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# Learning media development of lighting simulator in electrical maintenance training course for vocational education

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**Abstract:** This research aims to develop learning media for lighting systems in the form of lighting simulator to support learning in electrical maintenance training subjects. This research was conducted at the Motorcycle Engineering Department of SMKN 1 Pancung Soal. The main focus of this research is to assess the feasibility of learning media which is a lighting system simulator. It is a Research and Development, adopting the Four-D models introduced by Thiagarajan. The steps taken include define (defining or analysing problems to formulating development objectives), design (designing the media to be produced), develop (development is carried out after going through expert and user trials), and disseminate (dissemination which is introducing the media in training). The results of this research are in the form of learning media, supporting learning electrical maintenance training courses. The results of the feasibility testing on this lighting simulator in terms of media aspects scored 88% with the category 'Very Decent' and in the material aspect scored 84% with the category 'Very Decent'. For the feasibility level, practitioners or users scored 89% which falls in the 'Very Decent' category. Based on the data from the feasibility test results conducted by experts, it can be concluded that this lighting system simulator is very feasible and can be used as a medium to support the implementation of the practicum of electrical maintenance training courses.

**Keywords:** Quality education; Learning media; Lighting simulator; Electrical maintenance

## 1. Introduction

Vocational education is education formed before employment, formed by combining theoretical teaching and practical experience for specific tasks in agriculture, business, or industry, offered by many vocational high schools and specialised colleges, such as agricultural colleges, technical schools, or technical education institutions (Estriyanto, 2021; Johansson, 2010; Le et al., 2022). In Indonesia, the term vocational education for secondary education is SMK/MAK, and vocational education for higher education is *Akademi, Sekolah Tinggi, Politeknik, Institut, and Universitas* (Lee Ed. & Lee Ed., 2021). In general, the main objective of vocational education is to prepare a skilled workforce.

One of the supporting factors of vocational education goals is facilities and infrastructure. In addition, learning in educational institutions is not supported by facilities that match those in industry, but only in the form of simulation tools (Jalinus, Syahril, et al., 2023). Facilities have a significant positive impact on school productivity in SMK (Elmunsyah & Rizza, 2018).

Infrastructure and media have a significant influence on student learning performance in obtaining results or findings (Yangambi, 2023). Media creation can be designed or utilised which aims to help students achieve goals. Based on this theory, it is concluded that SMK as a vocational school with the aim of preparing graduates who are ready to work so that during the learning process requires practicum media that can improve students' ability to achieve learning objectives.

However, based on the results of the survey and identification to SMK Negeri 1 Pancung Soal, it was found that there is still a lack of facilities and infrastructure in supporting the implementation of practicum learning. This has an impact on the quality of vocational education graduates themselves. SMK graduates contribute the largest number of unemployment in Indonesia, which is 9.31% (BPS-Statistics Indonesia, 2024). Therefore, efforts are needed to improve the quality of graduates so as to reduce the number of unemployed vocational education graduates. In addition, SMK graduates must master the soft skills competencies needed in the era of the industrial revolution 4.0 in the 21st century, namely critical thinking, creativity, communication, and collaboration or known as 4Cs Skills (Jalinus, Sukardi, et al., 2023).

The development of learning media in the form of simulators is one of the efforts that can be made to improve the quality of learning, so that the learning media developed is in accordance with the learning objectives, validation is carried out by experts, both media experts and material experts (Mayefis et al., 2019; Novaliendry et al., 2021). The media that has been validated by this expert is then used in the implementation of the electrical maintenance practicum. Further research can be done by comparing student learning outcomes before the simulator media is developed.

## 2. Methods

### *Type of research*

This type of research method is research and development (R&D), which adopts Thiagarajan's development model, namely the 4D model including define, design, development, and dissemination (Thiagarajan, 1974). The flow of the 4D development research stages in detail is presented in Figure 1.

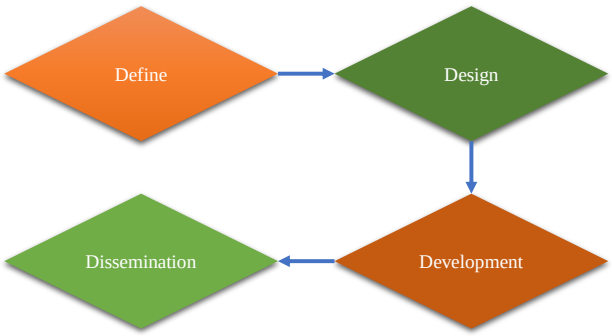


Figure 1. Flowchart of the 4-D model

### *Research subject*

The subjects of this study involved four FT UNP lecturers, where two lecturers will be material expert validators, two lecturers will be media expert validators, and two teachers of electrical maintenance subjects as practitioners at SMK. Determination of media expert validators and material experts based on experience in teaching both from teaching learning media and teaching

electricity. Teachers as practitioners (users) are determined based on teaching electrical maintenance courses. The assessment was carried out by exploring each item according to the aspects of ease of understanding in terms of language, the relationship of the item to the dimensions or statements being measured, the affordability of the item to measure each dimension or statement, and the importance of including the items (Syahril et al., 2021).

### *Research instrument*

Data collection tools in this study used questionnaires for validation and interviews to obtain the necessary information. This instrument includes 3 types, namely: (1) media expert feasibility test, (2) material expert feasibility test, and (3) practitioner or user feasibility test. The media assessment questionnaire grids used by media experts are presented in table 1.

Table 1. Media assessment questionnaire grid

| No. | Assessment Aspect | No. | Assessment Aspect |
|---|---|---|---|
| 1 | Interest in learning | 5 | Clarity of components |
| 2 | Component introduction | 6 | Practical use |
| 3 | Colour display | 7 | Easy mobility |
| 4 | Media quality | | |

The material assessment questionnaire lattice used by material experts is presented in table 2.

Table 2. Questionnaire grids for material assessment

| No. | Assessment Aspect | No. | Assessment Aspect |
|---|---|---|---|
| 1 | Systematised components | 5 | Indicator light function |
| 2 | Headlight system | 6 | Appropriateness of learning objectives |
| 3 | Turn signal light working system | 7 | OHS Aspects |
| 4 | Brake light working system | | |

The questionnaire lattice for practitioner or user assessment used by SMK teachers is presented in Table 3.

Table 3. Questionnaire lattice for practitioner or user assessment

| No. | Assessment Aspect | No. | Assessment Aspect |
|---|---|---|---|
| 1 | Component introduction | 6 | Clarity of components |
| 2 | Practical use | 7 | Media security |
| 3 | Easy to learn | 8 | Component sequencing |
| 4 | Colour display | 9 | Adding learning materials |
| 5 | Easy mobility | 10 | Safety with Fuse |

### *Data analysis technique*

The data analysis used in this study was qualitative analysis through questionnaires given to validators and practitioners. The results of the assessment from validators and practitioners were percentageed using the formula:

$$Ps = \frac{S}{N} x100\%$$

Description:

Ps = Percentage score
S = Score obtained
N = Total score

The percentage value of validity and practicality is obtained based on the formula and modified from the source (Waskito et al., 2024). Based on the above calculations, the percentage range and qualitative criteria can be determined as in table 4.

Table 4. Feasibility Interpretation Criteria

| No | Interval | Category |
|---|---|---|
| 1 | 80 < X ≤ 100% | Very Decent |
| 2 | 60 < X ≤ 80% | Decent |
| 3 | 40 < X ≤ 60% | Enough |
| 4 | 20 < X ≤ 40% | Not decent |
| 5 | 0 < X ≤ 20% | Very undecent |

## 3. Results and discussion

The result of learning media development research is a lighting system simulator that will be used to facilitate practicum activities. The procedure of this research will be clearly seen from the presentation of Figure 2.

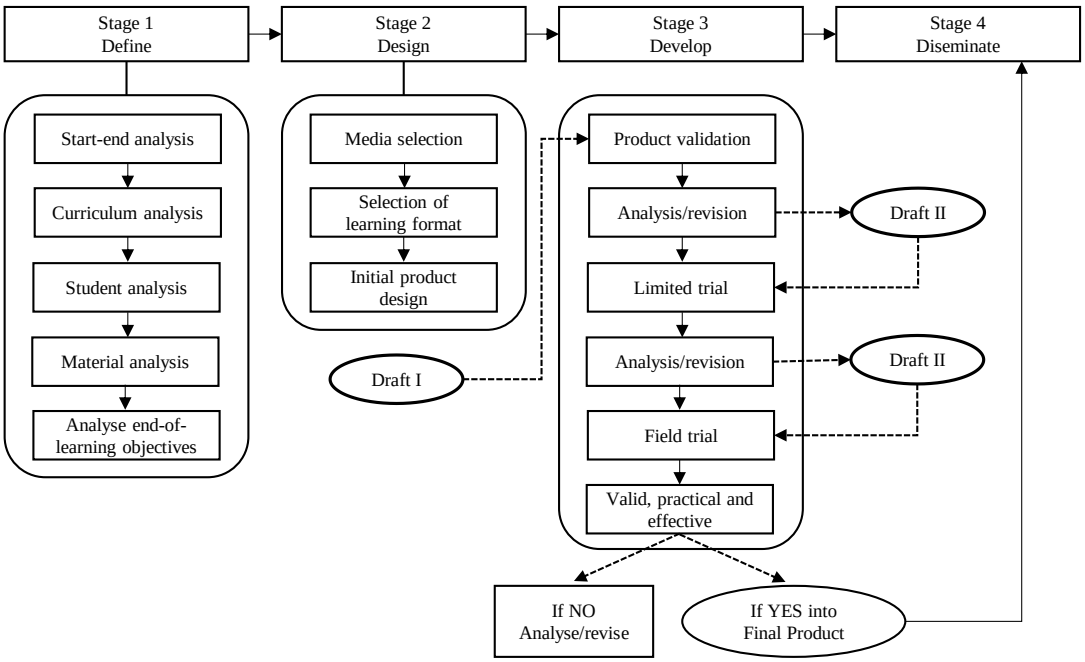


Figure 2. Flow of development steps of the modified four-D model

### *Define*

The define stage includes an end-to-end analysis to be able to formulate the objectives of the research. This initial-end analysis begins with a survey and identification of needs at SMK Negeri 1 Pancung Soal through interviews with the principal and motorcycle engineering vocational teachers to find problems experienced by students in the implementation of the practicum. Based on the results of the interview, it was found that practicum media in the form of simulators for electrical maintenance courses were not yet available so that during the practicum students could only observe the electricity of motorcycles directly.

Figure 3. Motorcycle practicum media

This does not motivate students in the practicum because it does not achieve the expected competencies. To overcome this, a lighting system simulator was developed with a design that is tailored to learning achievements, easy to use, and attracts student interest in practicum implementation. The development stage aims to produce a simulator design that will be used. At this stage, the design is analysed and compiled based on the Learning Outcomes (CP) and Analysis of Learning Objectives (ATP) of the electrical maintenance training course.

### *Design*

The design stage of making this lighting system simulator goes through several steps, namely designing media, selecting materials and tools, making media, and testing media. The design drawing of the lighting system simulator can be seen in Figure 3.

The design of the lighting system simulator is made using a solidwork device with an electric current source capable of using a battery or power supply. The purpose of choosing a design using two sources of electricity is so that this simulator can be used in any circumstances and situations so as not to interfere with practicum activities. Based on experience and discussion of simulators that use a source of electric current using batteries sometimes the battery can no longer be used and its procurement takes time so that the simulator cannot be used as long as the battery is damaged. Therefore, with a design using two sources of electric current, it is hoped that later this simulator can be used effectively and optimally. This lighting system simulator is made using a mica board and iron frame while the lighting system uses mio motorcycle components.


Figure 4. Lighting system simulator design

***Develop***

This stage includes several important aspects. First of all, the blueprint design, once established, undergoes development based on the user interface concept, integrating an aesthetically pleasing visual presentation consisting of colours, images, animations, typography, buttons, and interactive elements. The develop stage is the stage of media assessment from experts. Validation of the lighting system simulator consists of two aspects, namely media aspects and material aspects. Validation aims to determine the feasibility level of the lighting system simulator. The feasibility assessment of the media aspect is based on the media display and media operation techniques.


Figure 5. The media assessment stage of the experts

The results of the feasibility assessment on the media aspect can be seen in table 5.

Table 5. Media expert validation results

| No. | Assessment Aspect | Respondent 1 | Respondent 2 |
|---|---|---|---|
| 1 | Interest in learning | 3 | 3 |
| 2 | Component introduction | 3 | 4 |
| 3 | Colour display | 4 | 3 |
| 4 | Media quality | 4 | 3 |
| 5 | Clarity of components | 3 | 3 |
| 6 | Practical use | 4 | 4 |
| 7 | Easy mobility | 4 | 4 |
| **Total Score** | | **25** | **24** |
| **Total Maximum Score** | | **28** | **28** |
| **Score Result (%)** | | **89** | **86** |
| **Average Score (%)** | | **88** | |

Table 5 displays the results of the assessment given by the expert testers with an average score obtained of 88%, which indicates the 'very decent' category. The feasibility assessment on the material aspect is based on the suitability of the media with the material of the lighting system in the electrical maintenance training. The results of the feasibility assessment on the material aspect can be seen in table 6.

Table 6. Material expert validation results

| No. | Assessment Aspect | Respondent 1 | Respondent 2 |
|---|---|---|---|
| 1 | Systematised components | 3 | 2 |
| 2 | Headlight system | 4 | 4 |
| 3 | Turn signal light working system | 4 | 4 |
| 4 | Brake light working system | 4 | 4 |
| 5 | Indicator light function | 3 | 3 |
| 6 | Appropriateness of learning objectives | 3 | 4 |
| 7 | OHS Aspects | 3 | 2 |
| | **Total Score** | **24** | **23** |
| | **Total Maximum Score** | **28** | **28** |
| | **Score Result (%)** | **86** | **82** |
| | **Average Score (%)** | **84** | |

Table 6 displays the results of the assessment given by the expert testers with an average score obtained of 85% which indicates the 'very decent' category. The feasibility assessment given by practitioners as users of the lighting system media is based on the benefits of the media to help understand the material from the electrical maintenance training course. The results of the feasibility assessment from practitioners can be seen in table 7.

Table 7. Practitioner validation results

| No. | Assessment Aspect | Respondent 1 | Respondent 2 |
|---|---|---|---|
| 1 | Component introduction | 3 | 4 |
| 2 | Practical use | 4 | 4 |
| 3 | Easy to learn | 4 | 4 |
| 4 | Colour display | 4 | 4 |
| 5 | Easy mobility | 4 | 4 |
| 6 | Clarity of components | 4 | 2 |
| 7 | Media security | 4 | 4 |
| 8 | Component sequencing | 3 | 4 |
| 9 | Adding learning materials | 4 | 2 |
| 10 | Safety with Fuse | 2 | 3 |
| | **Total Score** | **36** | **35** |
| | **Total Maximum Score** | **40** | **40** |
| | **Score Result (%)** | **90** | **88** |
| | **Average Score (%)** | **89** | |

Table 7. The results of the assessment given by the practitioners with an average score obtained of 89% which indicates the 'very decent' category.

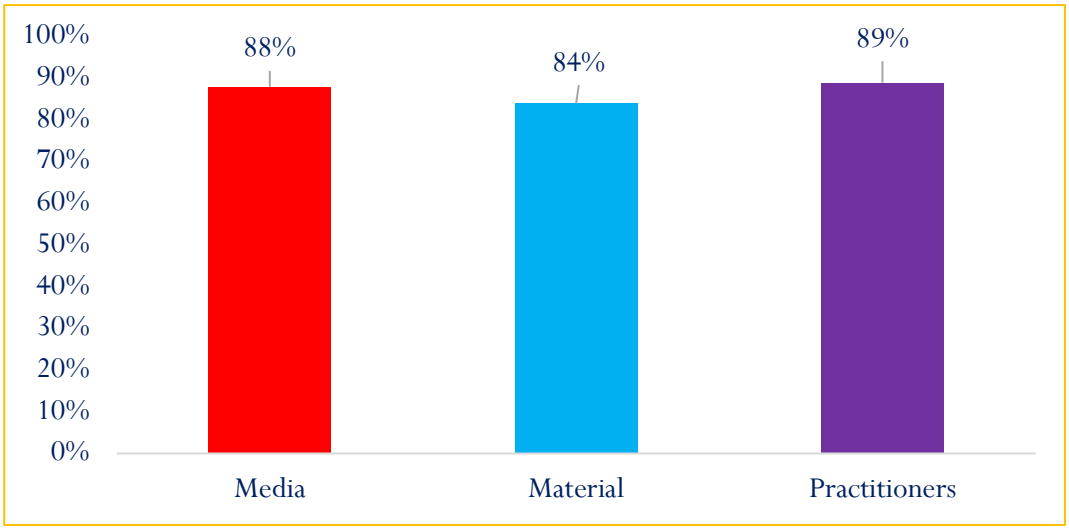


Figure 6. Chart diagram of media experts, material experts and practitioners

Figure 4 shows the scores of the three aspects. The media aspect scored 88%, the material aspect scored 84%, and the practitioner aspect scored 89%. By referring to the graph above, it can be concluded that the lighting system simulator learning media is feasible to be implemented in learning as evidenced by the validity value of the three aspects that fall into the 'very decent' category. Therefore, this lighting system simulator can be used in learning at SMK Negeri 1 Pancung Soal.

### *Disseminate*

At the disseminate stage, introductions are made as well as providing training on the use of lighting system simulator learning media after being validated and revised to several students so that this lighting system simulator media can be used for practicum that supports electrical maintenance courses.


Figure 7. Training on the use of simulator media

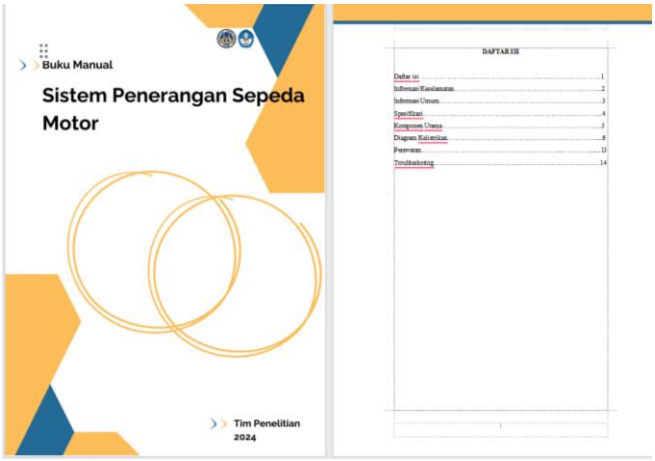


Figure 8. Simulator operational handbook

## 4. Conclusion

Research on the development of lighting simulator media in electrical maintenance training subjects in vocational education shows that simulator media developed using Four-D models consisting of four steps, including define (defining or analysing problems to formulate development objectives), design (designing media to be produced), develop (development is carried out after going through expert and user trials), and disseminate (dissemination is the introduction of media through training). The validity test from experts showed that this simulator media was declared 'very decent' with a value of 88% from media experts and 84% from material experts. As well as 89% of users and practitioners. So it is concluded that this lighting system simulator is suitable for use as a learning medium for electrical maintenance training courses.

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## Declarations

### Author contribution

Yogi Dian Alfana: Developed the methodology, conducted the investigation, and wrote the original manuscript; Ilham Yuliady and Zulfadli: provided resources, analysed the data and contributed to the writing of the original manuscript; Erik Fernandes: revised the manuscript.

### Funding statement

This research has not been funded by any person or organisation.

### Conflict of interest

The authors declare no conflict of interes

### Ethical Clearance

This research has been approved by SMK Negeri 1 Pancung Soal with letter number 56/108.420.03/SMKN1 PS/KP 2024 for media application and data collection. Teachers and

students have agreed to be subjects in this study and are willing for the data provided to be published. The participation of teachers and students as subjects in this study is in accordance with the Declaration of Helsinki.

## References

Elmunsyah, H., & Rizza, M. (2018). The Effect of Laboratory Facilities and Teacher Competence on Student Learning Outcomes in Vocational High School (VHS). *Letters in Information Technology Education (LITE)*, *1*(1). https://doi.org/10.17977/um010v1i12018p018

Estriyanto, Y. (2021). Realizing the demand-driven paradigm in vocational education: A case study on vocational high school teaching-industry partnership program. *Jurnal Pendidikan Vokasi*, *11*(2), 146–154. https://doi.org/10.21831/jpv.v11i2.39980

Jalinus, N., Sukardi, S., Wulansari, R. E., Heong, Y. M., & Kiong, T. T. (2023). Teaching activities for supporting students' 4cs skills development in vocational education. *Journal of Engineering Researcher and Lecturer*, *2*(2), 28–37. https://doi.org/10.58712/jerel.v2i2.95

Jalinus, N., Syahril, Haq, S., & Kassymova, G. K. (2023). Work-based learning for the engineering field in vocational education: Understanding concepts, principles and best practices. *Journal of Engineering Researcher and Lecturer*, *2*(1), 9–17. https://doi.org/10.58712/jerel.v2i1.22

Johansson, S. (2010). Vocational Teacher Education. *International Encyclopedia of Education, Third Edition*, 744–748. https://doi.org/10.1016/B978-0-08-044894-7.00686-2

Le, S. K., Hlaing, S. N., & Ya, K. Z. (2022). 21st-century competences and learning that Technical and vocational training. *Journal of Engineering Researcher and Lecturer*, *1*(1), 1–6. https://doi.org/10.58712/jerel.v1i1.4

Lee Ed., Y.-F., & Lee Ed., L.-S. (2021). Trends and Issues in International Technical and Vocational Education in the Indo-Pacific Region. In *Online Submission* (Issue October 2022).

Mayefis, R., Sukardi, S., & Usmeldi, U. (2019). Validity of Android Based Mobile Learning Media in Computer and Based Network Vocational High School. *Journal of Education Research and Evaluation*, *3*(4), 239. https://doi.org/10.23887/jere.v3i4.22869

Novaliendry, D., Huda, A., Sanita, D., Putra, D. A., Feiyska Nasution, M. D., Putra, R. S., & Hidayati, R. N. (2021). Android-Based Network Services Application Learning Media for Vocational High Schools. *International Journal of Interactive Mobile Technologies (IJIM)*, *15*(20), 83. https://doi.org/10.3991/ijim.v15i20.23745

Syahril, S., Nabawi, R. A., & Safitri, D. (2021). Students' perceptions of the project based on the potential of their region: A Project-based learning implementation. *Journal of Technology and Science Education*, *11*(2), 295. https://doi.org/10.3926/jotse.1153

Thiagarajan, S. (1974). *Instructional Development for Training Teachers of Exceptional Children*.

BPS-Statistics Indonesia. (2024). *Unemployment Rate by Education Level - Statistical Data - BPS-Statistics Indonesia*. https://www.bps.go.id/en/statistics-table/2/MTE3OSMy/unemployment-rate-by-education-level.html

Waskito, Fortuna, A., Prasetya, F., Wulansari, R. E., Nabawi, R. A., & Luthfi, A. (2024). Integration of Mobile Augmented Reality Applications for Engineering Mechanics Learning with Interacting 3D Objects in Engineering Education. *International Journal of Information and Education Technology*, *14*(3), 354–361. https://doi.org/10.18178/ijiet.2024.14.3.2057

Yangambi, M. (2023). Impact of School Infrastructures on Students Learning and Performance: Case of Three Public Schools in a Developing Country. *Creative Education*, *14*(04), 788–809. https://doi.org/10.4236/ce.2023.144052