

Interactive E-Module for Learning Algorithms and Programming in Informatics Education

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ABSTRACT

The need for interactive digital teaching materials in Informatics learning highlights the importance of media that support students in understanding abstract concepts, particularly algorithms and programming. However, learning resources in junior high school are often dominated by text-based materials and teacher explanations, limiting opportunities for independent and visual learning. This research aims to develop and examine the feasibility of an interactive e-module using a flipbook-based format for learning algorithms and programming in seventh-grade Informatics education. This research adopted a Research and Development approach based on the 4D model, consisting of the define, design, develop, and disseminate stages. The research involved material and media expert validators, one Informatics teacher, and 57 seventh-grade students at MTs Miftahul Khair Loa Janan. Data collection involved observations, interviews, and questionnaires, while the obtained data were analyzed using descriptive quantitative percentage analysis. The developed e-module was created using Canva and Heyzine and incorporated organized learning materials, Scratch-based activities, instructional videos, reflection tasks, and evaluation features. The material expert validation reached 88% in the very valid category, media expert validation reached 79.25% in the valid category, teacher response reached 75.00% in the valid category, and student response reached 88.41% in the very valid category. These findings indicate that the e-module is feasible as a contextual digital teaching material for supporting algorithmic learning.

Keywords: Algorithms And Programming, E-Module, Flipbook, Informatics Education, Scratch.

ABSTRAK

Kebutuhan akan bahan ajar digital yang interaktif dalam pembelajaran Informatika menunjukkan pentingnya media yang mampu mendukung peserta didik dalam memahami konsep-konsep abstrak, khususnya algoritma dan pemrograman. Namun, sumber belajar di tingkat sekolah menengah pertama masih didominasi oleh materi berbasis teks dan penjelasan guru, sehingga membatasi kesempatan peserta didik untuk belajar secara mandiri dan visual. Penelitian ini bertujuan untuk mengembangkan serta menguji kelayakan e-modul interaktif berbasis flipbook pada pembelajaran algoritma dan pemrograman untuk mata pelajaran Informatika kelas VII. Penelitian ini menggunakan metode Research and Development (R&D) dengan model pengembangan 4D yang meliputi tahapan define, design, develop, dan disseminate. Penelitian melibatkan validator ahli materi, validator ahli media, satu orang guru Informatika, serta 57 peserta didik kelas VII MTs Miftahul Khair Loa Janan. Pengumpulan data dilakukan melalui observasi, wawancara, dan angket, sedangkan data dianalisis menggunakan teknik analisis deskriptif kuantitatif berbasis persentase. E-modul yang dikembangkan dibuat menggunakan Canva dan Heyzine serta dilengkapi dengan materi pembelajaran yang tersusun secara sistematis, aktivitas berbasis Scratch, video pembelajaran, kegiatan refleksi, dan fitur evaluasi. Hasil validasi ahli materi memperoleh persentase sebesar 88% dengan kategori sangat valid, validasi ahli media memperoleh 79,25% dengan kategori valid, respons guru memperoleh 75,00% dengan kategori valid, sedangkan respons peserta didik memperoleh 88,41% dengan kategori sangat valid. Hasil penelitian menunjukkan bahwa e-modul yang dikembangkan layak digunakan sebagai bahan ajar digital kontekstual untuk mendukung pembelajaran algoritma dan pemrograman.

Kata Kunci: Algoritma dan Pemrograman; E-Modul; Flipbook; Pendidikan Informatika; Scratch.

INTRODUCTION

The rapid integration of digital technology into education has shifted expectations of teaching materials from static sources of information into interactive tools that can support understanding, engagement, and independent learning (Chen et al., 2025). This shift is particularly important in Informatics education, where students are required not only to receive information but also to process concepts logically and systematically (Budiarto et al., 2024). In this context, teaching materials that merely present textual explanations are often insufficient to support meaningful learning (Tacuban, 2024). Instead, digital teaching materials need to be designed to align with students' characteristics and to facilitate active knowledge construction through visual, interactive, and structured presentation (Reinhold et al., 2024). Among various digital formats, e-modules have gained attention because they integrate instructional content, guidance, and evaluation into a single multimedia learning environment, and prior studies have shown that such media can improve student engagement and learning participation (Wahyuni et al., 2023).

One promising form of e-module is the flipbook-based format, which offers a digital reading experience similar to printed books while incorporating videos, quizzes, hyperlinks, and other multimedia features (Oronce & Manalo, 2021). Previous studies have reported that the flipbook-based format is feasible and can support students' independent learning (Tampa et al., 2023). However, the pedagogical value of this format does not lie only in its visual attractiveness, but in its potential to present concepts in a more sequential, interactive, and accessible way (Oronce & Manalo, 2021). This potential is especially relevant for algorithms and programming, a topic that demands logical reasoning, step-by-step understanding, and repeated practice. For junior high school students, these concepts are often perceived as abstract and difficult, particularly when learning resources are dominated by static text and conventional explanation (Chuang & Lee, 2020). In line with this, text-based materials tend to limit students' ability to study independently, highlighting the need for more interactive digital resources for algorithm-related learning (Mahendri et al., 2023).

Based on observations, the instructional practices in Informatics at MTs Miftahul Khair Loa Janan, particularly in algorithms and programming, are still largely dominated by lectures and note-taking. Such practices may deliver information, but they provide limited support for conceptual visualization, guided practice, and active student engagement. As a result, students tend to be passive and face difficulties in understanding abstract materials. Although prior research has demonstrated the usefulness of the flipbook-based format, important gaps remain. Previous studies have primarily focused on higher education contexts (Mahendri et al., 2023). Meanwhile, other research has examined flipbook-based e-modules in broader Informatics contexts (Eliyasni et al., 2021). Furthermore, similar developments have also been conducted without specifically addressing algorithms and programming at the junior high school level (Charlina et al., 2022). In addition, previous studies have primarily emphasized product feasibility, with less attention to contextual design that aligns media features with the cognitive demands of algorithmic learning (Mahdiyah et al., 2025).

Therefore, this research addresses both a literature gap and a practical educational need by developing an interactive e-module using a flipbook-based format for algorithms and programming learning at the seventh-grade level. The novelty of this research lies in its focus on abstract algorithmic content in junior high school Informatics, its use of a flipbook-based format integrated with multimedia features to support logical and sequential understanding, and its contextual adaptation to the learning conditions of MTs Miftahul Khair Loa Janan. Therefore, this research aims to develop and examine the feasibility of an interactive e-module using a flipbook-based format.

RESEARCH METHOD

This research uses the Research and Development (R&D) method with a 4D development model, which consists of four stages, namely define, design, develop, and disseminate (Zuhrie et al., 2020). The 4D model was selected because it provides a structured yet adaptable framework for developing educational products, allowing continuous refinement through validation and revision processes (Lasala, 2023). The define stage aimed to identify development needs through interviews with subject teachers to examine learning conditions, encountered obstacles, and the need for innovative teaching materials, as well as analysis of student characteristics including learning interests, understanding levels, and the need for interactive media (Raharjo et al., 2023). Based on this analysis, learning objectives were

formulated as the foundation for product development (Herrmann et al., 2023).

The design stage involves planning interactive e-modules by organizing learning materials according to curriculum objectives, designing evaluation questions, and determining media and formats using Canva and Heyzine to produce interactive learning content (Mesra et al., 2025). This stage also included layout design, color selection, typography, and systematic structuring of content to ensure clarity and ease of use (Satyawan et al., 2023). The develop stage focused on product validation by material and media experts using questionnaires that assessed aspects such as content suitability, language clarity, visual design, and usability (Sudarma et al., 2022). The validation results were used for revision before the product was tested on teachers and students to obtain user responses (Murni et al., 2023). The final stage, dissemination, involved distributing the developed e-module through digital platforms such as links or QR codes to facilitate wider accessibility (Fachrunisa et al., 2022). The development procedure of the e-module following the 4D model is illustrated in Figure 1:

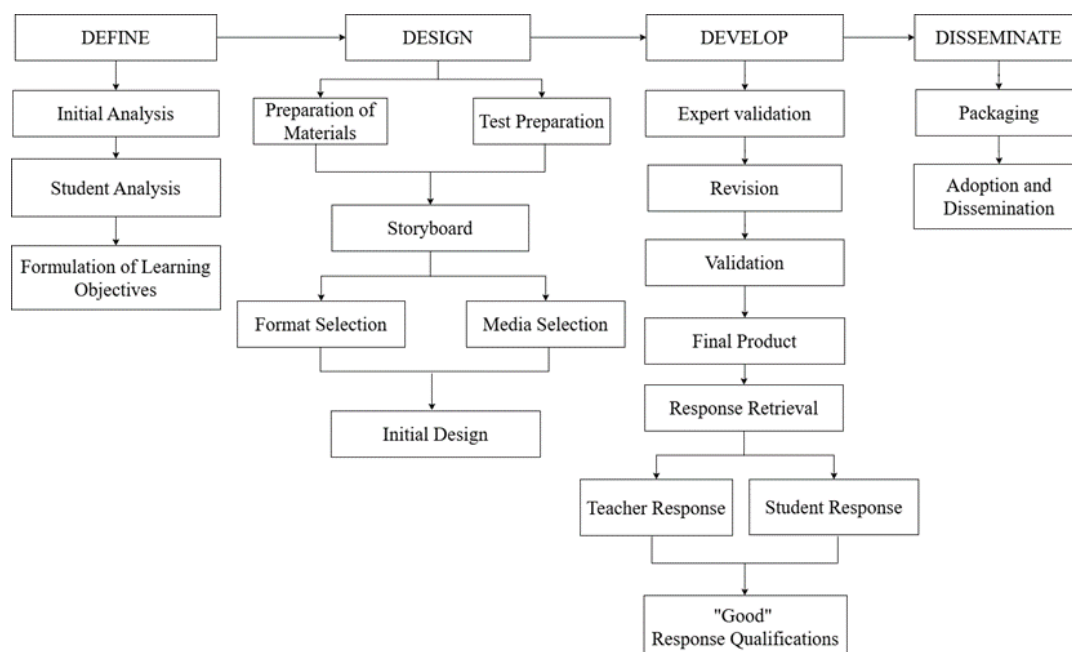


Figure 1 Development Procedure

The research subjects consisted of expert validators, teachers, and students. Validators included material and media experts who assessed product feasibility, while teachers and students were involved to evaluate practicality and user responses (Andini et al., 2023). The population of this research was all 57 seventh-grade students at MTs Miftahul Khair Loa Janan, and due to the small population size, a saturated sampling technique (total sampling) was applied, meaning all students were used as research samples to ensure accurate and representative data (Irawan & Wahyudi, 2022). Research data were gathered using interviews, observations, and questionnaires. Interviews and observations were conducted to explore learning conditions, while questionnaires were administered to obtain validation results and user responses (Ansor et al., 2023).

The questionnaire instruments used in this research consisted of validation questionnaires and user response questionnaires. The validation questionnaires were given to material experts and media experts to assess the feasibility of the developed e-module. The aspects assessed by material experts included content appropriateness, clarity of learning objectives, completeness of material, language use, and presentation structure. Meanwhile, media experts assessed visual design, layout, typography, consistency, usability, and interactivity of the e-module. In addition, response questionnaires were distributed to teachers and students to measure practicality and attractiveness, including aspects of content quality, presentation, language clarity, graphical design, and ease of use. The instruments were adapted from Puskurbuk and BSNP standards and adjusted to research needs (Tambusai & Rakhmawati, 2023). Detailed aspects of the instrument assessment are presented in the following table 1:

Table 1 Instrument Assessment Aspects

Respondent	Aspects Assessed
Material Expert	Content suitability, learning objectives, completeness, language, presentation
Media Expert	Visual design, layout, typography, consistency, usability, interactivity
Teacher	Content quality, presentation, language clarity, usability
Students	Attractiveness, ease of use, understanding, visual appearance

Data analysis used quantitative descriptive techniques with percentage calculations based on a 4-point Likert scale. In this scale, *strongly disagree* was scored 1, *disagree* was scored 2, *agree* was scored 3, and *strongly agree* was scored 4 (Titania & Widodo, 2020). The percentage is calculated by comparing the total score obtained with the maximum possible score, then categorized into eligibility criteria, namely 85.01% – 100.00% (very valid), 70.01% – 85.00% (valid), 50.01% – 70.00% (sufficient), and 01.00% – 50.00% (Sofyan & Haris, 2025). Reliability testing of the instrument was conducted using Cronbach's Alpha, where a value ≥ 0.7 indicates good reliability (Sofyan & Haris, 2025). In addition, qualitative descriptive analysis was used to support the interpretation of data obtained from observations and interviews.

The percentage is calculated by comparing the total score obtained with the maximum possible score using the following formula:

$$\text{Percentage} = \frac{(\text{Total Actual Score})}{(\text{Maximum Ideal Score})} \times 100\%$$

The percentage results obtained are categorized according to the interpretation in the following table 2 :

Table 2 Criteria Validity

Criteria Validity (%)	Validity Level
85,01% – 100,00%	Very Valid
70,01% – 85,00%	Valid
50,01% – 70,00%	Fair
01,00% – 50,00%	Invalid

Ethical considerations were also applied in this research. The research was conducted after obtaining official permission from the school, including approval from the principal and subject teachers. Parental consent was ensured since the participants were minors, and all data were collected confidentially without coercion and used solely for academic purposes and learning development.

RESULTS AND DISCUSSION

Results

The primary outcome of this research was the development of an interactive e-module presented through a flipbook-based format for seventh-grade algorithms and programming learning. The e-module was designed using Canva and presented in a digital format accessible via smartphones and computers. The completed product consists of several components, including a cover page, user guide, learning objectives, concept maps, learning materials, videos, reflection activities, evaluations, and a developer profile.

The content focuses on basic concepts of algorithms and programming, particularly visual programming using Scratch. The material is arranged systematically, starting from algorithms in daily life, followed by programming concepts, Scratch interface, basic functions, and simple program creation to support gradual understanding.

In terms of appearance, the e-module integrates local cultural elements of East Kalimantan with consistent colors, readable typography, and engaging visuals to enhance students' interest. Interactive features such as Scratch examples, learning videos, reflection questions, and QR code-based evaluations support active and independent learning.

The development process followed four stages: define, design, develop, and disseminate. In the define stage, interviews showed that learning was still lecture-based and students preferred interactive materials. In the design stage, the e-module was developed using Canva and converted into a flipbook using Heyzine, with attention to layout, typography, and visual balance. In the develop stage, the module was validated by material and media experts

and revised accordingly. Finally, in the disseminate stage, the e-module was distributed digitally through links and QR codes, allowing flexible use in both classroom and independent learning. The appearance of the developed e-module is presented in Figure 2 :



Figure 2 E Module View

Further details of the developed e-module, illustrating a more comprehensive overview of its content structure and organization, are presented in Figure 3 :

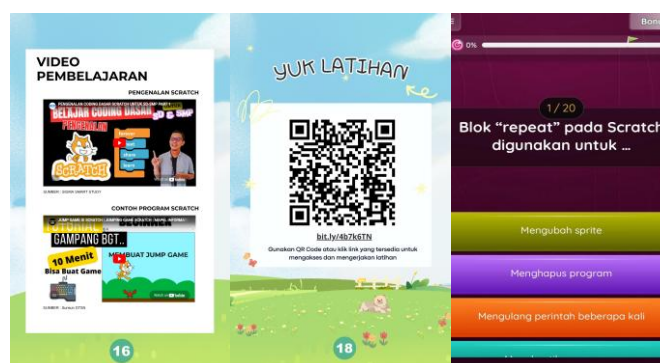


Figure 3 Content and Features of the E-Module

Furthermore, the feasibility of the developed e-module was evaluated through expert validation involving material and media experts. Based on the material expert assessment conducted by Fahmi Romisa, S.Kom., M.Kom., the overall validation result reached 88%, which falls into the "very valid" category. This indicates that the content of the e-module is appropriate and suitable for use in learning.

In more detail, the content feasibility aspect obtained a percentage of 90% with a "very valid" category, indicating that the material is in accordance with learning objectives, relevant to students' needs, and supported by appropriate examples and explanations. The language aspect obtained a percentage of 83.33%, categorized as "valid", which shows that the language used is generally clear, communicative, and understandable for seventh-grade students, although minor improvements may still be needed. Meanwhile, the presentation aspect reached 90% with a "very valid" category, reflecting that the material is presented systematically, coherently, and able to support students' understanding effectively.

In addition to material validation, media expert validation was also conducted, involving three validators: Dr. Eko Subastian, S.Pd., M.Kom., Vina Zahrotun Kamila, S.Kom., M.Kom., and Muhammad Labib Jundillah, S.Kom., M.Kom. The overall result of media validation showed an average percentage of 79.25%, which is categorized as "valid", indicating that the e-module design and interface are feasible to be used as a learning medium.

Specifically, the display and screen feasibility aspect obtained a percentage of 80.95% with a "valid" category, showing that the layout, color composition, and visual appearance are appropriate and attractive. The user-friendliness aspect reached 78%, indicating that the e-module is relatively easy to use and navigate. The consistency aspect obtained 75%, reflecting that the design elements such as layout and typography are sufficiently consistent throughout the module. Furthermore, the usefulness aspect reached 83.33%, indicating that the e-module is beneficial in supporting learning activities. Lastly, the graphical aspect obtained 79.17%, showing that the use of fonts, images, and visual elements is appropriate and supports the

overall appearance of the module.

Overall, these results indicate that the developed e-module meets the feasibility criteria in both content and media aspects, and can be used as an effective learning resource for seventh-grade students in learning basic algorithm and programming concepts.

Teacher response was collected to examine the practicality of the developed e-module in the actual learning context. The assessment was conducted by Siti Aisah, S.Pd., as the Informatics teacher at MTs Miftahul Khair Loa Janan. The overall teacher response reached 75.00% and was categorized as “valid”. This result indicates that the e-module is feasible to be used as a learning medium for seventh-grade Informatics learning, although minor improvements are still needed.

Based on each assessed aspect, the e-module, content, presentation, language, and graphical aspects each obtained 75.00% and were categorized as “valid”. These results show that the teacher considered the e-module usable, relevant to students’ learning needs, systematically presented, generally understandable, and visually appropriate. Thus, the teacher response supports the feasibility of the product for classroom use, particularly in learning algorithms and programming.

Student responses were also analyzed to determine the practicality and attractiveness of the e-module from the perspective of direct users. The questionnaire was distributed to 57 seventh-grade students after they used the e-module. The overall student response reached 88.41%, which falls into the “very valid” category. This result shows that students responded positively to the e-module and considered it helpful in supporting the learning process.

In terms of specific aspects, the e-module aspect obtained 87.06%, the content aspect reached 87%, the presentation aspect obtained 89%, the language aspect reached the highest score of 90%, and the graphical aspect obtained 88%. All aspects were categorized as “very valid”. These findings indicate that students perceived the e-module as easy to use, relevant to the material, clearly presented, understandable in language, and visually attractive. The results of the student responses are presented in Figure 4 :

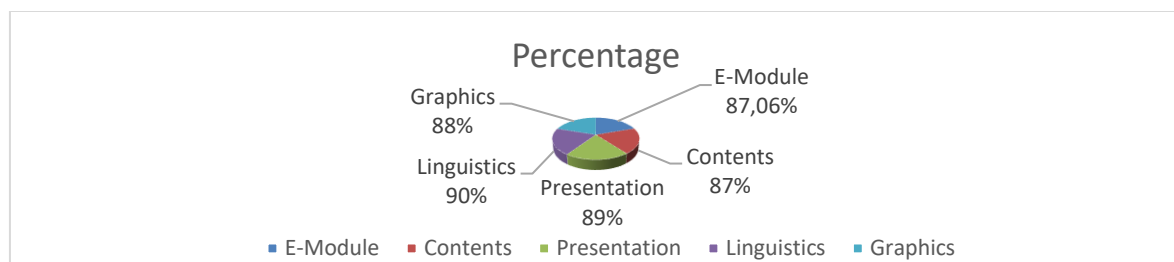


Figure 4 Student Response

Discussion

The findings indicate that the interactive e-module using a flipbook-based format is feasible to be used as a learning medium for algorithms and programming in seventh-grade Informatics learning. This feasibility is supported by material expert validation, media expert validation, teacher response, and student response, which generally fall into the valid to very valid categories. These results show that the e-module has met the main aspects of digital learning media, including content suitability, media design, practicality, readability, and visual attractiveness.

The very valid result from the material expert shows that the e-module content is aligned with learning objectives and students’ needs. The material was arranged gradually, starting from algorithms in daily life, programming concepts, Scratch interface, basic functions, and simple program creation, so it supports students in understanding abstract concepts step by step. A similar development principle was applied in Android-based learning media using the 4D model, where systematic development and expert validation were used to determine product feasibility before implementation (Saputra et al., 2020).

These findings can be interpreted through Constructivist Learning Theory, which emphasizes that learners actively construct knowledge through meaningful learning experiences rather than passively receiving information. The organization of the material from daily-life algorithms to Scratch-based programming activities enables students to gradually build conceptual understanding. By providing examples, practice activities, and contextual

learning experiences, the e-module supports students in connecting new concepts with their prior knowledge, which is essential for understanding abstract algorithmic concepts (Krakowski et al., 2022).

The media expert validation was categorized as valid, indicating that the e-module design and interface are feasible, although minor improvements are still needed. This result can be understood because the e-module integrates layout, typography, color composition, navigation, videos, and interactive access through Heyzine, but consistency and user-friendliness still need refinement. Technology-based Informatics learning media using iSpring Suite also showed that digital media can be used as a learning tool after receiving positive responses from media experts (Romisa, 2023). In addition, Android-based learning media with usage instructions, learning materials, videos, practice questions, and glossary features also supports independent learning (Subastian & Kamila, 2023).

The teacher response was categorized as valid, while the student response reached the very valid category. This difference may occur because teachers assess the e-module from the perspective of classroom implementation, including content accuracy, language clarity, instructional suitability, and practicality. Meanwhile, students responded more positively because they directly experienced the ease of access, visual appearance, videos, examples, and evaluation activities. The importance of teacher readiness in using digital learning media is also supported by training on Android application development for ICT teachers, which emphasizes the need for practical skills in designing and applying digital technology in learning (Prayogo et al., 2023).

The positive student response is also supported by the interactive and evaluative features provided in the e-module. Website-based Informatics learning media containing learning materials, videos, and educational games has also been shown to support students' learning needs and increase learning engagement (Rosita et al., 2025). The evaluation component in this e-module also helps students review their understanding, and this is relevant to the development of an online quiz system with automatic scoring that can support more efficient learning evaluation (Nirawana et al., 2025).

The positive response from students may also be explained through Mayer's Cognitive Theory of Multimedia Learning, which suggests that students learn more effectively when information is presented through a combination of verbal and visual representations. The integration of videos, visual illustrations, Scratch demonstrations, and interactive evaluations in the e-module allows students to process information through multiple cognitive channels. This multimedia approach can reduce cognitive overload and facilitate a deeper understanding of algorithms and programming concepts, which are often considered abstract by junior high school students (Turčáni et al., 2024).

The main contribution of this research lies in the development of an interactive e-module that specifically focuses on algorithms and programming for seventh-grade students. Unlike several previous studies that developed Android-based media, website-based media, or online quiz systems, this research emphasizes abstract algorithmic content and adapts it to the learning conditions at MTs Miftahul Khair Loa Janan. However, this research is limited to feasibility testing and user responses, so future research is recommended to examine the effectiveness of the e-module on students' learning outcomes and to develop more project-based programming activities.

CONCLUSION

This research demonstrates that the developed interactive e-module using a flipbook-based format is feasible to be used as a learning medium for algorithms and programming in seventh-grade Informatics learning. The feasibility of the product is supported by material expert validation, media expert validation, teacher response, and student response, which indicate that the e-module meets the required criteria in terms of content suitability, media design, practicality, readability, and visual attractiveness. The main contribution of this research lies in the development of a contextual digital teaching material that integrates a flipbook-based format, Scratch-based examples, learning videos, reflection activities, and evaluations to support the gradual understanding of abstract algorithmic concepts at the junior high school level. Practically, the e-module can be used by teachers as an alternative learning resource and by students as a medium for independent learning through digital devices. However, this research is limited to feasibility testing and user responses, so it has not yet measured the direct impact of the e-module on students' learning outcomes. Future research is therefore

recommended to examine the effectiveness of the e-module through experimental studies and to develop more project-based programming activities to strengthen students' algorithmic thinking.

REFERENSI

- Andini, D. W., Annisa, F. Y., Praheto, B. E., & Taryatman, T. (2023). The Development of the Sariswara Method in Accommodating the Students' Diversity in Thematic Learning Material of Elementary School. *Jurnal Prima Edukasia*, 11(1), 72–80. <https://doi.org/10.21831/jpe.v11i1.53254>
- Ansor, F., Zulkifli, N. A., Jannah, D. S. M., & Krisnaresanti, A. (2023). Adaptive Learning Based on Artificial Intelligence to Overcome Student Academic Inequalities. *Journal of Social Science Utilizing Technology*, 1(4), 202–213. <https://doi.org/10.70177/jssut.v1i4.663>
- Budiarto, M. K., Rahman, A., Asrowi, Gunarhadi, & Efendi, A. (2024). Proposing information and communication Technology (ICT)-Based Learning transformation to create competitive human resources: A theoretical review. *Multidisciplinary Reviews*, 7(4), 2024076. <https://doi.org/10.31893/multirev.2024076>
- Charlina, C., Septyanti, E., Mustika, T. P., & Rahmi, A. (2022). Electronic module as learning needs to write exposition texts for junior high school students. *Journal of Education and Learning (EduLearn)*, 16(2), 219–225. <https://doi.org/10.11591/edulearn.v16i2.20402>
- Chen, H., Liu, Y., Kong, F., Jiang, W., Wei, G., Wang, H., Shao, L., Zeng, J., & Zhao, X. (2025). Advancing Smart Education: Role Analysis of Digital Textbooks and Exploration of Classroom Construction Pathways. *Creative Education*, 16(12), 2130–2139. <https://doi.org/10.4236/ce.2025.1612128>
- Chuang, H.-M., & Lee, C.-C. (2020). Interactions of construal levels on programming ability and learning satisfaction: A case study of an Arduino course for junior high school students. *PLOS ONE*, 15(8), e0236500. <https://doi.org/10.1371/journal.pone.0236500>
- Eliyasni, R., Habibi, M., Rahmatina, R., & Azima, N. F. (2021). E-Module Flipbook Model for Designing E-Learning Materials in Higher Education. *Proceedings of the 2nd Progress in Social Science, Humanities and Education Research Symposium (PSSHERS 2020)*. <https://doi.org/10.2991/assehr.k.210618.004>
- Fachrunisa, A., Kuncoro, K. S., & Arigiyati, T. A. (2022). Development of Interactive E-Modules Assisted by The Kvisoft Flipbook Maker Application on Algebraic Forms Grade VII. *Journal of Mathematics and Mathematics Education*, 12(1), 11–20. <https://doi.org/10.20961/jmme.v12i1.61091>
- Herrmann, J. E., Spielman, S., Venook, R., Yock, P., & Denend, L. (2023). Lessons from Developing Multimedia Learning Materials for the Digital Generation. *Biomedical Engineering Education*, 3(2), 353–358. <https://doi.org/10.1007/s43683-023-00110-w>
- Irawan, R., & Wahyudi, U. (2022, September). Using the Tsanawiyah English Grammar Android Application to Improve Grammar Accuracy and Build Islamic Values. *4th International Conference on Education and Social Science Research (ICESRE)*. <https://doi.org/10.18502/kss.v7i14.12020>
- Krakowski, A., Greenwald, E., Hurt, T., Nonnecke, B., & Cannady, M. (2022). Authentic Integration of Ethics and AI through Sociotechnical, Problem-Based Learning. *Proceedings of the 36th AAAI Conference on Artificial Intelligence, AAAI 2022*, 36, 12774–12782. <https://doi.org/10.1609/aaai.v36i11.21556>
- Lasala, N. J. (2023). Development and Validation of E-SelfIMo: E-Learning Self-Directed Interactive Module in Earth Science. *Recoletos Multidisciplinary Research Journal*, 11(1), 85–101. <https://doi.org/10.32871/rmrj2311.01.07>
- Mahdiyah, M., Priyanto, P., & Hartopo, I. (2025). Improving Students' Understanding and Learning Outcomes in Algorithms through Scratch-Based Interactive Learning Media. *JP (Jurnal Pendidikan): Teori Dan Praktik*, 10(2), 143–155. <https://doi.org/https://doi.org/10.26740/jp.v10n2.p143-155>
- Mahendri, R. P., Amanda, M., Latifah, U., & Rawas, S. (2023). Development of Interactive Flipbook-Based E-Module for Teaching Algorithms and Basic Programming in Higher Education. *Journal of Hypermedia & Technology-Enhanced Learning*, 1(1), 1–17. <https://doi.org/10.58536/j-hytel.v1i1.18>
- Mesra, E. R., Hakim, R., Darmansyah, D., & Zuwirna, Z. (2025). Development of Interactive E-Modules Using Canva and Heyzine Flipbook to Improve the Learning of Grade VII Junior High School Students. *Jurnal Penelitian Pendidikan IPA*, 11(9), 370–377.

- <https://doi.org/10.29303/jppipa.v11i9.12364>
- Murni, D., Nopita, D., Hanifah, H., & Nuzulia, R. (2023). The Development of a New Task-based Maritime Culture Content Multimedia Textbook for Vocabulary Instruction to Student Ability. *BIO Web of Conferences*, 79, 1–11. <https://doi.org/10.1051/bioconf/20237908003>
- Nirawana, I. W. S., Prayogo, M. A., & Haris, C. A. (2025). Pengembangan Sistem Kuis Online dengan Deteksi Kecurangan Berbasis Kecerdasan Buatan. *EduTIK: Jurnal Pendidikan Teknologi Informasi Dan Komunikasi*, 5(6), 2392–2402.
- Oronce, J. P., & Manalo, D. A. O. (2021). Development and validation of flipbook in earth and life science. *IOER: International Multidisciplinary Reserach Journal*, 3(1), 111–117. <https://doi.org/https://doi.org/10.54476/jimrj273>
- Prayogo, M. A., Insan, P. P., Sudinugraha, T., Atma, Y. D., Wijayanto, A., Indrayani, N., & Alimyaningtias, W. N. (2023). Pelatihan Pembuatan Aplikasi Android untuk Guru Teknologi Informasi dan Komunikasi (TIK) Kota Balikpapan. *Jurnal Mulia*, 2(2), 96–101. <https://doi.org/https://doi.org/10.47002/jpm.v2i2.594>
- Raharjo, M., Safitri, E. R., & Harlin, H. (2023). Interactive Video Development With a Scientific-Based Ethnopedagogical Approach for Elementary School Students: An Analysis Review. *Pedagogia: Jurnal Pendidikan*, 13(1), 1–12. <https://doi.org/10.21070/pedagogia.v13i1.1604>
- Reinhold, F., Leuders, T., Loibl, K., Nückles, M., Beege, M., & Boelmann, J. M. (2024). Learning Mechanisms Explaining Learning With Digital Tools in Educational Settings: a Cognitive Process Framework. *Educational Psychology Review*, 36(1), 14. <https://doi.org/10.1007/s10648-024-09845-6>
- Romisa, F. (2023). Pengembangan media pembelajaran berbasis Android menggunakan iSpring Suite pada mata pelajaran Informatika materi perangkat keras komputer. *Jurnal Ilmiah Sains Teknologi Dan Informasi*, 1(2), 17–23. <https://doi.org/10.59024/jiti.v1i2.170>
- Rosita, D., Isnaynun, I., Andrea, R., & Pratama, A. (2025). Pengembangan Media Pembelajaran Berbasis Website Untuk Meningkatkan Literasi Digital Siswa SMP. *Jurnal Muara Pendidikan*, 10(1), 39–44. <https://doi.org/10.52060/mp.v10i1.2596>
- Saputra, G. Y., Harjanto, A., & Ningsih, Y. A. (2020). Pengembangan Media Pembelajaran Berbasis Android untuk Mata Pelajaran Fisika Materi Pokok Energi di Kelas X IPA 1 SMA Negeri 2 Muara Badak Tahun Ajaran 2019/2020. *Journal of Advances in Information and Industrial Technology*, 2(2), 10–24. <https://doi.org/10.52435/jaiit.v2i2.67>
- Satyawan, I. M., Lasmawan, I. W., Artanayasa, I. W., Swadesi, I. K. I., & Yoda, I. K. (2023). The development of interactive multimedia in e-learning Undiksha to improve soccer learning outcomes in FOK Undiksha. *JPES: Journal of Physical Education and Sport*, 23(12), 3468–3477. <https://doi.org/10.7752/jpes.2023.12398>
- Sofyan, M., & Haris, C. A. (2025). Interactive Excel E-Module for Grade VII Informatics Learning. *Pedagogia: Jurnal Pendidikan*, 14(2), 355–372. <https://doi.org/10.21070/pedagogia.v14i2.1953>
- Subastian, E., & Kamila, V. Z. (2023). Implementasi Aplikasi Cloud Design Untuk Pembelajaran Siswa di SMK Negeri 10 dan 18 Samarinda. *Jurnal Sistem Informasi Dan Ilmu Komputer*, 1(2), 112–116. <https://doi.org/10.59581/jusiik-widyakarya.v1i2.493>
- Sudarma, I. K., Prabawa, D. G. A. P., & Suartama, I. K. (2022). The Application of Information Processing Theory to Design Digital Content in Learning Message Design Course. *International Journal of Information and Education Technology*, 12(10), 1043–1049. <https://doi.org/10.18178/ijiet.2022.12.10.1718>
- Tacuban, T. N. (2024). Decoding Success: Assessing the Online Pseudocode Interpreter through Users Insights. *International Journal of Information and Education Technology*, 14(5), 770–777. <https://doi.org/10.18178/ijiet.2024.14.5.2101>
- Tambusai, A. R., & Rakhmawati, F. (2023). Pengembangan e-modul berbasis pendekatan STEAM (science, technology, engineering, art and mathematic) Pada materi segi empat dan segitiga. *Euclid*, 10(1), 213.
- Tampa, A., Nasrullah, N., & Amry, K. (2023). Development of PDF Flip-Based E-Module for Mathematics Learning. *MaPan: Jurnal Matematika Dan Pembelajaran*, 11(1), 53–70.
- Titania, T., & Widodo, S. (2020). Pengembangan Media Pembelajaran Video Animasi Untuk Mata Pelajaran Mekanika Teknik Kelas X DEsain Pemodelan Dan Informasi Bangunan di SMK N 2 Yogyakarta. *Jurnal Pendidikan Teknik Sipil*, 2(2), 89–94. <https://doi.org/10.21831/jpts.v2i2.36343>
- Turčáni, M., Balogh, Z., & Kohútek, M. (2024). Evaluating computer science students reading comprehension of educational multimedia-enhanced text using scalable eye-tracking

- methodology. *Smart Learning Environments*, 11(1). <https://doi.org/10.1186/s40561-024-00318-5>
- Wahyuni, D. S., Rozimela, Y., Ardi, H., Mukhaiyar, M., & Fatdha, T. S. E. (2023). Proposing A Web-Based Interactive Module for Education for Sustainable Development In English for Computer Science. *Register Journal*, 16(1), 1–23. <https://doi.org/10.18326/rgt.v16i1.1-23>
- Zuhrie, M. S., Munoto, M., Asto B, I. G. P., Anifah, L., & Hasanah, N. (2020). Learning Tool for Robotics Basic Programming Based on Contextual Teaching and Learning to Improve Problem-Solving Skills. *Jurnal Pendidikan Teknologi Dan Kejuruan*, 26(1), 76–82. <https://doi.org/10.21831/jptk.v25i1.22856>