



Sketchup E-Module as an Innovative Competency-Based Learning Media in the Building Engineering Education Study Program

Nuraini¹, Laras Oktavia Andreas², Risma Apdeni³, Muvi Yandra⁴

^{1,2,3,4} Universitas Negeri Padang, Indonesia

Corresponding Author: ✉ aini.km2003@gmail.com

ABSTRACT

This study aims to develop a SketchUp E-Module as an innovative competency-based learning medium for the Planning Drawing course in the Building Engineering Education Study Program at Universitas Negeri Padang. This research is motivated by the absence of structured module-based teaching materials, as well as learning processes that are still dominated by demonstration methods, videos, and PowerPoint. The research method used is Research and Development (R&D) with the DDD-E development model, which includes the stages of Decide, Design, Develop, and Evaluate. The research subjects consisted of lecturers and students from the Building Engineering Education Study Program. The instruments used were validation questionnaires by material experts and media experts, as well as practicality questionnaires completed by students. Data analysis techniques employed Aiken's V formula for validity and percentage analysis for practicality. The results of the study indicate that the developed E-Module has a high level of validity, with media expert validation reaching 91.5% (very feasible) and material expert validation reaching 80% (feasible). In addition, the practicality test results from students showed an average score of 96.67%, categorized as very practical. This demonstrates that the developed SketchUp E-Module is easy to use, engaging, and effective in helping students understand the material and improve their 3D building design skills. Thus, it can be concluded that the competency-based SketchUp E-Module developed in this study is both feasible and highly practical to be used as an innovative learning medium in the Planning Drawing course.

ARTICLE INFO

Article history:

Received
19 April 2026
Revised
27 April 2026
Accepted
15 May 2026

Key Word

E-Module SketchUp, Learning Media, Competency-Based.

How to cite

<https://pusdikra-publishing.com/index.php/josr>



This work is licensed under a
[Creative Commons Attribution-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/)

INTRODUCTION

Education is a strategic instrument in shaping the quality of human resources and the nation's civilization. Therefore, efforts to improve the quality of education continue to be carried out by the Indonesian government, even though the expected achievements are not fully optimal. National Education has the goal of developing abilities and shaping the character and civilization of

a dignified nation in order to educate the life of the nation (*Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 Tentang Sistem Pendidikan Nasional*, 2003). In this context, the role of lecturers is very crucial, not only as a material presenter, but also as a facilitator who is able to create a conducive learning environment and encourage students' active participation in the learning process.

At the higher education level, institutions are required to be able to produce graduates who are adaptive to global developments and the needs of the world of work. Padang State University as one of the state universities is committed to providing competency-based education that emphasizes the mastery of applicative skills. The Faculty of Engineering, especially the Building Engineering Education Study Program, has an important role in producing competent educators and professionals in the field of construction. Engineering Education itself is designed to prepare educators who master the field of technology as well as have pedagogic skills Putri et al (2024), so that graduates are expected to be able to answer the challenges of the construction industry that continues to develop.

In the learning process in the Building Engineering Education Study Program, students are required to master various technical skills, such as drawing constructions, designing structures, and conducting building analysis. To support the achievement of these competencies, innovative and technology-based learning media is needed. Learning media acts as a means to convey information that is able to stimulate students' thoughts, attention, and interest in learning effectively (Arsyad, 2019b). The right use of media can help concretize abstract concepts and increase learning motivation. One potential media alternative is the use of E-Modules based on three-dimensional design applications.

SketchUp as a 3D modeling software has the advantage of supporting interactive and efficient visualization of building designs. This application allows students to understand construction concepts more clearly through visual representations (Wulandari & Ramadhan, 2020). In addition, the use of computer-based media can help students understand complex material to be simpler (Munir, 2017). This is strengthened by the opinion of (Wijaya et al., n.d.) who states that SketchUp is effectively used in engineering learning because it is easy to understand and applicative, and is able to improve students' visual design skills (Oscarius Yudhi Ari Wijaya, 2020).

However, based on the results of interviews with lecturers in the Planning Drawing course, it is known that learning is still dominated by demonstration methods, learning videos, and the use of PowerPoint. Although this method is

quite helpful in delivering the material, there are still obstacles in the form of the unavailability of structured and systematic SketchUp learning modules. This condition has the potential to hinder the optimization of technology-based learning which should be able to improve students' practical skills.

The results of initial observations of 45 students of the Building Engineering Education Study Program batch of 2021, 2022, and 2023 showed that 64.4% of students had used SketchUp in lectures and 60% of them had basic skills in making 3D models. However, only 42.2% of students have officially acquired the SketchUp learning module. On the other hand, the majority of students showed a positive response to the use of digital media, where 93.3% stated that digital-based learning was more interesting and 84.4% had a high interest in learning 3D-based building design. These findings show that there is great potential as well as an urgent need to present a more systematic and targeted learning media.

Based on these conditions, the development of competency-based SketchUp E-Modules is very relevant to be carried out. E-Modules not only function as a flexible independent learning resource, but are also able to increase interactivity and learning effectiveness (Daryono & Rochmadi, 2020). With a structured module, it is hoped that students can learn the material gradually, improve design skills, and achieve the learning outcomes that have been set. Therefore, this research aims to develop a valid and practical SketchUp E-Module as an innovative learning medium in the Building Engineering Education Study Program.

RESEARCH METHOD

This research uses the Research and Development (R&D) method, which is a research approach that aims to produce products as well as test their effectiveness (Sugiyono, 2013). In this context, research refers to the process of collecting data and analyzing needs, while development is the stage of designing and manufacturing products that are then tested for feasibility (Saputra, 2021). The development model used is DDD-E which consists of four stages, namely Decide, Design, Develop, and Evaluate, as stated by (Tegeh et al., 2019). The research was carried out at the Department of Civil Engineering, Faculty of Engineering, State University of Padang in the even semester of the 2025/2026 academic year with research subjects in the form of students and lecturers in the Drawing Planning course using the SketchUp E-Module in the learning process.

The research procedure in this study follows the DDD-E development model, which consists of four stages: Decide, Design, Develop, and Evaluate.

The DDD-E model was chosen because it provides systematic steps in developing instructional media that are valid, practical, and effective for learning activities (Sugiyono, 2019). Through this model, the development process of the SketchUp E-Module can be carried out in a structured manner according to students' learning needs and course competencies.

The first stage is Decide, which focuses on identifying learning problems, analyzing student needs, and determining the objectives of product development. At this stage, observations and preliminary analyses were conducted to identify difficulties faced by students in understanding 3D building visualization in the Drawing Planning course. The results showed that learning activities still relied on lectures and PowerPoint presentations, so students had limited opportunities for independent practice. Therefore, the development of an interactive E-Module integrated with SketchUp software was considered necessary to support competency-based learning (Arsyad, 2019).

The second stage is Design, which involves designing the structure, appearance, and content of the E-Module. The researchers prepared learning materials, tutorials, illustrations, exercises, and evaluations systematically to support students in learning independently. In addition, the visual appearance and navigation system were designed to be attractive and easy to use. At this stage, research instruments such as validation sheets and practicality questionnaires were also developed to collect data during the product evaluation process (Munir, 2017)

The third stage is Develop, where the E-Module design was transformed into a real product and validated by media experts and material experts. The validation process aimed to determine the feasibility of the E-Module in terms of content, design, readability, and usability. Revisions were made based on experts' suggestions, such as improving the layout, correcting writing errors, and adding exercises and reflections. After the product was declared valid, a practicality test was conducted on students to identify the level of ease, attractiveness, and usefulness of the E-Module in the learning process (Daryono & Rochmadi, 2020)

The final stage is Evaluate, which involves formative and summative evaluations of the developed E-Module. Formative evaluation was carried out during each stage of development through revisions and improvements based on expert feedback. Meanwhile, summative evaluation was conducted after the practicality test to determine the overall effectiveness of the E-Module as a learning medium. Through this evaluation process, the developed SketchUp E-Module was expected to meet the criteria of validity, practicality, and

effectiveness in supporting competency-based learning in the Drawing Planning course (Daryono & Rochmadi, 2020)

The data collection instruments in this study consist of validation and practicality instruments compiled using a Likert scale with a score range of 1 to 5 (Sugiyono, 2017). The data obtained was analyzed through two stages, namely validity analysis and practicality analysis. Product validity is calculated using the Aiken's V formula to determine the level of feasibility based on expert assessments (Retnawati, 2016), while practicality is analyzed by calculating the percentage score from the questionnaire filled out by lecturers and students, then categorized according to the product's practicality criteria (Rofiq & Arthaningtyas, 2026). Through this stage of analysis, it is hoped that the SketchUp E-Module developed can be declared valid and practical as a competency-based learning medium.

RESULT AND DISCUSSION

Result

The development of the SketchUp E-Module using Heyzine Flipbook is carried out through the DDD-E model which includes the Decide, Design, Develop, and Evaluate stages. At the Decide stage, the results of interviews with the lecturer in the Planning Drawings course show that learning is still dominated by demonstration methods and PowerPoint media, and a structured E-Module is not available. This is the basis for the need for the development of new learning media that is more systematic and interactive.

Table 1.

Interview Results of the Lecturer in Planning Drawings Course

No	Lecturer Name	Interview Results	Needs Analysis
1	Muvi Yandra	There is no E-Module yet, using the demonstration method	Learning still uses demonstrations and PPTs
2	Risma Apdeni	No structured E-Modules yet, using PPT	Need for a more systematic learning medium

In the Design stage, the researcher designed an E-Module using Canva which was then converted to Heyzine Flipbook to be more interactive and easily accessible through links. The structure of the E-Module includes the cover, instructions for use, learning objectives, materials, summaries, exercises, and bibliography. Furthermore, at the Develop stage, validation is carried out by media experts and material experts. The validation results showed that the

E-Module had a high level of eligibility, with the media aspect obtaining the category of "very feasible" and the material aspect "feasible".

The validation results from media experts show that the SketchUp E-Module developed has excellent quality in terms of appearance and use. The assessments given by the two validators resulted in an average of 91.5% in the "very feasible" category. This indicates that the graphic aspects, content design, and ease of use have met the standards as an effective learning medium. Attractive appearance, neat layout, and clear navigation are considered to be able to support the learning process and increase students' interest in understanding the material.

On the other hand, the validation results from subject matter experts show that the E-Module is in the "feasible" category with an average score of 80%. This assessment includes the completeness of the material, the suitability of the content with the learning outcomes, and the evaluation aspects in the module. Although in general the material is appropriate and relevant, there are still some things that need to be improved to be more optimal. Therefore, revisions are made based on suggestions from validators, such as writing improvements, addition of supporting materials, independent exercises, learning reflections, and information related to the version of SketchUp used.

After going through the improvement stage, the E-Module is then tested to students to see the level of practicality in learning. The test results showed that the E-Module had a very high level of practicality with an average of 96.67%. This means that E-Modules are considered easy to use, attractive, and provide real benefits in helping students understand the material. The consistency of student assessment results also shows that the developed product is not only theoretically feasible, but also effective and practical when used in learning activities.

Table 2.

Descriptive Statistical Value of Student Response Results

No	X (Value V)	X - Mean (9,67)	(X - Mean) ²
1	10	0,33	0,1089
2	10	0,33	0,1089
3	10	0,33	0,1089
4	9	-0,67	0,4489
5	10	0,33	0,1089
6	10	0,33	0,1089
7	10	0,33	0,1089
8	10	0,33	0,1089

9	10	0,33	0,1089
10	9	-0,67	0,4489
11	8	-1,67	2,7889
12	10	0,33	0,1089
13	10	0,33	0,1089
14	10	0,33	0,1089
15	9	-0,67	0,4489
Σx	145		5,7335

Table 3.
Descriptive Statistical Results of Student Responses

Statistics	Source of Calculation	Value
Mean	$\Sigma x / n = 145/15$	9,67
Median	Middle data after sorting	10
Standard Deviation	$\sqrt{(5,7335 / 15)}$	0,64
Maximum Value	Highest value on data	10
Minimum Value	Lowest value on data	8

Based on the results of descriptive statistical data processing from the results of student responses, a mean value of 9.67, a median of 10, and a standard deviation of 0.64 were obtained. The maximum score obtained is 10 and the minimum score is 8. This shows that most of the instrument items have a high degree of validity with a relatively small data spread.

Discussion

This research aims to develop the SketchUp E-Module as a competency-based learning medium in the Drawing Planning course in the Building Engineering Education Study Program, Padang State University. The development process was conducted using the DDD-E model, which consists of the stages of Decide, Design, Develop, and Evaluate. The use of development models in instructional media research is considered effective because it provides systematic procedures in producing educational products that are valid and practical for learning activities (Sugiyono, 2019). Previous studies also showed that the application of structured development models contributes positively to the quality of digital learning media, especially in vocational

education that emphasizes practical competencies and independent learning abilities (Kurniawan et al., 2025).

At the Decide stage, the researchers identified students' needs and analyzed the problems faced in the Drawing Planning course. The findings revealed that students had difficulty understanding three-dimensional building visualization through conventional teaching methods such as lectures and PowerPoint presentations. This condition is consistent with the study conducted by Munir (2012), which explained that abstract concepts are easier to understand when supported by interactive multimedia and visual-based learning media. Similarly, research by (Daryono & Rochmadi, 2020) emphasized that digital modules can improve students' learning motivation and understanding because they provide opportunities for repeated and independent learning activities.

The Design stage focused on preparing the structure, appearance, and instructional components of the E-Module. The E-Module was designed systematically by including learning objectives, theoretical explanations, practical tutorials, illustrations, assignments, and evaluations. An attractive interface and consistent layout were also developed to improve usability and student engagement during learning activities. According to Arsyad, (2019) effective learning media should combine visual attractiveness, clarity of information, and suitability with learning objectives in order to support optimal learning outcomes. Previous research conducted by also indicated that technology-based learning media with interactive features could create more Kurniawan et al (2025) active, student-centered, and effective learning environments.

At the Develop stage, the SketchUp E-Module was validated by media experts and material experts to determine its feasibility. The validation results from media experts showed an average score of 91.5% with the category "Very Feasible." The assessment covered aspects such as typography, layout consistency, image quality, navigation, and visual communication. These findings indicate that the developed E-Module successfully fulfilled the criteria of effective digital learning media. This result is supported by previous research conducted by Arsyad, (2019) which stated that learning media with clear visual design and easy navigation can improve students' interest and understanding during the learning process. Furthermore, studies related to multimedia learning revealed that attractive visual elements contribute significantly to student motivation and learning effectiveness (Munir, 2017).

Several revisions were carried out based on suggestions from the validators, including enlarging the font size, improving the placement of logos,

and redesigning the cover page to create a more professional appearance. The revision process is important in educational product development because feedback from experts helps improve the quality and usability of the learning media. According to Sugiyono, (2019) the revision stage in research and development methods is essential to ensure that the final product meets quality standards and user needs. Similar findings were reported in previous studies on E-Module development, where revisions based on expert recommendations significantly improved the practicality and effectiveness of digital learning media in vocational education settings (Daryono & Rochmadi, 2020)

The validation conducted by material experts resulted in an average score of 80% with the category "Feasible." The material experts evaluated the suitability of the content with course learning outcomes, the accuracy of explanations, the completeness of the materials, and the sequence of presentation. The results indicate that the E-Module successfully supports competency achievement in the Drawing Planning course. These findings are relevant to previous research emphasizing that competency-based instructional materials should provide clear explanations, practical exercises, and learning evaluations that support skill mastery (Sugiyono, 2019). In addition, competency-oriented digital modules are considered effective in helping students connect theoretical concepts with practical applications in vocational learning contexts (Daryono & Rochmadi, 2020)

The revisions suggested by the material experts included correcting writing errors, adding independent exercises, including reflection activities, and clarifying the version of SketchUp software used in the tutorials. These improvements were intended to make the E-Module more systematic, accurate, and user-friendly. According to Arsyad (2019), learning media should provide complete and structured information to facilitate independent learning processes. Research conducted by Kurniawan et al., (2025) also demonstrated that multimedia-based learning resources that include exercises and self-evaluation activities can improve students' comprehension and practical skills because learners become more actively involved in the learning process.

The results of this research demonstrate that the integration of SketchUp software into the E-Module provides significant benefits in helping students understand technical drawing concepts. Through three-dimensional visualization features, students are able to observe building objects more concretely and interactively. This finding supports the theory proposed by Daryono & Rochmadi (2020) who argued that multimedia and computer-based applications are highly effective for presenting abstract material in a more concrete and understandable form. Previous studies on computer-aided design

learning also found that visualization software enhances students' spatial understanding and technical competencies in architecture and engineering education (Kurniawan et al., 2025).

In the Evaluate stage, the E-Module was tested on 15 students who had completed the Drawing Planning course. Based on the student response questionnaires, the E-Module obtained the category "Very Practical." Students stated that the E-Module was easy to operate, visually attractive, and effective in guiding them through the steps of creating 3D building models. These findings are in line with previous research showing that interactive E-Modules increase student participation and support self-directed learning activities because learners can study materials independently and repeatedly (Daryono & Rochmadi, 2020). In addition, practical digital learning media are proven to improve learning efficiency and reduce students' dependence on teacher demonstrations during practical courses (Kurniawan et al., 2025)

Students also reported that the tutorial-based presentation and systematic learning steps made it easier to understand the process of using SketchUp software. The availability of exercises, evaluations, and reflection activities further supported students in measuring their understanding after completing each topic. According to instructional media should encourage active learning participation through interactive and evaluative components. Similarly, Daryono & Rochmadi (2020) explained that multimedia learning environments support students in developing independent learning skills and improving problem-solving abilities through direct interaction with learning materials.

The practicality results indicate that the developed E-Module is not only theoretically feasible but also practically effective for vocational learning. Before the implementation of the E-Module, learning activities depended heavily on lecturer explanations and classroom demonstrations, limiting students' opportunities for independent practice outside class hours. After the use of the E-Module, students were able to revisit tutorials and practice independently according to their own learning pace. This condition aligns with previous studies showing that digital learning modules improve flexibility, accessibility, and learning independence among students in higher education environments (Kurniawan et al., 2025). Furthermore, competency-based digital learning media are considered effective tools for supporting practical learning activities that require repeated practice and technical skill development (Sugiyono, 2019).

Overall, the competency-based SketchUp E-Module developed in this research has fulfilled the aspects of validity and practicality as an innovative learning medium for the Drawing Planning course. The E-Module successfully supports students in improving their competencies in technical drawing and 3D

building design through interactive and technology-based learning experiences. These findings are relevant to previous studies which concluded that digital learning media integrated with multimedia applications can improve student motivation, practical competencies, and learning outcomes in vocational education. Therefore, the research objective of producing a valid, practical, and competency-based SketchUp E-Module has been successfully achieved

CONCLUSION

Based on the results of research and development, it can be concluded that the SketchUp E-Module in the Planning Drawings course developed using the DDD-E model has succeeded in becoming an interactive, structured, and in accordance with the needs of practical learning. This development is motivated by the unavailability of E-Module-based teaching materials, so that previously learning was still dominated by demonstration methods and PowerPoint. The validation results showed that the E-Module was classified as "very feasible" from the media aspect with a score of 91.5% and "feasible" from the material aspect with a score of 80%, so that overall it met the feasibility standards as a digital learning medium. In addition, the results of the practicality test on students showed the category of "very practical" with an average of 96.67%, which means that the E-Module is easy to use, attractive, and effective in helping students' understanding both independently and in the classroom. Thus, this E-Module not only fulfills the research objectives in terms of feasibility and practicality, but also becomes a solution to learning problems and is able to increase student motivation and understanding. The advice that can be given is that students are still advised to look for additional learning resources, lecturers are expected to use the E-Module as a complement to learning to be more effective and innovative, and the next researcher can develop this E-Module further with the integration of other technologies to make it more optimal.

ACKNOWLEDGEMENT

The author would like to express his deepest gratitude to all parties who have provided support, assistance, and contributions in the preparation and completion of this work. Gratitude is expressed to the supervisors who have provided invaluable direction, guidance, and input during the research process. In addition, the author also thanked the institution for providing facilities and opportunities in the implementation of this research. Not to forget, the highest appreciation is given to colleagues and all parties who have helped, both directly and indirectly, so that this work can be completed properly.

REFERENCES

- Arsyad, A. (2019). *Media pembelajaran* (Edisi revisi). Rajawali Pers.
- Daryono, R. W., & Rochmadi, S. (2020). Development of learning module to improve competency achievement in the department of civil engineering education in Indonesia. *Psychology, Evaluation, and Technology in Educational Research*, 3(1), 34–43. <https://doi.org/10.33292/petier.v3i1.54>
- Kurniawan, E. D., Nopriyanti, N., Hermawan, R., Mbakwa, P. N., Pratama, A., Rianto, R., Febriansyah, F., & Yanti, P. I. (2025). Case method textbook innovation for Autodesk inventor-assisted CAM learning. *Jurnal Inovasi Dan Teknologi Pembelajaran*, 12(2), 100–112. <https://doi.org/10.17977/um031v12i22025p110>
- Munir. (2017). *Multimedia: Konsep dan aplikasi dalam pendidikan*. Alfabeta.
- Oscarius Yudhi Ari Wijaya. (2020). *THE ROLE OF ORGANIZATIONAL CITIZENSHIP BEHAVIOR AS MEDIATION VARIABLES BETWEEN ORGANIZATIONAL COMMITMENTS AND EMPLOYEE PERFORMANCE : EVIDENCE FROM THE HOSPITALITY INDUSTRY IN SURABAYA*. 18(1). <https://doi.org/10.21776/ub.jam.2020.018.01.13>
- Putri, A. H., Maulana, A., & Murtinugraha, E. (2024). *Desain Interior Digital : Pengembangan E-Modul Aplikasi Sketchup sebagai Bahan Ajar pada SMK Desain Pemodelan dan Informasi Bangunan*. 8, 32569–32576.
- Retnawati, H. (2016). *Analisis kuantitatif instrumen penelitian*. Parama Publishing.
- Rofiq, M. A., & Arthaningtyas, D. R. (2026). Pengembangan E-Modul Berbasis SketchUp pada Materi Jembatan Rangka Baja di SMK Negeri Dander Bojonegoro. *Jurnal Penelitian Inovatif*, 6(2), 1317–1328. <https://doi.org/10.54082/jupin.2394>
- Saputra, H. (2021). Metode research and development (R\&D) dalam penelitian pendidikan . In *Jurnal Pendidikan dan Inovasi* (Vol. 5, Issue 1, pp. 25–33). <https://doi.org/10.21831/jpi.v5i1.38921>
- Sugiyono. (2013). *Metode Penelitian Kualitatif*. Alfabeta.
- Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Alfabeta.
- Sugiyono, P. (2017). *Metode penelitian bisnis*. Alfabeta.
- Tegeh, I. M., Jampel, I. N., & Pudjawan, K. (2019). *Model penelitian pengembangan*. Graha Ilmu .
- Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional . (2003).
- Wijaya, K., Sebayang, N., & Harahap, R. G. (n.d.). *Development of E-Module-Based Learning Media to Improve Competence in Building Interior Design Practices*. 512–520.

Wulandari, D., & Ramadhan, A. (2020). Pemanfaatan SketchUp sebagai media pembelajaran desain bangunan . In *Jurnal Pendidikan Teknik Bangunan* (Vol. 6, Issue 2, pp. 101-108). <https://doi.org/10.21831/jptb.v6i2.34567>