



## The Use of Problem-Based Learning Physics E-Module on Global Warming Material: High School Students Perception

Julius Wilson<sup>✉</sup>, Paulina Nelce Mole, Maria Bernadetha Dua Riong

Nusa Nipa University, Maumere, East Nusa Tenggara, Indonesia

### Article Info

Article History :

July 2023

Accepted

October 2023

Published

December 2023

Keywords:

E-module; Global Warming; Problem-Based Learning;

### Abstract

Global warming as one of the physics materials, is a topic that tends to be abstract so it causes difficulties for students. In addition, limited time for learning activities in class is an obstacle to achieving optimal understanding. Lack of learning time in class can limit students' exploration space. The use of e-modules based on Problem-Based Learning is an innovative solution to visualize the phenomenon of global warming through images, videos, animations, and simulations. Limited learning time in class can be overcome through the flexibility of using e-modules. The purpose of this study is to describe the perception of high school students towards the use of Problem-Based Learning physics-based e-modules on global warming material. E-modules are designed to stimulate student learning by utilizing a problem-based learning model, where real-life problems are integrated into learning. This research was conducted with a qualitative approach. The subjects of this study were students of St. Gabriel Maumere Catholic High School. The research instruments used are perception questionnaire sheets, documentation, and interviews. The results showed that the percentage of student perception on the e-module display indicator was 85.25%, the presentation of material in the e-module was 82.68% and the overall benefits of the e-module were very good. Based on the results of data analysis through questionnaires and interviews, students gave a very good perception of the e-module on global warming material.

<sup>✉</sup> correspondence:

Jl. Kesehatan No.3, Beru, Kec. Alok Tim., Kabupaten Sikka, Nusa Tenggara Tim., Indonesia 86094  
E-mail: willsonfajar@gmail.com

**p-ISSN 2252-6412**

**e-ISSN 2502-4523**

## INTRODUCTION

Education in the digital era demands innovation in learning, especially in the context of physics learning which is often considered abstract. Digital transformation has driven demands for innovation in education, especially in the way of delivering learning materials and building student understanding. Riong et al. (2022) Emphasize the importance of understanding physics concepts and principles so that students can build a solid knowledge base in understanding learning material.

Based on the results of the questionnaire analysis given to Catholic High School students, Gabriel Maumere showed that abstract physics material is difficult for students to understand, and limited learning time in class is an obstacle to learning optimally. Abstract learning is often faced with the difficulty of students imagining or relating these concepts to real-world experiences.

The phenomenon of global warming is one of the abstract high school physics materials because it involves understanding the processes that occur in nature on a long time scale and cannot be observed directly (Setianita et al., 2019). The integration of technology is a solution to visualize abstract material and overcome the limitations of learning time in the classroom. E-module is an alternative that can be used to answer student needs for learning situations that occur in the classroom.

Dalaila et al. (2022), Watoni et al (2022), Aryawan et al (2018), and Elvarita et al (2020) suggest that e-modules are teaching materials that are designed interactively and interestingly using technological assistance to be used independently by students by paying attention to the basic principles of modules to understand certain learning materials. The use of technology in an educational context not only provides access to information but also provides opportunities for students to become independent and responsible learners (Mole & Maria, 2021).

Research results Putri et al. (2021) Related to the Development of Global Warming Based E-Module Creative Troubleshooting (CPS) states that it is suitable for use in learning in junior high school grade VII. Nurhasanah et al. (2023) in their research concluded that the Global Warming E-module is based on Project-Based Learning valid and worthy of use as a learning medium in high school.

The use of e-modules in studying global warming can increase students' understanding through the process of self-study and presentation of multimedia content. Students can learn concepts through visual illustrations and concrete examples using videos. This helps students to understand things related to global warming in an interesting and easily digestible way that may be difficult to understand just by reading the text.

E-modules can be integrated with learning models Problem-Based Learning (PBL) to facilitate students in learning to be responsive to global issues and play an active role in problem-solving. Learning model Problem-based learning is a learning approach using real-life problems as part of what students need to learn to improve their thinking and problem-solving skills (Fathurohman & Lutfi, 2022; Hotimah, 2020; Syahrial et al., 2019).

Implementation of e-module-based Problem-Based Learning Involves students actively in learning, allowing students to collaborate to solve given problems, share ideas, and enrich understanding through discussion. Findings from the study by Pramana et al. (2020); Kimianti & Prasetyo (2019) and Permatasari et al. (2021) confirm that e-module-based *Problem-Based Learning* meets excellent qualifications and is worthy of use in learning.

Some previous research results show that the integration of e-modules with the *Problem-Based Learning* learning model has proven feasible and effective in the context of physics learning. However, it is necessary to analyze students' perceptions of PBL-based e-modules to determine their contribution to student learning needs.

Student perception is the view or perspective of students on information that has been received when learning activities take place (Yulizar et al., 2023; Rohim & Wardana, 2019). Student perceptions provide important information related to the way students think, work, and attitudes are formed (Rahman et al., 2023). A study conducted by Nuriawati (2022) found a relationship between students' perceptions of digital modules and students' perceptions of learning mathematics. This provides an important insight, the use of technology in learning can affect students' views on certain learning. Understanding students' perceptions of PBL-based e-modules can help identify challenges

students may face and potential successes that can be improved.

Based on the background above, this study aims to describe the perception of high school students towards the use of Problem-Based Learning physics-based e-modules on global warming material.

**METHODS**

This type of research is qualitative and descriptive. The subjects of this study is students of class XE1 St. Gabriel Catholic High School in Maumere, totaling 20 students. Subject

determination is carried out by *purposive sampling* techniques based on the consideration that the subject has been taught global warming material using e-modules based on *Problem-Based Learning*.

The data collection instrument used was in the form of student perception questionnaires given to 20 students and free interviews. The student perception questionnaire sheet is a collection of written statements that must be answered by respondents. Indicators and aspects of assessing students' perceptions of e-modules in this study were adopted from Astalini et al. (2021).

**Table 2.** Student Perception Indicators

Assessment Indicators	Assessment Aspect
E-module display	Text readability Multimedia proportions Clarity of color contrast and image shape Multimedia visual quality The appeal of multimedia displays
Presentation of material in e-modules	Ease of understanding learning content The regularity of the order of matter Simple and easy-to-understand sentences Communicative language Relevance of content to the material Relevance of multimedia to the material Ease of use of modules
Benefits of e-modules	The effectiveness of media in student understanding Interest in using the module Increased learning motivation

Student perception is expressed in percentage terms with the following criteria (Mellyzar, 2021).

**Table 1.** Percentage Range and Qualitative Criteria

Percentage Range (%)	Criterion
81 < P > 100	Excellent
62 < P > 80	Good
43 < P > 61	Not Good
25 < P > 42	Bad

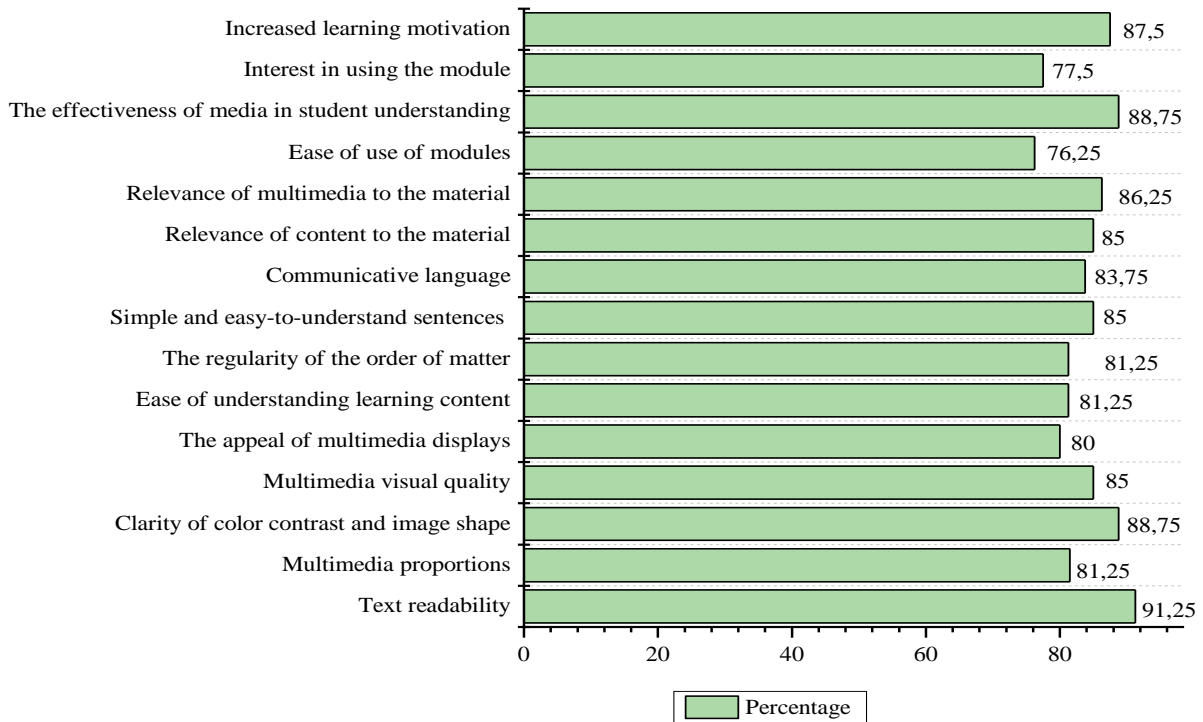
Students who have been categorized based on the criteria in Table 1 are then selected to represent each criterion for the interview.

Data analysis of this research was carried out through the process of data reduction, data

presentation, and conclusion drawing (Sugiyono, 2020). Research data needs to be tested for validity to ensure the findings and interpretation of the data are accurate and reliable. The triangulation technique is one of the credibility test methods that is often used. Researchers compared data from interviews with documentation and questionnaires of students' perceptions of the e-module.

**RESULTS AND DISCUSSION**

The results of data analysis through questionnaires show the percentage of student perception in each aspect of assessment classified as good and very good.



**Figure 1.** Student Perceptions on Every Aspect of Assessment

The results on the chart show the presentation of the e-module obtained an excellent qualification. As well as research results Arsyka & Wahyuni (2021) that students' responses to e-modules on aspects of appearance, presentation of material and benefits of obtaining presentations with good categories. Most students express positive perceptions towards various aspects of e-module-based assessment Problem-Based Learning on global warming material. The positive perception of e-modules is due to the advantages that exist in e-modules. Nila & Mustika (2022) state that the advantages of e-modules include an attractive appearance, and equipped with learning facilities in the form of images, audio, and video to increase student learning motivation and problem-solving abilities. In addition, the e-module is more practical and easy to carry (Hutomo et al., 2022). The display of the e-module includes text readability, multimedia proportions, clarity of colors and images, and quality and attractiveness of multimedia displays. The students' perception of these aspects is very good. Suryani et al. (2020) Stating the appearance of material on the e-module that is appropriate and appropriate can affect student understanding.

Sentences that are presented make it easy to capture information. The right and clear multimedia size can increase the appeal enrich the learning experience and help students remember information better. Multimedia that is considered to have appeal and quality, sparks curiosity and encourages students to further explore global warming learning materials. Qotimah & Mulyadi (2021) Argue that the ease of students in understanding learning material can be facilitated through the application of interactive e-modules with the presentation of material in the form of text, images, audio, and video to optimize student learning outcomes.

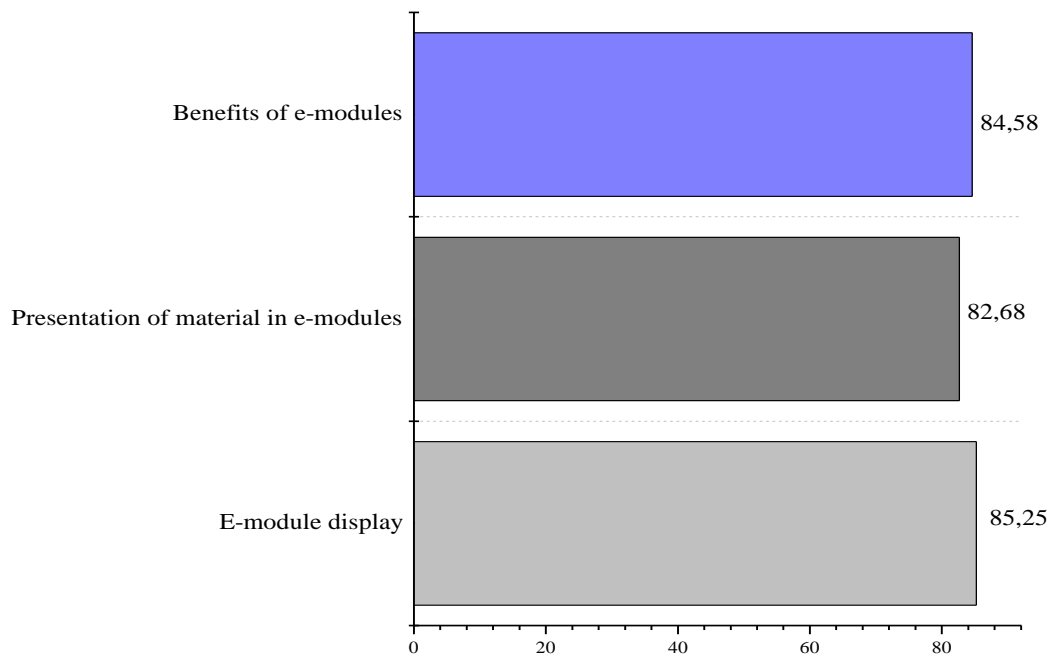
Presenting material on e-modules in a structured manner can help students follow the learning flow smoothly and gain understanding gradually from simple to complex concepts. The simplicity of sentences and the use of communicative language increase student interaction with learning content so that this aspect gets a positive response. In line with opinion, Laili et al. (2019) state that the material presented in the e-module is coherent, communicative language, and usage Smartphones What the average student has can help ease learning. In addition, it is strengthened by the results of research Janna et al. (2023) that well-organized material components, module

suitability with integrated learning models, and easy-to-understand language, writing, and image composition are suitable for use in learning.

The percentage of assessment of the benefits of e-modules includes the effectiveness of learning media to support student understanding, interest in using modules and increased learning motivation reflects a positive outlook. By presenting learning materials in an innovative and interesting manner, students tend to be more motivated to be actively involved in the learning process so that they can improve the quality of learning as a whole. These

findings are supported by research Agustina (2021) which highlights the use of interactive e-modules to improve students' academic performance, and suggests that the use of e-modules is an effective way to increase student engagement and participation, facilitating a convenient and interactive learning process.

Several aspects of assessment indicate the perception of students gaining a high percentage. The following Figure 2 shows that students tend to appreciate the e-modules used in learning.



**Figure 2.** Percentage of Student Perception

Students give a very good perception of the display of the e-module with a percentage reaching 85.25%. An engaging visualization of e-modules that are easy for students to understand contributes to students' understanding of the learning material provided. Visualization can help students see the relevance of learning material to everyday life.

The presentation of material in the e-module also received a positive response reaching 82.68%. This is an indication that the Problem-Based Learning-based e-module achieves its goals and provides a satisfying learning experience. The integration of the Problem-Based Learning model in the presentation of material is considered effective and gives students challenges to solve the given problems. The learning process becomes more interactive and relevant to life.

Furthermore, the e-module benefit indicator based on the results of the analysis showed the achievement of 84.58% of students felt significant benefits from using the e-module. In line with the results of the study Erdi & Padwa (2021), e-modules aim to facilitate students in each learning material and improve learning outcomes in each subject.

The acquisition of a high percentage of student perception, can be a benchmark for the success of implementing learning strategies. To gain a deeper understanding of students' perceptions, researchers conducted interviews with 2 students who had perceptions with good and very good categories.

The fragments of interviews conducted by researchers on subject A10 are:

P: *What do you think about the display of e-modules used in learning, especially on global warming material?*

A10: *I like it, the visual design makes me comfortable to learn. The use of interesting images and videos makes learning not monotonous. I focus more on studying.*

P: *What do you think of the presentation of the material in the e-module?*

A10: *I have an easier time understanding global warming material because Each concept is accompanied by case examples.*

P: *How can e-modules benefit you in learning?*

A10: *I can access the e-module at any time, making it easier for me to study outside the classroom.*

Researchers also conducted interviews with subject A5, as follows.

P: *What do you think about the display of the learning e-module?*

A5: *Very interesting, but it needs to be improved video quality.*

P: *What do you think of the presentation of the material in the e-module?*

A5: *The sentences used are simple, so I can easily understand them. The images and videos helped me understand the material of global warming.*

P: *How can e-modules benefit you in learning?*

A5: *E-modules provide variety in learning keeping me motivated to learn.*

The interview data showed consistency between the perceptions of subjects A10 and A5 with the questionnaire data that had been filled in. The subject A10 responded positively to the display of the e-module. Comfortable visual design, and the use of attractive images and videos are considered successful in avoiding boredom and increasing the focus of learning the subject. The most striking benefit of e-modules for A10 subjects is the ease of access at any time, making learning outside the classroom more flexible.

Meanwhile, subject A5 found the e-module's display attractive but provided the need for improved video quality. However, subject A5 considered that the presentation of e-module material was fairly simple and easy to understand, especially with the support in the form of images and videos that helped understanding global warming material. The main benefit of the e-module for subject A5 is that it provides variety in learning so that students have a passion for studying the phenomenon of global warming.

The results of this study are in line with the findings Main et al. (2021) If students have a good (positive) perception of the module, they will have the enthusiasm to learn and understand the module. This research focused on students' perceptions of e-module-based *Problem-Based Learning*. But the results of the research obtained Nia et al. (2022) proposing PBL-based e-modules containing various media obtained good validation results and were declared very suitable for use in learning.

Problem Based Learning based e-modules create a positive learning experience by integrating attractive design and effective presentation of material. Limited learning time should not be an obstacle for teachers, but rather a challenge to find creative and efficient solutions. It is important for teachers to see the limited time and learning difficulties experienced by students as opportunities to design effective and relevant learning resources to improve the quality of learning.

## CONCLUSION

The design of e-modules that combine multimedia can visualize abstract learning materials. E-modules can be used as independent teaching materials for students so as to provide solutions to limited learning time in class. Student perceptions of e-modules based on *Problem Based Learning* on global warming material are in the very good category. Student perception of the e-module display was 85.25%, material display on the e-module was 82.68% and student perception on the benefits of the e-module was 84.58%. This research is limited to the description of student perceptions, so it is hoped that further researchers can examine the effectiveness of Problem Based Learning based e-modules on global warming material to improve the ability of students.

## REFERENCES

- Agustina, R. (2021). The use of interactive emodules using the discovery learning method to improve students' academic performance in English subjects in class X Mipa 7 SMAN1 Garut. *SCHOLAR: Journal of Science*, 1(2). <https://doi.org/10.51878/cendekia.v1i2.154>
- Arsyka, A. T. Z., & Wahyuni, T. S. (2021). Development of Multiple Representation-

- Based E-Modules in Flipped Classroom Learning Reaction Rate Material. *JRPK: Journal of Chemical Education Research*, 11(2). <https://doi.org/10.21009/jrpk.112.01>
- Aryawan, R., Gde Wawan Sudatha, I., Wayan Ilia Yuda Sukmana, A. I., & Educational Technology, J. (2018). Development of Interactive E-Modules for Social Studies Subjects at SMP Negeri 1 Singaraja. *EDUTECH Journal of Ganesha Education University*, 6(2).
- Astalini, A., Darmaji, D., Kurniawan, D. ., & Chen, D. (2021). Students' perception of the E-module of mathematical physics on multiple integral matter. *Journal of Educational Technology*, 5(4).
- Dalaila, I., Widiyaningrum, P., & Saptono, S. (2022). Developing E-modules based on scientific social issues to improve students' scientific literacy. *Journal of Innovative Science Education*, 11(3). <http://journal.unnes.ac.id/sju/index.php/jise>
- Elvarita, A., Iriani, T., & Handoyo, SS (2020). Development of E-module-based Soil Mechanics Teaching Materials in the Building Engineering Education Study Program, Jakarta State University. *Journal of Civil Engineering Education (JPenSil)*, 9(1).
- Erdi, P. N., & Padwa, T. R. (2021). Use of E-Modules with Project Based Learning System. *Journal of Vocational Informatics*, 1(1).
- Fathurohman, A., & Lutfi, H. M. (2022). Analysis of the Physics Learning Process Based on Problem Based Learning. *Journal of Physics Education Alauddin State Islamic University Makassar*, 10(2).
- Hotimah, H. (2020). Application of Problem Based Learning Method in Improving Storytelling Skills in Elementary School Students. *Journal of Education*, 7(3). <https://doi.org/10.19184/jukasi.v7i3.21599>
- Hutomo, B. A., Saptono, S., & Subali, B. (2022). Development of E-modules based on Science, Technology, Engineering, and Mathematics (STEM) to improve science literacy of junior high school students. *Journal of Innovative Science Education*, 11(64).
- Janna, RD, Yovita, & Vebrianto, R. (2023). Development of E-module Based on Problem Based Learning to Improve Critical Thinking Skills and Student Learning Outcomes. *Journal of Literacy*, 7(1).
- Kimianti, F., & Prasetyo, Z. K. (2019). Development of Problem-Based Learning Science E-Module to Improve Student Science Literacy. *Kwangsan: Journal of Educational Technology*, 7(2). <https://doi.org/10.31800/jtp.kw.v7n2.p1--13>
- Laili, I., Ganefri, & Usmeldi. (2019). The effectiveness of project based learning e-module development on electric motor installation subjects. *Journal of Imiah Education and Learning*, 3(3). <https://ejournal.undiksha.ac.id/index.php/JIPP/article/download/21840/13513>
- Mellyzar, M. (2021). Teacher and Student Perceptions of Guided Inquiry-Based Chemistry Modules on Redox Reaction Materials and Compound Nomenclature. *Indonesian Journal of Science Education and Learning (JPPSI)*, 4(1). <https://doi.org/10.23887/jppsi.v4i1.31677>
- flies, P. N., & Maria, S.K. (2021). Professionalism of Certified Educator Teachers in the Implementation of Online Learning during the Covid-19 Pandemic. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)*, 4(4).
- Nia, N., Leksono, S. M., & Nestiadi, A. (2022). Development of e-module on environmental conservation based on Problem Based Learning (PBL) to improve the critical thinking skills of junior high school students. *PENDIPA Journal of Science Education*, 6(2). <https://doi.org/10.33369/pendipa.6.2>
- Nilu, W. T., & Mustika, D. (2022). Development of E-module Based on Problem Based Learning (PBL) Model Material for Animal and Human Motion Organs Class V. *Journal of Education and Counseling*, 4(2).
- Nurhasanah, D., Iswanto, B. H., & Nasbey, H. (2023). Project Based Learning e-module for high school physics learning on global warming material. *Physics of Ejection Today*, 2(1).
- Nuriawati, E. (2022). The Relationship Between Students' Perceptions of Digital Modules and

- Perceptions of Learning Mathematics. *National Seminar on Mathematics Education*.
- Permatasari, N. E., Koeswati, H. D., & Giarti, S. (2021). Development of Problem Based Learning and Simple Aircraft Learning Model (Probalpena) to Improve Science Learning Outcomes of Class V Students of Sdn Karanganyar 01. *PGSD Journal*, 7(2).
- Pramana, M. W., Jampel, I. N., & Pudjawan, K. (2020). Improve biology learning outcomes through problem-based learning e-modules. *EDUTECH Journal of Ganesha University of Education*, 8(2).
- Putri, L. E., Mahardika, I. K., & Wicaksono, I. (2021). Validity of Global Warming E-Module Based on Creative Problem Solving for Junior High School Class VII Students. *OPTIKA: Journal of Physics Education*, 5(2). <https://doi.org/10.37478/optika.v5i2.1085>
- Qotimah, I., & Mulyadi, D. (2021). Criteria for Development of Interactive E-Modules in Distance Learning. *Indonesian Journal of Education and Learning Counseling*, 4(2).
- Rahman, A. A., Astalini, & Darmaji. (2023). Differences in Student Perception of the Use of Mathematical Physics E-module. *Journal of Modern Education*, 08(02).
- Riong, M. B. D., Ahmadi, F., & Supriyadi, S. (2022). Mastery of concepts and mathematical problem solving skills of high school students in uniform straight-line motion. *Journal of Innovative Science Education*, 11(3).
- Rohim, M., & Wardana, A. (2019). Millennial Political Analysis: High School Students' Perceptions of Political Dynamics in the 2019 ELECTIONS in Indonesia. *JIP (Journal of Government Science) : Study of Government Science and Regional Politics*, 4(1). <https://doi.org/10.24905/jip.4.1.2019.47-63>
- Setianita, O. T., Liliawati, W., & Muslim. (2019). Identification of High School Student Misconceptions on Global Warming Material Using Four-tier Diagnostic Test with Confidence Discrimination Quotient (CDQ) Analysis. *Proceedings of the National Seminar on Physics 5.0*.
- Sugiyono. (2020). *Qualitative Research Methods*. Bandung: Alfabeta.
- Suryani, K., Utami, I. S., Khairudin, K., Ariska, A., & Rahmadani, A. F. (2020). Development of STEM-based Digital Modules using the 3D FlipBook Application in the Operating System Course. *Journal of Pulpit Science*, 25(3). <https://ejournal.undiksha.ac.id/index.php/MI/article/view/28702>
- Syahrial, Arial, Kurniawan, D. A., & Piyana, S. O. (2019). E-Module Ethnoconstructivism: Implementation in Grade V Elementary School Viewed from Perception, Interest and Motivation. *Journal of Educational Technology*, 21(1).
- Main, O. P. A., Adinugraha, F., & Ratnapuri, A. (2021). Student Perception of Chordata Module with Scientific Approach at SMA Negeri 18 Bekasi City. *Spizaetus: Journal of Biology and Biology Education*, 2(3).
- Watoni, E. S., Ngabekti, S., & Wijayati, N. (2022). Development of Lombok Island Environmental Change E-Module to Improve Environmental Literacy and Data Literacy of High School Students. *Journal of Innovative Science Education*, 11(2). <https://journal.unnes.ac.id/sju/index.php/jise/article/view/51081>
- Yulizar, I., Aminah, S., & Khairunnisa, E. (2023). MTS Al-Bukhary students' perception of English lessons. *Journal of Religious and Science Education*, 7(1).