

Practical E-Module Using Flipbook Maker as A Solution For Visual Learner Type Students

Maltha Kharisma, Syafri Anwar and Darmansyah

Universitas Negeri Padang, Indonesia

This study addresses the development of a cognitive-based e-module for Technical Drawing courses in Fine Arts Education, aiming to enhance students' procedural and motor skills through structured, stepwise learning. Post-pandemic shifts toward hybrid learning have highlighted the need for digital instructional materials that integrate enactive, iconic, and symbolic representation stages as proposed by Bruner. Employing a Research and Development approach with the ADDIE model, the study conducted curriculum, instructional, and student analyses to design, develop, implement, and evaluate the e-module. The sample collection used a totally sampling technique for subjects in this study, namely 25 fine arts education students taking the Technical Drawing course. Validation by experts yielded an average Aiken's V of 0.951 and ICC of 0.855, indicating high validity and reliability. Implementation with pretest-posttest design demonstrated significant improvement in students' orthogonal projection skills, with mean scores increasing from 60.22 to 77.13 and N-gain of 0.73. The paired t-test results were $t(24) = 12.00$, $p < .001$ and Cohen's d effect size measurement value was 2.40. Findings confirm that the e-module effectively supports independent, structured learning, bridging gaps in procedural comprehension and practical application. The study contributes to digital pedagogy in art and vocational education, providing a validated model for hybrid learning environments that enhances cognitive, procedural, and psychomotor competencies.

Keywords: e-module, technical drawing, cognitive, hybrid learning, motor skills

In the wake of the COVID-19 pandemic, the government has been gradually implementing a transformation and focusing on improving hybrid public services—that is, a combination of digital and in-person services. Various social, economic, and educational activities have resumed at a relatively stable level, in line with the national development agenda as outlined in the Indonesia Digital Vision 2045 (National Economic Council, 2025). In line with this, the government, through Presidential Instruction No. 7 of 2025 on the Revitalization of Educational Units, has demonstrated its commitment to promoting equitable, technology-based education while strengthening an inclusive and sustainable digital learning ecosystem (Nurmahmudah et al., 2025). Long before that, universities had already begun digitizing their educational processes. This is clearly evident in the learning process, which has long made use of various digital devices and supporting applications (Gudoniene et al., 2025; Jnr et al., 2020).

This policy indirectly provides opportunities for faculty members to initiate and develop the digitization of the learning process, including by providing materials in the form of Word documents, PDFs, and videos shared through the Learning Management System (LMS) platform (Lazar et al., 2020). In practice, Zoom Meetings and Learning Management Systems (LMS) serve as the primary tools supporting the teaching and learning process. Higher education institutions have formalized and institutionalized digital learning through a hybrid system—that is, a combination of online (virtual) and in-person (face-to-face) learning. Over time, this hybrid method has become a popular learning approach among college faculty members (Gudoniene et al., 2025; Heilporn et al., 2021).

Hybrid learning offers a high degree of flexibility and ease of access. Instructors can provide a variety of literacy resources and learning materials that students can use to support their independent learning. These teaching materials are tailored to the current week's course content and presented in digital formats, such as scanned books, links to articles and journals, PDF files, instructional videos from video-sharing platforms, worksheets, and practical learning guides (Jnr et al., 2020; Gudoniene et al., 2025). In addition, the hybrid learning method supports the government's agenda in preparing for the era of the Fifth Industrial Revolution, which emphasizes the predominant use of digital media in the dissemination of information, public services, and social interactions. The use of digital media enables more effective communication and service delivery without being hindered by distance, time, or location (Gudoniene et al., 2025; Mishra et al., 2020).

In Fine Arts Education programs at various universities in Indonesia, practical courses such as Technical Drawing or Projection Drawing require students to master cognitive and psychomotor skills in an integrated manner. Students are not only expected to understand concepts and theories but also to be able to apply work procedures accurately, systematically, and in accordance with technical standards. In this context, the practical learning process should ideally facilitate students' cognitive development.

According to Jerome Bruner's cognitive theory, the learning process occurs through three stages of representation: enactive, iconic, and symbolic. The enactive stage occurs when students learn through direct action and concrete experiences; the iconic stage occurs when students understand concepts through visual representations; while the symbolic stage is characterized by the ability to represent learning experiences in the form of symbols, language, or written rules. These three stages are highly relevant to the characteristics of Technical Drawing practice, which emphasizes demonstration, visualization, and procedural understanding. (Bruner & Olson, 2014; Khoiriyah & Murni, 2021).

In technical drawing practices, the enactive and iconic stages are generally best facilitated through in-person demonstrations in the classroom. Instructors demonstrate the use of tools, measurement techniques, and the steps of the drawing process so that students can learn through observation and imitation. However, challenges arise when practical instruction is conducted online or in a hybrid format. Online learning tends to take students directly to the symbolic stage through verbal explanations and text-based worksheets, while the enactive and iconic stages are not adequately facilitated. (Chernikova et al., 2020; Gudoniene et al., 2025).

These conditions make it difficult for students to fully understand and remember the entire workflow. Errors in one step often affect subsequent steps because the Technical Drawing course is procedural and sequential in nature. Furthermore, the limited direct interaction and delayed feedback in online learning have further increased students' reliance on instructors' guidance. This indicates that the challenges in practical Technical Drawing practices do not lie solely in the online learning format but in the lack of support for students' cognitive representation processes in their entirety. (Chernikova et al., 2020; Rourke, 2019).

In this context, Jerome Bruner's cognitive theory, with its enactive, iconic, symbolic stages, serves not only as a conceptual framework but also as a pedagogical solution to address students' difficulties in understanding and remembering sequential work procedures (Khoiriyah & Murni, 2021; Bruner & Olson, 2014). Based on this analysis, Jerome Bruner's cognitive theory is considered relevant and strategic to serve as the primary foundation for developing digital teaching materials for practical learning.

The enactive iconic symbolic stages provide a clear framework in designing procedure-based learning so that the development of e-modules with the Procedural Orientation Structure (SOP) strategy becomes a logical and systematic solution to the SOP strategy in line with Bruner's theory because it places students in a gradual learning process from concrete experiences of visualizing work steps to symbolic understanding of rules and technical standards (Rahmagandi et al., 2024; Nafeli et al., 2024).

With this design, the practical e-module serves not only as a source of information but also as a self-study guide, capable of partially replacing live lecture demonstrations in online or hybrid learning. This is expected to help students develop a more comprehensive and sustainable procedural understanding.

Based on these problems, this study uses a Research and Development (R&D) approach with the ADDIE model which includes the Analyze, Design, Develop, Implement, Evaluate phases. This study aims to develop a practical e-module based on Jerome Bruner's Cognitive Theory, namely enactive, iconic, symbolic in the Technical Drawing/Projection Drawing course (Rahmagandi et al., 2024; Nafeli et al., 2024).

With the development of digital technology, the use of printed learning modules has gradually shifted toward e-modules or digital modules, including those for practical courses. However, most e-modules currently available still tend to focus on delivering theoretical material and do not optimally accommodate interactive, applied practice components (Rahmagandi et al., 2024; Cahyani et al., 2024). Furthermore, empirical studies on the effectiveness of practical e-modules in improving students' hands-on skills are still relatively limited, particularly in the context of fine arts education.

Several studies have also shown that important aspects such as student engagement, ease of navigation, and the impact of practical e-modules on long-term knowledge retention are often overlooked (Heilporn et al., 2021; Getenet et al., 2024). Therefore, this research, focused on the development and evaluation of practical e-modules that not only present theoretical content but also include step-by-step simulation guides based on SOPs and instant feedback mechanisms, is an important contribution to innovation in vocational and fine arts education in the era of digital transformation.

Method

Research Design

This study employed an observational method combined with an experimental approach in the form of research and development (R&D). The R&D method is a research approach used to develop a specific product and test its effectiveness (Sugiyono, 2009:297). The development model in this study follows a model adapted from the ADDIE instructional design model, which includes the analysis, design, development, implementation, and evaluation phases (Branch, 2009).

1. In the analysis phase, a needs analysis is conducted before designing the e-module product. The analysis begins with curriculum analysis, instructional analysis, and student characteristics analysis.
2. The design phase of the data obtained is followed by product design in the form of a learning e-module by formulating specific, measurable, useful, and realistic learning objectives. In this case, the e-module is realized with a description of each material per practical lecture along with syntax to assist students. The descriptions in the e-module are in the form of directives for students.
3. This development phase is carried out based on the results of the initial needs analysis by determining the course plan (starting from the initial mid-semester meeting to the final exam) in the form of an evaluation sheet. At this phase, a trial will be conducted by experts, faculty members, and students by filling out an observation sheet containing suggestions and input. The trial will be conducted by experts and students, namely against the criteria of the product being developed. Based on the results of the trial, suggestions and feedback will be obtained for improvements that will be used to revise the learning.
4. At this phase, the learning model is implemented in learning activities. The development results are applied to learning to determine their impact on learning quality, including effectiveness, attractiveness, and efficiency.
5. At this phase, an evaluation of the developed product is conducted, from design to learning evaluation. The evaluation in this study includes validation from subject matter experts, media experts, and language experts, as well as student assessments. Learning outcomes are assessed by measuring the achievement of product development objectives, assessing what the target audience has been able to achieve, and seeking information on what can help students achieve good results.

In general, the entire research and development process is to develop a specific product that is valid, practical, and effective for use as a medium in learning. Through this research, the researcher attempts to develop a product in the form of an e-module that is good and useful for the implementation of lectures on Technical Drawing courses. In this research, the resulting product is the Development of a Practical E-module using the Procedural Orientation Structure strategy for the Technical Drawing Course in Fine Arts Education, FBS UNP.

The following is a summary of the activities carried out during the 5 phases:

1. **Analysis:** Curriculum analysis was conducted by reviewing the learning plans material for the Technical Drawing Course from several other public universities, which includes an introduction to brainstorming at each meeting, an introduction to materials, tools, and practice media, as well as practice techniques and procedures, with a focus on important points for students in practical courses. Instructional analysis was conducted through discussions with the faculty member regarding material criteria, learning processes, and forms of assessment and evaluation. Meanwhile, student character analysis was conducted through discussions outside of class during free time, finding that students have a visual learning style and tend to utilize direct experience (real time) as learning material.
2. **Design:** This research produced a book containing content that encompasses three stages of representation: enactive, iconic, and symbolic. The book is an e-module for students, presented in digital form using the web-based flipbook maker Heyzine. The content presented in this e-module consists of course materials for Technical Drawing courses at both the college and high school levels. The e-module contains various visual elements that can be used according to the learners' characteristics, including text, video links, 3D models, and clips.
3. **Development:** In the development phase, researchers carry out several activities as follows: first, compiling an e-module prototype; second, self-evaluation with colleagues; third, product revision based on self-evaluation; fourth, validation of the research product with experts.
4. **Implementation:** The implementation phase is the research stage where the product is tested in the Technical Drawing course in one class using an e-module. In this phase, the researcher conducted a pretest at the beginning of the trial without using the e-module and a posttest using the e-module on 25 students taking the technical drawing course.
5. **Evaluation:** Various prototypes created during the development phase are reviewed using formative assessment techniques. Formative assessment is a process that begins with self-evaluation and continues with instrument validation and expert review (materials, educational planning, and language). Summative assessment is conducted through student assignments.

Instruments and Data Analysis

Aspects that are very important, especially in the development of teaching materials, which will later become the strength in the validity of an e-module product:

Table 1
Aspects Assessed in the E-Module

No	Rated aspect
1	Appearance
2	Contents
3	Construct
4	Criteria

The results of the E-Module validation were analyzed using validator scores for each criterion, validation using values from the Aiken's V formula (Bashooir & Supahar, 2018), determining the level of validity (Bayu et al, 2023).

Table 2
Aiken's V Coefficient Values and Criteria

No	Rated Coefficient of Aiken's V	Validity Criteria
1	$0 \leq V \leq 0.4$	Not Valid
2	$0.4 < V \leq 0.8$	Valid
3	$0.8 < V \leq 1$	Very Valid

To determine and determine the consistency and stability of the validators' assessments, the intraclass correlation coefficient (ICC) was used. The ICC value was calculated using SPSS 23.0 using the Rosner criteria (Murti, 2011).

Table 3
Interpretation of ICC Index

Index	Information
<0.40	Weak
0.40-0.75	Good
>0.75	Very well

The results of the effectiveness of the use of the Student E-Module, carried out the N-Gain (Normalized Gain Score) test, paired T-test and using Cohen's effect size.. The N-Gain test was obtained by comparing the difference between the pretest and posttest scores with the difference between the maximum score and the pretest score. The calculation results were interpreted using the Gain index (Yefterson, 2025).

Table 4
N-Gain Score Criteria

Index	Criteria
>0.70	High
0.30-0.70	Currently
<0.30	Low

Cohen's effect size is obtained from how big the influence or difference between the pre-test and post-test is in practice from a statistical treatment.

Table 5
Jacob Cohen Classification Standards

Indeks	Classification
0,20	Small Effect
0,50	Medium Effect
>0,80	Large Effect

Results

Based on the results obtained in this study, with various ADDIE series, analysis, design, development, implementation and evaluation, but this article focuses on data exposure based on needs analysis on curriculum, instruction and students, followed by development based on expert validation, and finally the results of implementation on students.

Curriculum, Instructional and Student Needs Analysis

The results of the needs analysis indicate that the development of e-modules in Technical Drawing courses is not simply an alternative medium, but rather an instructional need arising from curriculum demands, learning characteristics, and student characteristics (Setiami & Maulana, 2021; Rahmagandi et al., 2024; Sujarwo et al., 2025). In development research, needs analysis serves to ensure that the developed product is truly born from real learning problems, not from the researcher's assumptions (Arif et al., 2022; Mizian, 2023). In this context, the need for e-modules arises because learning Technical Drawing requires mastery of concepts, procedural accuracy, and the ability of students to learn independently and repeatedly outside of face-to-face hours (Setiami & Maulana, 2021; Isnaini & Nuryanto, 2024; Nafeli et al., 2024). From a curriculum perspective, the learning outcomes of the Technical Drawing course demonstrate that students are not only required to understand the history, objectives, and benefits of technical drawing, but also to be able to adapt to drawing tools, master the procedures for projecting points, lines, planes, and objects, and design three-dimensional objects as a form of application (Sujarwo et al., 2025; Isnaini & Nuryanto, 2024). The scope of the material spread across one semester also shows that the material is structured in stages and is interconnected, with the projection of geometric objects being an important foundation for mastering subsequent material. This means that students need teaching materials that are not only informative, but also systematically structured, sequential, and accessible when they encounter difficulties at certain stages (Setiami & Maulana, 2021; Rahmagandi et al., 2024; Mizian, 2023). This condition strengthens the reason that e-modules need to be

developed as a learning tool that can maintain the continuity of students' understanding from basic concepts to more complex skills (Rahmagandi et al., 2024; Nafeli et al., 2024).

These findings align with the concept of e-modules as electronic teaching materials designed for independent learning, systematically structured, and capable of integrating text, images, animation, video, navigation, and evaluation into a single learning unit (Setiami & Maulana, 2021; Rahmagandi et al., 2024; Arif et al., 2022; Manggala et al., 2024). In learning that requires visual and procedural understanding such as Technical Drawing, the advantage of e-modules lies not only in their digital form, but also in their ability to present material in a gradual, flexible, and rich representational manner (Nafeli et al., 2024; Rahmagandi et al., 2024). Thus, the development of e-modules in this study has a strong theoretical basis because the electronic format allows students to review the material, pay attention to detailed steps, and learn at their own pace (Setiami & Maulana, 2021; Rahmagandi et al., 2024).

From an instructional perspective, the analysis shows that Technical Drawing learning adheres to Outcome-Based Education (OBE) and KKNI level 6, utilizing the Case Method and Project-Based Learning approaches. This means the learning process is directed not only at increasing knowledge but also at developing students' analytical, problem-solving, decision-making, and technical skills (Isnaini & Nuryanto, 2024; Sujarwo et al., 2025). The problem is, this learning model will struggle to run optimally if students lack learning resources that provide clear, step-by-step directions. Without a coherent material structure, students risk partially understanding assignments, relying on faculty members' explanations, and experiencing difficulties when working independently. Therefore, the need for e-modules in this study is logical, as a tool that bridges the demands of Case Method and Project-Based Learning with students' need for structured study guides (Rahmagandi et al., 2024).

The need for a clear structure can also be explained through the theory of Procedural Orientation Structure (SOP). The literature review explains that SOPs are relevant for use in procedurally demanding fields of study because they organize prerequisite relationships between steps, from simple to more complex. In Technical Drawing courses, sequences such as point projection, line projection, plane projection, and geometric object projection demonstrate a strong procedural-prerequisite relationship. Students cannot properly master advanced stages if they have not mastered the basic ones. Therefore, the results of the needs analysis not only point to the need for e-modules but also indicate that these e-modules must be designed based on coherent procedural logic, not simply a collection of digital materials (Setiami & Maulana 2021; Isnaini & Nuryanto 2024).

In terms of student characteristics, the analysis shows that Fine Arts Education students tend to learn through visual observation, real-life experiences, and the ability to re-present observed objects. Student responses that emphasize direct observation, studying the shape, then imagining and re-drawing it indicate that their learning process is strong in the aspects of visualization and manipulation of mental images. However, academically, these findings are more appropriately written as an indication of visual tendencies in learning Technical Drawing, rather than as an absolute conclusion that all students have the same visual learning style. This refinement is important to ensure a more careful and less generalized discussion. Nevertheless, these findings are still strong enough to indicate that the learning media developed need to emphasize the visual aspects of concrete examples and gradual representation (Santoso et al., 2021).

This trend reinforces the relevance of Robert Gagne's information processing theory in the development of e-modules. Gagne emphasized that effective learning occurs when information is presented in a structured manner through clear stages, starting from attracting attention, conveying objectives, activating prior knowledge, presenting stimuli, providing guidance, eliciting performance, providing feedback, assessing results, and strengthening retention and transfer. When linked to the results of the needs analysis, the developed Technical Drawing e-module should not stop at delivering material but also include clear learning objectives, engaging visual illustrations, demonstrations of work steps, exercises, and evaluations that provide feedback on student learning outcomes (Manggala et al., 2024; Setiami & Maulana, 2021). In other words, what is needed

for e-modules is not the digitization of printed modules but rather a learning design that is purposefully built to support students' thinking processes.

Furthermore, the need for e-module development in this study can also be explained through Jerome Bruner's cognitive theory. Bruner emphasized that good learning moves from concrete experiences to more abstract representations through the enactive, iconic, and symbolic stages. In learning Technical Drawing, students need to first understand objects concretely or through demonstrations, then see their visual representations, and finally be able to express this understanding in the form of accurate technical drawings. Thus, the developed e-module can be positioned as a medium that helps students move from the enactive stage to the iconic and symbolic. This is important because one of the main problems in learning Technical Drawing is the gap between seeing forms and understanding spatial relationships and producing procedurally correct drawings. A good e-module can bridge this transition process (Rahmagandi et al., 2024).

The results of the needs analysis in this study are also supported by relevant research studies showing that e-modules can improve learning independence, understanding of material, engagement, and learning outcomes, including in the context of Technical Drawing and art learning (Setiami & Maulana, 2021; Nafeli et al., 2024; Isnaini & Nuryanto, 2024). Furthermore, the application of a procedural orientation structure has also been shown to help students understand work sequences, increase learning motivation, and strengthen cognitive and psychomotor engagement (Isnaini & Nuryanto, 2024). This means that the development needs identified in this study are not isolated but consistent with previous research findings. Therefore, the decision to develop an e-module based on Bruner's theory and a procedural orientation structure has adequate empirical and theoretical basis.

Based on all the above discussion, it can be emphasized that the need to develop e-modules in Technical Drawing courses is rooted in three main things, namely the demands of a tiered curriculum, the instructional need for learning that remains structured in a case-based and project-based approach, and the characteristics of students who require visual-procedural support. Therefore, the developed e-modules must be designed with the main characteristics of a coherent presentation of material, strong visualization, explicit work steps, independent practice and evaluation with feedback. With such a design, e-modules have the potential to be a tool that not only helps students understand Technical Drawing material but also strengthens independent learning, the accuracy of the drawing process, and their readiness to complete assignments more systematically (Setiami & Maulana, 2021; Rahmagandi et al., 2024; Isnaini & Nuryanto, 2024).

E-module Validation (Development)

Table 6
Results of expert assessment using Aiken's V and ICC criteria

No	Aspect	V-Aiken	Category	ICC	Category
1	Appearance	0.941	Very Valid	0.936	Very well
2	Contents	0.947	Very Valid	0.785	Very well
3	Construct	0.952	Very Valid	0.889	Very well
4	Criteria	0.964	Very Valid	0.810	Very well
	Average	0.951		0.855	

Based on the validity test results in table 6 by expert validators on the e-module, the average score of the three validators was 0.951. Referring to the results obtained, it can be said that the e-module is very valid and very suitable for use in Technical Drawing courses. The results of the e-module reliability calculation using the intraclass correlation coefficient (ICC) formula obtained a reliability value of 0.855. This value illustrates that the e-module reliability level is in the very good category. Referring to the results described, it can be concluded that the e-module is very suitable for use in Technical Drawing courses.

Pretest and Posttest (Implementation)

Table 7
Results of Normalized Gain Score Pretest and Posttest

Material	Pretest Average	Posttest Average	Average N- gain	Category
Orthogonal Projection	60.22	77.13	0.73	High

Table 7 shows the pretest results for students in the Technical Drawing course, showing an average score of 60.22, categorized as “more than adequate.” This finding indicates that students have a basic understanding of the Orthogonal Projection material, but still experience inaccuracies in the application of procedures, dimensions, object positions, and drawing symbols, resulting in suboptimal technical consistency and motor skills. After implementing the e-module for five meetings, the posttest average increased to 77.13, categorized as “very good,” and an N-gain of 0.73, indicating a significant improvement in ability.

Further statistical analysis confirmed this finding, with the paired sample t-test showed a significant increase in scores after the subjects were given intervention, $t(24) = 12.00$, $p < .001$. The results of the data analysis showed an average difference in pretest and posttest scores of 16.91 with a standard deviation of 7.05. The measurement of the effect size produced a Cohen's d value = 2.40, which indicates that the application of the practical e-module using a flipbook maker with the reinforcement of Jerome Bruner's cognitive theory and procedural orientation structure strategy provided a very large effect in practice in improving the achievements of the research subjects, while normality and homogeneity of variance tests ensured the validity of the use of parametric analysis. The posttest results also showed higher consistency in the application of procedures, tool use, accuracy of projection plane identity, and drawing rules, although some aspects such as Z-axis coordinates, horizontal projector line alignment, and visual neatness still require additional attention.

The effectiveness of the e-module can be explained through a cognitive theory framework. Gagne's principles, including gaining students' attention, conveying learning objectives, stimulating prior memory, presenting structured material, guiding learning, providing performance activities, providing feedback, assessing performance, and enhancing retention and transfer of knowledge, are applied in the e-module design through interactive visual and audio elements, step-by-step guidance, and direct feedback, enabling students to process information and apply it in projective drawing practice. Furthermore, Bruner's constructivist approach emphasizes students' role as active builders of knowledge, through hands-on experiences that enable them to discover, transform, and evaluate knowledge from the concrete to the abstract. Improvements in technical skills and procedural understanding seen in the posttest indicate that students have successfully actively constructed knowledge in accordance with these principles.

The Procedural Orientation (SOP) structure in the e-module provides a sequential framework for students to understand the steps of drawing projections. The organization of the material from procedure-prerequisite to procedure-decision allows students to follow the steps systematically, improving mastery of technical procedures, motor skills, and conceptual understanding. The consistency of posttest scores in the range of 70–90 indicates that the SOP helps students apply the procedures in a more structured manner, while reducing error variation compared to the pretest. Student interaction with the module demonstrates the effectiveness of scaffolding, where interactive guides facilitate independent learning, increase motivation, and facilitate more accurate performance.

The long-term development strategy for e-modules should consider improving content and interactive features, such as 3D visualization-based coordinate exercises, a more detailed automated feedback system, and simulation modules for intensive practice, to improve fine motor skills, procedural consistency, and conceptual understanding. The use of Gagne and Bruner's principles should be reinforced through scaffolding, reflective activities, case studies, and collaborative activities that encourage self-regulation and problem-solving. SOPs can be developed into a multi-level hierarchy of procedures, supporting differentiated and personalized

learning, and utilizing analytical dashboards to monitor student progress. The integration of blended and distance learning will also increase flexibility, accessibility, and student engagement.

Overall, the integration of cognitive theory-based e-modules using the SOP strategy has been proven effective in improving the learning outcomes of Technical Drawing students, both in cognitive, motoric, and procedural aspects. This module strengthens mastery of technical procedures and motoric skills, supports the development of critical thinking, and facilitates more structured independent learning. Although some aspects such as visual neatness and Z-axis coordinates still need strengthening, e-modules have the potential to become interactive and adaptive learning media that can improve the quality of higher education in the fields of art and engineering, as well as prepare students to face the demands of the 21st century.

Conclusion

High validity, based on the assessment results by three expert validators, the e-module obtained an average score of 0.951, indicating a very high level of validity. The calculation of reliability using the intraclass correlation coefficient (ICC) produced a value of 0.855, indicating that the reliability of the e-module is in the very good category. Thus, this e-module is very valid and suitable for use in Technical Drawing courses. These findings ensure that the product is ready to be implemented in learning, both in class and for independent use, to assess its impact on improving student abilities more broadly.

The E-module product has been proven to be effective in improving the ability of Technical Drawing students in drawing orthogonal projections. The pretest results showed a basic understanding of students with an average of 60.22 (more than sufficient), while the posttest increased significantly to 77.13 (very good) with an N-gain of 0.73, supported by valid statistical analysis (significant t-test, normality and homogeneity of variance are met). This improvement is seen in the consistency of the application of procedures, the use of tools, the accuracy of the projection plane identity, and drawing rules, although some technical aspects such as Z-axis coordinates and visual neatness still require attention.

Reference

- Arif, C., Ta'ali, T., Muskir, M., & Refdinal, R. (2022). Pengembangan E-Modul Pembelajaran Berbasis Web pada Mata Pelajaran Gambar Teknik Listrik di Sekolah Menengah Kejuruan. *Scaffolding: Jurnal Pendidikan Islam Dan Multikulturalisme*. <https://doi.org/10.37680/scaffolding.v4i2.1409>
- Bashooir, K., & Supahar, S. (2018). Validitas dan reliabilitas instrumen asesmen kinerja literasi sains pelajaran fisika berbasis STEM. *Jurnal Penelitian dan Evaluasi Pendidikan*, 22(2), 219–230. <https://doi.org/10.21831/pep.v22i2.19590>
- Bayu, E. S., Fauzan, A., & Armianti. (2023). The development of teacher and student's book based on realistic mathematics education in statistics for package a program. *European Journal of Educational Research*, 12(1), 119-131. <https://doi.org/10.12973/eu-jer.12.1.119>
- Branch, R. M. (2009). *Instructional Design: The ADDIE Approach*. Springer US. <https://doi.org/10.1007/978-0-387-09506-6>
- Bruner, J., & Olson, D. (2014). Jerome Bruner: The Cognitive Revolution in Educational Theory. <https://doi.org/10.5040/9781472541369>
- Cahyani, Y. S. D., Sutopo, Y., & Kusumastuti, A. (2024). Effectiveness of the Ibis Paint X-Based E-Module in Technical Drawing for Fashion Technology Training. *Journal of Vocational and Career Education*. <https://doi.org/10.15294/jvce.v9i2.29455>
- Chernikova, O., Heitzmann, N., Stadler, M., Holzberger, D., Seidel, T., & Fischer, F. (2020). Simulation-Based Learning in Higher Education: A Meta-Analysis. *Review of Educational Research*, 90, 499–541. <https://doi.org/10.3102/0034654320933544>
- Getenet, S., Cantle, R., Redmond, P., & Albion, P. (2024). Students' digital technology attitude, literacy and self-efficacy and their effect on online learning engagement. *International Journal of Educational Technology in Higher Education*, 21, 1–20. <https://doi.org/10.1186/s41239-023-00437-y>
- Gudoniene, D., Staneviciene, E., Huet, I., Dickel, J., Dieng, D., Degroote, J., Rocio, V., Butkienė, R., & Casanova, D. (2025). Hybrid Teaching and Learning in Higher Education: A Systematic Literature Review. *Sustainability*. <https://doi.org/10.3390/su17020756>

- Heilporn, G., Lakhal, S., & Bélisle, M. (2021). An examination of teachers' strategies to foster student engagement in blended learning in higher education. *International Journal of Educational Technology in Higher Education*, 18. <https://doi.org/10.1186/s41239-021-00260-3>
- Isnaini, R. R. N. A., & Nuryanto, A. (2024). Feasibility Test of Interactive E-Module Project Based Learning Model in Manufacturing Engineering Drawing Learning. *International Journal of Social Science and Human Research*, 07(10). <https://doi.org/10.47191/ijsshr/v7-i10-74>
- Jnr, B. A., Kamaludin, A., Romli, A., Raffei, A. F. M., Phon, D. N. E., Abdullah, A., & Ming, G. (2020). Blended Learning Adoption and Implementation in Higher Education: A Theoretical and Systematic Review. *Technology, Knowledge and Learning*, 27, 531–578. <https://doi.org/10.1007/s10758-020-09477-z>
- Khoiriyah, B., & Murni, M. (2021). Peran Teori “Discovery Learning” Jerome Bruner Dalam Pembelajaran Pendidikan Agama Islam. Thawalib | *Jurnal Kependidikan Islam*. <https://doi.org/10.54150/thawalib.v2i2.20>
- Lazar, I., Pânișoară, G., & Panisoara, I. (2020). Digital technology adoption scale in the blended learning context in higher education: Development, validation and testing of a specific tool. *PLoS ONE*, 15. <https://doi.org/10.1371/journal.pone.0235957>
- Manggala, M. A., Nyanasuryanadi, P., & Suherman, H. (2024). Innovative Learning Using E-Modules. *JETISH: Journal of Education Technology Information Social Sciences and Health*. <https://doi.org/10.57235/jetish.v3i1.1983>
- Mishra, L., Gupta, T., & Shree, A. (2020). Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *International Journal of Educational Research Open*, 1, 100012–100012. <https://doi.org/10.1016/j.ijedro.2020.100012>
- Mizian, Z. (2023). Development of an Electronic Brick Bonding Module Using the Autocad Program for Students. *Tekno - Pedagogi: Jurnal Teknologi Pendidikan*, 13(2), 35–43. <https://doi.org/10.22437/teknopedagogi.v13i2.32531>
- Murti, B. (2011). Validitas dan reliabilitas pengukuran [Measurement validity and reliability] [Doctoral dissertation, Universitas Sebelas Maret]. *Fakultas Kedokteran, UNS*. <https://library.uns.ac.id>
- Nafeli, O. G., Abdullah, R., Ambiyar, & Huda, A. (2024). The Development of Android-Based Interactive E-Modules in Technical Drawing Subjects. *Jurnal Penelitian Pendidikan IPA*. <https://doi.org/10.29303/jppipa.v10i11.7655>
- Nurmahmudah, F., Putra, E. C. S., Rahman, A., & Harsono, A. M. B. (2025). Quality Learning Management: Framework Design to Support and Understand in the Digital Era. *FWU Journal of Social Sciences*, 153. <https://doi.org/10.51709/19951272/Winter2025/13>
- Rahmagandi, I. O., Khumaedi, M., & Anis, S. (2024). Development of a Flipbook-Based E-Module to Enhance Learning Outcomes in Manufacturing Design for Vocational High School Students. *Journal of Vocational and Career Education*. <https://doi.org/10.15294/jvce.v9i1.23623>
- Rourke, S. (2019). How does virtual reality simulation compare to simulated practice in the acquisition of clinical psychomotor skills for pre-registration student nurses? A systematic review. *International Journal of Nursing Studies*, 102, 103466. <https://doi.org/10.1016/j.ijnurstu.2019.103466>
- Santoso, H. B., Hadi Putra, P. O., & Farras Hendra S, F. F. (2021). Development & Evaluation of E-Learning Module Based on Visual and Global Preferences Using a User-Centered Design Approach. *International Journal of Emerging Technologies in Learning (iJET)*, 16(15), 139. <https://doi.org/10.3991/ijet.v16i15.24163>
- Setiami, R., & Maulana, A. (2021). DEVELOPMENT OF E-MODULES IN ENGINEERING DRAWING COURSES WITH THE BIM SYSTEM BUILDING MODELING APPLICATION. *Jurnal PenSil*, 10(1), 1–7. <https://doi.org/10.21009/jpensil.v10i1.17013>
- Sugiyono, (2009). Metode Penelitian Kuantitatif, Kualitatif dan R&D. Alfabeta.
- Sujarwo, I., Fatirul, A., & Waluyo, D. (2025). PENGEMBANGAN E-MODUL GAMBAR TEKNIK SEBAGAI MEDIA PEMBELAJARAN UNTUK SISWA KELAS X SMK. *EDUTECH*. <https://doi.org/10.17509/e.v24i1.76860>
- Yefterson, R, B (2025). Pengembangan E-Modul Multimedia Interaktif Untuk Meningkatkan Nilai Identitas Nasional Pada Pembelajaran Sejarah Di Sma.