JURNAL PENDIDIKAN TEKNIK SIPIL

Online (e-ISSN): e-ISSN 2715-0437 || Printed (p-ISSN): p-ISSN 2715-7601
2023, Volume V, No 1, pp.54-62

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To cite this article:
Rahmayani R , Asrib, A. R., Arfandi, A., and Kamin, Y. (2023). Developing a Learning Module for Road Material Testing Course. *Jurnal Pendidikan Teknik Sipil*, 5 (1), Pp 54-62. DOI: 10.21831/jpts.v5i1.55016

To link to this article:
http://doi.org/10.21831/jpts.v5i1.55016

2023, Volume V, No 1, pp.54-62, e-ISSN 2715-0437

Jurnal Pendidikan Teknik Sipil

Journal homepage: https://journal.uny.ac.id/index.php/jpts

Research paper

Developing a Learning Module for Road Material Testing Course

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ARTICLE INFO

Article History:
Received: 1 December 2022
Accepted: 11 July 2023
Published: 13 July 2023

Keywords:
Learning Module, Road Material Testing.

How To Cite:
Rahmayani, R., Asrib, A. R., Arfandi, A., and Kamin, Y. (2023). Developing a Learning Module for Road Material Testing Course. *Jurnal Pendidikan Teknik Sipil*, 5 (1), Pp 54-62. DOI: 10.21831/jpts.v5i1.55016

ABSTRACT

Background: A learning module, which is one of the learning facilities contains material, methods, and limitations. At Universitas Negeri Makassar, especially in the Department of Civil Engineering and Planning Education, there are only limited courses that provide learning modules. This study aims to develop a learning module for Road Material Testing course in the Department of Civil Engineering and Planning Education, Faculty of Engineering, Universitas Negeri Makassar. Modules are beneficial because the self-instruction learning system in the module allows students to study independently so that learning resources do not always have to come from lecturers.
Methods: This study employed the model by Puslitjaknov (2013) which is the simplified RnD design by Borg and Gall. The stages of research include the development of learning modules, analysis of data validation results, and revision of the developed products. The research instrument used was questionnaires which were given to media and material experts to assess the validity. The other instrument was used for testing students who had previously learned about Road Material Testing.
Results: Based on the validation done by material and media experts, the developed module is in the Very Valid category. The results of large-scale field trials of the module with students of the Building Engineering Education study program at Universitas Negeri Makassar show that it is Very Valid (89.65%).
Conclusion: The Road Material Testing learning module was developed in accordance with the Semester Lesson Plan of Road Material Testing course with four Course Learning Outcomes (CPMK), nine sub-Course Learning Outcomes of final competencies, and four learning activities. The module was developed based on the results of the validation from material and media experts. Then, based on small and large-scale trials, the module is considered easy to understand.

INTRODUCTION

Learning facilities and infrastructure influence student learning outcomes. A learning module, which is one of the learning facilities contains material, methods, and limitations. It is made to meet the learning needs of certain learning materials. The module material is arranged in such an interesting way to help students to achieve the expected learning competencies in learning.

Teaching materials are an important component to assist teachers and students in carrying out teaching-learning activities. Teaching materials include written and unwritten materials. Written teaching materials include books, student workbooks, learning modules, etc. Meanwhile, the unwritten teaching materials include audio, audio-visual, and interactive multimedia. Learning modules will make it easier for students to understand and achieve learning goals (Anista et al., 2022). In addition, learning modules (teaching materials) are designed to assist teachers in facilitating learning and supporting students in independent learning, mastering material, and achieving competencies that involve three aspects, namely: knowledge, attitudes, and skills (Mangesa & Dirawan, 2016).

At Universitas Negeri Makassar, especially in the Department of Civil Engineering and Planning Education, there are only limited courses that provide learning modules. Modules are one of the learning media that should be available, especially during this pandemic era since learning modules help students to learn from home. Having a learning module will help students learn independently but remain focused on the practicum learning. Moreover, lecturers can direct students to carry out independent practice guided by learning modules (Syamsudin et al., 2022), especially while taking the Road Material Testing course.

The developed module is expected to make the learning process more effective. As the module is in the form of a soft file, it is easier for both students and lecturers to access it. Based on the above explanation, the researchers aim to conduct a study entitled Developing a Learning Module for Road Material Testing Course for Students of Civil Engineering and Planning Education Department, Faculty of Engineering, Universitas Negeri Makassar.

METHODS

This study employed the model by Puslitjaknov (2013) which is the simplified RnD design by Borg and Gall. The design is used to produce certain products. The stages of research include

the development of learning modules, analysis of data validation results, and revision of the developed products. This study was conducted in the Department of Civil Engineering and Planning Education, Universitas Negeri Makassar from March to April 2022.

The research instrument used was questionnaires which were given to media and material experts to assess the validity. The other instrument was used for testing students who had previously learned about Road Material Testing.

1. Instrument for a media expert

Table 1.
Instrument for Media Expert

No	Aspect	Indicator
1	Desain and Modul Appearance	- Color - letter - Space - Margin - Paper - Text - Grammar - Picture
2	Modul Utility and Advantage	- Learning resources - Explaining material clearly - Practicality in learning

2. Instrument for material expert

Table 2.
Instrument for material expert

No.	Aspect	Indicator
1	Quality of learning material	- Competency Based - Learning Purposes - Material content - Material catching
2	Modul Utility and advantage	- Learning resources - Explaining material clearly - Practicality in learning

3. Instrument for student

Table 3.
Instrument for student

No	Aspect	Indicator
1	Media appearance	- Language - Letter - Picture
2	Advantage	- Practicality in learning - Learning Motivation

The research participants were the Civil Engineering and Planning Education Department students of the Year 2018. They had taken *Road Material Testing* course in the previous semesters. The object being studied was the developed learning module. The score obtained is then entered into the table of assessment qualification criteria as follows:

Table 4.
Criteria of Qualification Assessment

Percentage	Validity	Indicator
85-100	Very Valid	Accepted
69-84	Valid	Less Revision
53-68	Enough Valid	Minor Revision
37-52	Less Valid	Mayor Revision
31-36	No Valid	Rejected

Source: Subali & Handayani (2012)

Based on the criteria mentioned above, the module is considered valid or interesting if it exceeds 69% of the aspects assessed in the questionnaires. The test on the product feasibility shows that it is feasible to be used although comments and suggestions from validators are obviously needed. Suggestions from these two validators are used as a reference for the improvement of the product design. Design improvements were made to products that passed the feasibility test to produce better product designs (Triaghosa et al., 2022).

RESULT AND DISCUSSION

This research and development (RnD) were developed based on Borg & Gall's model. The focus of this research is to develop or produce a product in the form of a module for the Road Material Testing course.

1. Module development

The learning module development was based on the Borg and Gall model, namely potential problems, data collection, product design, design validation, design revision, small-scale try-out, product revisions, large-scale try-out, and product revisions. Based on the research findings, the learning module was effective to be used as learning media for the Road Material Testing course by both lecturers who teach the subject as the material expert, media expert, and students. The research findings are relevant to research by Ariana et al., (2020) entitled Development of Discovery Learning-Based Module in Plant Tissue Material to Improve Scientific Literacy of Grade XI IPA High School Students, by Lazulfa & Putra, 2020 entitled Development of Arias-Based Discrete Mathematics Modul for Informatics Engineering Students, and by Nurhadi et al., (2021) entitled Development of POE (Predict, Observe, Explain) Oriented

Module with Environment Knowledge on Pollution Material to Improve Students' Learning Outcomes. The conclusions from the three results of this study indicate that the development of the learning modules is effective to be employed as a source of learning based on expert assessment or validation.

2. Data analysis

Module validation by the media expert was carried out to assess the design in terms of layout and appropriateness as learning media. The media expert assessed the module design by filling out the questionnaire. The also assessed the aspects of the usability and benefits of the module as a learning media. Based on the assessment, some details should be revised.

Table 5.
Validation Result of Media Expert

No.	Aspect	No.	Media Expert			
			1		2	
			Valid	Rejected	Valid	Rejected
1	Desain and Modul Appearance	1	✓		✓	
		2	✓		✓	
		3	✓		✓	
		4	✓		✓	
		5	✓		✓	
		6	✓		✓	
		7	✓		✓	
		8	✓		✓	
		9	✓		✓	
		10	✓		✓	
		11	✓		✓	
		12	✓		✓	
2	Use fullness and Advantage	13	✓		✓	
		14	✓		✓	
		15	✓		✓	
		16	✓		✓	
		17	✓		✓	
	Total		**17**	**0**	**17**	**0**
	Percentage		**100%**	**0%**	**100%**	**0%**
	Average				**100**	
	Criteria				**Accepted**	

The result of validation by the media expert shows a percentage of 100% with the Very Valid or Accepted category. The module validation from the material expert was carried out to assess the module design. The material expert provided assessments, suggestions, and comments on the design by filling out the questionnaire. Also, the expert assessed the suitability of the module with the learning objectives.

Table 6.
Validation Result of Content Expert

No.	Aspek	No	Material Expert			
			1		2	
			Valid	Rejected	Valid	Rejected
1	Quality of Learning Material	1	✓		✓	
		2	✓		✓	
		3	✓		✓	
		4	✓		✓	
		5	✓		✓	
		6	✓		✓	
		7	✓		✓	
		8	✓		✓	
		9	✓		✓	
		10	✓		✓	
		11	✓		✓	
		12	✓		✓	
2	Use fullness and Advantage	13	✓		✓	
		14	✓		✓	
		15	✓		✓	
		16	✓		✓	
	Total		**16**	**0**	**16**	**0**
	Percentage		**100 %**	**0%**	**100%**	**0%**
	Average Criteria				**100 Accepted**	

The result of the validation obtained a percentage of 100% which is in the Very Valid category. This is in line with research conducted by Sukmantari et al., 2022. The feasibility score was obtained from the validation of learning media by the material expert with the assessment result which belongs to the "very valid" category. The percentage of module assessment based on the student responses was divided into 2 aspects, namely display and usability of the module. The data analysis based on the student assessment can be seen in the table 7.

The assessment was carried out by 30 students of Year 2018, in which overall, the result obtained an average percentage of 89.65%. Based on the achievement percentage scale, the quality of the Road Material Testing learning module was included in the Very Valid category.

Based on the results of the validation and try-out, the Road Material Testing learning module is very appropriate for use as a learning media. This is in line with research by Ulinuha et al., (2020) entitled The Validation Analysis of the Development of Contextual Teaching and Learning-Based Cube and Block Learning Modules, by Barus & Barus (2021) entitled Development of Multilateral Movement-Based Wrestling Learning and Training Modules in Karo District, and by Rohmaini et al., (2020). The conclusion from the three research findings is that

the module has been validated by two experts, namely media and material experts. The results of the module validation from the media expert, material expert, and field try-out obtained Very Valid results.

Table 7.
Student responds

No.	Aspect	No.	Score	Percentage (%)
1	Modul Appearance	1	109	90,83
		2	102	85,00
		3	108	90,00
		4	109	90,83
		5	111	92,50
		6	108	90,00
		7	105	87,50
2	Use Fullness	8	105	87,50
		9	105	87,50
		10	109	90,83
		11	109	90,83
		12	111	92,50
	Total		**1291**	
	Average			**89,65**

3. Product

The Road Material Testing module which had been validated by 2 material experts, 2 media experts, and field try-out by 30 students of Year 2018 of the Building Engineering Education Study Program, Makassar State University, consisted of 4 course learning outcomes (CPMK), 9 sub-CPMK final ability, 4 learning activities, and 4 learning objectives. This module consisted of 16 meetings in 1 semester.

The learning module produced which was based on the results of the validation was appropriate for use in the learning process according to the material experts and media experts. Then, based on the results of small-scale and large-scale try-outs, this learning material in the module was comprehensive and understandable.

CONCLUSIONS

Based on the research findings, the effective development of the learning module consisted of potential problems, data collection, product design, design validation, design revisions, small-scale try-out, product revisions, large-scale try-out, and product revisions. The

validation by both material experts and media experts shows results in the "very valid" category, and the large-scale field try-out obtained a result in the "very valid" category. The Road Material Testing learning module is in accordance with the Semester Lesson Plan (RPS) so that it is effective and appropriate for use as learning media in the Road Material Testing course.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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