

E-MODULE FOCUSED ON PROBLEM-BASED LEARNING INCORPORATING MEDICINAL PLANTS FROM RIAU FOR TEACHING ABOUT THE DIGESTIVE SYSTEM

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Abstract

The limited availability of diverse, engaging, and contextually relevant learning resources remains a challenge in biology education, particularly in facilitating students' understanding of the digestive system. This study aimed to develop a Problem-Based Learning (PBL) electronic module integrating local medicinal plants from Riau for Grade XI students. A Research and Development (R&D) approach was employed using the Analyze, Design, and Development phases of the ADDIE model. Participants comprised 72 students from SMAN 2 Siak Hulu and SMAN 03 Siak Hulu, selected through purposive sampling, as well as three expert validators and two biology teachers. Data were collected through interviews, needs-assessment questionnaires, expert-validation forms, student-response questionnaires, and documentation and were analyzed using qualitative and quantitative descriptive techniques. The electronic module achieved an overall validity score of 95%, comprising scores of 94% from the subject-matter expert and 96% each from the media and instructional experts. Student responses were also highly positive, with an overall score of 92% across visual design, readability, language, content, and presentation. These findings indicate that the developed electronic module is suitable as supplementary instructional material for teaching the digestive system. By integrating medicinal plants from Riau, the module contextualizes biological concepts within students' familiar environment and offers a locally relevant resource for PBL-based instruction. Further research should undertake the Implementation and Evaluation phases of the ADDIE model and assess the

module's effectiveness in improving learning outcomes and other educational competencies.

Keywords: Digestive System; Electronic Module; Local Medicinal Plants; Problem-Based Learning; Riau Contextual Learning

INTRODUCTION

Education acts as a fundamental basis for nurturing human capabilities through knowledge, abilities, and ethics (Suarningsih et al., 2024). In light of the advances in science and technology during the 21st century, it is essential for education to modify its teaching methods to align with contemporary needs. Instructors are anticipated to cultivate not just critical thinking, problem-solving, creativity, communication, and teamwork skills, but also to adequately incorporate technology into their teaching (Sholeh & Fathurrohman, 2023). Within this framework, educational resources are essential as they assist students in gaining skills in an organized way and contribute to positive learning results (Famulaqih, S., & Lukman, 2024). Nevertheless, the application of educational materials in educational institutions encounters difficulties since the majority of resources provided are in printed formats that often do not capture students' interest (Ricu Sidiq & Najuah, 2020).

This scenario underscores the importance of creating educational resources that are more captivating, creative, and in tune with the requirements of learners (Simatupang, 2023). Materials designed with creativity can enhance student engagement and foster a more enjoyable educational experience, while the effective presentation of these materials aids students in attaining a better understanding of the subject matter (Ramadhina & Pranata, 2022). One option that corresponds to advances in technology is the E-Module, a digital version of traditional modules that can include text, images, animations, and videos (Zinnurain, 2021). E-Modules are available on multiple electronic devices, providing increased flexibility to facilitate the educational process (Irmawati & Yulinda, 2021). To maximize their educational benefits, E-Modules can be combined with the Problem-Based Learning (PBL) approach, which focuses on students being actively involved in learning through teamwork, problem-solving, and inquiry-based tasks (Rohmatulloh & Nindiasari, 2023). The creation of PBL-oriented e-modules can be made more relevant by incorporating local medicinal plants found in Riau. Using local materials in teaching enables

students to appreciate the resources within their surroundings and is consistent with the application of the Independent Curriculum (Anisa et al., 2024). The use of medicinal plants is still essential in community living, and these plants possess bioactive compounds that contribute to various health benefits (Noviyanti et al., 2024). Certain species like ginger (*Zingiber officinale*), turmeric (*Curcuma longa*), and Java ginger (*Curcuma xanthorrhiza*) are recognized for their digestive health advantages (Moraes & Souza, 2021). Thus, incorporating regional medicinal plants can create a relevant educational atmosphere that connects with the daily experiences of students, especially while addressing the digestive system, a subject that encompasses organs, digestive functions, nutrition, and gastrointestinal ailments (Hafizah, 2024).

The necessity for this enhancement is underscored by discussions with Biology educators from Grade XI at SMAN 2 Siak Hulu and SMAN 03 Siak Hulu, who disclosed that instructional resources were primarily confined to printed textbooks and student worksheets (LKPD). A needs assessment survey further revealed that every teacher and 89% of the students expressed approval for developing an e-module that aligns the topic of the digestive system with local medicinal plants found in Riau. These circumstances underscore the demand for teaching aids that are engaging, contextual, and conducive to self-directed learning. Prior research backs the incorporation of e-modules and Problem-Based Learning (PBL) within educational frameworks. Amanah, (2023) showed that e-modules could significantly improve learning efficacy and student performance, while Mutmainna et al., (2025) confirmed that PBL is a practical and effective method for teaching the digestive system, enhancing student involvement and autonomy. Furthermore, Nurmasitoh et al., (2025) demonstrated the practical application and effectiveness of e-modules focused on PBL that incorporate local healing plant from Riau.

However, earlier studies have not specifically created educational resources that combine e-modules, PBL, and regional medicinal plants from Riau focused on the digestive system theme, tailored to the particular requirements of instructors and learners at SMAN 2 Siak Hulu and SMAN 03 Siak Hulu. This absence underpins the development of the product in this investigation. The innovation of this research is centered on the creation of an e-module based on PBL that incorporates local Riau medicinal plants to provide a contextual framework for studying the digestive system. The product was crafted using the ADDIE model, which includes Analysis, Design, Development, Implementation, and Evaluation as a structured approach for developing educational materials (Sahaat et al.,

2020). As a result, the final product serves not only as digital educational content but also connects problem-solving tasks to the local resources present in the students' surroundings.

Given this context, this research is centered on creating an e-module rooted in PBL that incorporates local healing plants from Riau, particularly focusing on the matter of the digestive system for students in Grade XI. The goal of this development is to create educational resources that address the requirements of both educators and learners; are interesting, interactive, and appropriate for self-directed learning; and can connect the concepts of the digestive system to the local surroundings and resources. Hence, this research seeks to produce a PBL-oriented e-module related to the digestive system that includes local medicinal plants from Riau.

METHODS

This research utilizes the Research and Development (R&D) approach with the goal of designing and advancing an educational product while evaluating its viability. R&D is a method of investigation aimed at creating particular items while also assessing their performance. The educational product developed in this research is an E-Module that is based on the Problem-Based Learning (PBL) approach, which incorporates details about this plants into the curriculum regarding the digestive system for Grade XI SMA/MA (Senior High School/Islamic Senior High School) learners. The development process adheres to the ADDIE framework. In the analysis phase, the curriculum, student needs, and characteristics were analyzed, in addition to a literature review concerning the plants. The design phase involved creating the framework, compiling content, structuring the e-module layout, and developing assessment tools. Following this, the development phase was conducted through validation by experts, revisions of the product, and trials based on student feedback.

The participants in the study were Biology educators, expert evaluators, and students in Grade XI from SMAN 2 Siak Hulu and SMAN 03 Siak Hulu. The overall population included 477 Grade XI students from the two institutions. Participants were chosen through purposive sampling, which is a method centered around certain criteria, specifically aiming at classes that had previously explored the digestive system subject. The selected sample consisted of 33 students from class XI.5 at SMAN 2 Siak Hulu and 39 students from class XI.1 at SMAN 03 Siak Hulu, leading to a cumulative sample total of 72

students. Besides the student population, the research also featured three expert evaluators each with a focus on subject matter expertise, media, and instructional design and two Biology teachers, one from each school. Additionally, discussions were held with the Biology teachers to gather insights regarding the educational atmosphere and the necessity for teaching resources in their respective schools.

For this study, the instruments and methods for gathering data encompassed interviews, surveys, validation forms, student feedback forms, and documentation. Discussions were held with the Biology teachers at both SMAN 2 Siak Hulu and SMAN 03 Siak Hulu to pinpoint learning challenges and assess the demand for educational resources. Averina, RY, & Widagda, (2021). Questionnaires were utilized to collect information regarding the initial requirements of students and their feedback on the created e-module, whereas validation forms were completed by experts in the subject, media, and instruction to evaluate the feasibility of the product.

The validation tools address different elements including content, teaching methods, language, visual presentation, programming, and usability; at the same time, the student feedback questionnaires focused on visual presentation, readability, language, content, and overall presentation. Documentation acts as supplementary data, recording the activities of interviews and trials of the product. The research data encompasses quantitative figures, especially validation scores and student feedback scores, alongside qualitative information such as suggestions, comments, and the outcomes of interviews. The primary sources of data consisted of validators, educators, and learners, while secondary sources were obtained from pertinent journals, books, and research studies.

The analysis of data was carried out through both qualitative and quantitative descriptive techniques. Qualitative descriptive analysis was used to examine recommendations and insights from validators for the purpose of refining the product, whereas quantitative descriptive analysis was applied to evaluate the scores obtained from the validation forms and student feedback questionnaires. The product's validity level was calculated using the formula $V_s = \frac{T_{se}}{T_{sh}} \times 100\%$, where T_{se} represents the total empirical score and T_{sh} represents the maximum expected score. Validation outcomes were classified into four categories: highly valid (85.01–100%), moderately valid (70.01–85%), less valid (50.01–70%), and invalid (1.00–50%), following the criteria adapted by Puspasari, R., & Suryaningsih, (2019). At the same time, student feedback was examined by comparing

the achieved scores with the highest possible score, and subsequently categorized in accordance with defined standards. The product's validity was established through evaluations by experts, while student feedback acted as supplementary evidence to gauge the acceptance level of the created e-module.

RESULTS

Preliminary evaluations suggest that the instructional resources available in both educational institutions consist solely of hard-copy textbooks and worksheets for students. Interviews conducted with educators indicated a demand for a wider variety of teaching resources that were more contextually relevant, and a survey assessing needs highlighted that students were in need of electronic modules to enhance their understanding of the digestive system; students also showed interest in creating an electronic module focused on local medicinal plants from Riau. Additionally, an exploration of plant knowledge revealed that students had a limited understanding of the variety of medicinal plants; most students are primarily acquainted with turmeric compared to other medicinal plant species.

The product was created using Canva in A4 size and composed in the Indonesian language. Its content is organized into three sessions spanning a total of six periods of 45 minutes each; the completed product was saved as a PDF and transformed using Flip PDF Professional. Elements of the product comprise a cover page, an introduction, a contents list, a guide for explanations and usage, anticipated learning results, educational objectives, a PBL framework, the Pancasila Student Profile, a conceptual diagram, combined material on the digestive system along with regional Riau herbal remedies, PBL assignments, practice tasks and evaluations, solutions, comments, self-assessment, reflections, an overview, a word list, pertinent articles, citations from the Qur'an and Hadith, a bibliography, and the author's life story.



Figure 1. Cover of the Developed E-Module

Figure 1 illustrates the front cover of the electronic module focused on the human digestive system, which is grounded in PBL and incorporates this traditional plants. The cover includes the title of the topic, information on the subject and grade level, along with a graphic representation of human digestive organs intertwined with a variety of medicinal plants such as ginger (Java ginger), turmeric, black ginger, red ginger, kencur (aromatic ginger), and aloe vera. This design aims to introduce the topic while emphasizing the module's main feature: the fusion of digestive system principles with the benefits of traditional plants. The visual elements showing the digestive organs alongside the medicinal plants also offer a preliminary glimpse into the module's subject matter, allowing students to grasp the links between the educational content, their surroundings, and everyday experiences.



Figure 2. Example of an E-Module Content/Activity Page

Figure 2 illustrates a sample page for a learning activity within the e-module, focusing on the subject of nutrition and food. This page features the title of the learning activity, illustrative images, key information about the module, and the learning goals intended for students to attain. The content is organized in a logical manner and includes relevant graphics to aid students in comprehending the topics being examined. Additionally, this page facilitates the adoption of PBL since the information is arranged in a sequence of engaging activities designed to lead students toward a deeper understanding of concepts through carefully planned tasks. Therefore, the content page functions not only as an informative resource but also as a supportive framework for students during their educational journey.

After finalizing the e-module design, the subsequent phase involved validation to evaluate the product's appropriateness prior to testing it with students. Qualified experts in the fields of content, media, and teaching methods conduct the validation process. The evaluations provided by these experts were crucial in determining the e-module's adequacy and pinpointing aspects that needed enhancement. Below are the results from the validation concerning the PBL-oriented e-module that incorporates healing plants into the curriculum on the digestive system.

1. Product Validation Results

The outcomes of the validation show that the e-module was rated as highly valid by all validator groups. Subject experts provided a rating of 94%, while media specialists and instructional professionals both gave scores of 96%. The cumulative average score for validation reached 95%, placing it in the highly valid classification. These findings illustrate that the product fulfills the requirements concerning content, visual aesthetics, programming, instructional design, language usage, and readability.

Table 1. Overview of Validation Outcomes

Validator	Percentage	Category	Explanation
Subject Matter	94%	Extremely Valid	Appropriateness of content
Media	96%	Extremely Valid	Graphics and coding
Instructional	96%	Extremely Valid	Teaching, terminology, clarity
Average	95%	Extremely Valid	General appropriateness

Source: Research data

During the expert validation process concerning content, the evaluation of suitability received an average rating of 94%. The metrics related to coherence and accuracy both achieved perfect scores of 100%, while depth or complexity and alignment each had

an average score of 88%. In the validation conducted by media experts, the visual aspect garnered a score of 92%, and the programming component received a perfect 100%, leading to an overall average score of 96%. In the validation by instructional experts, the layout received a score of 99%, language scored 92%, and readability was rated at 96%.

2. Student Response Test Results

The evaluation test involved 72 participants, which included 33 individuals from class XI-5 at SMAN 2 Siak Hulu and 39 individuals from class XI-1 at SMAN 3 Siak Hulu. The survey was made up of 36 statements that addressed five different areas. Every area was rated in the very good range, with an overall mean score of 92%.

Table 2. Overview of Student Feedback

Aspect	Percentage	Category
Visuals	92%	Excellent
Readability	90%	Excellent
Language	93%	Excellent
Content	93%	Excellent
Presentation	92%	Excellent
Average	92%	Excellent

Source: Research data

According to the data presented in Table 2, the feedback from students regarding the PBL electronic module, which incorporates this plants, yielded very favorable outcomes. The overall average was 92%, categorizing it as very excellent. This suggests that students responded positively to the e-module and found it effective in aiding their understanding of the digestive system. In terms of visual appeal, the e-module achieved a score of 92% (very good); this indicates that elements like design, layout, text clarity, and image quality were viewed as engaging and beneficial during lessons. In terms of readability, the e-module received a rating of 90% (very good), showing that the chosen font type and size, along with text layout, facilitated a comfortable user experience for students.

Additionally, both the language and content sections reached the highest score of 93% (very good). These findings suggest that the language utilized within the e-module was straightforward, easy to understand, and well-suited to the students' profiles. The content area also received a rating of 93%, indicating that the information regarding the digestive system was logically arranged and easily understood by the learners. Furthermore, the presentation element scored 92% (very good), showcasing that the e-module's format

effectively captured student interest and encouraged motivation throughout the learning experience. In general, every element was rated in the very good range, achieving scores between 90% and 93%; none of the components received a poor or unfavorable evaluation. Therefore, student responses indicate that the e-module designed around PBL and incorporating local medicinal plants from Riau offers an attractive layout and clear readability, uses suitable language, conveys information efficiently, and enhances the educational experience.

DISCUSSION

Research results show that PBL e-module, which incorporates this plants, is extremely feasible. Validators have given it high ratings, confirming that it satisfies important standards for educational resources, including the appropriateness of content, design, programming, instructional framework, language use, and readability. The resource not only covers information regarding the digestive system but also links the topics to real-life contexts and biological resources that are significant to students. These outcomes correspond with the findings of Jayanti & Pertiwi (2020), who note that e-modules can effectively enhance educational results, promote analytical abilities, encourage critical thinking, build self-confidence, develop scientific attitudes, and help achieve educational goals. Additional support for these conclusions comes from Mufida & Widodo, (2021) and Nisa et al., (2020), who highlight that well-designed e-modules are valuable teaching tools that enhance comprehension and facilitate the meeting of educational objectives.

The study shows that design and programming are strong points of the product, but image clarity and interactivity are not as strong. These results show that the quality of an e-module depends on more than just how complete the content is; it also depends on how the information is shown and made easy to use. Oksa & Soenarto, (2020) highlight that how digital teaching materials look visually helps in grabbing attention and increasing students' interest in learning. Rahmawati et al., (2025) say that creating an e-module that is both organized and interesting, with good fonts and pictures, can help students understand the material better and stay focused. Because of this, making changes to the images, layout, and interactive parts of the medicinal plant content based on the validator's feedback is an important step in maintaining the quality of the content and how it's presented in balance.

Student answers that were rated as excellent show that the e-module was well liked by the people it was meant for. The language and content got good scores because the material was easy to understand, well-organized, and helpful for learning. These results match what Ningtyas et al., (2025), found, which is that the way language is used in teaching materials is very important for how easy they are to read. Aeni & Widodo, (2022) also mention that e-modules which have good readability and are easy to use are considered practical for learning. Additionally, Ratnasari & Mubasiroh, (2022) highlight a connection between effective readability and favorable student reactions to e-modules. Therefore, feedback from students suggests that the material effectively fulfills the demand for teaching resources that are engaging, easy to read, and diverse instead of dull.

The inclusion of local medicinal plants from Riau signifies a contextual enhancement of the produced material. These plants are not just added as extra details, but are associated with the curriculum on the digestive system, allowing students to link biological ideas with the natural resources found in their own surroundings. Leny et al., (2024) clarify that medicinal plants can act as tangible educational tools, while also familiarizing students with the variety of plants in their local area. Furthermore, Andarias & Yanti., (2022) indicate that using local plants as educational tools aids students in understanding biological concepts more contextually. In the realm of Problem-Based Learning (PBL), Amelia et al., (2024) assert that integrating PBL into e-modules encourages active involvement from students through activities centered on problem-solving. These observations indicate that merging PBL with the context of local medicinal plants can lead to more impactful learning experiences, as students understand concepts while witnessing their use in everyday life.

The findings of the research suggest that the e-module can act as an additional teaching tool for teachers and a material for self-led student learning. This resource helps educators provide lessons that are more engaging and relevant, while giving learners materials that are easily accessible. These conclusions align with Wakhyudi & Mulasih, (2023), who argue that easy-to-use, engaging e-modules can enhance student interest and participation. They also relate to the research by Ningtyas et al., (2025), which discusses how engaging and versatile PBL-centered e-modules aid independent study and motivation among learners. Furthermore, Amelia et al., (2024) highlight the necessity of organizing content according to the needs of students to promote better understanding of concepts.

Thus, this product has meaningful implications as a digital teaching tool that combines an active learning approach with local relevance.

However, this study has certain limitations that need to be recognized. The development process adhered to the ADDIE framework but was confined to the Analyze, Design, and Development stages; thus, the implementation and comprehensive assessment stages were not carried out. The experiments focused on the opinions of students, indicating that the findings are not enough to experimentally assess how well the e-module enhances learning outcomes, critical thinking abilities, or process skills.. Moreover, certain elements, such as image clarity and interactivity, received comparatively lower scores during the media validation phase. Thus, future studies could move on to the implementation and evaluation stages, examine effectiveness through experimental methodologies, and enhance visual and interactive elements. This way, the quality of the product would be verified not just in terms of validity and user feedback, but also in relation to its effect on learning results.

CONCLUSION

Drawing from the development and examination of an e-module centered on Problem-Based Learning (PBL) that incorporates local medicinal plants from Riau, with a focus on the digestive system for Grade XI SMA/MA students, it can be stated that the e-module was effectively created following the ADDIE model, specifically through the Analyze, Design, and Development phases. Validation outcomes suggest that the e-module is highly valid, while feedback from students rates it as excellent. These results imply that the constructed e-module adheres to the required standards in terms of content, media, instructional design, and acceptance from users, thus rendering it appropriate as additional teaching material for the topic of the digestive system.

Regarding its impact on knowledge and biology teaching, this study has created digital instructional resources that combine the Problem-Based Learning approach with local medicinal flora from Riau. This combination provides a learning method that is more relevant by connecting ideas about the digestive system to the variety of life present in the students' neighborhood. As a result, the e-module aids in understanding the topic while also acting as a different teaching tool that presents the application of local medicinal plants in biology training.

Future studies should focus on progressing to the Implementation and Evaluation phases of the ADDIE model and to examine how effective the e-module is in terms of learning results, critical thinking capabilities, problem-solving skills, or other educational competencies. Additional research might also increase testing to a wider array of schools and students to obtain a more comprehensive view of the e-module's application, as well as to enhance the product's interactive functions and visual aspects.

REFERENCES

- Aeni, W. N., & Widodo, W. (2022). Penggunaan E-Modul Interaktif untuk Meningkatkan Hasil Belajar Siswa SMP pada Materi Kalor. *Pensa E-Jurnal: Pendidikan Sains*, 10(2), 193–202. <https://ejournal.unesa.ac.id/index.php/pensa/article/view/44740>
- Al Zayyan, A., & Laura, I. (2025). Penerapan Model Pembelajaran Berbasis Proyek dalam Pembelajaran PKn SD. *Jurnal Intelek Insan Cendikia*, 2(5), 9650–9656. <https://jicnusantara.com/index.php/jiic/article/view/3487>
- Amelia, O., Sundari, P. D., Mufit, F., & Dewi, W. S. (2024). Analisis Kebutuhan Pengembangan E-Modul dengan Pendekatan Contextual Teaching and Learning untuk Meningkatkan Pemahaman Konsep pada Materi Energi Terbarukan. *Jurnal Ilmiah Profesi Pendidikan*, 9(1), 34–39. <https://doi.org/10.29303/jipp.v9i1.1849>
- Andarias, S. H., Yanti, D., & Ardyati, D. P. I. (2022). Potensi Tumbuhan Lokal sebagai Sumber Belajar Biologi. *JEC (Jurnal Edukasi Cendekia)*, 6(1), 1–6. <https://doi.org/10.35326/jec.v6i1.2166>
- Anisa, S., Erika, F., & Nurhadi, M. (2024). Analisis Kebutuhan Siswa untuk Pengembangan E-LKPD Berbasis Problem-Based Learning Terintegrasi Kearifan Lokal sebagai Pendukung Implementasi Kurikulum Merdeka. *Journal of Innovation and Technology in MBKM*, 1(1), 20–25. <https://journal.unesa.ac.id/index.php/jit-mbkm/article/view/32692>
- Famulaqih, S., & Lukman, A. (2024). Pengembangan Bahan Ajar Modul Pembelajaran. *Karakter: Jurnal Riset Ilmu Pendidikan Islam*, 1(2), 1–12. <https://doi.org/10.61132/karakter.v1i2.156>
- Hafizah, N., & Fitmawati. (2023). Studi Etnobotani Pemanfaatan Zingiberaceae oleh Masyarakat Melayu di Pulau Rupat, Kabupaten Bengkalis, Riau. *Al-Kaunyah: Jurnal Biologi*, 17(1), 32–45. <https://doi.org/10.15408/kaunyah.v16i2.1.24374>
- Irmawati, I., Syahmani, & Yulinda, R. (2021). Pengembangan Modul IPA pada Materi Sistem Organ dan Organisme Berbasis STEM-Inkuiri untuk Meningkatkan Literasi Sains. *Journal of Mathematics Science and Computer Education*, 1(2), 64–73. <https://doi.org/10.20527/jmscedu.v1i2.4048>
- Jayanti, M. A., & Pertiwi, K. R. (2023). Pengembangan E-Modul Berbasis PBL untuk Meningkatkan Kemampuan Analisis dan Rasa Ingin Tahu Siswa. *JINoP (Jurnal Inovasi Pembelajaran)*, 9(1), 112–127. <https://doi.org/10.22219/jinop.v9i1.23178>
- Leny, L., Wahidah, W., Mahdian, M., & Kusasi, M. (2024). Development of e-modules of basic laws of chemistry based on problem-based learning to improve critical

- thinking skills. *Jurnal Inovasi Teknologi Pendidikan*, 11(4), 367–376. <https://journal.uny.ac.id/index.php/jitp/article/view/72576>
- Moraes, J. N. de, & Souza, G. O. de. (2021). Plantas medicinais amazônicas utilizadas na terapêutica de distúrbios do sistema digestório: Uma revisão de literatura. *Research, Society and Development*, 10(15), e271101522953. <https://doi.org/10.33448/rsd-v10i15.22953>
- Mufida, A. A., & Widodo, A. (2021). Analisis Kedalaman dan Keterkaitan Antar Konsep pada Pembelajaran IPA di Masa Pandemi. *Jurnal Inovasi Pendidikan IPA*, 7(2), 116–127. <https://doi.org/10.21831/jipi.v7i2.40887>
- Mutmainna, Hayati, R. S., & Hambali, H. (2025). Pengembangan E-Modul Berbasis Problem-Based Learning pada Materi Sistem Pencernaan Manusia. *Jurnal Biogenesi*, 10(3), 2048–2055. <https://doi.org/10.30605/biogenesi.v10i3.6890>
- Ningtyas, A., Leny, & Saadi, P. (2025). Pengembangan E-Modul Hidrokarbon Berbasis Problem-Based Learning Menggunakan Heyzine Flipbook untuk Meningkatkan Motivasi Belajar dan Literasi Sains. *JCAE (Journal of Chemistry And Education)*, 9(1), 15–26. <https://doi.org/10.20527/jcae.v9i1.3474>
- Nisa, H., Hidayat, A., & Parid, M. (2021). Relevansi Kesesuaian Kompetensi Dasar dengan Materi Buku Ajar Matematika Kelas VI SD/MI. *JKPD (Jurnal Kajian Pendidikan Dasar)*, 6(1), 119–132. <https://journal.unismuh.ac.id/index.php/jkpd/en/article/view/3531>
- Noviyanti, D., Hastiana, Y., & Hidayat, S. (2024). Pemanfaatan Tumbuhan Obat oleh Battrra: Studi Etnobotani dan Kearifan Lokal. *Jurnal Intelektualita: Keislaman, Sosial dan Sains*, 13(2), 329–340. <https://doi.org/10.19109/intelektualita.v13i2.25235>
- Nurmasitoh, Q. A., Sudarmin, S., Ngabekti, S., Irsadi, A., & Sutopo, A. (2025). Development of a problem-based learning (PBL) ethnoscience e-module on the biodiversity of herbal plants to enhance junior high school students' critical thinking and environmental literacy. *Unnes Science Education Journal*, 14(2), 204–210. <https://doi.org/10.15294/usej.v14i2.25904>
- Oksa, S., & Soenarto, S. (2020). Pengembangan E-Modul Berbasis Proyek untuk Memotivasi Belajar Siswa Sekolah Kejuruan. *Jurnal Kependidikan: Penelitian Inovasi Pembelajaran*, 4(1), 99–111. <https://doi.org/10.21831/jk.v4i1.27280>
- Puspasari, R., & Suryaningsih, T. (2019). Pengembangan Buku Ajar Teori Graf untuk Mahasiswa Pendidikan Matematika. *Jurnal Tadris Matematika*, 2(1), 85–100. <https://doi.org/10.21274/jtm.2019.2.1.85-100>
- Rahmawati, L., Bachri, B. S., & Maureen, I. Y. (2025). Kajian Literatur: Pengaruh E-Modul Interaktif terhadap Motivasi Siswa dalam Pembelajaran. *Paedagogie*, 20(2), 47–58. <https://doi.org/10.31603/paedagogie.v20i2.14025>
- Ramadhina, S. R., & Pranata, K. (2022). Pengembangan E-Modul Berbasis Aplikasi Flipbook di Sekolah Dasar. *Jurnal Basicedu*, 6(4), 7265–7274. <https://doi.org/10.31004/basicedu.v6i4.3470>
- Ratnasari, C. I., & Mubasiroh, S. L. (2022). Evaluasi Hasil Pembelajaran Ejaan Bahasa Indonesia Sesuai EYD dan KBBI dengan Adopsi Teknologi. *Edumatic: Jurnal Pendidikan Informatika*, 6(2), 374–383. <https://doi.org/10.29408/edumatic.v6i2.6714>

- Ricu Sidiq, & Najuah. (2020). Pengembangan E-Modul Interaktif Berbasis Android pada Mata Kuliah Strategi Belajar Mengajar. *Jurnal Pendidikan Sejarah*, 9(1), 1–14. <https://doi.org/10.21009/jps.091.01>
- Rohmatulloh, Nindiasari, H., & Fatah, A. (2023). Pengembangan E-Modul Interaktif Berbasis Problem-Based Learning (PBL) untuk Meningkatkan Kemampuan Berpikir Kritis Matematis. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 12(4), 3599–3612. <https://doi.org/10.24127/ajpm.v12i4.8172>
- Sahaat, Z., Nasri, N. M., & Abu Bakar, A. Y. (2020). ADDIE model in teaching module design process using modular method: Applied topics in design and technology subjects. In *Proceedings of the 1st Progress in Social Science, Humanities and Education Research Symposium (PSSHERS 2019)* (pp. 719–724). Atlantis Press. <https://doi.org/10.2991/assehr.k.200824.161>
- Sholeh, B., Hufad, A., & Fathurrohman, M. (2023). Pemanfaatan E-Modul Interaktif dalam Pembelajaran Mandiri Sesuai Kapasitas Siswa. *Risalah: Jurnal Pendidikan dan Studi Islam*, 9(2), 665–672. https://jurnal.faiunwir.ac.id/index.php/Jurnal_Risalah/article/view/458
- Simatupang, A. M. (2023). Pengembangan Bahan Ajar Teks Cerita Pendek Berbasis Nilai Pendidikan Karakter pada Siswa. *Jurnal Pendidikan Indonesia*, 4(7), 765–773. <https://doi.org/10.59141/japendi.v4i7.2125>
- Siti Amanah. (2023). *Pengembangan E-Modul IPA Interaktif Berbasis Discovery Learning dengan Pendekatan Etnosains pada Materi Sistem Pencernaan Manusia untuk SMP/MTs Kelas VIII* [Skripsi, Universitas Islam Negeri Sultan Syarif Kasim Riau]. <https://repository.uin-suska.ac.id/74381/>
- Suarningsih, N. M., Santika, I. G. N., Roni, A. R. B., & Kristiana, R. J. (2024). Pendidikan Karakter di Indonesia dalam Berbagai Perspektif (Definisi, Tujuan, Landasan, dan Prakteknya). *JOCER: Journal of Civic Education Research*, 2(2), 61–73. <https://doi.org/10.60153/jocer.v2i2.100>
- Wakhyudi, Y., & Mulasih. (2023). Pengembangan Bahan Ajar E-Modul Dasting (Cerdas Menyunting) Berbasis Flipbook pada Mahasiswa Pendidikan Bahasa Indonesia Universitas Peradaban. *Lingua Rima: Jurnal Pendidikan Bahasa dan Sastra Indonesia*, 12(3), 217–229. <https://doi.org/10.31000/lgrm.v12i3.10086>
- Zinnurain. (2021). Pengembangan E-Modul Pembelajaran Interaktif Berbasis Flip PDF Corporate Edition pada Mata Kuliah Manajemen Diklat. *ACADEMIA: Jurnal Inovasi Riset Akademik*, 1(1), 132–139. <https://doi.org/10.51878/academia.v1i1.546>