



Validity and Effectiveness of E-Module-Based Learning Media in Informatics Subjects

Dimi Oksila¹, Giatman¹, Dedy Irfan¹, Khofifah Alawyah^{1*}

¹Program Magister Pendidikan Teknologi dan Kejuruan, Fakultas Teknik, Universitas Negeri Padang, Padang, Indonesia.

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Corresponding Author:

Khofifah Alawyah

khofifah@student.unp.ac.id

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Abstract: Understanding programming algorithms, is a basic competency that must be mastered by high school students in informatics subjects. However, students have difficulty in mastering programming algorithm material as seen by the learning outcomes of students who are still below the KKM, the use of learning media is still conventional (ordinary printed books, whiteboards, limited teaching modules, LCD projectors as well as power points). This research uses the Research and Development (R&D) research method with the 4D development model which consists of 4 stages, namely define, design, development, and disseminate. The data analysis technique used is descriptive data analysis to describe the validity, practicality, and effectiveness of the developed learning media. The results of this development research are informatics e-modules. The results of feasibility validity media experts in the very feasible category, the results of feasibility validity material experts in the very feasible category, the results of practicality teachers in the very practical category, the results of practicality testing by students in the very practical category, and the results of Paired Samples Test testing obtained data $Sig < 0.005$ ($0.001 < 0.005$), $T_{count} > T_{table}$ ($3.734 > 20.040$) means effective, so this media is valid, practical, and effective to use as learning media.

Keywords: E-Module; Informatics; Learning media

Introduction

Education is an academic process in improving the social, cultural, moral or religious values of learners (Awwaliyah & Baharun, 2019). Education can also prepare learners to face challenges in real life (Alawyah et al., 2024; Fidela & Fadilah, 2024; Karmana, 2024). Educators are required to make students a generation that is able to increase the capacity to develop their ability to find, manage, and evaluate information and solve problems, and actively participate in community activities (Alawyah et al., 2024; Supriadi et al., 2020). Law number 20 of 2003 concerning the National Education System states that education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their

potential to have religious spiritual strength, self-control, personality, intelligence, noble character and skills needed in society, nation and state (Alawyah et al., 2024). The learning atmosphere is created in order to create interaction between teachers and students, students with students and students with learning media and the environment in achieving educational goals (Sapira & Ansori, 2024; Faruqi, 2018). Therefore, learning methods, strategies and media must be designed as effectively as possible by utilizing learning resources and technological developments (Adhana & Andriani, 2024; Hikmawati et al., 2023).

Changes to methods, strategies, and utilization of learning resources also occur due to changes in the curriculum (Lahiya et al., 2025; Wong & Tian, 2025). The change in curriculum from 2013 to the independent learning curriculum turned out to make significant

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changes to approaches, strategies, methods and learning models (Suryati et al., 2023). The independent learning curriculum is given meaning as a learning design that provides opportunities for students to learn calmly, relaxed, fun, pressure-free to show their natural talents. Independent learning focuses on freedom and creative thinking (Anita et al., 2024). The independent learning policy is expected to be able to make the world of education carefree, dynamic, and also flexible in a way that utilizes the use of technology (Kapelela et al., 2025; Shahab et al., 2025).

The structure of the independent learning curriculum for grades X, XI and XII SMA/MA in 2023/2024 is based on Kepmendikbudristek Number 262 of 2022 concerning Amendments to Kepmendikbud Number 56 of 2022. Regarding Guidelines for Curriculum Implementation in the Context of Learning Recovery, that the development of the education unit curriculum refers to the Merdeka Curriculum for upper education as a whole. The curriculum structure in upper education is divided into two main activities, namely, Intracurricular Learning and the Pancasila Student Profile Strengthening Project Intracurricular learning activities for each subject refer to learning outcomes.

Informatics subjects that were originally in the 2013 curriculum were only used as ICT guidance. This is also influenced by changes in current environmental conditions, that humans live in a digital era which is often called Industry 4.0 (Shahzad et al., 2025; Sulich & Zema, 2025). Industry 4.0 many things are done by humans by utilizing computer-based intelligent machines and the internet (Kumar & Vijay, 2025). Humans today are also referred to as society 5.0 because they live in the physical world as well as in the cyber world when doing all activities online (Raghu et al., 2025). This is why informatics subjects are not only taught at the university level, but have begun to be taught at the secondary education level (Kidwai et al., 2025). In this subject, computer technology and systems built using computer technology are taught (Murodov, 2023; Gong et al., 2024). It also teaches how to utilize computer technology, and how computers work (Liu, 2025). Through informatics subjects, it is hoped that in the future students will not only be able to use computer technology, but also know when technology is appropriate to be used to complete work, even to create technological applications to solve various problems (Rashid & Kausik, 2024).

Based on researcher observation using Interview techniques at SMA Negeri 1 Batang Anai with one of the teachers, he conveyed especially in class XII that the teaching materials used at SMA Negeri 1 Batang Anai were already available, such as printed books, LKS, conventional modules. Print books that can be borrowed in the library are also limited. E-Modules used at SMA

Negeri 1 Batang Anai are only in the form of word or PDF documents, no one has used Flipbook E-Modules. The E-Module developed at SMA Negeri 1 Batang Anai only consists of a series of writings and is not accompanied by audio, video, and motion animation used in the E-Module so that in implementing teaching materials during class learning activities it does not attract students' attention and does not create active learning.

Teaching materials that only consist of a series of writings and pictures do not make the material information received by students last long in their memories, because they do not make much use of students' sensory organs, causing students to feel bored during learning activities. Learning resources are still oriented to memorization not concept development, limited learning resources so as not to invite students to learn independently. For this reason, the use of innovative and creative teaching materials is needed through the creation of teaching materials with the Flip PDF Corporate Edision application, so that students can have independent learning materials that can be used anywhere with unlimited time and students can be active and able to think scientifically in the learning process at SMAN1 Batang Anai. Thus, creating a learning atmosphere that is in harmony with science and technology.

According to Bayne (2024), the Flip PDF corporate edision application is one of the applications that supports as learning media that helps in the learning process, because the Flip PDF Corporate Edision application is not only fixated on writing but is supported by motion animation, video, and audio which can make an interactive learning media interesting so that learning becomes not monotonous. Flip PDF Corporate is a software that can be used to open a module page like a book. By using Flip PDF Corporate, students are more interested in learning because the appearance of Flip PDF Corporate is very attractive (Susanti & Sholihah, 2021).

Teaching materials that use the Flip PDF corporate edition application encourage students to learn independently, and students can repeat the material until they really understand what they are learning (Putri et al., 2024; Sanz-Angulo et al., 2025; Yuan et al., 2024). Flip PDF Corporate Edition is an application for creating Flip-based teaching materials that have a book-like appearance with content inside that can add animation or video, both offline and online videos, and can add audio and images for material explanation (Arafah & Febianti, 2024), to Susanti & Sholihah (2021), Flip PDF Corporate is a software that can be used to open the pages of a teaching material like a book. Teaching materials that use the Flip PDF Corporate

Edition application can increase interaction between educators and student (Alawyah et al., 2024).

Method

This research is a Research and Development (RnD) study, the development model in this study refers to the 4D (four-D) research and development model. The 4D research and development model consists of 4 main stages, namely define, design, development, and disseminate (Indaryanti et al., 2025). The research instruments used are media expert validation questionnaire sheets, teacher and student practicality sheets, and test instruments in the form of pre-test and post test questions. The data analysis technique used is descriptive data analysis to describe validity, practicality, and T test to see how influential the learning media developed.

Result and Discussion

Result

This research aims to produce E-Modules on Informatics subjects. In accordance with the discussion, this research uses the Research and Development method on learning media development with the 4D research model (Define, Design, Development, Disseminate). The results of learning media development research are presented in accordance with those set out in chapter 3 The stages of developing learning media from the results of research with the 4D model, are as follows.

Define Stage

In the needs analysis of the learning module, matters relating to the initial preparation and preparation for its development were carried out. This was done by interviewing teachers and students at SMA Negeri 1 Batang Anai. Algorithms and programming subchapters in class XII informatics subjects are the most important part that students must master. One of the scopes of discussion on algorithms and programming is programming with C language on Arduino and practicing arrays on Arduino.

Based on the results of interviews with teachers and students of SMA Negeri 1 Batang Anai, it was concluded that algoritma and programming aim to provide basic concepts while introducing students to programming with the C language. The teaching materials presented include programming with the C language, variables in programming, understanding operators in arduino programs, synthesizing basic arduino commands, looping on arduino, practicing arrays on arduino using the UnoArduSim Simulator. However, students have

difficulty understanding and knowing how to use programming with C language due to limited teaching materials and there is no E-Module learning media in the learning process.

Researchers found in the field that all XII grade students of SMA Negeri 1 Batang Anais already have android smartphones, but they are still not utilized in the learning process optimally. Therefore, the proposed alternative solution is to utilize students' android smartphones as a tool to open interactive informatics E-Modules packaged in interactive E-Modules. With this media, it is expected that students can learn independently, flexibly (students can use it anywhere and anytime), increase motivation, and understanding in the learning process of basic visual principles and visual communication subjects. Therefore, it is necessary to have a learning module for basic principles of visual and visual communication to assist theoretical learning activity.

Learner analysis was conducted to find out the characteristics in the face-to-face teaching and learning process at school. The interview was conducted in the informatics subject of SMA Negeri 1 Batang Anai. Based on the results of the interview, students are known to be active students and not physically disabled or students who do not have special needs and are able to accept the learning delivered by the teacher in charge of the subject. So that students have no reason not to be able to learn, students can learn by looking at the informatics E-Module. At this stage the researcher also analyzes the material used by the teacher so that students can meet the learning outcomes of the subject. SMA Negeri 1 Batang Anai is currently using the independent curriculum. At the element of programming algorithms in informatics subjects, there are learning outcomes, namely At the end of phase F, students are able to develop large modular programs using the specified programming language, able to understand, maintain, and improve the program structure (static aspects) and execution (dynamic aspects) of a source code, understand standard algorithms and their efficiency strategies, design and implement abstract data structures.

Design Stage (Planning)



Figure 1. cover view

In this second stage, the design of the informatics E-module to be developed began, and researchers have selected materials in accordance with the competencies to be achieved with various references that will help researchers to develop products. Informatics E-Module Design.



Figure 2. Introduction



Figure 5. Learning activities page



Figure 3. General information and core components



Figure 6. Closing page

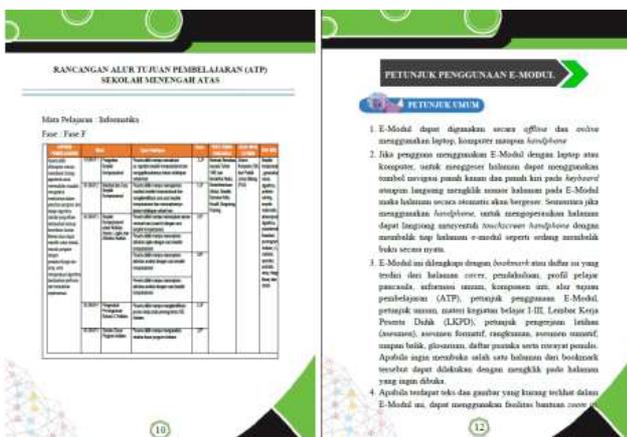


Figure 4. ATP & Instructions page

Development Stage

This development stage is carried out three times, namely product feasibility, product revision, practicality and module effectiveness. At the product manufacturing stage, it is carried out according to the product design. The work on this product is carried out and takes 1 month to complete the informatics E-Module, be it looking for material, drafting designs. Media expert feasibility validity Media validation is the process of evaluating the feasibility of the product design that has been developed.

Validity

Table 1. Media expert feasibility validity1

Assessment Aspect	Average Score	Category
Cover	4.86	Very Feasible
Introduction	4.67	Very Feasible
Main Part	4.67	Very Feasible
Closing section	4.67	Very Feasible
Overall Average	4.71	Very Feasible

Table 1 shows the validation results from media experts on the informatics E-Module that was developed. The validation results show that the media has a feasibility value in the cover design aspect of 4.86, then the feasibility value in the introduction aspect of 4.67, then in the main part of the media aspect gets a feasibility value of 4.67, while in the closing part aspect the feasibility value is 4.67. The assessment results for each aspect of media validation are included in the very appropriate category. Then the average feasibility value in media validation was obtained at 4.71 which is also included in the very eligible category.

Table 2. Media expert feasibility validity 1

Assessment Aspect	Average Score	Category
Cover	4.86	Very Feasible
Introduction	4.33	Very Feasible
Main Part	4.56	Very Feasible
Closing section	4.67	Very Feasible
Overall Average	4.60	Very Feasible

Table 2 shows the validation results from media experts on the developed informatics E-Module. The results of this validation show that the media has a feasibility value in the cover design aspect of 4.86, then a feasibility value in the introductory aspect of 4.67, then in the main aspect of the media the feasibility value is 4.67, while in the cover aspect the feasibility value is 4.67. The results of the assessment of each aspect of this media validation are included in the category of very feasible. Then the average feasibility value in the media validation is obtained at 4.71 which is also included in the category of very feasible.

Table 3. Validity of the eligibility of material expert 1

Assessment Aspect	Average Score	Category
Material Suitability	4.75	Very Feasible
Design Appearance Quality	4.50	Very Feasible
Benefits	4.75	Very Feasible
Overall Average	4.67	Very Feasible

Table 3 shows the validation results from material experts on the developed informatics E-Module. The validation results show that the material has a feasibility

value in the material suitability aspect of 4.75, then the feasibility value in the display quality aspect of 4.50, while the benefit aspect gets a feasibility value of 4.75. The results of the assessment of each aspect of this material validation are included in the very feasible category. Then the average feasibility value in the media validation was obtained at 4.67 which is also included in the very feasible category.

Tabel 4. Material expert feasibility validity 2

Assessment Aspect	Average Score	Category
Material Suitability	4.67	Very Feasible
Design Appearance Quality	4.75	Very Feasible
Benefits	4.50	Very Feasible
Overall Average	4.64	Very Feasible

Table 4 shows the validation results from material experts on the developed informatics E-Module. The validation results show that the material has a feasibility value in the material suitability aspect of 4.67, then the feasibility value in the display quality aspect of 4.75, while the benefit aspect gets a feasibility value of 4.50. The results of the assessment of each aspect of this material validation are included in the very feasible category. Then the average feasibility value in the media validation was obtained at 4.67 which is also included in the very feasible category.

Practicality

Practicality of Informatics E-Module, related to ease of use of the developed media. Practicality results were obtained from responses from practitioners, namely Informatics subject teachers and grade XII students by filling out a practicality questionnaire. Based on filling out the questionnaire, the results of the Informatics E-Module can be seen in Table 5.

Table 5. Results of teacher response questionnaire data

Assessment Aspect	Average Score	Percentage %	Category
Material Suitability	4.60	92.00	Very Practical
Presentation	4.57	91.43	Very Practical
Language	4.75	95.00	Very Practical
Appearance	4.83	96.67	Very Practical
Overall Average	4.69	93.77	Very Practical

Table 5 shows the results of the practicality test of teacher responses to the developed informatics E-Module. The results of this practicality show that the media has a practicality value in the aspect of suitability with the material of 92%, then the practicality value in the presentation aspect of 91.43% in the language aspect of 95%, and the display aspect of 96.67%. The results of the assessment of each aspect of the practicality of the

teacher's response are included in the category of very practical. Then the average practicality value in the teacher response questionnaire was obtained at 93.77% which is also included in the category of very practical. Thus, based on the teacher's response to the developed media, it is categorized as very practical.

Table 6. Results of student response questionnaire

Assessment Aspect	Average Score	Percentage %	Category
Material Suitability	4.31	86.25	Very Practical
Presentation	4.33	86.52	Very Practical
Language	4.39	87.81	Very Practical
Appearance	4.35	87.08	Very Practical
Overall Average	4.35	86.92	Very Practical

Table 6 shows the results of the practicality test of students' responses to the developed informatics E-Module. The results of this practicality show that the media has a practicality value in the aspect of suitability with the material of 86.25%, then the practicality value in the presentation aspect of 86.52% in the language aspect gets a practicality value of 87.81%, in the display aspect of 87.08%. The results of the assessment of each

Table 7. Results of the T-Test (paired samples test)

		Paired Differences							t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference						
					Lower	Upper					
Pair 1	Pre-Test Experimental Class - Pre-Test Control Class	14.844	20.926	3.699	7.299	22.388	4.013	31	.000		
Pair 2	Post-test Experimental Class - Post-test Control Class	14.063	21.306	3.766	6.381	21.744	3.734	31	.001		

The calculation and output results of SPSS Statistics 23 in Table 7 b obtained a sig value, (2-tailed) of 0.001 and a t_{count} value of 3.734. These data indicate that $sig, (2-tailed) < 0.05$, so it can be concluded that H_a is accepted and H_0 is rejected. Then if reviewed based on the t_{count} value (of 3.734) of the post-test of the Control and Experimental classes, it can be compared with the t_{table} value with a df value = 31 (with a t_{table} value = 2.040). It can be seen that these data state $t_{count} > t_{table}$ ($3.734 > 2.040$), so it can be concluded that H_a is accepted and H_0 is rejected. If viewed from the t_{count} value of the pre-test of the control and experimental classes of 4.031 where the t_{table} value of 2.040 means that $t_{count} > t_{table}$ indicates that H_a is accepted and H_0 is rejected.

Based on the analysis, it can be concluded that there is a significant difference between the Post-test learning outcomes of students in the experimental group and the Post-test learning outcomes of students in the control group. In other words, it can also be concluded that this informatics E-module has an effect on the Post-test

aspect of the practicality of the students' responses are included in the category of very practical. Then the average practicality value in the teacher response questionnaire was obtained at 86.92% which is also included in the category of very practical. Thus, based on the students' responses to the media developed, it is categorized as very practical.

Effectiveness

E-Informatics Module in the informatics subject, sub-chapter of programming algorithms, was obtained from effectiveness data by looking at the comparison of student learning outcomes given the E-Informatics Module (experimental class) with students who were not given the E-Informatics Module (control class). The pre-test and post-test given consisted of 20 multiple-choice questions that had been tested based on the results of the test items. For this effectiveness analysis, an independent sample T-test was also used. This test was conducted to obtain evidence that there was a difference in the post-test results between the experimental class given treatment with teaching using the E-Informatics Module and the group not given treatment.

results of the experimental group. With the acceptance of the proposed hypothesis (H_a), the informatics E-module on the programming algorithm subject that was developed is stated to have been effectively used on class XII students of SMA Negeri 1 Batang Anai.

Disseminate Stage (Dissemination)

The dissemination stage is carried out. The developed informatics e-module has been declared valid, practical and effective, this is obtained from the results of validity, practicality and effectiveness tests that have been carried out on the learning media. At this stage, the developed learning media is ready to be used by teachers and students in the informatics subject, sub-chapter of programming algorithms, so that this valid, practical and effective media can be said to be worthy of being distributed. This informatics e-module is ready to be distributed or used by other classes that have the same subject. This media is also promoted to other schools in classes that have the same subject as class XII.

Dissemination of the informatics e-module for the informatics subject, sub-chapter of programming algorithms, is already in the form of an access link. This aims to allow teachers and students to access the informatics e-module on their respective Androids. During the dissemination process, students listen to an explanation of the use of the disseminated informatics e-module. The purpose of this dissemination stage is to determine the implementation of the use of E-learning modules by teachers and students, so that schools can use them as a tool to improve the quality of learning and student learning outcomes.

Discussion

Validity of the Feasibility of the Informatics E-Module

Validity is a measure that shows the extent to which the developed learning media can be considered valid. The learning media validity analysis technique is carried out to evaluate the results of the validation of the developed learning media, with the aim of determining whether the learning media is feasible to proceed to the next stage or not (Della et al., 2024; Aondover et al., 2025). This validity assessment is carried out using a Likert scale with five alternative answers (Bušac et al., 2025). The validity of the informatics E-Module in this study was evaluated through responses from validators consisting of 2 lecturers as media expert validators and two high school teachers as material expert validators. The validators provided an assessment by filling out a validity questionnaire and discussion by showing the developed learning media (Ibrahim et al., 2025).

The evaluation results from the media validator showed an average media feasibility value of 4.71 Validator 1 and 4.60 Validator 2, with the category of very feasible. Meanwhile, the material feasibility validator gave an assessment with an average value of 4.67 Validator 1 and 4.60 Validator 2 also with the category of very feasible. These results are in line with previous research (Hadian et al., 2025), showing that the developed learning media is in the very feasible category. This means that the media must be easy to read and attractively designed to motivate students. Based on the assessment of validators consisting of media experts and material experts, the informatics E-Module is considered very feasible and suitable for use in the learning process in the classroom or independently (Zhang et al., 2025).

Practicality of Informatics E-Modules

The practicality of Informatics E-Modules is related to the ease of use of the media that has been developed. The practicality of learning media is used to measure the extent of the practicality of the learning media (Dai, 2025; Alizadeh et al., 2025). The practicality assessment is carried out using a Likert scale with five alternative

answers. The practicality of Informatics E-Modules was taken through a trial conducted at SMA Negeri 1 Batang Anai. The practicality of this learning media was carried out by distributing practicality questionnaires to teachers and students. The questionnaire was given to 1 teacher and 32 students at SMA Negeri 1 Batang Anai.

The assessment of the practicality of Informatics E-Modules was carried out by teachers who obtained an average result of 93.77% with the category very practical. The practicality of the learning media was also assessed based on student responses and obtained results with an average of 86.92% with the category very practical. The results obtained in this study are in line with research conducted by the results of this study provide information about the practicality of learning media filled by teachers and students in the Practical category (Busuttil & Calleja, 2025). Based on the responses given by students and teachers to the use of modules in learning, it can be concluded that this learning media is very practical. This is in line with the results of Mofu & Kolibu (2025) which states that learning media must be practical and simple. Learning media must be easy to use in order to help teachers in the efficiency of time and energy, so that it can be used easily to achieve learning goals. In addition, learning media also needs to be developed in an attractive form to increase student motivation and learning outcomes.

Effectiveness of Informatics E-Module

The effectiveness of Informatics E-Module is seen from the learning outcomes in the form of pretest and posttest on grade XII students of SMA Negeri 1 Batang Anai. Experimental class students use Informatics E-Module, while control class students receive conventional learning without special treatment. After the treatment was carried out, students in the experimental and control classes were given 20 objective questions that had been tested for validity, reliability, difficulty index, and discriminatory power. The analysis of the effectiveness of learning media was evaluated through hypothesis testing using the t-test.

The t-test analysis (Paired Samples Test) was carried out to compare learning outcomes (posttest) between the control and experimental classes in the Informatics subject, sub-chapter of programming algorithms. Before carrying out the t-test, prerequisite tests must be carried out first, namely the normality test and the homogeneity test. After ensuring that the data distribution is normal and homogeneous, the t-test analysis (Paired Samples Test) was carried out. The results of the analysis showed that the sig value (2-tailed) was 0.001 and the t_{count} value was 3.734. With a sig value smaller than 0.05 and a t_{count} greater than t_{table} ($t_{\text{table}} = 2.040$), it can be concluded that there is a significant difference between the posttest learning outcomes of students in the

experimental group and the posttest learning outcomes of students in the control group.

The results of this study indicate that the Informatics E-Module is effective for use in learning the basic principles of programming algorithms. The research on the development of the Informatics E-Module has received support from several previous research results. The study shows that the Informatics E-Module can help the teaching and learning process. In addition, the development of Informatics E-Module media has also been shown to improve student learning outcomes and stimulate positive responses from students (Erkin & Kiyan, 2025). The use of Informatics E-Module learning media also provides various benefits for teachers and students. Teachers can easily train students' abilities and activeness, motivate students, and make the learning process more enjoyable. Then this media also provides varied, alternative, and innovative learning resources (Mahendri et al., 2023). Based on the results of the research conducted, it can be concluded that the informatics E-Module can be categorized as valid, practical and effective for use in the learning process.

Conclusion

The results of feasibility validity media experts in the very feasible category, the results of feasibility validity material experts in the very feasible category, the results of practicality teachers in the very practical category, the results of practicality testing by students in the very practical category, and the results of Paired Samples Test testing obtained data $\text{Sig} < 0.005$ ($0.001 < 0.005$), $T_{\text{count}} > T_{\text{table}}$ ($3.734 > 20.040$) means effective, so this media is valid, practical, and effective to use as learning media.

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Conceptualization and design of research work, data analysis and interpretation, D.O.; Implementation of field/laboratory experiments and data collection, manuscript preparation, G., D.I., and K.A.

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Conflicts of Interest

The authors declare no conflict of interest.

References

Adhana, H. M., & Andriani, A. E. (2024). Development of Interactive Multimedia based on Problem-Based

- Learning to Improve IPAS Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, 10(9), 6737-6745. <https://doi.org/10.29303/jppipa.v10i9.7588>
- Alawyah, K., Giatman, G., Rizal, F., & Irfan, D. (2024). Needs Analysis of Augmented Reality (AR) Based Learning Media Development in Road and Bridge Construction Subjects. *Jurnal Penelitian Pendidikan IPA*, 10(9), 6993-6700. <https://doi.org/10.29303/jppipa.v10i9.8475>
- Alizadeh, M., Kubli, M., Samei, Z., Dehghani, S., Zahedivafa, M., Bermeo, J. D., Korobeynikova, M., & Gilardi, F. (2025). Open-Source LLMs for Text Annotation: A Practical Guide for Model Setting and Fine-Tuning. *Journal of Computational Social Science*, 8(17), 1-25. <https://doi.org/10.1007/s42001-024-00345-9>
- Anita, A., Yusuf, M., & Hamdany, M. Z. A. (2024). Implementasi Kurikulum Merdeka Belajar pada Pembelajaran Pendidikan Agama Islam dan Budi Pekerti Fase B di SD Negeri 358 Pengkasalu Kabupaten Luwu. *Indonesian Journal of Islamic Educational Review*, 1(3), 169-175. <https://doi.org/10.58230/ijier.v1i3.229>
- Aondover, E. M., Daushe, A. U., Ogunbola, O., & Aondover, P. O. (2025). Media Coverage of Internally Displaced Persons in Two Selected Newspapers in Nigeria. *Journal of Migration and Health*, 11, 100301. <https://doi.org/10.1016/j.jmh.2024.100301>
- Arafah, T. S., & Febianti, Y. N. (2024). Development of Flip pdf Corporate Edition Flip Based E-Module Teaching Materials on Transaction Document Management Materials in Class X Vocational Schools. *Cirebon International Conference on Education and Economics (CICEE)*, 1(1), 454-460. Retrieved from <https://ejournalugj.com/index.php/cicee/article/view/9395>
- Awwaliah, R., & Baharun, H. (2019). Pendidikan Islam dalam Sistem Pendidikan Nasional (Telaah Epistemologi Terhadap Problematika Pendidikan Islam). *Jurnal Ilmiah DIDAKTIKA*, 19(1), 34-49. Retrieved from <https://jurnal.ar-raniry.ac.id/index.php/didaktika/article/download/4193/2726>
- Bayne, S. (2024). Digital Education Utopia. *Learning, Media and Technology*, 49(3), 506-521. <https://doi.org/10.1080/17439884.2023.2262382>
- Bušac, V., Kanceljak, N., Puzić, A. Z., & Ljevak, I. (2025). Croatian Translation and Initial Psychometric Validation of the Negative Behaviors in Health Care Questionnaire. *Nursing Reports*, 15(2), 69. <https://doi.org/10.3390/nursrep15020069>
- Busuttil, L., & Calleja, J. (2025). Teachers' Beliefs and Practices About the Potential of ChatGPT in Teaching Mathematics in Secondary Schools. *Digital*

- Experiences in Mathematics Education*, 1-27. <https://doi.org/10.1007/s40751-024-00168-3>
- Dai, J. (2025). Is Policy Pilot a Viable Path to Sustainable Development? Attention Allocation Perspective. *International Review of Financial Analysis*, 98, 103923. <https://doi.org/10.1016/j.irfa.2025.103923>
- Della, E. I., Ismail, M. H., & AM, M. A. (2024). Development of Interactive Powerpoint Media to Stimulus the Ability to Recognize Flat Shape in Children Aged 5-6 Years. *Jurnal Smart Paud*, 7(2), 102-119. <https://doi.org/10.36709/jspaud.v7i2.130>
- Erkin, Ö., & Kiyan, S. G. (2025). How Does Integrating 'Disaster Nursing' Into Nursing Curricula Impact Nursing Students' Perception of Disaster Literacy and Preparedness?. *BMC Nursing*, 24(1), 1. <https://doi.org/10.1186/s12912-024-02478-8>
- Faruqi, D. (2018). Upaya Meningkatkan Kemampuan Belajar Siswa Melalui Pengelolaan Kelas. *Evaluasi: Jurnal Manajemen Pendidikan Islam*, 2(1), 294-310. <https://doi.org/10.32478/evaluasi.v2i1.80>
- Fidela, W., & Fadilah, M. (2024). Literature Review: Penerapan Model Project Based Learning (PjBL) untuk Meningkatkan Hasil Belajar dan Kemampuan Berpikir Kreatif Siswa SMA. *Jurnal Pendidikan dan Pembelajaran Indonesia (JPPI)*, 4(4), 1498-1511. <https://doi.org/10.53299/jppi.v4i4.745>
- Gong, Y., Ji, H., Tan, K., Qian, W., & Pan, Y. (2024). Research on a Multilevel Practical Teaching System for the Course' Digital Image Processing. *Old and New Technologies of Learning Development in Modern Conditions*, 272. Retrieved from https://books.google.com/books?hl=en&lr=&id=bQ_3EAAAQBAJ&oi=fnd&pg=PA272&dq=info:H Vrv-RKUUIJ:scholar.google.com&ots=RE7gTj9jb8&sig=5xwACbppG0MWtLBGBC06-xd8tEo
- Hadian, M. S. D., Barkah, M. N., Khadidjah, U. L. S., Yuliawati, A. K., Aryanti, A. N., & Suhardiman, S. (2025). Urban Geotourism Development in the Perspective of Stakeholders. *International Journal of Geoheritage and Parks*. <https://doi.org/10.1016/j.ijgeop.2024.12.001>
- Hikmawati, N., Sufiyanto, M. I., & Jamilah, J. (2023). Konsep dan Implementasi Kecerdasan Buatan (Artificial Intelligence) dalam Manajemen Kurikulum SD/MI. *ABUYA: Jurnal Pendidikan Dasar*, 1(1), 1-16. <https://doi.org/10.52185/abuyaVol1iss1Y2023278>
- Ibrahim, N. H., Wallace, J., Piaggio, D., & Pecchia, L. (2025). Validation of a Framework for Assessing Healthcare Facilities in Low-Resource Settings: A Field Study in Selected Facilities in Ethiopia. *Health and Technology*, 15, 201-209. <https://doi.org/10.1007/s12553-025-00943-1>
- Indaryanti, R. B., Harsono, H., Sutarna, S., Murtiyasa, B., & Soemardjoko, B. (2025). 4D Research and Development Model: Trends, Challenges, and Opportunities Review. *Jurnal Kajian Ilmiah*, 25(1), 91-98. <https://doi.org/10.31599/na7deq07>
- Kapelela, C., Mislal, M. A., & Manyengo, P. R. (2025). The Politics of School Governance in the Context of Education Decentralisation Policy Reforms in Selected Public Secondary Schools in Tanzania. *Cogent Education*, 12(1), 2442251. <https://doi.org/10.1080/2331186X.2024.2442251>
- Karmana, I. W. (2024). Penerapan Model Project Based Learning (PjBL) Terhadap Kemampuan Literasi Sains dan Hasil Belajar Peserta Didik pada Pembelajaran IPA di Sekolah. *Panthera: Jurnal Ilmiah Pendidikan Sains dan Terapan*, 4(2), 79-92. <https://doi.org/10.36312/panthera.v4i2.273>
- Kidwai, S., Rojas-Velazquez, D., Lopez-Rincon, A., Kraneveld, A. D., Oberski, D. L., & Meijerman, I. (2025). Keeping Pace in the Age of Innovation: The Perspective of Dutch Pharmaceutical Science Students on the Position of Machine Learning Training in an Undergraduate Curriculum. *Currents in Pharmacy Teaching and Learning*, 17(2), 102231. <https://doi.org/10.1016/j.cptl.2024.102231>
- Kumar, A., & Vijay, R. (2025). Cloud-Based Cobots for Industry 5.0: A Human-Centric Solution. *Intelligent Robots and Cobots: Industry 5.0 Applications*, 221-245.
- Lahiya, A., Arifudin, O., & Matiala, T. F. (2025). Education Administration Reform: A Case Study on the Implementation of The Merdeka Curriculum. *INJOSEDU: International Journal of Social and Education*, 2(2), 29-37. Retrieved from <https://btqur.net/index.php/EDUS/article/view/10>
- Liu, J. (2025). Development of Interactive English E-Learning Video Entertainment Teaching Environment Based on Virtual Reality and Game Teaching Emotion Analysis. *Entertainment Computing*, 52, 100884. <https://doi.org/10.1016/j.entcom.2024.100884>
- 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>
- Mofu, B. D. R., & Kolibu, D. R. (2025). Instilling PAK Values Using Augmented Reality as an Innovative Learning Media. *Enrichment: Journal of Multidisciplinary Research and Development*, 2(10), 1-8. <https://doi.org/10.55324/enrichment.v2i10.249>
- Murodov, O. T. (2023). Innovative Information Technologies and New Methods and Tools for Their Application in Today's Education. *International*

- Multidisciplinary Journal for Research & Development*, 10(12). Retrieved from <https://www.ijmrd.in/index.php/imjrd/article/view/664>
- Putri, S. F. A., Siminto, S., & Qamariah, Z. (2024). The Development of a Vocabulary Module Using Flip PDF Corporate Software at Secondary School. *Darussalam English Journal (DEJ)*, 4(2), 120-149. <https://doi.org/10.30739/dej.v4i2.3335>
- Raghu, N., Mahesh, T. R., Vivek, V., Kumaran, S. Y., Kannanugo, N., & Vishwanatha, S. (2025). IoT-Enabled Safety and Secure Smart Homes for Elderly People. In *Future of Digital Technology and AI in Social Sectors* (pp. 297-328). IGI Global.
- Rashid, A. B., & Kausik, MD. A. K. (2024). AI Revolutionizing Industries Worldwide: A Comprehensive Overview of Its Diverse Applications. *Hybrid Advances*, 7, 100277. <https://doi.org/10.1016/j.hybadv.2024.100277>
- Sanz-Angulo, P., Galindo-Melero, J., De-Diego-Poncela, S., & Martín, Ó. (2025). Promoting Soft Skills in Higher Engineering Education: Assessment of the Impact of a Teaching Methodology Based on Flipped Learning, Cooperative Work and Gamification. *Education and Information Technologies*, 1-44. <https://doi.org/10.1007/s10639-025-13322-0>
- Sapira, S., & Ansori, I. (2024). Development of Science Learning Media Based on Augmented Reality Book with Problem Based Learning Model to Improve Learning Outcomes of Third Grade Students. *Jurnal Penelitian Pendidikan IPA*, 10(6), 3249-3260. <https://doi.org/10.29303/jppipa.v10i6.7642>
- Shahab, S., Ayub, A., Shabir, M., & Aziz, Z. (2025). The Impact of New Managerialism on Academic Identity and Governance: A Comparative Study of University Cultures in the UK and Pakistan. *Journal for Social Science Archives*, 3(1), 452-467. <https://doi.org/10.59075/jssa.v3i1.131>
- Shahzad, M. F., Liu, H., & Zahid, H. (2025). Industry 4.0 Technologies and Sustainable Performance: Do Green Supply Chain Collaboration, Circular Economy Practices, Technological Readiness and Environmental Dynamism Matter?. *Journal of Manufacturing Technology Management*, 36(1), 1-22. <https://doi.org/10.1108/JMTM-05-2024-0236>
- Sulich, A., & Zema, T. (2025). Role of the Management in the World Driven by the Industry 4.0. *Education Excellence and Innovation Management: A 2025 Vision to Sustain Economic Development during Global Challenges*, 2565-2576. <https://doi.org/10.5281/zenodo.4083795>
- Supriadi, S., Wildan, W., & Laksmiwati, D. (2020). Implementasi Model Pembelajaran Berbasis Masalah dan Pengaruhnya Terhadap Perkembangan Karakter Mahasiswa. *Jurnal Penelitian Pendidikan IPA*, 6(1), 63-68. <https://doi.org/10.29303/jppipa.v6i1.323>
- Suryati, L., Ambiyar, A., & Jalinus, N. (2023). Evaluation of the Implementation of the Independent Curriculum with a Technology-Based Learning Model. *Jurnal Penelitian dan Pengembangan Pendidikan*, 7(3), 438-447. <https://doi.org/10.23887/jppp.v7i3.66635>
- Susanti, E. D., & Sholihah, U. (2021). Pengembangan E-Modul Berbasis Flip Pdf Corporate pada Materi Luas dan Volume Bola. *RANGE: Jurnal Pendidikan Matematika*, 3(1), 37-46. <https://doi.org/10.32938/jpm.v3i1.1275>
- Wong, C. Y. C., & Tian, Z. (2025). Maximizing Students' Content and Language Development: The Pedagogical Potential of Translanguaging in a Chinese Immersion Setting. *Learning and Instruction*, 95, 102023. <https://doi.org/10.1016/j.learninstruc.2024.102023>
- Yuan, X., Wan, J., An, D., Lu, J., & Yuan, P. (2024). Multi-Method Integrated Experimental Teaching Reform of a Programming Course Based on the OBE-CDIO Model Under the Background of Engineering Education. *Scientific Reports*, 14(1), 16623. <https://doi.org/10.1038/s41598-024-67667-6>
- Zhang, D., Fu, M., Zhang, J., Li, Y., Chen, L., Chen, Y. J., Zhong, Z., & Zhang, Y. P. (2025). Evaluating Whether Nonimmersion Virtual Reality Simulation Training Improves Nursing Competency in Isolation Wards: Randomized Controlled Trial. *Journal of Medical Internet Research*, 27, e63131. <https://doi.org/10.2196/63131>