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Development of Moodle-Based Teaching Modules to Improve Students' Basic Competencies in the Subject of Electric Motor Installation for Class XI of SMKN 7 Surabaya

Reja Diki Pradana¹, Subuh Isnur Haryudo², Fendi Achmad³, Yulia Fransisca⁴

¹State University of Surabaya, Indonesia, rezadikyp@gmail.com

²State University of Surabaya, Indonesia.

³State University of Surabaya, Indonesia.

⁴State University of Surabaya, Indonesia.

Corresponding Author: rezadikyp@gmail.com¹

Abstract: This study aims to develop and evaluate the effectiveness of a Moodle-based teaching module to enhance students' basic competencies in the Electrical Motor Installation subject for Grade XI at SMKN 7 Surabaya. The research was motivated by low student motivation and learning outcomes due to the limited use of interactive learning media. The study employed the ADDIE development model with a mixed-methods approach, combining qualitative and quantitative analysis. Validation was conducted by content and assessment experts, followed by limited implementation in classroom settings. The results indicate that the module was highly feasible, with expert validation scores averaging above 80%. Student responses reflected high practicality, with an average score of 86.76%. Effectiveness was assessed through comparisons between pre-test and post-test scores, showing a significant improvement with an average N-Gain score of 0.80, categorized as high. In conclusion, the Moodle-based teaching module is feasible, practical, and effective in improving students' understanding and skills in Electrical Motor Installation learning.

Keywords: Moodle, Teaching Module, Electrical Motor Installation, Media Development, Student Learning Outcomes.

INTRODUCTION

Rapid technological advances have driven changes in the world of education, including in how to manage and deliver learning. Information technology is now an inseparable part of life, and its use in learning is a necessity to create a more effective and relevant learning process with the demands of the times. In the context of vocational education, such as at SMKN 7 Surabaya, this demand is increasingly real because students are required to master applicable and work-ready skills. Therefore, learning innovations are needed that are not only oriented towards theory, but also support interactive and flexible practices.

Modular Object-Oriented Dynamic Learning Environment (Moodle)-based teaching modules are one alternative innovation in learning media that can be developed to answer these challenges. Moodle not only allows teachers to upload learning materials in various formats but also provides interactive features that can increase student engagement in the learning process,

such as discussion forums, quizzes, and project-based assessments (Putri & Amrizal, 2020). With these advantages, Moodle can act as a learning medium that supports the implementation of blended learning and provides opportunities for students to learn independently outside the classroom (Uska et al., 2021).

Learning in the subject of Electric Motor Installation at SMKN 7 Surabaya is still dominated by the lecture method. Based on the results of the interview, the teacher said that the limitations in the use of interactive media made students less enthusiastic in participating in learning. The students also said that this subject was considered difficult because it contained many symbols and schemes that were not easy to understand if only explained verbally or through a messaging application (Student Interview 1, May 1, 2025). This situation is exacerbated by the low motivation of students to learn and the limited learning strategies that are in accordance with the characteristics of students.

These problems indicate an urgent need to develop more varied learning media that can adapt to students' learning styles. Moodle, as a Learning Management System, offers various features that support online and offline learning, and allows personalization of materials according to the level of understanding of students (Wibowo, 2016). With this approach, students not only receive materials passively, but can also interact with content, teachers, and fellow students through various pedagogically designed digital activities.

Through a blended learning approach, Moodle can be combined with face-to-face learning to create a more meaningful learning experience. The concept of blended learning integrates the advantages of online and offline learning to accommodate the diversity of students' learning needs, both in terms of time, place, and learning style (Mulder et al., 2023). This model is becoming increasingly relevant in the digital era, where students need flexible access to learning materials and opportunities for independent learning.

This study aims to develop a Moodle-based teaching module on the subject of Electric Motor Installation that is in accordance with the curriculum and characteristics of students at SMKN 7 Surabaya. The focus of the study lies in the analysis of the practicality, effectiveness, and feasibility of the module in improving students' basic competencies, especially in understanding theory, reading electrical diagrams, and practicing electric motor installation. Through this development, it is expected that the learning process will be more interactive, interesting, and relevant to the needs of students, so as to improve their learning motivation and overall learning outcomes.

The development approach used is the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), which facilitates a systematic process in designing and implementing learning media based on real needs in the field (Muruganatham, 2015). Each stage in this model allows for continuous evaluation, so that the resulting product is not only theoretically feasible, but also practical in its use. The developed Moodle module will be tested through expert validation stages, limited implementation in class, and effectiveness evaluation through pre-test and post-test.

By considering the existing challenges and needs, the development of Moodle-based teaching modules is expected to be a strategic solution to improve students' basic competencies in the subject of Electrical Motor Installation. The implementation of this module is also expected to be able to bridge the gap between students' abilities and the demands of the industrial world, as well as improve the quality of vocational school graduates to be better prepared to compete in the world of work.

METHOD

This research is a type of Research and Development (R&D) with a mixed qualitative and quantitative approach. The development model used is ADDIE (Analysis, Design, Development, Implementation, and Evaluation), which is commonly applied in instructional

design (Muruganatham, 2015). The research was conducted at SMKN 7 Surabaya in the even semester of the 2024/2025 academic year.

The subjects of the study were 34 students of class XI Electrical Power Installation Engineering, while the object of the study was the development and evaluation of Moodle-based teaching modules. The instruments used included expert validation questionnaires, student response questionnaires, and pre-test and post-test tests. The development procedure consisted of five stages: analysis of student needs, design of module appearance and content, development of media in the Moodle platform, implementation in learning, and evaluation of the effectiveness and practicality of the product. Validation was carried out by two teachers from SMKN 7 Surabaya and one expert lecturer from Surabaya State University.

Data were collected through observation, interviews, questionnaires, and tests. Data analysis used a Likert scale for validation and response, and statistical tests included normality, homogeneity, t-test, and N-Gain tests to assess improvements in learning outcomes (Mulder et al., 2023). The feasibility of the media was determined from the results of expert validation, the practicality of student responses, and effectiveness based on the increase in post-test scores.

RESULTS AND DISCUSSION

RESULTS

This study aims to evaluate the practicality, effectiveness, and feasibility of using Moodle-based learning modules in learning Electric Motor Installation. Practicality is assessed through ease of access and use by students and teacher involvement. Effectiveness is analyzed from a comparison of student learning outcomes before and after using the module, while feasibility is reviewed based on teacher and student responses to the quality of the material. Module development follows the ADDIE (Analysis, Design, Development, Implementation, Evaluation) stages with a quantitative approach to measure its effect on improving student competence.

1. Analysis

Observations at SMKN 7 Surabaya showed that students had difficulty understanding the technical concepts of Electric Motor Installation, especially when applying theory in practice. The main obstacles came from limited face-to-face time, minimal media variety, and lack of access to independent learning. Interviews with students indicated the need for interactive and flexible media, such as videos, simulations, and automatic practice questions. Teachers also expressed difficulties in delivering material evenly and the need for a learning approach that could accommodate student diversity. Based on these findings, a Moodle-based teaching module was developed that allows access to online learning, interactive multimedia, and automatic evaluation to support improving student understanding.

2. Design

This stage includes designing the module structure in Moodle, including creating pre-test and post-test questions that are aligned with learning objectives. The module is designed with an intuitive and responsive interface, supporting various devices. The main menu includes materials, assignments, forums, and interactive quizzes. Initial validation by experts was carried out to ensure the feasibility of the module's content and features.

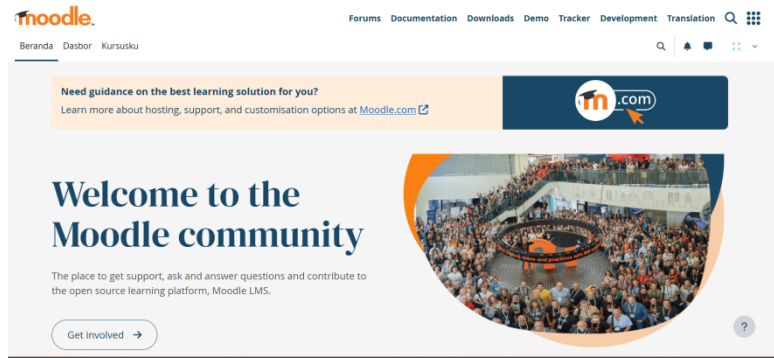


Figure 1 Moodle Dashboard Menu



Figure 2 Cover of the Electric Motor Installation Teaching Module

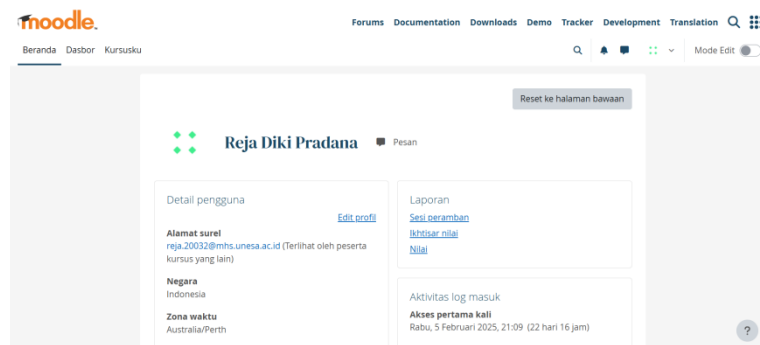


Figure 3 Developer Profile Menu

3. Development

The content is developed in various formats (text, video, images, simulations) to be easily accessible and understood. The Moodle system is enriched with automated exercises and discussion forums. The trial was conducted in two stages:

- 1) *Alpha Testing, involves teachers and some students to assess technical functions and appearance.*

2) *Beta Testing, applied to the full class to observe engagement and learning effectiveness.*

Feedback from early adopters was used to revise the module, and the test results became the basis for wider implementation. This process ensures that Moodle is an effective, interactive, and self-directed learning tool. The practicality of the Moodle-based learning module was assessed through student responses during the Electric Motor Installation learning. The assessment included ease of access, clarity of material, and effectiveness of interactive features. The module was considered practical if students were able to use it independently without significant technical constraints or high dependence on the teacher.

The results of the questionnaire showed that the majority of students gave very positive responses. The user-friendly interface, easy navigation, and the presence of features such as videos, automatic quizzes, and discussion forums make it easier for students to understand the material and are motivated to learn. The average response percentage reached 86.76%, indicating that Moodle was well received as a learning medium. Students also felt practical benefits such as time efficiency, flexibility of access, and savings on internet data. Moodle is considered capable of reducing confusion in working on questions and encouraging new ideas during the learning process.

With the dominance of “Very Good” scores in every aspect, it can be concluded that Moodle is a practical and effective media to support learning of Electric Motor Installation. Its use contributes to understanding the material, learning comfort, and increasing student motivation.

4. Implementation stage

In the implementation stage, the Moodle-based teaching module was tested in class XI of Electrical Motor Installation of SMKN 7 Surabaya to assess its effectiveness in improving student learning outcomes. The evaluation was conducted using pre-test and post-test instruments of 40 multiple-choice questions.

Before the use of the module, students followed conventional learning with an average pre-test score of 66.91, reflecting a low initial understanding. After students fully accessed and utilized the Moodle module, the post-test results showed a significant increase with an average score reaching 95.15, indicating a jump in understanding of 42.2%. In terms of skills, the average student score increased from 65.18 (pre-test) to 83.15 (post-test), indicating an increase in practical ability in applying the material. Meanwhile, the attitude score also increased, from 70.88 to 81, reflecting a positive change in students' motivation and responsibility for learning.

The effectiveness of the module was further evaluated using N-Gain analysis, with an average value of 0.7979, which is categorized as high. Manual calculations showed similar results, namely 0.8093, confirming that the increase in learning outcomes was optimal. Students' responses to this media were also very positive. They felt helped by interactive features such as videos, automatic quizzes, and materials that could be accessed at any time. Student engagement during learning increased, and most scored above 90, some even achieving a perfect score.

Overall, the implementation of Moodle-based teaching modules has proven to be effective in improving students' knowledge, skills, and attitudes, and is able to replace conventional learning methods that are less flexible. These findings strengthen Moodle as an innovative solution in digital learning that supports the Independent Curriculum.

5. Evaluation stage (evaluation)

The final stage is evaluation, where analysis is carried out on the assessment and responses from the collected student learning outcome tests. The purpose of this evaluation

is to improve the quality of the moodle-based teaching module before it is implemented, as well as to assess its overall effectiveness.

Discussion

1. Analysis of validation results and student responses

The development result data was obtained through a validation process on November 15, 2024. Validation includes an assessment of the suitability of the material to the curriculum, interface readability, feature effectiveness, and user input. These findings are the basis for improving the module to meet quality standards and provide maximum benefits to users.

a. Validation of the feasibility of moodle-based learning module materials.

The validators of the material eligibility are 2 teachers of SMK Negeri 7 Surabaya, one of whom is Mr. Igo Nanda Deka and also Mrs. Dr. Puput Wanarti R., ST, MT as a lecturer in the electrical engineering education group, Faculty of Engineering, Surabaya State University. Here are some aspects assessed by the validator:

Table 1 Summary of Material Validation Results

No.	Aspect	Assessment Score				Total Validation of Material	Maximum	(%)	Criteria
		1	2	3	4				
1	Appearance		3	12	9	78	96	81.25 %	Very good
2	Media Content		1	9	8	61	72	84.72 %	Very good
3	Language		2	7	4	41	64	64.6 %	Very good
4	Material		1	12	11	82	96	85.42 %	Very good
5	Practice in Use			6	6	42	72	58.33 %	Very good

Based on Table 1, the Material (85.42%) and Media Content (84.72%) aspects show the highest achievement, indicating that the quality of the content and structure of the material are classified as very good. The Appearance aspect reached 81.25%, but can still be improved in terms of aesthetics. On the other hand, the Language (64.06%) and Practicality of Use (58.33%) aspects still need improvement, especially in more communicative delivery and ease of access for users.

b. Validation of the feasibility of moodle-based learning module questions

The validators of the material eligibility are 2 teachers of SMK Negeri 7 Surabaya, one of whom is Mr. Igo Nanda Deka and Mrs. Dr. Puput Wanarti R., ST, MT as a lecturer in the electrical engineering education group, Faculty of Engineering, Surabaya State University. Here are some aspects assessed by the validator:

Table 2 Summary of Question Feasibility Validation Results

No.	Aspect	Indicator	Score			
			1	2	3	4
1.	Relevance	Suitability of materials to learning objectives			1	2
		Suitability to student needs			2	1
		Completeness of materials			2	1
		Material breakdown			2	1
		Accuracy of material selection			1	1
		Easy to understand material			2	1

		Accuracy of display in explaining the material			2	1
		Total Score			68/84	
					80.95%	
2.	Language	Clarity of terms			3	
		Standardization of terms			1	2
		The effectiveness of sentences in the material presented			2	1
		Total Score			30/36	
					83.33%	
3.	Question	Communicative test items				3
		The question items do not have double meaning			3	
		The questions do not provide clues to the answer key.			1	2
		The questions are formulated clearly			1	2
		Homogeneous and logical answer choices			1	2
		Suitability of questions to competencies			2	1
		The questions do not contain SARA				3
		The questions use interesting stimuli			1	2
		The questions measure the cognitive level of reasoning.			1	2
		The questions use contextual stimuli.		1	2	
				Total Score		
					83.33%	

Based on Table 2, the aspects Relevance scored 68 out of a maximum of 84 (80.95%), Language scored 30 out of 36 (83.33%), and Questions scored 106 out of 120 (88.33%). The Questions aspect showed the highest achievement, reflecting that the questions had been well-structured, clear, unambiguous, and relevant to competencies and able to stimulate students' cognitive reasoning.

The module's practicality assessment is based on the results of the student response questionnaire after using Moodle media. Student responses reflect the involvement and ease of use of the module during the learning process.

Table 3 Recapitulation of Student Response Results

Item No.	Response Score				Number of Students	Total Score	Ideal Score	Percentage of Score Acquisition
	1	2	3	4				
1			18	16	34	118	136	86.76%
2			19	15	34	117	136	86.03%
3			14	20	34	122	136	89.71%
4			18	16	34	118	136	86.76%
5			17	17	34	119	136	87.50%
6			19	15	34	117	136	86.03%
7			17	17	34	119	136	87.50%
8			19	15	34	117	136	86.03%
9			17	17	34	119	136	87.50%
10			18	16	34	117	136	86.03%
11			19	15	34	117	136	86.03%
12			19	15	34	117	136	86.03%
13			19	15	34	116	136	85.29%

14			18	16	34	118	136	86.76%
15			17	17	34	119	136	87.50%
AveragePercentageResponse								86.76%

Based on Table 3, the average percentage of student responses to the use of Moodle-based learning modules reached 86.76%, which is included in the very good category. All indicator items obtained values above 84%, with the highest percentage of 89.71% (3rd indicator) and the lowest 85.29% (13th indicator). This finding shows that students gave a positive and enthusiastic response to the application of modules in learning.

2. Competency Analysis

To assess the effectiveness of the Moodle-based learning module, a comparison was made between the results of the pre-test and post-test of students. The pre-test was given before using the module, while the post-test was after learning with Moodle. Effectiveness was measured through the increase in scores and the number of students who achieved the Minimum Completion Criteria (KKM) of 75. Based on Table 2, before using the module, only 7 students achieved the KKM, while after learning it increased to 32 students. These results indicate that the Moodle-based learning module is effective in improving students' understanding and skills in the subject of Electric Motor Installation.

Table 4 Percentage of Student Learning Outcomes

Mark	Percentage (%)	
	Completed	Not Completed
Pre Test	20.59%	79.41%
Post Test	94.12%	5.88%

The improvement of student learning outcomes is shown through a comparison of pre-test and post-test scores. Referring to the assessment criteria (Dermawan & Fahmi, 2020), student learning outcomes are categorized as very high. Before the effectiveness analysis is carried out using the N-Gain test, a normality and homogeneity test is first carried out to ensure the feasibility of the data.

Table 5 Normality Test Results

	df	Sig.
Pre Test	34	0.67
Post Test	34	0.21

Based on the results of the normality test *shapiro wilk* In Table 5, the significance value (Sig.) for the pre-test is 0.67 and the post-test is 0.21. Because both Sig. values are greater than 0.05, it can be concluded that the data is normally distributed. Thus, the next analysis is the homogeneity test.

Table 6 Homogeneous Test Results

	Sig
<i>Pre Test-Post Test</i>	0.675

Based on the results of the homogeneity test in Table 6, a significance value (Sig.) of 0.675 was obtained. Because this value is greater than 0.05, it can be concluded that the data variance is homogeneous.

Table 7 t-test

Pair	N	Mean	Std. Deviation	Std. Error Mean
Pre Test	34	66.91	7,073	1.213
Post Test	34	93.68	7,815	1,340

Based on the results of the t-test in Table 7, it is known that there is a significant difference in scores between the pre-test and post-test results. The average pre-test score was 66.91 with a standard deviation of 7.073, while the average post-test score increased to 93.68 with a standard deviation of 7.815. This shows an increase of 26.77 points after the intervention was given. With 34 respondents, the standard error mean value for the pre-test was 1.213 and for the post-test was 1.340. This finding indicates that the intervention carried out had a positive impact on improving the learning outcomes of participants.

Table 8 N-Gain Test Results

<i>N-Gain</i>	<i>N</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>	<i>Std. Deviation</i>
Pre Test	34	50	80	66.91	7,073
Post Test	34	65	100	93.68	7,815

The results of the analysis showed a significant increase from pre-test to post-test, with the mean score increasing from 66.91 to 93.68 and higher minimum and maximum scores. The standard deviation increased slightly from 7.07 to 7.81, indicating a greater variation in scores after the intervention. Overall, these results indicate that the treatment or method applied was effective in improving the academic performance of the participants.

Calculation of the average N-Gain, can use the average data of pre-test and post-test:

Pre-test average (*Spre*) = 66.91

Post-test average (*Spost*) = 93.68

$$N. Gain = \frac{Spost - Spre}{Smaks - Spre}$$

$$N. Gain = \frac{93,68 - 66,91}{100 - 66,91}$$

$$N. Gain = \frac{26,77}{33,09} = 0.8093$$

The calculation result of 0.80 is almost the same as the average value obtained (0.7979), which is included in the high category. This shows that the Moodle-based teaching module is very effective in improving student learning outcomes.

CONCLUSION

This study proves that the development of Moodle-based teaching modules can significantly improve students' basic competencies in the subject of Electric Motor Installation in class XI of SMKN 7 Surabaya. The module designed with the ADDIE approach is proven to be valid in terms of material, practical in its use, and effective in improving student learning outcomes, as reflected in the significant increase in post-test scores and the results of the N-Gain test which are included in the high category.

This finding answers the main objective of the study, which is to create learning media that can answer the challenges of learning electrical engineering practices that have so far been conventionally oriented. With Moodle as an interactive and flexible Learning Management System, students get the opportunity to learn independently and in a structured manner, which ultimately has a positive impact on improving their knowledge, skills, and attitudes in the field of engineering.

The contribution of this research to the field of industrial engineering and science education lies in the integration of digital learning technology in mastering vocational competencies. Moodle-based teaching modules have the potential to be adaptive learning solutions that support the independent curriculum, strengthen students' work readiness, and open up opportunities for the development of other digital platform-based learning models in the fields of engineering and vocational studies.

REFERENCE

- Dermawan, & Fahmi, R. (2020). Pengembangan E-Modul Berbasis Web Pada Mata Pelajaran Pembuatan Busana Industri. *Jurnal Pedagogi Dan Pembelajaran*, 3(3), 508–515.
- Mulder, W. R. S. P., Khoiri, N., & Hayat, M. S. (2023). Validitas media pembelajaran IPA berbasis web dengan pendekatan STEAM untuk meningkatkan kemampuan berpikir kreatif peserta didik. *Practice of The Science of Teaching Journal: Jurnal Praktisi Pendidikan*, 2(1), 11–17. <https://doi.org/10.58362/hafecspost.v2i1.31>
- Muruganatham, G. (2015). Developing of E-content package by using ADDIE model. *International Journal of Applied Research*, 1(3), 52–54.
- Putri, N. R., & Amrizal. (2020). Pengembangan E-Modul Berbantuan Flip PDF Profesional Pada Materi Ekosistem Kelas VII Di MTS Miftahussalam Medan. *ADIJAYA: Jurnal Multidisiplin*, 1(01), 229–240.
- Uska, M. Z., Wirasasmita, R. H., Lutfi, S., Arianti, B. D. D., Kholisho, Y. N., & Nurmayana. (2021). E-modul interaktif mata pelajaran susunan huruf komputer di sekolah menengah kejuruan. *Jurnal Education and Development*, 9(3), 590–595.
- Wibowo. (2016). *Prilaku Dalam Organisasi* (Edisi Ke-2). Rajawali Pers.