

Development of Physics Learning E-Module for Class X High School Students

Nur Indriati Harahap^{1*}, Ramalis Hakim², Rayendra¹, Ridwan³

¹Curriculum and Educational Technology Department, Universitas Negeri Padang, Padang, Indonesia.

²Fine Arts Department, Universitas Negeri Padang, Padang, Indonesia.

³Electrical Engineering Department, Universitas Negeri Padang, Padang, Indonesia.

Received: May 02, 2024

Revised: June 11, 2024

Accepted: July 25, 2024

Published: July 31, 2024

Corresponding Author:

Nur Indriati Harahap

indriatihp98@gmail.com

DOI: [10.29303/jppipa.v10i7.7548](https://doi.org/10.29303/jppipa.v10i7.7548)

© 2024 The Authors. This open access article is distributed under a (CC-BY License)



Abstract: This research aims to determine the validity of the physics e-module for grade X Senior High School students. The type of research used is research and development (R&D) by adopting the ADDIE development model. The stages of the ADDIE development model consist of Analysis, Design, Development, Implementation, and Evaluation. Data analysis was conducted to assess the validity of the physics e-module in three aspects: media, content, and language. Validity was evaluated by six experts: two media experts, two content experts, and two language experts. The results of the validity test of the physics e-module obtained from media experts was 79% with the category "Valid", from content experts was 94% with the category "Very Valid", and from language experts was an average of 90% with the category "Very Valid". It can be concluded that the physics e-module is valid and suitable for use in physics learning for grade X Senior High School students.

Keywords: ADDIE development model; E-module; Development; Physics learning

Introduction

The era of the Industrial Revolution 4.0 requires education to have various competencies to compete globally. Therefore, it impacts the education sector and students, necessitating the preparation of professional teachers to face these challenges (Safitri et al., 2022). Teachers are also required to utilize digital technology as an effective and innovative learning resource, as well as understand the characteristics and potential of students (Indira et al., 2020). This necessitates changes in education management to meet these challenges (Nunung et al., 2022).

Education plays a crucial role in creating high-quality and potential individuals in the broadest sense. Through education, a process of self-maturation occurs, enabling individuals to make decisions responsibly when facing problems. Considering the role of education, it is appropriate that this aspect receives

attention from the government to enhance the quality of Indonesia's human resources and improve students' abilities (Nurfauziah, 2019). Physics, as one of the subjects in school, plays an important role in shaping students into quality individuals, as it provides a means of thinking to examine things logically and systematically (Susilawati, 2012).

Efforts to enhance the quality of education in Indonesia (Irman et al., 2023) have become a government priority, including changes to the school curriculum. The introduction of the independent curriculum aims to elevate educational standards. The implementation of the Independent Curriculum seeks to address issues such as poor school management, which contribute to challenges in educational quality (Kamila et al., 2023). This curriculum reform, combined with an emphasis on higher-order thinking skills (HOTS), includes critical and creative thinking skills (Utami et al., 2019). Additionally, it highlights the need to improve the

How to Cite:

Harahap, N. I., Hakim, R., Rayendra, & Ridwan. (2024). Development of Physics Learning E-Module for Class X High School Students. *Jurnal Penelitian Pendidikan IPA*, 10(7), 3689-3696. <https://doi.org/10.29303/jppipa.v10i7.7548>

HOTS levels of Indonesian students, as indicated by PISA results (Shoimah & Fatoni, 2023).

Physics education encourages students to actively engage in problem-solving, investigation, and communication of natural processes and phenomena, enabling them to apply their knowledge in everyday life (Septyowaty et al., 2023). In the first semester of 10th grade, the topic of global warming is included. The researcher chose the topic of global warming because it is important for students to learn. Global warming is an environmental issue occurring worldwide and is currently a global concern. The threat to human life continues to increase due to global warming because of its direct impact on the living environment (Adibah, 2017). Students find this topic challenging because they cannot directly observe the processes or natural events involved. This abstract nature makes it difficult for students to understand the material.

To improve students' understanding, it is necessary to optimize learning to make it easier and more effective. Therefore, it is important for teachers to develop teaching materials and learning media to stimulate student engagement, attract student interest, and foster student innovation (Efendi et al., 2021; Nirmala et al., 2022; Triliana et al., 2021). This aligns with the demands of the independent curriculum and the scientific approach currently implemented. Educators should utilize instructional materials and learning media to inspire students and improve their educational experiences. Furthermore, adopting innovative teaching concepts, such as student-centered approaches and the integration of digital tools, can significantly impact student participation and create a more effective learning process (Omeh & Odelewe, 2021). Additionally, innovative teaching methodologies in physical education have been linked to enhancing the effectiveness of physical education and creating a conducive learning environment (Ampa & Nurqalbi, 2021).

One of the alternative learning media that aligns with the demands of the independent curriculum and the Fourth Industrial Revolution is the electronic module (e-module). E-modules are electronic teaching materials designed for independent use, with each learning activity linked to a URL and enriched with instructional videos, animations, images, and audio to support the learning process of students (Adelia et al., 2023). These digital resources meet the evolving needs of the educational landscape in the era of the Fourth Industrial Revolution, emphasizing the importance of digital skills and adaptive learning approaches (Alshaiikh, 2022).

E-modules are a type of digital teaching material used to support teachers and students in the learning process. In the context of physics education, e-modules

serve as learning resources aimed at enhancing comprehensive learning and helping students achieve skills aligned with learning objectives. The use of e-modules or electronic learning modules has been widely implemented in the learning process (Ataji & Sujarwanta, 2016; Hakiki et al., 2022; Sari et al., 2022; Shodiqin et al., 2016). By utilizing these e-modules, students can learn independently without teacher guidance, thereby reducing the amount of time spent on learning.

E-modules can be accessed through various electronic devices such as computers, mobile phones, or tablets. E-modules have advantages as teaching materials compared to textbook-based materials. Rahmadhani et al. (2021) state that E-modules excel in two-way communication, which is useful for distance education or training, they are interactive, and their structure is clearer. Apart from improving student learning outcomes, students' responses to using E-modules also provide valuable feedback. E-modules empower educators to be more creative and innovative in developing teaching media.

Based on preliminary research data gathered through a questionnaire among 10th-grade students at SMA Negeri 5 Bukittinggi, the findings are as follows: 62.5% of students find it difficult to understand the topic of global warming; 77.8% attribute the difficulty of global warming to complex concepts that are hard to grasp; and 72% of students have not yet experienced using e-modules created with the assistance of Flip PDF Corporate Edition. Additionally, 81.2% of participants agree on the development of e-modules for the topic of global warming.

The results of observations conducted at SMA Negeri 5 Bukittinggi on July 24, 2023, during school learning activities for 10th-grade students indicated several findings. These included the observation that the learning process remains conventional, with physics teaching materials still primarily consisting of printed textbooks and worksheets. Limited classroom time prevents in-depth explanation of material and adequate practice. Diverse learning styles among students cannot be fully accommodated with conventional teaching methods, and learning assessments often fail to provide prompt and effective feedback. Moreover, the lack of technological integration in the learning process makes teaching methods less engaging and interactive. Another observed fact is that student learning outcomes have not yet reached proficiency. The Mid-Semester Exam results for 10th-grade students (Classes X E-4 and X E-6) in the 2022/2023 academic year for physics can be seen in Table 1.

Based on the table 1, sourced from the teacher's grade book, the results of the Mid-Semester Exam in physics on the topic of global warming show the

following; For Class X E-4, 9 students achieved passing grades while 16 did not. In Class X E-6, 12 students passed and 13 did not. The average UTS scores for both classes are 61.92 and 64.96 respectively. These scores categorize as not meeting the Learning Objectives Achievement Criteria (KKTP) because the school's KKTP threshold is set at 75.

Table 1. Summary of Average Mid-Semester Exam Scores for Students in Physics Subject Global Warming Topic

Class	Number of students passing	Number of students not passing	Average mid-semester exam score
X e-4	9	16	61.92
X e-6	12	13	64.96

Researchers have developed electronic modules that can be used on computers, laptops, tablets, and smartphones (Setyaningsih et al., 2023). One useful application for creating these modules is Flip PDF Corporate Edition. This software enables users to create page-flipping modules resembling books. Flip PDF Corporate Edition offers advantages such as animations, images, audio, video, and attractive symbols to enhance media resources and electronic modules. These electronic modules can be saved in various formats and accessed online or offline through electronic devices like computers and smartphones (Kusuma et al., 2023).

The choice of Flip PDF Corporate Edition for creating e-modules is based on several important considerations. One key reason is its user-friendly interface, enabling developers to efficiently create learning materials without requiring deep technical expertise. This aligns with the importance of a systematic user-interface design framework for e-learning systems, emphasizing user-centric design approaches (Das & Chatterjee, 2015). Additionally, the application can produce visually appealing and interactive e-modules that resemble physical books with realistic page-flipping features, expected to enhance students' interest and motivation in the learning process. Developing interactive e-modules aims to improve students' digital literacy abilities and engage them in independent problem-solving in subjects like mathematics (Wahyuni, 2023).

Method

The aim of this research is to evaluate students' abilities in learning physics regarding the concept of global warming which is presented in the physics learning E-Module which is intended for class X high school students. This type of research is included in the research and development (R&D) category, which is

type of research that focuses on creating and testing product effectiveness, according to Sugiyono (2021). Research and development does not always produce products in the form of objects or hardware. The aim of this research and development is to create an e-module for physics learning for class X SMA.

The design model used is ADDIE, the research and development steps of the ADDIE model are as shown in Figure 1.

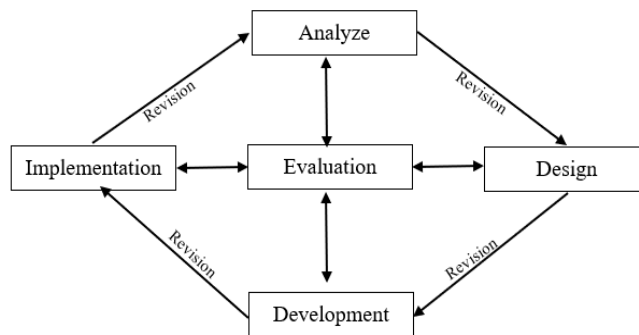


Figure 1. ADDIE model

Analysis

The development of electronic modules using the ADDIE model starts with the analysis stage, which includes analyzing the concept, students, and curriculum. This stage is crucial for understanding the needs of learners and the requirements of the curriculum. The analysis phase, being the first step in the ADDIE model, focuses on collecting information and data to guide the design and development stages that follow (Sumarni et al., 2019).

Design

Design is a plan that can provide a path, goals, and techniques for starting and completing a task. In this phase, product design is carried out. This is done by preparing various references, compiling a module framework, and designing a product concept. The e-module development guide allows this e-module to incorporate elements of creative thinking skills. In this research, the author created a physics learning e-module based on the 2017 Department of National Education (Depdiknas, 2017).

Development

Transforming designs into electronic modules (E-Modules) through creativity is a process known as product development. At this stage, the material content that was created at the design stage will be created and combined. After the preparation of the e-module draft is complete, the next stage is validity testing. To test the validity, a questionnaire was given and assessed by 6 experts to see the validity of the product being developed. After the e-module is validated, if there are

revisions made by the validator then revisions will be made to improve the product created.

Implementation

The implementation stage is the concrete phase in creating the physics e-module that has been developed. In this research, the implementation stage involves product practice by teachers and students. At this stage, practical testing is carried out in small groups to evaluate the effectiveness of the physics e-module in the learning process. Teachers and students will fill out a questionnaire related to practicality, which includes statements regarding the performance of the e-module in the learning context.

Evaluation

Evaluation is carried out at this stage until the formative evaluation determines the need for revision. After evaluation by experts and physics lecturers at the implementation stage, three stages of data analysis were carried out: validity data analysis (material validation, media validation, and language validation). Validity data analysis is used for data in the form of criticism, suggestions and input from experts to be used gradually to improve product development (Sanjoyo et al., 2023).

The instrument for assessing the validity of the physics learning E-Module was prepared using a Likert scale. The data resulting from the expert responses was analyzed using the following two steps, namely first adding up the total score of each expert for all indicators and secondly assigning a validity value. The validity value is sought using an equation to get the total average value for all criteria: (Arikunto, 2018).

$$Value = \frac{score\ achieved}{maximum\ score} \times 100\% \tag{1}$$

The criteria used to determine the validity of the physics learning E-Module are in Table 2. The validity analysis of the modules is performed use descriptive statistics, the results are presented in the form of graphs. The validation score becomes a limited value of 0 to 100. The classification of valid values used in this study ranges from 61 to 100 in the Valid and Very Valid categories.

Table 2. Module Validation Categories (Riduwan, 2013)

Percentage (%)	Category
0 - 20	Invalid
21 - 40	Less valid
41 - 60	Sufficiently valid
61 - 80	Valid
81 - 100	Very valid

Result and Discussion

Based on research that has been carried out regarding the development of physics learning E-Modules, the results obtained in this research are validation values by experts. To obtain results that are in accordance with the research objectives that have been set, after validation by experts, revisions will then be carried out taking into account suggestions and input regarding the strengths, weaknesses and limitations of this product.

The results and validation process of the physics learning E-Module will be explained as follows:

Instrument Validation

Instrument validation is carried out to show the achievement or success of a tool in measuring what it wants to measure. Instrument Validator by UNP lecturer, Faculty of Education, namely Prof. Daharnis., M.Pd, Kons. The validated instruments consist of Validity Instruments (Media, Material and Language), Teacher and Student Practicality Instruments.

The description of the validation results of the Physics Learning E-Module Instrument can be summarized in Table 3.

Table 3. Validation Results of the Instrument

Aspects Assessed	Validity Score	Practicality Score
Instructions for filling out the instrument sheet.	4	4
Statements made on the questionnaire.	4	4
The language used.	5	5
Effective sentence usage.	5	5
Sequence of statements on the questionnaire.	5	5
Amount	23	23
Percentage	92%	92%
Category	Very valid	Very valid

The results of the validation questionnaire and practicality questionnaire were 92% and 92% respectively. The following graph displays the findings of the validation analysis of this research instrument as shown in Figure 2.

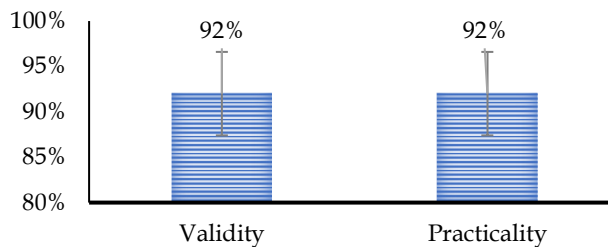


Figure 2. E-module instrument assessment recapitulation graph

E-Module Validation

At this stage, the physics learning E-Module that has been developed is validated by the validator. Validation of the Physics Learning E-Module consists of media validation, material validation and language validation, each consisting of 2 validators. Material validation by Mr. Prof. Dr. Usmeldi, M.Pd and Mr. Dr. Fuja Novitra, media validation by Mrs. Dr. Ulfia Rahmi, M.Pd, and Mr. Dr. Nuridin Widya Pranoto, S.Pd., M.Or, S.Pd., M.Pd, and language validation by Mr. Dr. Amril Amir, M.Pd and Mr Dr. Abdurahman, M.Pd. This validation aims to determine the quality of the Physics learning E-Module before testing in the field. The validity of the Physics learning E-Module is based on assessments from experts and validators. The following are the results of assessments from media experts, material experts and language experts:

Validation by Material Experts

The material expert in developing the physics learning E-Module is the Physics Lecturer at Padang State University, namely Mr. Prof. Dr. Usmeldi, M.Pd and Mr. Dr. Fuja Novitra. Material experts provide score assessments, criticism and suggestions for the Physics learning E-Module. The validity results of the Physics Learning E-Module Material obtained from the results of validator 1 were 96% and by validator 2 it was 93%, and both were classified in the "Very valid" category.

The material used aligns with the Annual Teaching Plan (ATP) and the Teaching Plan (TP) for physics lessons in grade X of high school. The content on global warming is organized evenly across learning activities, supplemented with relevant images and videos at the end of each topic sourced from the internet or other applications, enhancing the presentation for students to better understand the subject matter (Riduwan, 2013). Moreover, allowing students to control video playback improves their comprehension, reinforcing the practice of enhancing physics lessons with pertinent images and videos (Dartini et al., 2022; Nisa et al., 2020).

Validation by Media Experts

The media expert in developing the physics learning E-Module is the Padang State University Educational Technology Lecturer, namely, Mrs. Dr. Ulfia Rahmi, M.Pd, and Health and Recreation Lecturer, Mr. Dr. Nuridin Widya Pranoto, S.Pd., M.Or. Media experts provide score assessments, criticism and suggestions for the Physics learning E-Module. The Validity Results of the Physics Learning E-Module Media obtained from the overall indicator results by validator 1 were 68% in the "Valid" category and by validator 2 the percentage value obtained was 91% in the "Very Valid" category.

In accordance with the statement put forward by Resiani et al. (2015), the attractiveness of the physical appearance of a media greatly influences the learning process. The more attractive the appearance of the media, the more motivated students will be to learn, thereby influencing student learning outcomes (Pratama et al., 2022).

Validation by a Linguist

The media expert in developing the physics learning E-Module is the Indonesian and Regional Language and Literature Lecturer at Padang State University, namely, Mr. Dr. Amril Amir, M.Pd and Mr Dr. Abdurahman, M.Pd. The linguist provides an assessment. This assessment involves considering the appropriateness of the language, sentences, and suitability for the students, then the linguist provides a score, criticism and suggestions for the Physics learning E-Module. The results of the Validity of the Physics Learning E-Module Language obtained from the overall indicator results by validator 1 were 85.4% in the "Very Valid" category and by validator 2 the percentage value obtained was 96% also belonging to the "Very Valid" category and was worth trying.

Based on the criteria for being highly valid, this rating was given by validators because the e-module includes a glossary, uses appropriate language in instructions, work steps, and lesson content that adhere to proper Indonesian language rules and the Enhanced Spelling System (EYD) Modified from Riduwan (2013). The language used is clear, easily understood by students, and communicative, The importance of using clear and easily understandable language in educational content to facilitate effective communication and student engagement (Boothe & Wickstrom, 2019).

Table 4. Validity Assessment Recapitulation

Assessment aspect	Score	Category
Material	94.6	Very valid
Media	79.3	Valid
Language	90.0	Very valid

The graph showing the results of the validity analysis of the content, media, and language of the Physics E-Module can be seen in the Figure 3. Referring to the validity categories, the results of the validity assessment of the Physics E-Module show that the average scores from the two validators for each aspect are as follows: The content aspect received a score of 94%, categorized as "Very Valid". The media aspect received a score of 79%, categorized as "Valid". The language aspect received a score of 90%, categorized as "Very Valid". In line with the research conducted by Ria & Nurfidah (2022; Sahjat et al. (2023; Sumarni et al. (2019), the results from several previous validations

conclude that the developed Physics E-Module falls into the "Very Valid" category. It is deemed appropriate and suitable to be used in terms of content, media and language for learning Physics for class X high school students.

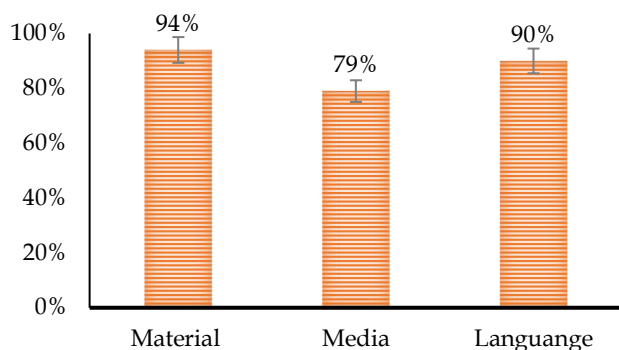


Figure 3. Graph of physics e-module validity test results

Conclusion

According to the validity results, the physics e-module designed for grade X Senior High School students is considered valid in terms of media, content, and language aspects. This e-module, created using the Flip PDF Corporate Edition application, can serve as a learning resource for physics lessons. A small group trial with users showed that the developed physics e-module is highly practical. Thus, the findings of this study can be used as a reference for evaluating e-modules as a product of physics education development.

Acknowledgments

During the process of completing this research, the researcher received a lot of support, both morally and materially, from various parties. Therefore, on this occasion, the author would like to express gratitude to Mr. Ramalis Hakim, Mr. Rayendra, Mr. Ridwan, Mr. Daharnis, Mr. Usmeldi, Mr. Fuja Novitra, Mr. Abdurahman, Mr. Amril Amir, Mr. Nuridin Widya Pranoto, and Mrs. Ulfia Rahmi for the motivation, guidance, direction, and instructions provided during the process of completing this article.

Author Contributions

All authors had significant contributions to the preparation of this article.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

References

Adelia, D., Linda, R., & Erna, M. (2023). Development of e-module based on multiple representation to

improve the competence of chemical literacy and learning independence of students on the material reaction rate. *Jurnal Penelitian Pendidikan IPA*, 9(12), 11101-11110.

<https://doi.org/10.29303/jppipa.v9i12.5541>

Adibah, S. (2017). Isu Pemanasan Global dalam pergeseran Paradigma Keamanan pada Studi Hubungan Internasional. *Jurnal Hubungan Internasional*, 6(1), 39-45.

<https://doi.org/10.18196/hi.61103>

Alshaikh, A. A. N. (2022). The Degree of Familiarity of Female Teachers at Secondary Schools in Al-Kharj Governorate, Kingdom of Saudi Arabia, with the Technologies of the Fourth Industrial Revolution and Their Applications in the Curriculum of Natural Sciences. *Journal of Educational and Social Research*, 12(5), 235-249.

<https://doi.org/10.36941/jesr-2022-0137>

Ampa, A. T., & Nurqalbi, N. (2021). Innovative Learning Strategies to Increase Students' Participation and Quality of English Teaching and Learning Process. *Technium Social Sciences Journal*, 26(1), 314-325.

<https://doi.org/10.47577/tssj.v26i1.5195>

Arikunto, S. (2018). *Dasar-Dasar Evaluasi Pendidikan*. Jakarta: Bumi Aksara.

Ataji, H. M., & Sujarwanta, A. (2016). Analisis Pentingnya Pengembangan Modul Berbasisvideo Assistant Menggunakan Link Qr Codeterintegrasi Al-Qur'an Dan Hadismaterisma Sistem Reproduksi Manusia. *Jurnal Bioloava*, 1(1), 1-7.

<https://doi.org/10.24127/bioloava.v1i1.38>

Boothe, D., & Wickstrom, C. D. (2019). Young Professional ESOL Learners Confront Competing Demands of Social Media and ESP. *Cognitive Science-New Media-Education*, 5(2), 53.

<https://doi.org/10.12775/csnme.2018.011>

Dartini, N. P. D. S., Satyawan, I. M., & Spyanawati, L. P. (2022). Thematic Based Video Games in Physical Education. *In International Conference on Physical Education, Sport, and Health (ICoPESH 2022)*, 110-116. <https://doi.org/10.2991/978-2-494069-79-4>

Das, M., & Chatterjee, B. (2015). Ecotourism and Empowerment: A Case Analysis of Bhitarkanika Wildlife Sanctuary, Odisha, India. *SAGE Publications*, 4(2), 136-145.

<https://doi.org/10.1177/2277975215613175>

Depdiknas. (2017). *Peraturan Pemerintah RI No.19 Tahun 2005 tentang Standar Nasional Pendidikan*. Depdiknas. Retrieved from <https://shorturl.asia/MnvDU>

Efendi, I., Sukri, A., & Safnowandi, S. (2021). Workshop Pembuatan Preparat Semi Permanen sebagai Media Pembelajaran bagi Guru Biologi di MA NW Kayangan Kabupaten Lombok Barat. *Nuras: Jurnal Pengabdian Kepada Masyarakat*, 1(1), 1-7.

- <https://doi.org/10.36312/njpm.v1i1.2>
- Hakiki, M., Arisman, S., & Maryana, A. (2022). Efektivitas Modul Digital Berbasis E-Learning pada Matakuliah Pendidikan Karakterdistkip Muhammadiyah Muara Bungo. *Jurnal Muara Pendidikan*, 7(2), 225–233. <https://doi.org/10.52060/mp.v7i2.901>
- Indira, E. W. M., Hermanto, A., & Pramono, S. E. (2020). Improvement of Teacher Competence in the. *Industrial Revolution Era*, 443(Iset 2019), 350–352. <https://doi.org/10.2991/assehr.k.200620.068>
- Irman, I., Wasliman, I., Warta, W., & Naufal, S. M. R. (2023). Management of The Implementation of The National Curriculum Based on Islamic Boarding School Education To Improve The Quality of Madrasah Aliyah (Descriptive Analytical Study at MA Al-Masthuriyah, MA Sunanul Huda, MA Al-Amin, Sukabumi Regency. *Jhss (Journal of Humanities and Social Studies*, 7(1), 022–029. <https://doi.org/10.33751/jhss.v7i1.7234>
- Kamila, S. N., & Agus RM, A. H. (2023). Implementation of Merdeka Curriculum in Improving the Quality of Senior High School. *Jurnal Educatio FKIP UNMA*, 9(1), 394–401. <https://doi.org/10.31949/educatio.v9i1.4591>
- Kusuma, D. K., Lucia, T. P., Sri, H., & Fatkhur, I. R. (2023). Pengembangan E-Modul Berbasis Flip PDF Corporate Edition Pada Kompetensi Dasar Puff Pastry Siswa Kelas XII SMK. *Journal of Creative Student Research (JCSR*, 1(2), 279–292. <https://doi.org/10.55606/jcsrpolitama.v1i2.1503>
- Nirmala, B. I., An-Nurdin, M. I., Muttaqin, M. Y. K., Fajriati, N. A., & Surur, A. M. (2022). Learning Media Palang Ajib (Papan Langka Ajaib) To Easy in Understanding the Meterials of Relationship and Functions. *Prima: Jurnal Pendidikan Matematika*, 6(1), 40. <https://doi.org/10.31000/prima.v6i1.5531>
- Nisa, H. A., Mujib, & Rizki, W. Y. (2020). Efektivitas E-Modul dengan Flip PDF Professional Berbasis Gamifikasi Terhadap Siswa SMP. *Jurnal Pendidikan Matematika Raflesia*, 5(2), 13–25. <https://doi.org/10.33369/jpmp.v5i2.11406>
- Nunung, S., Sholih, & Luluk, A. (2022). Hubungan Antara Motivasi Kerja dan Kompetensi Profesional dengan Kinerja Guru SD. *Jurnal Ilmiah Pendidikan Citra Bakti*, 9(2), 286–297. <https://doi.org/10.38048/jipcb.v9i2.703>
- Nurfauziah. (2019). Analisis Kemampuan Pemecahan Masalah Matematik Siswa SMP Pada Materi Bilangan Bulat. *Journal On Education*, 4(2), 215–228. <https://doi.org/10.31004/joe.v1i2.49>
- Omeh, C. B., & Olelewe, C. J. (2021). Assessing the Effectiveness of Innovative Pedagogy and Lecture Method on Students Academic Achievement and Retention in Computer Programming. *Education Research International*. <https://doi.org/10.1155/2021/5611033>
- Pratama, R. A., Saputra, M. A., Pratiwi, I. M., & Lestari, N. I. (2022). Student Teachers's Readiness to Face Society 5.0 Challenges: Are They Ready to Teach with Competencies Needed? *Proceedings of the Universitas Lampung International Conference on Social Sciences*, 628(ULICoSS 2021), 470–476. <https://doi.org/10.2991/assehr.k.220102.061>
- Rahmadhani, S., & Efronia, Y. (2021). Penggunaan E-Modul di Sekolah Menengah Kejuruan pada Mata Pelajaran Simulasi Digital. *Jurnal Vokasi Informatika*, 1(1), 6–11. <https://doi.org/10.24036/javit.v1i1.16>
- Resiani, N. K., Agung, A. A. G., & Jampel, I. N. (2015). Pengembangan Multimedia Pembelajaran Interaktif pada Mata Pelajaran IPS Siswa Kelas VII Semester Genap Di SMP N 7 Singaraja Tahun Ajaran 2014/2015. *E-Journal Edutech Universitas Pendidikan Ganesha*, 3(1), 1–10. Retrieved from <https://shorturl.asia/YQe5d>
- Ria, A., & Nurfidah, D. (2022). Pengembangan E-Modul Kalfis Matlab Gerak Vertikal menggunakan Flip PDF. *Corporate Edition*, 6(1), 889–894. <https://doi.org/10.30998/semnasristek.v6i1.5824>
- Riduwan. (2013). *Pengantar Statistika Sosial*. Bandung: Alfabeta.
- Safitri, N. A., Elvinawati, & Salastri, R. (2022). Pengembangan E-Modul Kimia Menggunakan Aplikasi Flip PDF Corporate Edition Pada Materi Larutan Penyangga. *Jurnal Pendidikan Dan Ilmu Kimia*, 6(2), 156–164. <https://doi.org/10.33369/alo.v6i2.25512>
- Sahjat, S., Taib, S., & Lastori, N. I. (2023). Pengembangan E-Modul Berbasis Flip Pdf Corporate Materi Momentum dan Impuls Untuk Siswa Kelas X IPA. *Jurnal Arjuna: Publikasi Ilmu Pendidikan, Bahasa Dan Matematika*, 1(5), 303–313. Retrieved from <https://journal.aripi.or.id/index.php/Arjuna/article/download/669/669>
- Sanjoyo, B. M., Susila, A. B., & Nasbey, H. (2023). E-Modul Gerak Melingkar Beraturan Berbasis Contextual Teaching And Learning Untuk Siswa Inklusif Slow Learner Berbantuan Flip PDF Professional. *Lontar Physics Today*, 2(1), 9–17. <https://doi.org/10.26877/lpt.v2i1.14439>
- Sari, W. P., Salmiah, E., M., N., Rohani, & Risqa, I. (2022). Pelatihan E-Module Materi Ekonomi Menggunakan Flip Pdf Profesional untuk Kemandirian Belajar Ekonomi dalam Pembelajaran Daring Selama Pandemi Covid-19. *Tasnim Journal for Community Service*, 3(2), 42–47. <https://doi.org/10.55748/tasnim.v3i2.150>
- Septyowaty, R., Azizahwati, & Syafii, M. (2023).

- Application of the Guided Inquiry Model to Improve Psychomotor Skills and Interest in Learning Physics. *Jurnal Penelitian Pendidikan IPA*, 9(10), 8106–8113.
<https://doi.org/10.29303/jppipa.v9i10.4434>
- Setyaningsih, A., Maryati, M., Wilujeng, I., & Ilma, A. Z. (2023). Electronic Science Module in the Merdeka Curriculum: Teacher and Student Perspectives. *Jurnal Penelitian Pendidikan IPA2023*, 9(SpecialIssue), 1172–1178.
<https://doi.org/10.29303/jppipa.v9ispecialissue.6591>
- Shodiqin, A., A., F., & Sutrisno. (2016). Pengembangan Modul Pembelajaran Berbantu Wolfram Mathematicadan Flipbook Makerdengan Model Time Game Tournament Pada Materi Turunan Kelas XI SMA. *Jurnal Pendidikan MIPA*, 6(2), 1–9.
<https://doi.org/10.21580/phen.2016.6.2.1056>
- Shoimah, R. N., & Fatoni, A. (2023). The Implementation of Higher Order Thinking Skill (HOTS) oriented Learning through Project Based Learning Model (PjBL) in Elementary Schools. *Syekh Nurjati International Conference on Elementary Education*, 1(0), 47–54.
<https://doi.org/10.24235/sicee.v1i0.14583>
- Sugiyono. (2021). *Metode penelitian kuantitatif, kualitatif, dan R&D (Cetakan Ke-3)*. Bandung: Alfabeta.
- Sumarni, S., Ramadhani, R., Sazaki, Y., Astika, R. T., Andika, W. D., & Prasetyo, A. E. (2019). Development of “child friendly ICT” textbooks to improve professional competence of teacher candidates: A case study of early childhood education program students. *Journal for the Education of Gifted Young Scientists*, 7(3), 643–658.
<https://doi.org/10.61132/arjuna.v2i2.669>
- Susilawati, W. (2012). *Model dan Pembelajaran Matematika*. Bandung: Insan Mandiri.
- Triliana, L. S., Munzil, M., & Sugiyanto, S. (2021). The Development of Augmented-Reality Based Guided Inquiry Teaching Material of Life Organization System. *Journal of Disruptive Learning Innovation (JODLI)*, 2(2), 113.
<https://doi.org/10.17977/um072v2i22021p113-123>
- Utami, D. F., Nurkamto, J., & Marmanto, S. (2019). Higher-Order Thinking Skills on Test Items Designed by English Teachers: A Content Analysis. *International Journal of Educational Research Review*, 4, 756–765.
<https://doi.org/10.24331/ijere.629581>
- Wahyuni, A. (2023). Development of Geogebra-Based Interactive E-Modules to Improve Students’ Digital Literacy Abilities. *International Journal of Advance Social Sciences and Education (IJASSE)*, 1(4), 261–268.

<https://doi.org/10.59890/ijasse.v1i4.1120>