of students after using the developed media. The data were analyzed using the t-calculated formula, then compared with the t-table at a significance level of 5% ($\alpha = 0.05$) to determine the significance of the difference. The hypotheses tested were H_0 (no significant difference) and H1 (significant difference), with the condition that if tCalculated ≥ tTable, then H1 is accepted, and if tCalculated < tTable, then H_0 is accepted (Ita Rahmawati and Rissalatul Illiyin 2021). The t-test was conducted using Microsoft Excel to determine whether there was a significant improvement in learning outcomes after using simple KIT-based learning media.

Next, to determine the extent of improvement in learning outcomes, the N-Gain test was used with the following formula.

$$\text{N} - \text{Gain} = \frac{Posttest\ score\ -\ Pretest\ score}{(Ideal\ maximum\ score\ -\ Pretest\ score)}$$

(1)

Description:

Ideal score = maximum score (highest score) obtained.

The N-gain test was conducted by researchers using Microsoft Excel, with the following criteria (Hake 2002).

Table 2. N-Gain Test Criteria

N-Gain Value	Criteria
N-Gain ≥ 0,70	High
0,30 < 0,70	Moderate
N-Gain ≤ 0,30	Low

Meanwhile, qualitative data was obtained from interviews with science teachers at SMPN 1 Tarokan as well as from validators' input, comments, and suggestions. This data was analyzed descriptively to identify user needs and improve the developed media based on feedback from experts. Qualitative data also provided insights into the design aspects, content suitability, and usability of the media, and served as the basis for the product revision process during the evaluation phase in the ADDIE model.

Results and Discussion

A. Product Development Results

This study uses the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) in the process of developing simple KIT-based learning media on light and optics. Each stage in the ADDIE model contributes significantly to producing valid, feasible, and effective media in improving student learning outcomes.

a. Analysis

In this stage, researchers conduct curriculum analysis, student characteristics analysis, concept analysis, student needs analysis, and learning objectives analysis. The first stage is the analysis of the curriculum that is relevant and in line with the basic competencies of the material. This curriculum analysis is important to ensure an effective learning process that is in line with the applicable lesson plans and syllabus (Fadil, K., Ikhtiono, G., & Nurhalimah 2024) at SMPN 1 Tarokan before starting the development of the Practical KIT for Light and Optics material.

Curriculum analysis was conducted through observation at SMPN 1 Tarokan to identify basic problems encountered in the science learning process at the school. Needs analysis was conducted to understand what students needed to improve the effectiveness and attract their interest in learning. Based on the needs analysis observation sheet, the researcher found several problems that occurred during the learning process. One of them was the lack of student motivation to learn due to the limited media available at the school. Another problem was caused by the scarcity of practical tools and materials, which affected practical activities. Needs analysis was conducted through the distribution of questionnaires to students and teachers, as well as through observation. Students reported that they only used printed books as teaching materials. The questionnaire results showed that there was a very high need among students and teachers to use the Practical KIT learning media, with a need percentage reaching 100% from both students and teachers. This confirms that teachers and students in class VIII E greatly need the Practical KIT media for the Light and Optics material.

This results in students becoming less active and not having the opportunity to hone the skills and knowledge they have acquired in science learning. Practical activities play an important role in increasing students' interest in learning because they can observe and apply theory directly. There are four main reasons why practical activities are so important: first, they stimulate students' motivation to learn; second, they help develop basic skills in conducting experiments; third, they serve as a means

of applying the scientific approach to learning; and fourth, they support a comprehensive understanding of learning concepts (Masruri 2020).

Researchers developed practical KIT media to increase student activity and motivation to learn. The learning media developed was a practical KIT for buffer solution material. The selection of buffer solution material was based on the need for media that supports practical activities, as well as the importance of direct experimentation to improve student skills. This media is expected to help students remember the material through visual and audio aids. Students tend to understand material more easily with the help of images or other visual media compared to lengthy texts.

Therefore, media that can support the implementation of practical work is needed. The learning objective is to formulate the results of curriculum analysis and concept analysis. The development of a Practical Work KIT for light and optics material aims to strengthen students' understanding in conducting observations.

b. Design

The objective of this stage is to design learning media that suits the needs of teachers and students, thereby supporting the learning process of students. The media selected for development is a practical kit for buffer solution material, consisting of various tools and materials such as combination mirrors, straight slit diagrams, shaped slit diagrams, paper clips, HVS paper, clear glasses, stainless steel chopsticks, acrylic glass, flashlights, and Student Worksheets (LKPD) arranged in a box. The researcher selected a format appropriate for the practical stages of the buffer solution material. The initial design involved preparing the main materials to make the practical KIT box, using cardboard to ensure the box was sturdy and durable. The KIT box is equipped with information about the contents of the KIT on the inside, while the outside has information about the KIT media. Additionally, the researcher created a user manual for the practical KIT in the form of an LKPD to guide students in conducting the practical, including KIT specifications, usage instructions, a list of tools and materials, and work procedures.

c. Development

The development stage consists of two main stages: validation by media experts and material experts. After undergoing validation by these two experts, the Practical KIT media will be tested in schools to obtain feedback from teachers and students on the media. Content validation is conducted by science subject experts who assess the suitability of the content, language, and presentation. To determine the overall suitability of the media, the validation results from both experts are then compiled. The average score for all evaluation aspects is presented in the following Table 3.

Table 3. Overall Research Data Results From All Validators

No	Validator	Score Obtained	Maximum Score	Percentage (%)
1	Material Validation	25	40	62,5
2	Media Validation	33	40	82,5
Average Number		26	40	72,5

Based on the table above, the validation results by both validators show a validity percentage of 72.5%. Based on the predetermined percentage range for the product, which is 71%–83%, this KIT Praktikum learning media is categorized as "valid" and "ready for use." This result is a positive indication that the KIT Praktikum learning media has met most of the validity criteria set by the validators and is ready to be implemented in the learning process. However, there are still some aspects that need to be improved to enhance the quality and effectiveness of this learning media.

d. Implementation

After undergoing development and refinement based on input from media experts and subject matter experts, the KIT Praktikum educational media product was declared ready for testing. The trial was conducted face-to-face at SMPN 1 Tarokan, involving 24 students. The validated and revised KIT media was used in learning activities that involved hands-on practical work. Before the activity began, the researcher first conducted a brief socialization session on how to use the KIT and the learning flow that would be implemented. After the learning took place, the researcher distributed response questionnaires to teachers and students to find out their responses to the media used.

Based on the results of the questionnaires given to two science teachers, an average score of 85.5% was obtained, which falls into the "very feasible" category. Teachers assessed that the KIT media made it easier to convey abstract material in a more concrete manner and enhanced students' active participation in the learning process. Meanwhile, students' responses to the KIT media were also very positive. The average student assessment of the media can be seen in Table 4 below.

Table 4. Data on Student Responses to the KIT Practicum Learning Media on the Subject of the Properties of Light

Statement	Response				
	1	2	3	4	5
The total score obtained from the statements submitted	1	34	111	444	1545
Total score	2135				
Maximum score	2400				
Percentage (%)	88,96%				
Percentage level (%)	86 – 100				
Criteria	Very valid				

Based on the data obtained from teachers' responses to the KIT Praktikum learning media, the following formula is used to calculate the percentage:

$$\boldsymbol{P} = \frac{score\ obtained}{total\ score} \times 100\% \quad (2)$$

The average score obtained was 83.5 out of a maximum score of 100, so:

$$\boldsymbol{P} = \frac{2135}{2400} \times 100\%$$

$$\boldsymbol{P} = 88{,}96\%$$

The student response questionnaire was administered to 24 students, with a maximum score of 2400. The data obtained had a percentage of 88.96% and was categorized as very acceptable.

The average student score was 88.96, and the average teacher validation score was 85.5. Based on the data obtained from the responses of teachers and students, the average score for both was 87.23, with a maximum average score of 100, resulting in a percentage of 87.23%, meeting the "highly acceptable" criterion. The results indicate that the KIT Praktikum learning media received a very positive response, making the product suitable for use in the learning process.

To determine the effectiveness of the learning program, students' cognitive learning achievement data was analyzed through scores obtained from pre-tests and post-tests.

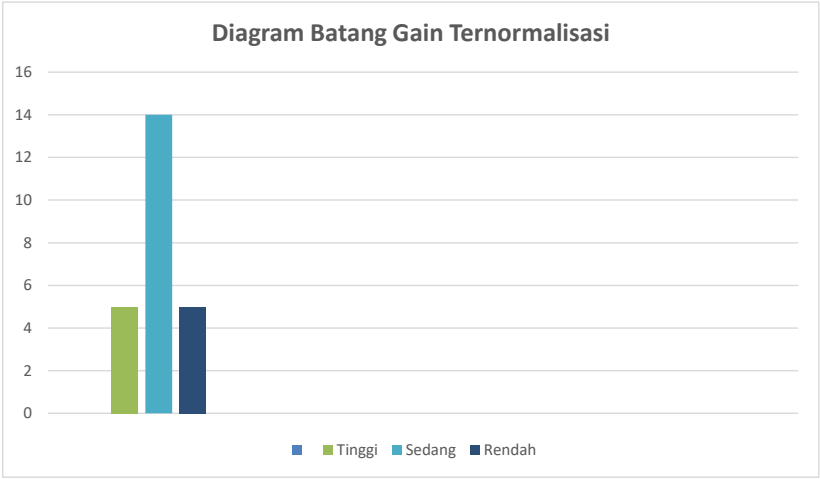

Figure 1. Normalized gain bar diagram

Based on the bar chart in the figure above, there are three categories based on the calculation of n-gain values. Five students fall into the low category with a gain score range of $0.00 \leq g < 0.30$, 14 students fall into the moderate category with a gain score range of $0.70 \geq g > 0.30$, and five students fall into the high category with a gain score range of $1.00 \geq g > 0.70$.

The student learning outcome data was then analyzed using a t-test with a significance level of $\alpha = 0.05$. The data processed using the t-test can be seen in Table 5 below.

Table 5. Hypothesis testing

Kelas	Pre-Test	Post-Test	Df	A	T_{count}	T_{table}	Description
VIII E	60	81,04	23	0,05	0,000	2,069	$t_{count} < t_{table}$

Based on Table 5, it shows that the average pre-test and post-test scores were analyzed using a t-test at a significance level of α = 0.05 and degrees of freedom df = n -1 = 24-1 = 23. The t-table value is 2.069, and since the calculated t-value is less than the t-table value (0.000 > 2.039), we must reject the null hypothesis (H_o) and accept the alternative hypothesis (H_a). From this, it can be concluded that learning using the KIT media can improve students' learning outcomes in Grade VIII on the topic of Light and Optics at SMPN 1 Tarokan.

e. Evaluation

This study applied a process of continuous evaluation and improvement at every stage of development. The researcher made revisions based on feedback from the supervisor during the design stage, and made improvements during the development stage based on suggestions from the expert team. During the implementation stage, no improvements were needed because there were no suggestions from the teacher. Evaluation was conducted at every stage of this research, resulting in learning media that can encourage students' independence and enthusiasm in learning, understanding the material, and practicing the preparation of buffer solutions effectively.

Conclusion

Based on the results of the study, several conclusions were drawn. First, the KIT Practicum learning media on the properties of light was deemed suitable for use, with a suitability percentage of 72.5%. Second, the responses from science teachers at SMPN 1 Tarokan to the KIT media showed a percentage of 85.5%, which falls into the very suitable category. Third, the feedback from students at the same school showed a percentage of 88.96%, also falling into the highly suitable category. Fourth, based on the t-test results, it was found that H_0 was rejected and H_a was accepted because the significance value showed that $t_{count} < t_{table}$ (0.000 < 2.039). This indicates that the use of the KIT media in learning can significantly improve student learning outcomes.

References

A. Asyar. 2011. *Media Pembelajaran*. Jakarta: Rineka Cipta.

A. Bandura. 1999. "Social Cognitive Theory: An Agentic Perspective." *Asian Journal of Social Psychology* Vol. 2, No:hlm. 21–41.

Djamarah. 2002. *Media Pembelajaran*. Jakarta: Rineka Cipta.

Dr. Muhammad Hasan, S. Pd., M. Pd. I. and Dkk. 2021. *Media Pembelajaran*. CV Tahta Media Group.

ElAlfi, A., ElAlami, M., & Asem, Y. 2009. "Knowledge Extraction for Discriminating Male and Female in Logical Reasoning from Student Model." *International Journal of Computer Science and Information Security* 6(1):6–15.

Fadil, K., Ikhtiono, G., & Nurhalimah, N. 2024. "Perbedaan Rencana Pelaksanaan Pembelajaran (RPP) Antara Kurikulum 2013 Dengan Kurikulum Merdeka Belajar." *Jurnal Pendidikan Dan Pembelajaran Indonesia (JPPI)* 4(1):224-238.

Hake. 2002. "Reliatonship of Individual Student Normalized Learning Gains in Mechanis with Gender, High School Physics, Dand Pretest Scoreon Mathematics and Spatial Visualization." *Physics Education Research Conference (Online)*.

Hewi, M. & Shaleh, I. 2020. "Meningkatkan Kemampuan Literasi Sains Siswa Melalui Pembelajaran Berbasis Inkuiri Pada Materi Suhu Dan Kalor." *Jurnal Pendidikan Fisika Dan Teknologi* 6(2):32–40.

Isran Rasyid Karo-Karo & R. Rohani. 2018. "Manfaat Media Dalam Pembelajaran." *(AXIOM : Jurnal Pendidikan Dan Matematika*.

Ita Rahmawati and Rissalatul Illiyin. 2021. "Pengaruh Motivasi, Persepsi Dan Sikap Konsonan Terhadap Keputusan Pembelian HP Oppo." *Jurnal Ilmiah Hospitality* Vol. 10, N.

J. Anidar. 2017. "Teori Belajar Menurut Aliran Kognitif Serta Implikasinya Dalam Pembelajaran."

Kementrian Pendidikan dan Kebudayaan. 2011. *Panduan Teknis Perawatan Peralatan Laboratorium Fisika.*

Komara Nur Ikhsan dan Supian Hadi. 2018. "Implementasi Dan Pengembangan Kurikulum 2013." 06, n:hlm. 193-194.

Marina. n.d. ""Konsep Dasar Dan Pengertian Bahan Ajar Sekolah" (On-Line)." Retrieved November 30, 2023 (http://www.scribd.com/doc/26566848/).

Masruri. 2020. "Identifikasi Hambatan Pelaksanaan Praktikum Dan Alternatif Solusinya Di SMA Negeri 1 Moga." *Pendidikan Dan Keguruan* Vol XI, No:h. 5.

N. Karlina & R. Setiyadi. 2019. "The Use Of Audio-Visual Learning Media In Improving Student Concentration In Energi Materials." *PrimaryEdu - Journal of Primary Education,.*

Novakovskaya, Y. 2013. "Is Ignoramus Our Ideal? Or What Education Do We Really Need?" *Russian Journal of General Chemistry* 83:1226-1235.

Putri, A. S., & Aznam, N. 2019. "The Effect of the Science Web Module Integrated on Batik's Local Potential towards Students' Critical Thinking and Problem Solving (Thinking Skill)." *Journal of Science Learning* 2 (3):92–96.

Sopandi, W. 2019. "Peningkatan Kemampuan Literasi Sains Siswa Melalui Pembelajaran Berbasis Masalah Pada Materi Listrik Dinamis." *Jurnal Pendidikan Fisika Dan Teknologi* 5(2):73–81.

Swartz, Robert J. 2001. "Thinking About Decision. Dalam Costa, Arthur (Penyunting). Developing of Minds." *Alexandria: Association for Supervision and Curriculum Development.* 58–66.

Y. Yusal. 2021. "Profile of Pre-Service Physics Teacher's Critical Thinking Skills Related to Heat Transfer." *Journal of Physics: Conferences Series, 1157032071*.