

Development of Instructional Video and E-Module Assisted by Oracle VM VirtualBox on Operating System Installation to Improve SMK Students' Competency

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Abstract: This research aims to develop learning media in the form of instructional videos and e-modules for Windows installation using Oracle VM VirtualBox, and to assess their validity, practicality, and effectiveness in improving the competency of Grade XI Computer and Networking Engineering (TKJ) students at SMK Negeri 3 Mukomuko. This study employed a Research and Development (R&D) method using the ADDIE development model, comprising five stages: analysis, design, development, implementation, and evaluation. The effectiveness test used a quasi-experimental design with a nonequivalent control group. Data were collected through expert validation sheets, practicality questionnaires, and pretest-posttest assessments covering cognitive, affective, and psychomotor domains. Results show that both media are valid, with mean validity scores of 0.87 for the instructional video and 0.88 for the e-module. Both are practical, with practicality rates of 88% and 89% respectively. In terms of effectiveness, cognitive outcomes improved from 67.36 to 87.16 ($p = 0.001$), affective outcomes from 63.43 to 84.47 ($p = 0.000$), and psychomotor outcomes from 52.38 to 81.42 ($p < 0.001$). These findings indicate that the combination of visual demonstration and self-directed conceptual guidance, supported by a safe virtual practice environment, effectively addresses the procedural learning challenges commonly faced in operating system installation instruction. The instructional video and e-module for Windows installation using Oracle VM VirtualBox are thus declared valid, practical, and effective as learning media for the Operating System Installation and Configuration subject, and are recommended as a replicable model for other procedural vocational learning topics.

Keywords: ADDIE model; E-module; Instructional video; Operating system installation; VirtualBox; Vocational education

Introduction

The rapid development of information and communication technology has brought significant changes in various aspects of life, including education. The integration of technology in learning is one of the efforts to improve educational quality and help students understand subject matter more effectively (Dwi Sanjaya et al., 2022). This reflects a broader recognized need for digital competence and literacy within educational

research and practice (Spante et al., 2018). In vocational education, particularly in the Computer and Networking Engineering (TKJ) study program, the use of learning technology is crucial because the majority of the content requires both conceptual understanding and practical skills related to the operation of computer hardware and software (Koriaty Sri, 2020). This is further underscored by evaluations of vocational education systems in the era of Industry 4.0 and Society 5.0, which have identified persistent challenges in

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facilities, teacher competence, and technology infrastructure that must be addressed to prepare a workforce aligned with industry needs (Wulandari et al., 2025).

One of the core competencies that TKJ students must master is the ability to install and configure operating systems. This is a fundamental skill that underpins more advanced topics in computer and network administration. This is reflected in prior efforts to develop dedicated operating system learning media, such as Budiman et al. (2019), who developed an Android-based learning medium specifically for introducing operating system concepts, and more recently Maulana et al. (2025), who developed a mobile-based e-module for server operating system configuration content in a Network Administration subject at a vocational high school after finding that conventional modules provided insufficient visualization of technical, step-by-step procedures, a challenge closely mirroring the installation difficulties addressed in the present study. The installation process demands not only conceptual understanding but also the ability to follow systematic procedures accurately. However, in practice, this learning content often faces various obstacles. Instruction dominated by verbal explanation makes it difficult for students to clearly follow the installation steps. Furthermore, limited laboratory time and the risk of damaging the primary operating system prevent students from practicing independently and repeatedly (Savira et al., 2025).

One viable solution is to leverage technology-based learning media. Research has shown that appropriate media can provide more engaging, interactive learning experiences and facilitate understanding of procedural content (Lestari et al., 2024). Two media types particularly suited for operating system installation are instructional videos and e-modules. Instructional videos are audio-visual media capable of demonstrating step-by-step processes directly, enabling students to observe each stage clearly (Yuliana et al., 2023). E-modules are digital teaching materials designed for self-directed learning, containing explanations, illustrations, and practice guides (Santosa et al., 2017), an approach also demonstrated by Aryawan et al. (2018) in their development of an interactive e-module for a technically dense secondary school subject, and supported by broader evidence that e-modules consistently achieve high practicality ratings from both teachers and students (Utama & Zulyusri, 2022). The combination of these two media is expected to complement each other: videos provide visual demonstration, while e-modules offer conceptual explanation and written guidance.

Additionally, virtualization software such as Oracle VM VirtualBox enables students to perform Windows installation simulations safely without risk to the

primary operating system, allowing repeated practice that reinforces skills (Anam et al., 2020). This approach aligns with the Cognitive Theory of Multimedia Learning, which posits that students learn more effectively from words and pictures presented together than from words alone, because dual-channel processing of verbal and visual information reduces cognitive load and strengthens the construction of mental models for procedural tasks (Mayer, 2024). It is further supported by Self-Regulated Learning theory, which emphasizes that materials allowing students to control the pace, repetition, and sequence of their own learning foster greater learner autonomy and sustained engagement, particularly for skill-based content that requires repeated practice such as operating system installation (Lan & Zhou, 2025). This is consistent with recent evidence that digitally-mediated learning environments strengthen student independence through improved self-regulation and reflective learning skills (Haikal et al., 2025).

Previous studies support the relevance of video tutorials and e-modules in improving learning outcomes for operating system installation content (Rejeki et al., 2023; Ayuardini, 2023; Maulidiansy et al., 2023). However, research that simultaneously develops and integrates instructional video and e-module media for Windows installation content using VirtualBox in the vocational context remains limited. This gap is particularly significant given that vocational schools often face constraints such as limited laboratory hours, restricted access to spare hardware for repeated installation practice, and the risk of system failure during hands-on training, conditions under which a combined video-and-e-module approach, supported by a safe virtual environment, offers a practical and scalable solution. Therefore, this study aims to develop instructional video and e-module media for Windows installation using Oracle VM VirtualBox, and to determine their validity, practicality, and effectiveness in improving student competency.

Method

This research employed a Research and Development (R&D) approach aimed at producing a learning media product and testing its feasibility in the learning process (Dewi, 2023), combined with a quasi-experimental design using a nonequivalent control group to test the effectiveness of the developed media. This research was conducted at SMK Negeri 3 Mukomuko during the Even Semester of the 2025/2026 Academic Year. The population of this study consisted of 60 Grade XI Computer and Networking Engineering (TKJ) students at SMK Negeri 3 Mukomuko. A sample

of 30 students was selected using a purposive sampling technique (Sugiyono, 2024), consisting of two groups of 15 students each: an experimental group receiving instruction with the developed instructional video and e-module, and a control group receiving conventional instruction. The research variables consisted of the instructional video and e-module (independent variable) and student competency in the cognitive, affective, and psychomotor domains (dependent

variable). Data collection methods included expert validation sheets (assessed using Aiken's V formula), practicality questionnaires, and pretest-posttest learning outcome tests covering the three competency domains. The tools and materials used in this research included laptop/computer units, Oracle VM VirtualBox software, a projector, expert validation sheets, and student questionnaires.



Figure 1. ADDIE development model stages applied in this research

The ADDIE development model was applied, consisting of five stages: analysis, design, development, implementation, and evaluation (Branch, 2013), as illustrated in Figure 1. The five stages were implemented systematically: (1) Analysis, identification of learning needs and existing media; (2) Design, planning objectives, content, and instruments; (3) Development, production, expert validation, and revision; (4) Implementation, applying media to the experimental group and assessing practicality; (5) Evaluation, testing effectiveness through pretest-posttest comparisons between the experimental and control groups.

Data analysis employed descriptive statistics for validation and practicality data, and paired sample t-test (SPSS) for effectiveness data.

Result and Discussion

Analysis Stage

The analysis stage showed that the development of instructional video and e-module for Windows installation using VirtualBox is strongly needed in the Operating System Installation and Configuration subject at SMK Negeri 3 Mukomuko. Based on a needs questionnaire administered to teachers and students, both groups gave very positive responses, as presented in Tables 1 and 2.

Table 1. Needs Analysis Results from the Teacher's Perspective

Needs Aspect	Code	Mean Score
Current Learning Conditions	KPSI	4.25
Student Characteristics	KS	4.32
Learning Media Needs	KMP	4.44
Curriculum Integration	IK	4.38
Expectations for video and e-module media	HMI	4.56
Overall Mean Score		4.39

Table 2. Needs Analysis Results from the Students' Perspective

Needs Aspect	Code	Mean Score
Current Learning Experience	PPSI	4.18
Student Characteristics	KS	4.35
Learning Needs	Kpem	4.52
Learning Media Preferences	PMP	4.45
Expectations for Video and E-Module Media	HMI	4.58
Overall Mean Score		4.42

The analysis findings confirm that students face challenges in understanding procedural content delivered solely through verbal instruction, and that both teachers and students strongly require innovative digital media. These results are consistent with the Cognitive Theory of Multimedia Learning (Mayer, 2024). A comparable need was identified by Nillofa Ende et al. (2022), who found that students in a vocational Basic Electrical and Electronics course struggled with procedural, technically dense material when taught through conventional teacher-centered methods, prompting the development of an interactive, self-directed e-module as a more effective alternative.

Design Stage

The design stage involved planning two digital media products: an instructional video and an e-module on Windows installation using Oracle VM VirtualBox. The instructional video was developed in MP4 format through screen recording, presenting step-by-step demonstrations with voice narration, text annotations, and high-resolution visuals. The e-module was prepared in PDF format with a systematic structure including introduction, learning objectives, content explanation, screenshot-illustrated procedures, and evaluation tasks. This design is grounded in the Cognitive Theory of

Multimedia Learning (Zain et al., 2022) and self-regulated learning principles (Møller-Skau et al., 2022).

Development Stage

The developed media were subjected to expert validation using Aiken's V formula. Results for the instructional video and e-module are presented in Tables 3 and 4, and visualized in Figure 2.

Table 3. Instructional Video Validity Results

Assessed Aspect	Aiken's V	Category
Content Appropriateness	0.90	Valid
Clarity of Presentation	0.88	Valid
Visual Appeal	0.92	Valid
Ease of Use	0.82	Valid
Learning Benefit	0.83	Valid
Mean	0.87	Valid

Table 4. E-Module Validity Results

Assessed Aspect	Aiken's V	Category
Self-Instructional	0.85	Valid
Self-Contained	0.88	Valid
Stand Alone	0.92	Valid
Adaptive	0.87	Valid
User Friendly	0.90	Valid
Mean	0.88	Valid

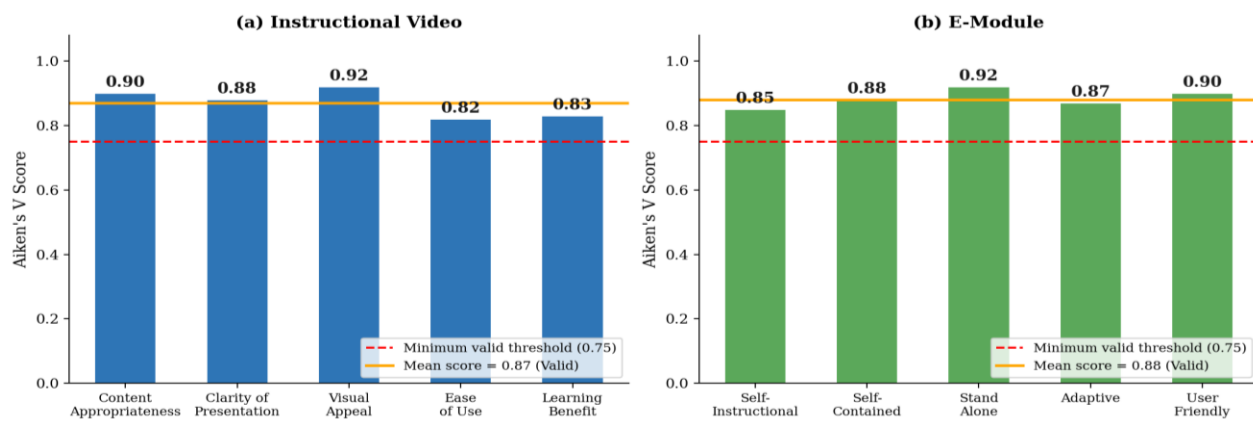


Figure 2. Expert validation results for instructional video and e-module

Implementation Stage

The implementation stage assessed practicality through student questionnaires after media use. Results are presented in Tables 5 and 6 and visualized in Figure 3.

Table 5. Instructional Video Practicality Results

Assessed Aspect	Aiken's V	Category
Self-Instructional	0.85	Valid
Self-Contained	0.88	Valid
Stand Alone	0.92	Valid
Adaptive	0.87	Valid
User Friendly	0.90	Valid
Mean	0.88	Valid

The instructional video achieved an overall validity score of 0.87 (Valid), with the highest score on visual appeal (0.92). The e-module obtained a mean validity score of 0.88 (Valid), with the highest score on stand-alone characteristics (0.92). Both media exceeded the minimum validity threshold of 0.75 on all assessed aspects, confirming their readiness for implementation. These results are consistent with the Cognitive Theory of Multimedia Learning and prior research on digital vocational media. Nugraha et al. (2024) similarly developed a video tutorial for graphic design instruction in vocational high schools using the Borg and Gall model and obtained comparably high validity scores (4.53–4.83 on a 5-point scale, categorized as "Very Valid"), along with a practicality score of 4.79 ("Very Practical"). Likewise, Masruri et al. (2024) developed a project-based learning video tutorial for high school biology instruction to strengthen students' collaborative skills and reported strong validation outcomes for the media. These findings reinforce that procedurally structured, visually demonstrated media consistently achieve strong expert validation across diverse vocational and academic subjects, supporting the validity results obtained in the present study.

Table 6. E-Module Practicality Results

Practicality Aspect	Score (%)	Category
Ease of Use	89	Practical
Clarity of Content	89	Practical
Visual Attractiveness	90	Very Practical
Learning Benefit	91	Very Practical
Learning Efficiency	86	Practical
Mean	89	Practical

The instructional video achieved a mean practicality score of 88% (Practical) and the e-module 89% (Practical). Both media surpassed the 80% practical threshold across all assessed aspects. The e-module's highest score on learning benefit (91%) confirms its strong role in supporting student comprehension and

practice activities. These results are consistent with the Cognitive Theory of Multimedia Learning and Self-Regulated Learning theory (Lan & Zhou, 2025; Santosa et al., 2017). This is consistent with Nillofa Ende et al. (2022), whose web-based interactive e-module, developed using the Richey and Klein Design and Development model, was similarly designed for accessible, self-directed use across devices, supporting practical, learner-controlled engagement with technical vocational content.

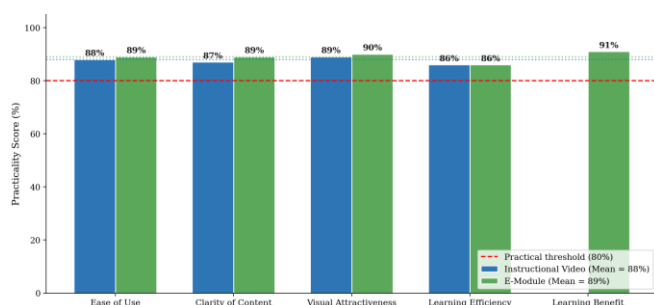


Figure 3. Practicality score comparison: instructional video vs. e-module

Evaluation Stage

The evaluation stage examined effectiveness through pretest-posttest comparisons using paired sample t-test across cognitive, affective, and psychomotor domains. A summary of results is presented in Table 7 and Figure 4.

Table 7. Summary of Learning Effectiveness Results

Domain	Mean Pretest	Mean Posttest	Gain	t-value	Sig.
Cognitive	67.36	87.16	19.80	6.828	0.001
Affective	63.43	84.47	21.04	9.367	0.000
Psychomotor	52.38	81.42	29.04	64.762	<0.001

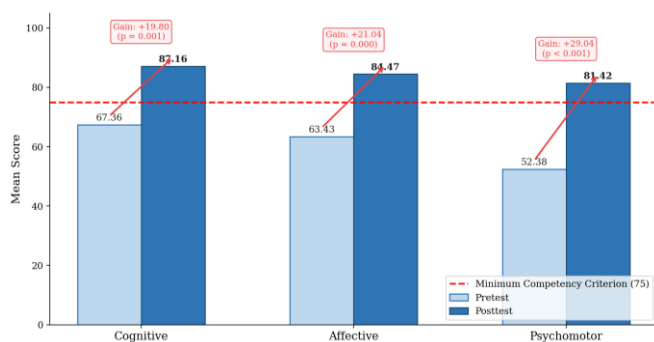


Figure 4. Pretest and posttest results across cognitive, affective, and psychomotor domains

In the cognitive domain, the mean score increased from 67.36 to 87.16 (gain = 19.80, $t = 6.828$, $p = 0.001$). In the affective domain, scores rose from 63.43 to 84.47 (gain = 21.04, $t = 9.367$, $p = 0.000$). The largest gain was in the psychomotor domain: from 52.38 to 81.42 (gain =

29.04, $t = 64.762$, $p < 0.001$). All three domains showed statistically significant improvement ($p < 0.05$), confirming that the media is effective. These outcomes reflect the Cognitive Theory of Multimedia Learning, the video provided concrete procedural demonstrations, while the e-module reinforced conceptual understanding. This pattern is consistent with Ayuning Tyas et al. (2024), who used a quasi-experimental nonequivalent control group design to compare a Canva-based e-module against conventional instruction among Grade X students and found improved cognitive learning outcomes in the experimental group through pretest-posttest evaluation. It is further supported by Sa'idah et al. (2024), who developed a Problem-Based Learning e-module using the ADDIE model and reported improved cognitive ability among elementary students following its implementation, and by Tralisno et al. (2023), who found that simulation-based mathematics multimedia effectively strengthened students' psychomotor skills in a geometry topic, a pattern that parallels the pronounced psychomotor gain observed in the present study's operating system installation practice.

Overall, the integration of instructional video and e-module media, supported by Oracle VM VirtualBox, produces a valid, practical, and effective learning solution for Operating System Installation and Configuration in vocational education. The use of VirtualBox as a virtual practice environment enables safe, efficient simulation of Windows installation, making it particularly suited to the vocational context (Manik et al., 2024). These results extend prior research and affirm that this integrated media approach can serve as a replicable model for developing digital learning materials in other procedural vocational topics.

Conclusion

This research successfully developed instructional video and e-module media for Windows installation using Oracle VM VirtualBox for Grade XI TKJ students at SMK Negeri 3 Mukomuko. Both media were declared valid (video: 0.87; e-module: 0.88), practical (video: 88%; e-module: 89%), and effective in improving student competency across cognitive ($p = 0.001$), affective ($p = 0.000$), and psychomotor ($p < 0.001$) domains, with the video's step-by-step visual demonstration and the e-module's structured self-directed guidance jointly addressing the difficulty of learning procedural content that is commonly reported in operating system installation instruction. The integration of instructional video and e-module, supported by VirtualBox as a safe virtual practice environment, provides an innovative and effective learning solution for procedural and

practical vocational content. This media development model is recommended for application in other practice-oriented vocational subjects with similar characteristics.

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Author Contributions

Conceptualization, F.M.F. and A.H.; methodology, F.M.F.; software, F.M.F.; validation, F.M.F. and A.H.; formal analysis, F.M.F.; investigation, F.M.F.; resources, F.M.F.; data curation, F.M.F.; writing — original draft preparation, F.M.F.; writing — review and editing, A.H.; visualization, F.M.F.; supervision, A.H.; project administration, F.M.F. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

References

- Anam, M. K., Sudyana, D., Ulfah, A. N., Lizarti, N., & Agustin. (2020). Optimalisasi Penggunaan VirtualBox Sebagai Virtual Computer Laboratory untuk Simulasi Jaringan dan Praktikum pada SMK Taruna Mandiri Pekanbaru. *J-PEMAS: Jurnal Pengabdian Masyarakat*, 1(2), 39–44. Retrieved from <http://jurnal.sar.ac.id/index.php/J-PEMAS/article/view/654>
- Aryawan, R., Sudatha, I. G. W., & Sukmana, A. I. W. I. Y. (2018). Pengembangan E-Modul Interaktif Mata Pelajaran IPS di SMP Negeri 1 Singaraja. *Jurnal Edutech Undiksha*, 6(2), 180–191. <https://doi.org/10.23887/jeu.v6i2.20290>
- Ayuardini, M. (2023). Pengembangan E-Modul Interaktif Berbasis Flipbook pada Pembahasan Biologi. *Faktor Exacta*, 15(4), 259. <https://doi.org/10.30998/faktorexacta.v15i4.14924>
- Ayuning Tyas, T., Sofyan Hardi, O., & Setiawan, C. (2024). Pemanfaatan E-Modul Berbasis Canva terhadap Hasil Belajar Kognitif Peserta Didik Di SMAN 61 Jakarta. *JPIG*, 9(1), 65–74. <https://doi.org/10.21067/jpig.v9i1.9801>
- Branch, R. M. (2013). *Instructional Design: The ADDIE Approach*. Springer. <https://doi.org/10.1007/978-0-387-09506-6>
- Budiman, R. D. A., & Nurbani, N. (2019). Pengembangan Media Pembelajaran Pengenalan Sistem Operasi Berbasis Android. *Edukasi: Jurnal Pendidikan*, 17(2), 183–197. <https://doi.org/10.31571/edukasi.v17i2.1305>
- Dewi, M. (2023). *Metode Penelitian Research is Fun*. CV. Muharika Rumah Ilmiah.
- Dwi Sanjaya, R., Prasetyo, I., & Rossydi, A. (2022). Evaluasi Program Pembelajaran on the Job Training di Lembaga Pendidikan Vokasi. *Airman: Jurnal Teknik Dan Keselamatan Transportasi*, 5(1), 29–37. <https://doi.org/10.46509/ajtk.v5i1.208>
- Haikal, A., Azahra, N., & Awalia, A. A. (2025). Kajian Literatur: Efektivitas Learning Management System (LMS) dalam Meningkatkan Kemandirian dan Hasil Belajar Siswa di Era Digital. *Paedagogie*, 20(2), 343–352. <https://doi.org/10.31603/paedagogie.v20i2.15324>
- Koriaty Sri, M. D. A. (2020). Pengembangan Model Pembelajaran Game Edukasi Untuk Meningkatkan Minat Siswa Kelas X TKL SMK Negeri 7 Pontianak. *Jurnal Edukasi*, 14(2), 277–288. Retrieved from <http://journal.ikipgriptk.ac.id/index.php/edukasi/article/view/360/349>
- Lan, M., & Zhou, X. (2025). A qualitative systematic review on AI empowered self-regulated learning in higher education. *Npj Science of Learning*, 10(1), 1–16. <https://doi.org/10.1038/s41539-025-00319-0>
- Lestari, E., Shaluhiah, Z., & Adi, M. S. (2024). Use of Android-Based Flipbook Educational Media to Increase Knowledge, Beliefs, Attitudes, and Intentions. *Jurnal Promkes*, 12(1), 54–63. <https://doi.org/10.20473/jpk.v12.i1.2024.54-63>
- Manik, L. A. O. S., Ghazali, T., & Windha Mahyastuty, V. (2024). Perancangan Jaringan Internet Menggunakan GNS3, Qemu, dan Virtual Box. *Jurnal Elektro*, 15(1), 11–20. <https://doi.org/10.25170/jurnalelektro.v15i1.5119>
- Masruri, M. A., Efendi, A., & Sumaryati, S. (2024). Innovative Project-Based Learning Video Tutorial Media: Development and Its Effect on Students' Collaborative Skills. *JTP - Jurnal Teknologi Pendidikan*, 26(3), 926–943. <https://doi.org/10.21009/jtp.v26i3.49648>
- Maulana, R., Saputra, H. K., Novaliendry, D., & Farell, G. (2025). Pengembangan Aplikasi E-Modul Berbasis Mobile Pada Mata Pelajaran Administrasi Sistem Jaringan Kelas XI TJKT, SMK Negeri 1 Bangkinang. *Jejak Digital: Jurnal Ilmiah Multidisiplin*, 1(5), 3166–3180. <https://doi.org/10.63822/rswcs646>
- Maulidiansy, H., Hendrayana, A., & Sultan Ageng Tirtayasa, U. (2023). E-Motivector (E-Modul Interaktif Berbantuan Video Creator). *Proximal: Jurnal Penelitian Matematika Dan Pendidikan*

- Matematika*, 6(2), 336-346.
<https://doi.org/10.30605/proximal.v5i2.2932>
- Mayer, R. E. (2024). The Past, Present, and Future of the Cognitive Theory of Multimedia Learning. *Educational Psychology Review*, 36(1), 1-25.
<https://doi.org/10.1007/s10648-023-09842-1>
- Møller-Skau, M., & Lindstøl, F. (2022). Arts-based teaching and learning in teacher education: A systematic literature review. *Teaching and Teacher Education*, 109, 103545.
<https://doi.org/10.1016/j.tate.2021.103545>
- Nillofa Ende, A. M., Jasril, I. R., & Jaya, P. (2022). Perancangan dan Pembuatan E-Modul Interaktif Berbasis Canva Pada Mata Pelajaran Dasar Listrik dan Elektronika. *JTEV*, 8(2), 193.
<https://doi.org/10.24036/jtev.v8i2.117118>
- Nugraha, A. R., & Iskandar, M. Y. (2024). Development of Video Tutorials as A Media for Learning Graphic Design in Vocational High Schools. *JERIT: Journal of Educational Research and Innovation Technology*, 1(1), 1-11.
<https://doi.org/10.34125/jerit.v1i1.1>
- Rejeki, S., Leksono, I. P., & Rohman, U. (2023). Pengembangan E-Modul Berbasis Canva Model ADDIE. *EDUKASIA*, 4(2), 1697-1704.
<https://doi.org/10.62775/edukasia.v4i2.468>
- Sa'idah, N. U., Handoyo, E., Supriyadi, Dirwanto, & Akanto, B. (2024). Development of E-Module Based on Problem Based Learning Integrated Wordwall to Improve Students' Cognitive Ability. *ELSE Journal*, 8(2), 340-350.
<https://doi.org/10.30651/else.v8i2.20967>
- Santosa, A. S. E., Santyadiputra, G. S., & Divayana, D. G. H. (2017). Pengembangan E-Modul Berbasis Model Pembelajaran Problem Based Learning pada Mata Pelajaran Administrasi Jaringan Kelas XII Teknik Komputer dan Jaringan di SMK TI Bali Global Singaraja. *KARMAPATI*, 6(1), 62-72.
<https://doi.org/10.23887/karmapati.v6i1.9269>
- Savira, A. Y., Ismael, K. A., & Fatah, Z. (2025). Pelatihan Instalasi Sistem Operasi Windows Menggunakan Virtualbox Di SMK Darul Hidayah Glagga Arosbaya Bangkalan. *EJECS*, 4(01), 60-66.
<https://doi.org/10.58812/ejecs.v4i01.365>
- Spante, M., Hashemi, S. S., Lundin, M., & Algers, A. (2018). Digital competence and digital literacy in higher education research: Systematic review of concept use. *Cogent Education*, 5(1), 1519143.
<https://doi.org/10.1080/2331186X.2018.1519143>
- Sugiyono. (2024). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Alfabeta.
- Tralisno, A., & Alfi, S. (2023). Efektivitas Multimedia Pembelajaran Matematika Berbasis Simulasi dalam Melatih Keterampilan Psikomotor Peserta Didik pada Konsep Geometri. *NUMBERS: Jurnal Pendidikan Matematika & Ilmu Pengetahuan Alam*, 1(4), 1-8. Retrieved from <https://mathedu.joln.my.id/index.php/edu/article/view/37/48>
- Utama, N., & Zulyusri. (2022). Meta-Analisis Praktikalitas Penggunaan E-modul Oleh Guru Dan Peserta Didik Dalam Pembelajaran. *Jurnal Biologi dan Pembelajarannya (JB&P)*, 9(1), 27-33.
<https://doi.org/10.29407/jbp.v9i1.17671>
- Wulandari, H. T., Susanto, H., Muhibbin, A., & Susilo, A. (2025). Evaluasi Pendidikan Vokasi di Era Revolusi Industri 4.0 dan Society 5.0. *Paedagogie*, 20(2), 231-240.
<https://doi.org/10.31603/paedagogie.v20i2.15010>
- Yuliana, D., Baijuri, A., Supartoc, A. A., Seitunid, S., & Syukria, S. (2023). Pemanfaatan Aplikasi Canva Sebagai Media Video. *JUKANTI*, 6(6), 247-257.
<https://doi.org/10.37792/jukanti.v6i2.1025>
- Zain, F. M., Sailin, S. N., Kasim, M., Karim, A. M. A., & Zameri, N. N. (2022). Developing an Augmented Reality Immersive Learning Design (AILEAD) Framework. *International Journal of Interactive Mobile Technologies*, 16(11), 65-90.
<https://doi.org/10.3991/ijim.v16i11.30063>