



Android-Based E-Module Design in Electric Motor Installation Lessons at SMK Negeri Agriculture, Serang City

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Abstract: This study aims to: (1) determine the process of designing Android-based E-Modules; and (2) knowing the feasibility of Android-Based E-Modules in helping class XI students understand the material for Electric Motor Installation at the Agriculture State Vocational School in Serang City. This research is a type of Research and Development research with reference to the Lee & Owens model (2004). The subjects of this study included 3 lecturers, 3 teachers, and students of class XI in the Department of Electrical Power Installation Engineering, Agriculture State Vocational School, Serang City. Data collection methods in this study are tests and non-tests. Based on the results of the Android-Based E-Module trial that was developed it is suitable for use as teaching materials, where the acquisition of an overall average aspect score by media experts is 3.59 in the very good category, the average overall aspect score by material experts is 3.50 in the category very good and the overall average score of aspects by student responses to the E-Module is 3.78 in the very good category. Evaluation of students shows the results of the percentage of success of 83.15% which fall into the category of high success criteria.

Keywords: design; e-module; and electric motor.

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INTRODUCTION

Based on Law Number 20 of 2003 concerning the State Education System, it explains that the purpose of vocational education is to prepare students to be ready to work in certain fields. In accordance with the 2013 Minister of Education and Culture Regulation concerning Implementation of the 2013 Curriculum, it can be underlined that learning is intended to make students more active and participate, while at the same time making students challenged and gain various experiences in the learning process.

As in the results of observations made at the Serang City Agricultural State Vocational School on Monday, June 7 2021, the curriculum used is the 2013 Curriculum and has been fully implemented in every department and grade level. Based on interviews with the Head of the Department of Electrical Power Installation Engineering at Serang City Agricultural State Vocational School, during the current pandemic conditions students are not allowed to come to school, so that learning activities experience many obstacles, such as: (1) limited internet quota due to uneven quota subsidies; (2) learning becomes less than optimal because the teacher only provides material through Power Point; (3) the learning method used is teacher center, so students become less active in learning activities; (4) the teaching materials in Serang City Agricultural State Vocational School are still limited in number and do not fully represent basic competencies in accordance with the 2013 Curriculum; and (5) students' interest in reading in the Department of Electrical Installation Engineering at Serang City Agriculture State Vocational School is still low which results in students not being able to understand the material that has been delivered by the teacher. So that the scores obtained by students in the Electric Motor Installation subject in class XI of the Electrical Power Installation Engineering Department of the Agriculture State Vocational School of Serang City are still below the Minimum Completeness Criteria with an average score of 60, while achieving the Minimum Completeness Criteria is 75.

Based on the existing problems, a teaching material is developed that can make it easier for students to understand the material and use the teaching material. The reason for choosing the Android-based E-Module design is as a solution to several problems that occur in the field, namely the limited number of teaching materials and the absence of E-Modules, besides that E-Modules can be used as an alternative to online learning during a pandemic. Through the Android-based E-Module, it is hoped that class XI students in the Department of Electrical Engineering at the Agriculture State Vocational School can understand the material optimally and can improve learning outcomes. The E-Module developed on an Android basis adapts to the conditions of smartphones used by Class XI students of the Department of Electrical Engineering at Serang City Agricultural Vocational School, namely the Android Operating System. This is also a consideration, because E-Modules that use the Android Operating System on smartphones can save students expenses in copying teaching materials and make the use of smartphones among students more optimal.

METHOD

The model development procedure (Lee & Owens, 2004) is carried out in five stages. These stages can be seen in Figure 1 below (Irwanto, 2021):

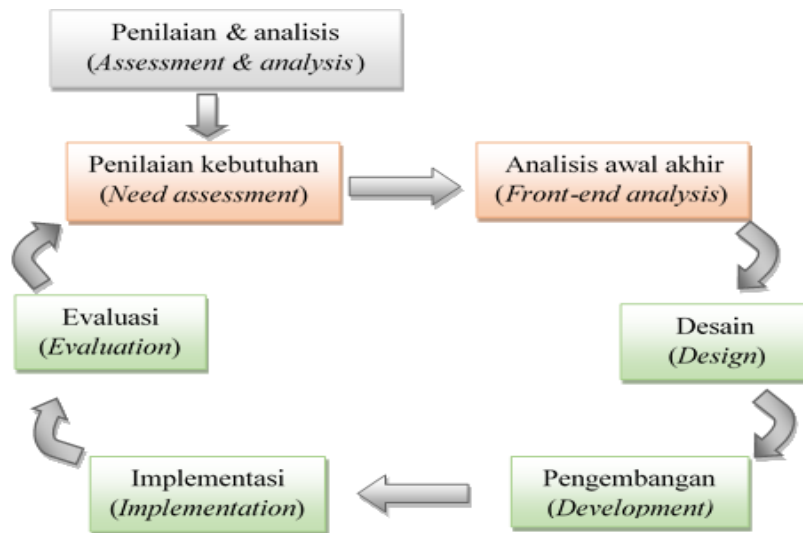


Figure 1. Model Development Procedure (Lee & Owens, 2004)

Research Design & Procedures

The stages are as follows: (1) Assessment and analysis (assessment & analysis) is divided into two parts, namely needs assessment and front end analysis; (2) The design is carried out starting from setting learning objectives, designing learning tools, designing learning materials, and designing learning outcomes evaluation tools, these steps are designing ideas that develop the next development process; (3) Design of Results-Based Product Development and design of assessment instruments, at this stage starting to realize products that are ready to be implemented and creating instruments to measure the performance of these products; (4) Implementation of products and methods that have been developed in real situations, namely in class XI students of Electrical Installation Engineering at the Agriculture State Vocational School, Serang City; (5) Evaluation is carried out to measure the promotion of development goals, the results of the evaluation are used to provide feedback to users and revisions are made according to the results of the evaluation or needs that have not been met.

Population and Sample

The design is made according to the needs of students as seen from the Core Competencies and Basic Competencies. The subjects taken are Electrical Motor Installation. This Android-Based E-Modul product design consists of materials that refer to the 2013 Curriculum, KI and KD, Syllabus and lesson plans. The research subjects were lecturers as media expert validators, teachers as material expert validators and students as users in class XI Electrical Power Installation Engineering at SMK Negeri Pertanian Serang City as many as 18 students. The collection of non-test data in this study were observations, interviews and questionnaires. Test data collection is a tool or procedure used in the form of tasks or orders that must be carried out and can also be in the form of questions or questions that must be answered. As for its use, researchers used test data collection to test students in the cognitive and psychomotor domains.

Data Collection and Instrument

Research data collection is divided into two types, namely non-test data collection and test data collection. In collecting non-test data in this study using observation techniques, interviews and questionnaires. Observation techniques aim to find out the media used in the learning process in class. The instrument used is the observation sheet. Interview techniques were carried out to collect data and analyze needs in the development of learning materials and media that will be developed, with informants, namely teachers who teach the subject of Electric Motor Installation at the Agriculture State Vocational School in Serang City.

The questionnaire technique for collecting non-test data used is a closed questionnaire. In this study, the questionnaire used was a questionnaire with a Guttman scale and a Likert scale (Sugiyono, 2013). This data collection instrument aims to validate the products made by researchers.

Collection of test data is a tool used in the form of tasks that must be carried out and questions that must be answered by students. As for its use, researchers used test data collection to test students in the cognitive and psychomotor domains.

Data Analysis

The data analysis technique used in this research is descriptive analysis technique. This data analysis analyzes the feasibility of the E-Modul from the results of filling out the questionnaire by media experts, material experts and student responses to the Electric Motor Installation E-Module (Aloraini, S, 2012). The results of the analysis of the data obtained are used as a reference in improving the development of E-Modules. The steps of the data analysis technique to determine the feasibility of the E-Modul are as follows:

1. Determining the validity score of the media, material and user expert instruments using the Guttman scale and to determine the E-Module eligibility score using the provisions of the Likert scale assessment criteria as in Table 1 (Sugiyono, 2013).

Table 1. Questionnaire Assessment Criteria

No	Description	Value
1	Strongly Agree	4
2	Agree	3
3	Disagree	2
4	Strongly Disagree	1

The maximum score is 4 and the minimum score is 1

2. Calculate the average score on each data that has been collected with the formula: (Cahyono et al., 2019)

$$\bar{X} = \frac{\sum x}{n}$$

Information:

\bar{X} = average score

$\sum X$ = total score of assessors

- n = number of raters
3. Changing the average score obtained into a qualitative value in accordance with the assessment criteria to determine the feasibility value of the E-Modul by validators and students (Ula & Fadila, 2018).
 4. Testing the validity of each item using the product moment correlation because the scores are worth 1 and 0. The results of the calculation use the product moment with the SPSS version 26 application.
 5. The criteria for high and low learning outcomes are based on a number scale from 0 to 100%, student achievement data is analyzed with descriptive statistics using a score conversion technique (Adnyana, 2020).

After the collected data is processed and analyzed, the Electric Motor Installation E-Module developed will be known how its feasibility is as teaching material or learning media and find out the percentage of student competency test results in working on questions and practices on the E-Module in Material 6 class XI TITL Agricultural Vocational School Serang City.

RESULT AND DISCUSSION

Results

The result of this research is a product in the form of an Android-based E-Modul. The resulting learning media is used to improve student learning outcomes in the subject of electric motor installation in class XI of the Electrical Power Installation Engineering Department (TITL) at the State Agricultural Vocational School of Serang City. This research is a type of Research and Development (R&D) research with a development model (Lee & Owens, 2004) which consists of 5 stages including: (1) analysis that includes needs analysis and initial final analysis; (2) design; (3) development; (4) implementation; and (5) evaluation. The following is an explanation of the data resulting from media development for each stage:

1. Analysis That Includes Needs Analysis and Initial Final Analysis

At the stage of assessment and analysis, the method used by the researcher was observation of teaching and learning activities for the subject of Electrical Motor Installation in class XI TITL and interviews with teachers of these subjects. Observations and interviews were conducted to determine the needs assessment and preliminary final analysis.

a. Need Assessment

This analysis begins with conducting field observations by conducting initial interviews with teachers and students. The initial interview was conducted with the aim of knowing the real conditions in the school. Next, collect various information needed for the Android-based E-Modul design process. From the interview obtained a problem and problem solving based on the level of need.

b. Front-End Analysis

Front-End analysis is part of the analysis phase with the aim of obtaining accurate data, namely: student analysis, technology analysis, situation analysis, task analysis, critical-incident analysis, objective analysis, media analysis, analysis of existing data, and cost analysis.

2. Design

At the design stage, the researcher designed an E-Module for Electrical Motor Installation in Class XI Electrical Power Installation Engineering. At this stage, the researcher designed the instrument to measure the feasibility of the developed E-Module.

3. Product Development

The development stage consists of three steps, namely: (1) E-Module development; (2) recapitulation of the validation results of the E-Module learning media; and (3) E-Module assessment. The results of the E-Modul development stage for the TITL class XI electric motor installation are as follows:

(1) E-Module development was developed using the Microsoft Word 2013 application to compile material and prepare questions, to create background designs, covers, layouts of images, sounds, video materials and learning tools using the Canva application, to combine the creation of exercises questions, link buttons, video and sound merging using the Flip PDF Corporation application, the result of the Flip PDF Corporation application in the form of HTML 5, to make an app file that can be installed on an android smartphone using the Website 2 APK Builder Pro application. The results of the development of the E-Module for electric motor installation class XI Electrical Power Installation Engineering class XI SMK Negeri Pertanian Serang City are as follows:

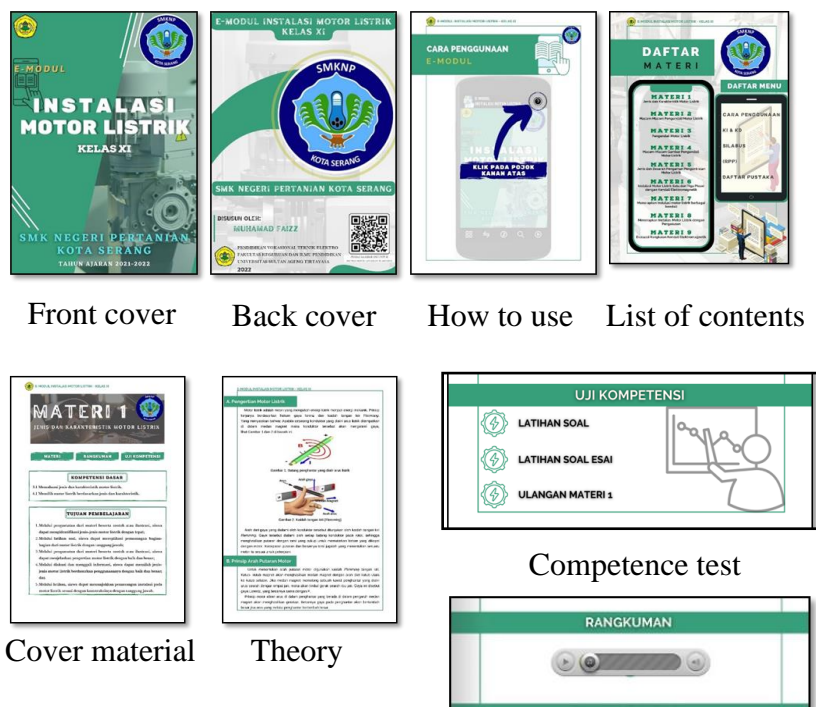


Figure 2. Design Results of Electric Motor Installation E-Module

(2) Instrument development

Instruments that have been designed at the design stage are then compiled and consulted with the supervisor. The media assessment instruments, materials and respondents (students) that have been compiled are then validated so that the resulting instruments are valid so that they are suitable for use in research. The validator lecturer for media, material and student assessment instruments is Mr. DR. H. Ediwarman, M.Pd. The table below shows the results of instrument validation.

Evaluation of the E-Module Learning Media that has been consulted with the supervisor and made improvements, then validated by media experts and material experts using the E-Module assessment sheet that was previously made. The media validation was carried out by Mr. Dr. John Pahamzah, M.Pd., Mrs. Dr. Iing Dwi Lestari, M.Sc., and Mr. Yus Rama Denny, Ph.D. Material validation was carried out by Ms. Dewi Lufi, S.Pd., Mr. Muhamad Kusdinar, S.Pd., and Ms. Fera Puspitasari, S.Pd. Validation from media experts and material experts aims to find out whether the E-Module made is suitable for use by users and receive criticism and suggestions so that the E-Modul is better. The results of the E-Modul validation are as follows:

a) Media Expert Validation

Validation by media experts includes aspects of ease of use and aspects of graphics. The results of the E-Module validation by 3 media experts are shown in Table 2.

Table 2. E-Module Validation Results by 3 Media Experts

No	Aspect Rating	Average Rating	Score for Each Aspect Category
1	Ease of Use	3.60	Very Good
2	Graphics	3,58	Very Good
	Overall Average Rating Score	3.59	Very Good

Based on Table 3 regarding the results of the validation of the E-Module Electric Motor Installation learning media, an average score of 3.59 was obtained from a scale rating range of 1 - 4 with a very valid category. The following is the process of calculating the reliability of media expert validation.

= Gross Conformity Index

= (Number of Same Answers)/(Number of Observable Objects)

= IKK = $15/27 = 0.60$ (moderate agreement)

The roughness index (IKK) on the validation of the E-Module Electric Motor Installation learning media is 0.60 or moderate agreement, which means that the reliability criteria are quite good.

4. Implementation

After the E-Module was validated by experts and had been repaired, the E-Module was tested on class XI students of Electrical Power Installation Engineering at SMK Negeri Pertanian Serang City with a total of 18 students to be used as teaching materials in learning activities. The test results will be used as a reference in improving the developed E-Module. Students as respondents gave responses to the E-Module Installation of Electric Motors for class XI TITL based on aspects of material

presentation, linguistic aspects, usability aspects and display aspects. The trial was carried out in 1 meeting with details of the trial time as shown in Table 4 below:

Table 4. Time of Trial Implementation at the State Agricultural Vocational School of Serang City

The meeting	Class	Date and time	Theory	Meeting Length
6	XI TITL	Friday, March 18, 2022	Installation of Single and Three Phase Electric Motors with Electromagnetic Control	8 x 45 JP

Recapitulation of Student Response Assessment to the E-Module to determine its feasibility when used in the learning process. To find out the results of the feasibility of the Electric Motor Installation E-Module, the researchers distributed a questionnaire to 18 respondents as many as 22 statements with the results in Table 5 as follows:

Table 5. Results of Assessment of Student Responses to E-Modules

No	Aspect Rating	Average Rating Score for Each Aspect	Category
1	Presentation of Material	3.84	Very Good
2	Language	3.77	Very Good
3	Benefits	3.78	Very Good
4	Display	3.81	Very Good
Average Overall Rating Score		3.78	Very Good

Based on Table 5 regarding the results of the assessment of student responses to the E-Module of Electric Motor Installation, an average score of 3.78 was obtained from the rating range on a scale of 1 - 4 with a very valid category. The following is the process of calculating the reliability of the respondent's validation.

= Gross Conformity Index

= (Number of Same Answers)/(Number of Observable Objects)

= IKK = 11/22

= 0.60 (moderate agreement)

The crude suitability index (IKK) on the E-Modul Electric Motor Installation learning media is 0.60 or moderate agreement, which means that it has quite good reliability criteria.

5. Evaluation

After going through the process from the previous stages, the development of the E-Module received several improvements that must be made based on the results of the assessment of material experts, media experts, student responses to E-Modules, and evaluation of student competency test results in 3 domains. The results of improvements according to the suggestions given are shown in Table 6.

Table 6. Suggestions and Follow Up

No	Suggestion	Follow Up
1	Add instructions for working on practical questions	Instructions for working on practice questions have been added to the jobsheet
2	Add video in all materials	Video is already in each material
3	The application file size is too large, maybe it can be reduced again	File size has been minimized and reduced than before

The results of the work on the competency test for material 6 by students are explained in the discussion of the research results.

Discussion

This development research produces a teaching material product in the form of an E-Module for Electric Motor Installation for class XI. Analysis of research data is described in the following discussion:

1. Stages of Designing an Android-Based E-Module in Electrical Motor Installation Subjects

The research on the design of an Android-based E-Modul in the subject of electric motor installation refers to the development model (Lee & Owens, 2004) with stages of needs assessment and analysis as well as initial and final analysis, design, development, implementation and evaluation.

In the initial assessment and analysis stage, the researcher collects requirements to find the required information data from various problem factors by analyzing needs. At the initial assessment and analysis stage, the data obtained can be obtained through observation and interviews with electric motor installation subject teachers as a form of collecting the required data. After conducting a needs analysis from the data obtained, the researcher then carried out the design stage of the product to be developed.

The design stage aims to prepare the requirements needed in designing an Android-based E-Modul by compiling an E-Modul framework, compiling the contents of the E-Module and compiling research instruments. In this stage, the researcher arranges the parts to compile the Android-based E-Modul framework, at the stage of compiling the contents of the E-Modul contains an initial design of the content written in the E-Modul and how the order of the material is presented. The preparation of the E-Module feasibility assessment instrument items is carried out at the design stage which refers to in the book (Sungkono, 2012). After the design is done then the next stage of development.

At the development stage, the researcher used the Microsoft Word 2013 application to compile material and prepare questions, to design the background, cover, image layout and learning tools using the Canva application. Merging buttons, making practice questions, merging video and sound using the Flip PDF Corporation application, the result of the Flip PDF Corporation application in the form of HTML 5, to make app files that can be installed on Android smartphones using the Website 2 APK Builder Pro application.

Instrument development is carried out at the development stage to validate the instruments used in assessing the products that have been made. The assessment instruments of media experts, material experts and users that have been valid and suitable for use were then tested on 6 experts including 3 lecturers from Sultan Ageng Tirtayasa University as media experts and 3 teachers at the State Agricultural Vocational School of Serang City as material experts. After the E-Module was assessed by 6 experts and declared very feasible, the researcher then proceeded to the implementation stage.

The implementation stage is carried out after the E-Module is declared feasible by the experts. Before being tested in the research object class, the items in this E-Module were tested in different classes, where for different classes it was carried out in class XI TITL SMK Negeri 2 Serang City. This trial in different classes is based on validating the items in the cognitive domain assessment. After the items are declared valid and reliable, the E-Module is tested on students of the research object class or in class XI of the TITL Department of SMK Negeri Agriculture in the subject of Electrical Motor Installation.

From these trials, the researchers conducted an assessment of the affective, cognitive and psychomotor domains. In the affective domain, an average score of 90 was obtained, in the cognitive domain an average value of 79 and in the psychomotor domain an average score of 78. on the subject of Electric Motor Installation, which is equal to 75. After obtaining these results, the researcher then proceeds to the evaluation stage.

The evaluation stage is the last stage of the development model (Lee & Owens, 2004), this stage is based on the results of the implementation of the E-Modul in class XI students of SMK Negeri Pertanian Serang City and the following results are obtained:

- a. The need for additional working instructions on practice questions, so that practice questions have been added to the worksheet.
- b. The need for adding videos in all materials, so researchers add videos in each material.
- c. There are still images that are small, colorless and too dense and in material 9 the layout of the writing is not neat, therefore the researchers made revisions and improvements to the images in question.
- d. The application file size is too large, so researchers make improvements by minimizing the file size so that it is reduced from before.

2. Analysis of the Feasibility Test Results of Android-Based E-Modules in Electrical Motor Installation Subjects

a. Eligibility assessment by media expert

From the results of the average assessment of media experts obtained 3.59, for the assessment of the ease of use aspect 3.60 and for the assessment of graphics 3.58.

b. Feasibility assessment by material expert

From the results of the media expert's average assessment, it was obtained 3.50, for the assessment of the content aspect 3.53, the linguistic aspect 3.46 and the presentation aspect 3.50.

From the data above, it can be concluded that the feasibility test carried out by media experts and material experts on Android-Based E-Modules for Electrical Motor Installation Class XI at Serang City Agriculture State Vocational School is very feasible to use because it has very good criteria (Irwanto, I., Bagus. D. C, dkk, 2022).

3. Analysis of Student Learning Outcomes on Assessment of 3 Areas and Student Responses

Based on the data that has been obtained the value in question 1 is 0.516, question 2 is 0.623, question 3 is 0.636, question 4 is 0.465, question 5 is 0.645, question 6 is 0.502, question 7 is 0.537, question 8 is 0.537, question 9 is 0.465 and question 10 is 0.633. All item items resulted in > 0.01 so that all item items were said to be valid.

Based on the results of the SPSS reliability test, it can be seen that the reliable value is in the Cronbach's alpha column. If the significance value is > 0.05 then the data can be said to be reliable. Table 26 above shows a significant 0.799 which means > 0.05 so the data is reliable.

a. Affective learning outcomes

As for the results of the affective assessment of students, it can be concluded that the scores obtained by students fall into the very good category. To measure classical learning mastery the formula: (Adnyana, 2020)

$$= \frac{15}{18} = 83,33\%$$

Based on the results of the calculations above, the score criteria obtained by students above 75 is 83.33% or is included in the high success criteria.

b. Cognitive learning outcomes

As for the results of the cognitive assessment of students, it can be concluded that the scores obtained by students fall into the very good category. To measure classical learning mastery the formula: (Adnyana, 2020)

$$= \frac{13}{18} = 72,22\%$$

Based on the results of the calculations above, the score criteria obtained by students above 75 is 72.22% or is included in the high success criteria.

c. Psychomotor learning outcomes

As for the results of the psychomotor assessment of students, it can be concluded that the scores obtained by students fall into the very good category. To measure classical learning mastery the formula: (Adnyana, 2020)

$$= \frac{13}{18} = 72,22\%$$

Based on the results of the calculations above, the criteria for the value obtained by students above 75 are 72.22% or enter the high success criteria.

d. Student feedback

From the results of the average student assessment obtained 3.80, the material presentation aspect is 3.84, the linguistic aspect is 3.77, the usefulness aspect is 3.78 and the display aspect is 3.81.

From the data above, it can be concluded that the user responses made by class XI students to the Android-Based E-Module Electric Motor Installation at SMK Negeri Pertanian Serang City are very feasible to use because they have very good criteria.

CONCLUSION

Based on the results of research and discussion regarding the development of the Electric Motor Installation E-Module, it can be concluded as follows.

This development research produces a teaching material product in the form of an Electric Motor Installation E-Module for class XI Electrical Power Installation Engineering at SMK Negeri Pertanian Serang City. This research refers to the development model (Lee & Owens, 2004) with the analysis stages which include needs analysis as well as initial and final analysis, design, development, implementation and evaluation.

The average value of the overall aspect score by media experts is 3.59 with a very good category, the overall average score of aspects by material experts is 3.50 in the very good category and the overall average score for aspects by students' responses to the E-Module is 3.78 in the very good category. Student evaluation shows the results of the success percentage of 83.15% which fall into the category of high success criteria in the competency test of 1 phase and 3 phase electric motor installation materials with electromagnetic control.

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