P-ISSN: 2776-7329, E-ISSN: 2776-7310
Proceedings
5th Vocational Education International Conference
Semarang, 13 July 2023

# The Influence of Electric Motor Installation Trainer Assisted Learning Models and Achievement Motivation on the Skill Competence of Students in Vocational School 1 Sidoarjo

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**ABSTRACT**
This study aims to obtain information: (1) differences in student learning outcomes taught using a project-based learning model assisted by an electric motor installation trainer and assisted by conventional media; (2) differences in student learning outcomes with high achievement motivation, compared to students with low achievement motivation; (3) the interaction between the use of electric motor installation trainers and achievement motivation on student skill competencies. The research design is a quasi-experimental design: the non-equivalent control group design. In this design, the experimental group and the control group were not randomly selected. As a measuring tool for competency achievement in this study, learning outcomes tools and instruments were made, which functioned as instruments to assess student skill competencies during the practicum learning process. The experimental treatment used a learning model based on a project assisted by an electric motor installation trainer and for conventional media assisted control classes. The study found: (1) skill competence for students who were taught with a project-based learning model assisted by electric motor installation trainers, was significantly higher than those assisted by conventional media; (2) skill competency for students with high achievement motivation is significantly higher than those with low achievement motivation; and (3) there is a significant interaction between the project-based learning model assisted by electric motor installation trainers and achievement motivation on student skill competencies.

***Keywords:*** *Project-Based Learning, Achievement Motivation, Electric Motor Installation Trainers, Student Skill Competencies.*

## 1. INTRODUCTION

RI Law No. 20 of 2003 concerning the National Education System, the definition of Vocational High School is, "Vocational education is education that prepares students to be able to work in certain fields." To achieve competency competence, there are several things to consider including technological developments, the job market, population growth, changes in work patterns, the concept of local excellence, infrastructure, number and quality of teachers [1-2].

Based on the author's experience as a productive teacher on the electrical installation engineering expertise package at SMK Negeri 1 Sidoarjo and Based on an initial survey of other teachers and curriculum departments, found several projects in our students studying in the industrial automation engineering expertise package. The projects they have include: their lack of understanding of learning control systems, students' lack of understanding of electric motor control systems in the Electric Motor Control System subject, students' lack of understanding of sensor functions in real or near real conditions, student learning activities in the Electrical Control System subject uneven (only a few students are active), and less interesting learning media, especially the electric motor control system media [3].

In order for students to play an active role in the teaching and learning process, an appropriate learning model is needed. The project-based learning model [4] is a learning approach that is used to stimulate students' high-level thinking in project-oriented situations, including learning how to learn.

Project-based learning is an innovation in learning to optimize thinking skills [5-6]. It means that project-based learning is learning that requires student activities to complete projects faced by students [7]. The characteristics of project-based learning are: authentic projects, involving many subjects, scientific investigations, producing real work, developing thinking skills and social skills in dealing with complex projects [4].

Basically the ultimate goal of learning is to produce students who have the attitudes, knowledge and skills in solving projects they face in their lives. For this reason, teachers must have appropriate learning strategies. Then a learning plan is needed that can be applied in problem based learning. In order to achieve optimal learning outcomes, it is necessary to design project-based learning model planning properly. Starting from preparing projects that are in accordance with the curriculum that will be developed in class, bringing up projects from students, equipment, and assessments used. The planning made is a means of smoothing the phases of project-based learning and achieving the desired learning objectives. In addition to using the right learning model, motivational factors also affect student learning outcomes.

"Motivation is an encouragement that exists in a person to try to make changes in behavior that are better in meeting their needs" [8]. That learning really needs motivation. Learning outcomes will be optimal, if there is motivation. The more precise the motivation given, the more successful the lesson will be. The function of motivation can be as a driving force for humans to act, namely determining what actions must be carried out in order to achieve goals by setting aside actions that are not beneficial to that goal [9]. Principles of motivation, namely making you do something, making you keep doing something, and determining which direction to do something [4].

So motivation is the urge to go to certain conditions where there was no such drive before so that one does something, with this encouragement one will continue to do something, and determine which way to do something to fulfill one's needs in a better direction.

"Motivation will deepen if it is realized that everyone has three types of needs, namely: (1) need for achievement, (2) need for power, and (3) need for affiliation". Concluded that achievement motivation is an impulse that arises from within the individual in connection with the expectation that the actions taken are a tool to achieve good results, compete and outperform others, overcome obstacles and maintain high spirits. The characteristics of high achieving people/students [7, 9, 10, 11], namely: daring to take moderate risks, wanting immediate feedback, success is carefully calculated, and integrated with assignments. [12] suggests a high need for achievement, namely: a taste for circumstances that cause a person to be personally responsible, a tendency to set appropriate (moderate) goals and take into account the risks, and the desire to get good feedback clear on performance. The need for achievement is: the desire to achieve something difficult, achieve high standards of success, master complex tasks, and outperform others [11]. That individuals who show a need for achievement try to achieve goals that are realistic but challenging [13-15]. Three essential elements, namely self-efficacy, task-value, and goal orientation. Self-efficacy (self-efficacy). The context of education, self-efficacy consists of two aspects, namely: Academic self-efficacy, an individual's self-assessment of his ability to succeed in achieving academic goals; and self-efficacy for self-regulation, an individual's self-assessment of his or her ability to regulate cognition, affection, and action in order to achieve academic success. stated that people who consider their level of competence high enough will try harder, achieve more, and be more persistent in carrying out tasks [4, 9, 12, 16, 17].

Based on the background described above, the project in this study is formulated as follows. 1) Is there a significant difference in learning outcomes between students who are taught using a project-based learning model assisted by an electric motor installation trainer, compared to those assisted by conventional media in learning to describe the design and implement an electric motor control circuit? 2) Is there a significant difference in learning outcomes between students with high achievement motivation, compared to students with low achievement motivation in learning to describe the design and apply the electric motor control circuit? 3) Is there a significant interaction between the learning model based on the project assisted by electric motor installation trainers and achievement motivation on students' competence in learning to describe the design and implementation of electric motor control circuits?

Based on the formulation of the project, the objectives of this research are as follows. 1) Obtain information on differences in the competency skills of students who are taught using a project-based learning model assisted by an electric motor installation trainer, compared to those assisted by conventional media in learning to describe the design and implement an electric motor control circuit. 2) Obtain information on differences in the competency skills of students with high achievement motivation compared to those with low achievement motivation in

learning to describe the design and apply the electric motor control circuit. 3) Obtain information on interactions between learning models based on projects assisted by electric motor installation trainers and achievement motivation on student skill competencies in describing designs and implementing electric motor control circuits [18].

## 2. RESEARCH METHODS

This research uses the type of experimental research. The purpose of this experimental research is to: test the hypotheses proposed in the research, predict events or events in the experimental setting, and draw generalizations of the relationships between variables. The design used in this study is a Quasi-Experimental design: the non-equivalent control group design. In this design, the experimental group and the control group were not randomly selected.

In this study the subjects were divided into two classes, namely: (1) Experimental class, namely the class taught using a learning model based on a project assisted by an electric motor installation trainer, and (2) Control class, namely a class taught using a learning model based on a media-assisted project conventional.

Determination of the high achievement motivation group and the low achievement motivation group by finding the middle score, namely the lowest score added together with the highest score divided by two. The high achievement motivation group if the score is greater than or equal to the middle score, while the low achievement motivation group scores less than the middle score. In conducting research, the separation of high achievement motivation groups and low achievement motivation groups is quasi or not separated in real terms.

### *2.1. Prerequisite Analysis Test*

**a. Normality test**

The normality test is used to test whether the learning outcomes obtained are normally distributed or not. The learning outcomes tested include: learning outcomes of knowledge, attitudes, and skills. For knowledge learning outcomes that are tested include: pre-test and post-test scores. The normality test used is the Kolmogorov-Smirnov test using the SPSS program. If a significance level of > 0.05 is obtained, the data is normally distributed and if < 0.05, the data is not normally distributed.

**b. Homogeneity Test**

The homogeneity test of knowledge competency scores between the experimental group and the control group was used to determine whether the variances of the two groups were the same or not. The learning outcomes tested include: learning outcomes of knowledge, attitudes, and skills. For knowledge learning outcomes that are tested include: pre-test and post-test scores. In this study, Levene's was used to test the variance. To test the homogeneity, the SPSS program is used. obtained a significance level of > 0.05 then the data is taken from a homogeneous sample and if < 0.05 then the data is taken from a non-homogeneous sample.

### *2.2. Hypothesis Test*

Testing the value of the hypothesis is the last step used to decide whether the temporary answer from the project formulation mentioned in the research hypothesis is true or false. In other words, statistical hypothesis testing is also meaningful if the null hypothesis is accepted or rejected. The statistical hypothesis test used is a two-way ANOVA. In this study, the separation of statistical hypothesis tests was carried out between learning outcomes of knowledge, learning outcomes of attitudes, and competency skills on students' achievement motivation. The research hypothesis above will be accepted if the significance value obtained from calculating the F value using SPSS is less than 0.05 and which effect is better by looking at the mean difference between groups.

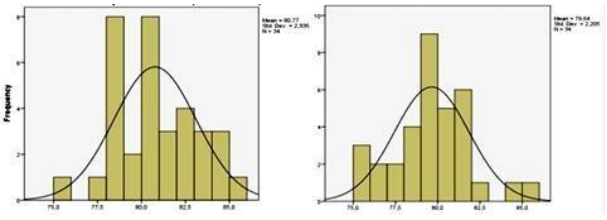
## 3. RESULTS AND DISCUSSION

The results of statistical data processing skills competency scores are given in Table 1.

**Table 1** Descriptive Statistical Data of Student Skills Competency

| Statistics | Experimental Class Learning Outcomes | Learning Outcomes Control Class |
|---|---|---|
| Mean | 80.77 | 79.64 |
| Std. Deviation | 2.335 | 2.205 |
| Variance | 5.450 | 4.860 |
| Skewness | 0.155 | 0.260 |
| Kurtosis | -0.646 | 0.522 |

Meanwhile, the normal curve for skill competency data for the experimental class and the control class is shown in Figure 1.



(a) (b)

**Figure 1.** Histogram and normal curve (a) skill competency scores for the control class, and (b) skill competency scores for the experimental class

The size of concentration and skills competence scores of the experimental class and the control class

were in the form of different average scores, for the experimental class was 80.77 and for the control class was 79.64. The size of the data distribution is indicated by the standard deviation, variance, skewenss (slope), and kurtosis (slope) values. The values of the standard deviation, variance, skewness (slope), and kurtosis (slope) of the experimental class data were 2.335, 5.450, 0.155, and -0.646 respectively, while those for the control class were 2.205, 4.860, 0.260, and 0.522, respectively. In the experimental class the tendency of the data is towards a low value due to a positive skewness value of 0.155 and the control class has a tendency of data towards a low value due to a positive skewness value of 0.260. Both the experimental and control classes have a kurtosis value below 0.263, so it can be concluded that the skill competency scores have a high distribution. Based on the histogram of Figure 1 it appears that both the skill competency scores for the experimental class and the control class are normally distributed.

## *3.1. Prerequisite Analysis Test*

### *3.1.1. Normality test*

The results of the normality test are used to test whether the scores obtained are normally distributed or not. The normality test used is the Kolmogorov-Smirnov test. The results of the normality test for the knowledge competency pre-test can be seen as shown in Table 2.

**Table 2.** Project Pre-Test Normality Test Results

| Tests of Normality | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Class | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
| | | Statistic | df | Sig. | Statistic | df | Sig. |
| Project Pre-test Score | Experiment Class | 0.136 | 34 | 0.111 | 0.956 | 34 | 0.188 |
| | Control Class | 0.139 | 34 | 0.093 | 0.955 | 34 | 0.176 |

a. Lilliefors Significance Correction

Learning outcomes data is said to be normally distributed if the significance value obtained from the normality test is > 0.05. From Table 2 it appears that the significance value of the normality test results for the pre-test knowledge competency score of the experimental class was 0.111, and that of the control class was 0.093. It can be concluded that the knowledge competency pre-test scores of the experimental class and control class using the Kolmogorov-Smirnov test have a significance of > 0.05, thus the pre-test knowledge competency scores of the experimental class and control class are normally distributed.

The results of the normality test for the knowledge competency post-test can be seen as shown in Table 3.

**Table 3.** Project Post-Test Normality Test Results

| Tests of Normality | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Class | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
| | | Statistic | df | Sig. | Statistic | df | Sig. |
| Project Post-test Score | Experiment Class | 0.147 | 34 | 0.059 | 0.943 | 34 | 0.074 |
| | Control Class | 0.142 | 34 | 0.082 | 0.953 | 34 | 0.150 |

a. Lilliefors Significance Correction

Learning outcomes data is said to be normally distributed if the significance value obtained from the normality test is > 0.05. From Table 3 it appears that the significance value of the normality test results for the post-test knowledge competency score of the experimental class was 0.059, and that of the control class was 0.082. It can be concluded that the knowledge competency post-test scores of the experimental class and the control class using the Kolmogorov-Smirnov test have a significance of > 0.05, thus the post-test knowledge competency scores of the experimental class and the control class are normally distributed.

### *3.1.2. Homogeneity Test*

The homogeneity test of learning outcomes scores between the experimental class and the control class is used to determine whether the variances of the two groups are the same or not. In this study, Levene's was used to test the variance. To test the homogeneity, the SPSS program was used, as shown in Table 4

**Table 4.** Homogeneity Test Results for Competency Scores for Experimental and Control Classes

| Test of Homogeneity of Variances | | | |
|---|---|---|---|
| Skills Competency Score | | | |
| Levene Statistic | df1 | df2 | Sig. |
| 0.859 | 1 | 66 | 0.357 |

Based on the data from the test score homogeneity test in Table 4 above, a value of 0.357 > 0.05 is obtained, it can be concluded that the sample variance is homogeneous.

## *3.2. Hypothesis testing*

The test results are shown in Table 5

**Table 5.** Test the Skills Competency Statistics hypothesis

| Tests of Between-Subjects Effects | | | | | |
|---|---|---|---|---|---|
| Dependent Variable: Experimental Class and Control Class Skill Competency Scores | | | | | |
| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
| Corrected Model | 152.859[a] | 3 | 50.953 | 15.603 | 0.000 |
| Intercept | 437431.654 | 1 | 437431.654 | 133948.176 | 0.000 |
| Model_Project | 21.606 | 1 | 21.606 | 6.616 | 0.012 |
| Achievement motivation | 103.592 | 1 | 103.592 | 31.721 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| Model_Project * Motivation_Achievement | 27.661 | 1 | 27.661 | 8.470 | 0.005 |
| Error | 209.003 | 64 | 3.266 | | |
| Total | 437793.516 | 68 | | | |
| Corrected Total | 361.862 | 67 | | | |
| a. R Squared = .433 (Adjusted R Squared = .406) | | | | | |

Then to answer the research hypothesis, hypothesis testing is carried out as follows.

### *3.2.1. First Hypothesis Testing*

**a. Student Skills Competency**

In Table 5 it appears that the results of testing the hypothesis obtained $F_{count}$ of 6.616 with a significance value of 0.012. If the test is carried out at α = 5%, df1 = (3-1) = 2, df2 = (68-3) = 65, so the value of $F_{table}$ is 3.99. Because $F_{count}$ = 6.616 > $F_{table}$ = 3.99, the skills competence for students who use project-based learning models assisted by electric motor installation trainers, is higher than the skill competencies for students who use project-based learning models assisted by conventional media in learning to describe designs and implement circuits electric motor control at SMK Negeri 1 Sidoarjo. Furthermore, to support the research hypothesis, the mean test is further used, as shown in Table 6.

**Table 6**. Results of Testing the Mean Competency of Skills on the Effect of the Learning Model

| **Dependent Variable:** | | | | |
|---|---|---|---|---|
| **Class** | **Mean** | **Std. Error** | **95% Confidence Interval** | |
| | | | **Lower Bound** | **Upper Bound** |
| Experiment Class | 80.769 | 0.310 | 80.149 | 81.388 |
| Control class | 79.641 | 0.310 | 79.022 | 80.260 |

Table 6 shows that the mean score of skills competency for students who use the project-based learning model assisted by the electric motor installation media trainer is 80.769, higher than the skills competency that uses the conventional media-assisted project-based learning model which is 79.641. With $F_{count}$ = 6.616 and a significance of 0.012 <0.05, then H0 is rejected and H1 is accepted. Thus it can be concluded that the skills competency for students who use project-based learning models assisted by electric motor installation trainers is higher than the skill competencies for students who use conventional media-assisted project-based learning models in learning to describe designs and implement electric motor control circuits in SMK Country 1 Sidoarjo. From testing the hypothesis on competency, it can be concluded that the learning outcomes of students who use project-based learning models assisted by electric motor installation trainers are higher than the learning outcomes of students who use conventional media-assisted project-based learning models in learning to describe designs and apply electric motor control circuits in SMK Negeri 1 Sidoarjo.

### *3.2.2. Second Hypothesis Testing*

**a. Skill Competence on the Influence of Achievement Motivation**

In Table 5 it appears that the results of testing the hypothesis obtained $F_{count}$ of 31.721 with a significance value of 0.000. If the test is carried out at α = 5%, df1 = (3-1) = 2, df2 = (68-3) = 65, so the value of $F_{table}$ is 3.99. Because $F_{count}$ = 31.721 > $F_{table}$ = 3.99, it means that the skills competency in describing the design and applying the electric motor control circuit for students who have high achievement motivation will be higher than students with low achievement motivation. Furthermore, to answer the research hypothesis, the mean test was used, as shown in Table 7.

Table 7 shows that the mean competency skills of students with high and low achievement motivation. Where the mean score of knowledge competence of students with high achievement motivation is 81.439, while students with low achievement motivation are 78.971. With $F_{count}$ = 31.721 and a significance of 0.000 <0.05, then H0 is rejected and H1 is accepted. So by considering the results of the mean test and the two-way ANOVA test, it can be concluded that the competency skills in describing the design and applying the electric motor control circuit for students who have high achievement motivation will be higher than students who have low achievement motivation.

**Table 7.** Results of Testing the Mean Price of Competency Skills on the Influence of Achievement Motivation

| **Achievement motivation** | **Mean** | **Std. Error** | **95% Confidence Interval** | |
|---|---|---|---|---|
| | | | **Lower Bound** | **Upper Bound** |
| Low Achiever Motivation | 78.971 | .310 | 78.351 | 79.590 |
| High Achievement Motivation | 81.439 | .310 | 80.820 | 82.058 |

From testing the hypothesis on competence, it can be concluded that the competence of students with high achievement motivation is higher than students with low achievement motivation in learning to describe the design and implementation of electric motor control circuits at SMK Negeri 1 Sidoarjo.

### *3.2.3. Testing the Third Hypothesis*

**a. Competency Skills on the Influence of Learning Models and Achievement Motivation**

In Table 5 it appears that the results of testing the hypothesis obtained $F_{count}$ of 8.470 with a significance value of 0.005. If the test is carried out at α = 5%, df1 = (3-1) = 2, df2 = (68-3) = 65, so the value of $F_{table}$ is 3.99. Because $F_{count}$ = 8.470 > $F_{table}$ = 3.99, it means that there is an interaction between the use of project-based learning models assisted by electric motor installation trainers, conventional media-assisted project-based learning models with high achievement motivation and low achievement motivation towards competency skills

in describing design and implementing control circuits electric motorcycle at SMK Negeri 1 Sidoarjo. Furthermore, to answer the research hypothesis, the mean test was used, as shown in Table 8 below.

**Table 8**. Testing the Mean Price of Competency Skills on the Influence of Learning Models and Achievement Motivation

| Use of Media Assisted Learning Models * Achievement Motivation Dependent Variable: Competency scores of Experimental Class and Control Class | | | | | |
|---|---|---|---|---|---|
| **Class** | **Achievement motivation** | **Mean** | **Std. Error** | **95% Confidence Interval** | |
| | | | | **Lower Bound** | **Upper Bound** |
| CE | Low Achiever Motivation | 78.896 | 0.438 | 78.021 | 79.772 |
| | High Achievement Motivation | 82.641 | 0.438 | 81.765 | 83.516 |
| CC | Low Achiever Motivation | 79.045 | 0.438 | 78.169 | 79.920 |
| | High Achievement Motivation | 80.238 | 0.438 | 79.362 | 81.113 |

Table 8 shows that the mean score of skills competence for high achieving motivated students who use a project-based learning model assisted by an electric motor installation trainer (experimental class) is 82.641 and the mean score of skill competence for high achieving motivated students who use a project-based learning model assisted by conventional media (control class) was 80.238, while the mean value of skill competency for low achieving motivated students who used a project-based learning model assisted by an electric motor installation trainer was 78.896 and the mean skill competency score for low achievement motivated students who used a media-assisted project-based learning model conventional (conventional media) is 79.045. With $F_{count}$ = 8.470 and a significance of 0.005 <0.05. To explain the existence of interaction, Table 9 is made of the interaction of the mean competency skills.

Table 9 shows that the mean value of skill competency for high achieving motivated students who use a project-based learning model assisted by an electric motor installation trainer is higher than the skill competency for high achievement motivated students who use a project-based learning model assisted by conventional media. On the other hand, the skills competence for students with low achievement motivation who use a project-based learning model assisted by an electric motor installation trainer is lower than the skill competence for students with low achievement motivation who use a project-based learning model assisted by conventional media.

**Table 9**. Interaction of Mean Competency Skills on the Influence of Learning Models and Achievement Motivation

| Achievement motivation | assisted by an electric motor installation trainer | conventional media | Information |
|---|---|---|---|
| High | 82.641 | 80.23 | CE > CC |
| Low | 78.594 | 9.045 | CE < CC |

The two conditions above describe an interaction relationship that influences each other between the project-based learning model assisted by electric motor installation trainers, the conventional media-assisted project-based learning model and achievement motivation towards skills competence.

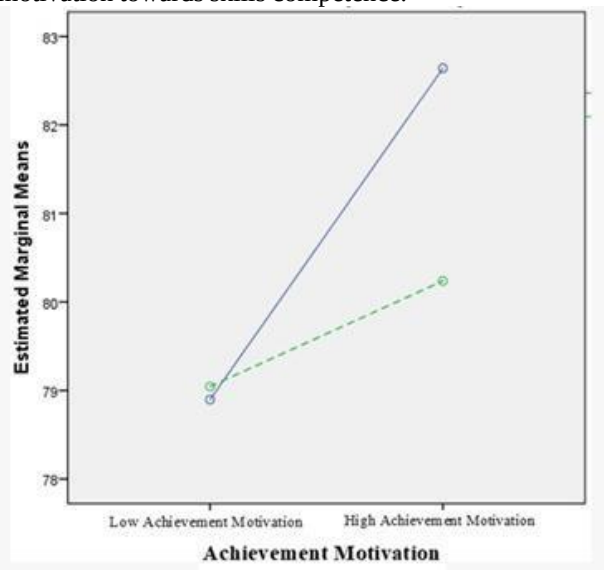



**Figure 2**. Graph of the interaction line pattern between the use of learning models on skill competencies

In this study there is an interaction between the use of learning models and achievement motivation on the competency skills to describe the design and apply the electric motor control circuit. The interaction between the use of different learning models and achievement motivation on competency skills describing the design and implementing the electric motor control circuit can be seen in Figure 2 [19-22]. From the hypothesis testing of competence, it is concluded that the interaction between the use of project-based learning models assisted by electric motor installation trainers, models conventional media-assisted project-based learning on learning outcomes describing the design and implementing electric motor control circuits at SMK Negeri 1 Sidoarjo.

## 4. CONCLUSIONS AND RECOMMENDATIONS

### *4.1. Conclusion*

Based on the discussion of research results, the following conclusions can be drawn.

1. The competency skills of students who are taught using a learning model based on a project assisted by learning media for electric motor installation trainers, are significantly higher than those assisted by conventional media in learning to describe the

design and implement an electric motor control circuit at SMK Negeri 1 Sidoarjo.

2. The skill competence of students with high achievement motivation is significantly higher than those with low achievement motivation in learning to describe the design and apply the electric motor control circuit at SMK Negeri 1 Sidoarjo.

3. There is an interaction between the learning model based on the media-assisted project and achievement motivation on the competency skills of students describing the design and implementation of electric motor control circuits at SMK Negeri 1 Sidoarjo.

### *4.2. Suggestion*

Based on the conclusions above, it can be suggested the following things.

1. The project-based learning model assisted by learning media electric motor installation trainers is very good for use in learning to describe the design and implement electric motor control circuits. Teachers can also apply the same thing to other subjects that have the same characteristics, by considering and paying attention to the level of student learning motivation. Students who are motivated by high achievement in learning using a learning model based on media-assisted projects will make it easier for students to learn and interact more positively so that they will be able to improve their learning outcomes. Meanwhile, students who are low motivated in learning using a learning model based on media-assisted projects will be helped by other students who have high achievement motivation to achieve higher learning outcomes.

2. To apply learning models based on media-assisted projects, students need to be given more adequate preparation, especially in terms of mastery in learning to describe designs and apply electric motor control circuits related to industry. With sufficient preparation, it is hoped that during the implementation of learning there will not be many obstacles in planning and operating.

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