Sustainability in Civil Engineering Journal
Volume 1, Number 1, Year 2026
P-ISSN: xxxx-xxxx E-ISSN : xxxx-xxxx
Open Access: https://journalcendekia.com/SICEJ

Development of Three-Dimensional Visual Learning Media for The Building Utility Construction Subject at SMK Negeri 1 Padang

Wahyu Ikhlas[1] Rusnardi Rahmat Putra [2],
[1] Faculty of Engineering, Universitas Negeri Padang
[2] Faculty of Engineering, Universitas Negeri Padang
Correspondence: wahyukece123456@gmail.com, rusnardi.rahmat@ft.unp.ac.id,

Article Info

Article history:
Received March 17th, 2026
Revised March 17th, 2026
Accepted March 18th, 2026

Keyword:
SketchUp, Animation Media, Building Utility Construction.

ABSTRACT

This research is motivated by the boredom of student learning, the use of teaching materials is not optimal, learning interactions are not maximized and the low learning outcomes obtained during learning. The purpose of this research is to create a three-dimensional visual learning media that is good and easy. the method used in the review is (RdanD) using the four-D development model (4D). the four-D flower terms are, one two , three and four. Based on the number of studies conducted, it was found that the assessment from material experts 1 category was very valid for class 2 nominal 94%, the category was very valid, the last media validation with the media expert validator obtained an assessment of 83% with a very valid category. In addition, this study tested practicality on students SMK N 1 Padang with an assessment of 82% which is categorized as very practical.

INTRODUCTION

Education is an effort to improve human resources whose role is very important in the development of society so that it is not left behind by the progress and changes of the times. Education also plays a role in shaping human resources, and at the same time it is required to provide training that can produce the best graduates. In addition, education prepares students to develop professional attitudes in vocational fields[1].

SMK Negeri 1 Padang is a vocational school that aims to prepare students with talents and skills so that they are ready to work according to their respective fields of expertise. One of the expertise competencies at SMK Negeri 1 Padang is Design Modeling and Building Information (DPIB) in grade XII, which includes the subject of Building Utility Construction, particularly in the basic competency of drawing electrical installations. In the Building Utility Construction subject, students are required to understand the components of a building structure, such as foundations, sloof beams, beams, columns, and roof frame structures.

Therefore, teachers as educators are responsible for guiding students to achieve the expected learning objectives, namely understanding the content of the subject matter. In order for the learning process in the classroom to be successful, teachers need to make innovations and improvements in the learning process. One innovation that can be applied is the use of Three-Dimensional Visual Learning Media to support the teaching and learning process[2].

Based on interviews conducted with one of the teachers in Padang, it was found that students had difficulty visualizing the material presented and understanding the teacher's explanations. The researcher also conducted interviews on October 18, 2022, with 10 students, and found several problems. During the learning process, students were not interested in participating in the class because the teacher mostly explained the material using the module method, and the jobsheets were not provided by the teacher.

The data from the Mid-Semester Examination results for the last three years in the Building Utility Construction subject show that in 2019/2020, the percentage of students who did not achieve mastery in class XII DPIB was 60.71%, while 39.28% achieved mastery. In 2020/2021, the percentage of students who did not achieve mastery was 48.14%, while 51.85% achieved mastery.

No	Standard Achievement %	Category
1	81-100	Very Valid
2	61-80	Valid
3	41-60	Quite Valid
4	21-40	Invalid
5	0-20	Very Invalid

In 2021/2022, the percentage of students who did not achieve mastery was 58.33%, while 41.66% achieved mastery, with a Minimum Mastery Criterion (KKM) of 65. Based on the problems described above, it is necessary to use learning media that can help students better understand the material. One of the learning media that can be used is animated video developed using the SketchUp application.

SketchUp is a program used to create three-dimensional models, and 3D media can help support the learning process. This is supported by previous research. According to the research results of Cahyanto (2018)[3], SketchUp-based 3D media can produce models that are consistent with the presented material and can be effectively used in learning applications[4].

RESEARCH METHODS

The type of research used in this study is Research and Development (R&D). The development model used in this research refers to Thiagarajan (1974, cited in Sugiyono, 2015: 37–38), which is known as the Four-D (4D) development model consisting of several stages[5].

1. Define Stage

   At this stage, preliminary research and information gathering were conducted through field observations. The researcher carried out observations to obtain initial information that supports the background of the problem and identifies the learning conditions in the classroom[6].

2. Design Stage

   This stage involves the design and modification of the learning media to be developed and implemented. In this development research, the learning media designed is a SketchUp-based Three-Dimensional Visual Learning Media intended to support the learning process in the Building Utility Construction subject[7].

3. Development Stage

   a. Validation Test

   The product that has been designed is then validated by media experts and subject matter experts. The validity of the product is calculated using the formula proposed by Aiken (1985) as follows:

$$V = \frac{\Sigma s}{n(c-1)}$$

Description:

V = Rater agreement index (validity index)
s = Score assigned by each rater minus the lowest score in the category
n = Number of raters
c = Number of rating categories

b. Practicality Test

According to Arikunto (2018), a product can be considered practical if it is easy to use and practical in its implementation. The revised learning media is then tested for practicality to determine whether the product is appropriate for use by students and teachers in the learning process. The practicality level is measured using a percentage of practicality assessment, which reflects how easy and effective the learning media is when used in classroom learning activities.

calculated using the formula proposed by Aiken (1985) as follows:

$$V = \frac{\Sigma s}{n(c-1)}$$

Description:

V = Rater agreement index (validity index)
s = Score assigned by each rater minus the lowest score in the category
n = Number of raters
c = Number of rating categories

No	Achievement Percentage	Category
1	81-100	Very Practical
2	61-80	Practical
3	41-60	Quite Practical
4	21-40	Impractical
5	0-20	Very Impractical

RESULT AND DISCUSSION

The results of this study can be described as follows:

1. Define Stage

At this stage, an analysis of students and learning conditions was conducted. The results of this stage indicated the need for animated learning media to support the delivery of learning materials. Based on the identified problems, a Three-Dimensional Visual Learning Media was developed specifically for Basic Competency (KD) 3.19, which focuses on applying the procedures for creating electrical installation drawings.

2. Design Stage

The design stage involved developing a learning animation model based on Basic Competency (KD) 3.19, which focuses on the procedures for creating electrical installation drawings. At this stage, the video-based media was adapted to align with the learning objectives of KD 3.19[8]. The designed media presents step-by-step explanations in three-dimensional visualization to facilitate students' understanding of the material.

3. Development Stage

a. Validity Test

The validation results from the subject matter experts showed that Validator 1 obtained an overall validity score of 89%, categorized as very valid. Validator 2 obtained a validity score of 83%, also categorized as very valid. Meanwhile, Validator 3 obtained an overall validity score of 88%, categorized as very valid.

In addition, the researcher conducted a practicality test with Grade XI DPIB students at SMK Negeri 1 Padang. The results showed an overall score of 82%, which falls into the very practical category. Based on the explanation above, the overall validation results from the three validators (material experts and media experts) showed an average validity percentage of 87%, which is categorized as very valid. Therefore, the three-dimensional visual learning media developed in this study is considered valid and practical to be used in the learning process[9].

CONCLUSION

The development of three-dimensional visual learning media in this study used the Research and Development (R&D) method with the Four-D (4D) development model[5]. The developed product was designed and tested and was found to be appropriate and feasible for use, as well as easy to implement in the learning process at SMK Negeri 1 Padang.

The evaluation results in the Building Utility Construction subject indicate that the developed media is very valid and suitable for use. This conclusion was obtained after conducting validation by

three material experts, resulting in an average validity score of 87%, which falls into the very valid category[10].

Furthermore, the responses from Grade XII students of the Building Information Modeling and Design program (DPIB) at SMK Negeri 1 Padang in the practicality testing of the Building Utility Construction learning media showed that the media is practical and effective to be used in the learning process.

[1] U. Widya *et al.*, "Seminar Nasional Ilmu Terapan (SNITER)".

[2] W. Saputra, W. Novalia Jufri, L. O. Andreas, and A. A. Agamuddin, "PENGEMBANGAN MEDIA PEMBELAJARAN VIDEO ANIMASI BERBASIS SKETCHUP PADA ELEMEN GAMBAR KONSTRUKSI DAN UTILITAS GEDUNG DI KELAS XI DPIB SMK NEGERI 2 SIJUNJUNG."

[3] A. Cahyanto, P. Teknologi, D. Kejuruan, and U. N. Makassar, "PENGEMBANGAN MEDIA PEMBELAJARAN MENGGUNAKAN PLANT VIRTUAL 3D MATA KULIAH PROGRAMABLE LOGIC CONTROL (PLC)."

[4] A. Cipta, P. Cummins, M. Irsyam, and S. Hidayati, "Basin resonance and seismic hazard in jakarta, Indonesia," *Geosciences (Switzerland)*, vol. 8, no. 4, Apr. 2018, doi: 10.3390/geosciences8040128.

[5] E. K. Alghiffari, R. Alam, D. H. Siswanto, and U. A. Dahlan, "Tren Publikasi Terkait Model Pengembangan 4D pada Pendidikan".

[6] K. Bangunan Dan Teknik Pengukuran Tanah Berbasis, F. Dwi Astutik, and R. Sri Agustin, "PENGEMBANGAN MEDIA PEMBELAJARAN MODUL DASAR-DASAR," vol. 5, no. 1, pp. 10–21, 2019.

[7] A. M. Azzahra, "PEMANFAATAN MEDIA PEMBELAJARAN INTERAKTIF DALAM KONSTRUKSI BANGUNAN," *Jurnal Pendidikan dan Keguruan*, vol. 2, no. 4, pp. 648–654, 2024.

[8] "ANALISIS+PENGARUH+MODEL+PEMBELAJARAN+PROJECT+BASED+LEARNING+TERHADAP+MATA+PELAJARAN+ESTIMASI+BIAYA+KONSTRUKSI+Ar+Razi+Atsil+W.".

[9] Santoso and A.Soehaimi, "Geo-Hazards," 2010.

[10] O. Marwiko, A. Syaiful, and R. Arifin, "PEMBUATAN E-MODUL INTERAKTIF PADA MATA PELAJARAN KONSTRUKSI DAN UTILITAS GEDUNG KELAS XI SMK NEGERI 2 PAYAKUMBUH DEVELOPMENT OF INTERACTIVE E-MODULES IN CLASS XI BUILDINGCONSTRUCTION AND UTILITIES SUBJECTPRIVATE VOCATIONAL SCHOOL 2 PAYAKUMBUH", doi: 10.36987/jpms.v9i1.