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APPLICATION OF PROJECT-BASED INQUIRY LEARNING MODEL IN ELECTRIC MOTOR INSTALLATION SUBJECT FOR CLASS XI STUDENTS OF VOCATIONAL SCHOOL

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ABSTRACT
This study aims to enhance learning quality by employing the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) for instructional design. Data were collected through pretest and posttest scores from 35 students in an electric motor installation class. Instrument validity was confirmed by field experts, and data analysis was conducted using Microsoft Excel and SPSS 27.0. The validity test revealed 42 valid pretest and posttest questions, while reliability tests indicated high reliability (0.876 for pretest and 0.90 for posttest). Difficulty level analysis categorized most pretest questions as moderate (37) and easy (13), and posttest questions similarly (35 moderate, 15 easy). The distinguishing power analysis showed most questions were fair to good. The results demonstrated that the experimental class using the Project-Based Inquiry learning model significantly outperformed the control class, with higher cognitive learning outcomes, validating the effectiveness of this innovative learning model.Keyword: case method, team based- project,learning.
KEYWORDS

Introduction

Vocational High School (SMK) is one form of education in Indonesia that aims to achieve national education goals by preparing graduates to work in certain fields. SMK is expected to produce students who master technology, science, have creativity, and competence in accordance with the needs of the world of work (1). The teaching and learning process in SMK is similar to other formal schools in Indonesia, but SMK has more practicum hours. In its learning process, SMK uses two learning methods, namely theoretical learning and practical learning. With this approach, SMKs prepare their graduates to be competent in a particular field, with a greater emphasis on practical learning (2).

(3) explains that the success of vocational education is not only measured by student learning outcomes, but also by the quality of graduates in the world of work. In other words, every SMK student must not only graduate with good grades, but must also be able to become a competent and professional workforce. Unfortunately, currently there are still many students who have low independence in learning. (4) mentioned The lack of student learning independence can be seen from the lack of motivation to learn independently, lack of perseverance, seriousness, discipline, and responsibility for the assigned tasks. Conversely, if students' learning independence is formed, they will have a high willingness and curiosity for knowledge, which will develop and progress.

One way to help students be independent in learning activities is through the use of learning models. This learning model can support the development of students' memory. Various learning models can be applied through studies that aim to improve problem solving skills and encourage learning independence. One of the effective and appropriate learning models to encourage learning independence is the inquiry learning model. According to (5) the inquiry learning model is an educational approach that involves responsive and systematic activities to understand or find answers to a problem. Therefore, students need to have an open and receptive way of thinking.

The results of initial observations at SMK 1 Muhammadiyah in the Class XI Electric Motor Installation subject, the practical learning process has not been carried out effectively and efficiently. The learning process begins with the delivery of material by the teacher, then students prepare job sheets based on the material delivered by the teacher, and ends with group division. The practical learning process is still teacher-centred, students are only fixated on oral instructions from the teacher because they do not have clear practice stages on the sheet job sheet prepared previously. If there are problems in terms of material and work procedures in the implementation of practice, there has not been a discussion of students in the practice group. For this reason, the researcher developed a project-based inquiry learning model to help grade XI students in SMK in learning electric motor installation. With this approach, students can be more actively involved in the learning process, develop critical thinking skills, and improve their understanding and practical competence in the field of electric motor installation. In addition, this model also aims to foster students' independence and creativity in solving real problems that they face in the world of work.

The Project-Based Learning model is an active method and involves learners directly to improve their thinking skills in dealing with problems found. According to (6) this model is an innovative approach that is highly effective in improving learners' competence, as it emphasises their active involvement in the learning process. This model focuses on project work with the aim of developing learners' problem-solving skills. In its implementation, learners are given the opportunity to think broadly, make decisions in choosing topics, planning, using tools and materials, completing projects, and drawing conclusions from their work. Project-based learning allows learners to work collaboratively to complete a specific project, thus fostering an attitude of co-operation. In addition, Project-Based Learning is very effective in improving learners' learning outcomes. The project-based inquiry learning model is an approach that combines active research with real project work, so that students can be directly involved in a deeper and more meaningful learning process. This model emphasises students' involvement in finding problems, designing solutions and implementing projects that are relevant to the subject being studied. In the context of learning electric motor installation, this model allows students to develop critical thinking skills, problem-solving abilities, and teamwork. This study aims to evaluate the effectiveness of project-based inquiry learning model in electric motor installation subject at SMK, focusing on improving students' learning outcomes, practical skills, and professional attitudes.

As for the syntax of the project-based inquiry learning model in the subject of electric motor installation in Class XI vocational students are: 1) Motivate and orientate, 2) Formulating the problem and designing the project, 3) Hypothesising and collecting data 4) Training in experimental set-up skills, 5) Conducting experiments, 6) Analyse data, test hypothesis and produce project report , 7)Evaluate project results. This research aims to improve students' practical and theoretical skills through a more active, collaborative, and contextualised learning approach, as well as to equip students with critical thinking and problem-solving skills relevant to industry needs. In addition, this study also aims to evaluate the results of this learning model on their learning outcomes in terms of cognitive and psychomotor, so that it can make a significant contribution to improving the quality of vocational education in Indonesia.

2. Scope and Methodology

Efforts to improve the quality of learning by designing learning models oriented to the theory of the system approach is the ADDIE approach model . One of the Instructional Design that is widely used by learning experts is the ADDIE approach (Analysis, Design, Development, Implementation, Evaluation).

A. Research Instrument

The data in this study were taken from learning outcomes data in the form of pretest and posttest scores. For the initial ability of The initial ability of students is measured from the pretest scores in the electric motor installation subject in class XI TITL, totalling 33 people. totalling 35 people. While the posttest is used to determine the final ability after applying the Project-Based Learning model. Project-Based Inquiry learning model. Before the research was carried out on the application of Project-Based Inquiry, the instruments in the form of pretest and

posttest questions used were measured for validity by validators in accordance with their respective fields. Data analysis in this study was processed using Microsoft Office Excel 2019 and SPSS 27.0 software.

1) validity test

A question is said to be valid if the question can measure what it is intended to measure and has correct support for the total score. To calculate the validity of the test can use the formula (7) such as:

Then the price is adjusted to the table price at the 5% significance level if it is calculated < table then the item is not declared valid. Based on the validity analysis of 50 pretest test questions, 42 questions were found valid and 8 questions were invalid. As for the posttest test questions, 42 valid questions and 8 invalid questions were obtained.

2) Reliability Test

Reliability of a test when used on the same subject. A test can be said to have a high level of determination if the test can provide constant results. The reliability test is carried out to determine the level of fixity of a test when carried out on the same subject. For this reliability, the formula is used.

Klasifikasi reliabilitas tes disajikan pada tabel 1 (8).

Table 1. CLASSIFICATION OF SOAL RELIABILITY

Based on the reliability analysis of the pretest and posttest test questions for the pretest question has a reliability value of 0.876 with a very high category. of 0.850 with a very high category. Meanwhile, the posttest question has a reliability value of 0.90 with a very high category.

3) Tingkat Kesukaran Soal

The test of the level of difficulty of the question is a number that indicates whether the question made is including difficult, moderate, or easy. The level of difficulty of the question is determined using the following formula as follows:

Description: P = Index of difficulty

B = The number of samples that answer the question correctly

Js = Number of samples that answer the question

The classification of the question difficulty index can be seen in table 2 (8).

Question Difficulty Index	**Classification**
0,00-0,03	Difficult
0,31-0,70	Medium
0,71-1,0	Easy

In the calculation of the question difficulty index, for the pretest test questions, there were 37 questions in the medium category, and 13 questions in the easy category. 35 questions, and 15 questions in the easy category. In the calculation of the question difficulty index, for the posttest test questions, there were 35 questions in the moderate category, and 15 questions in the easy category questions.

4) Calculating the Distinguishing Power Index

The index of distinguishing power of a question item is an indicator to distinguish between students who are smart (high ability) and students who are stupid (low ability), (high ability) with students who are stupid (low ability).

The classification of the index of distinguishing power can be seen in table 3 (8).

Divisibility Index	**Classification**
0,00-0,20	*ugly*
0,21-0,40	*enough*
0,41-0,70	*good*
0,71-1,00	*very good*

In the analysis of differential power, for the pretest test questions out of 50 questions there were 2 questions in the bad category, 10 questions, 28 questions in the fair category, 11 questions in the good category, and no questions in the good category.
questions, 9 bad questions, 26 questions in the moderate category, 13 questions in the good category, and no questions in the excellent category. questions in the excellent category. Meanwhile, for the posttest test questions out of 50 questions there were bad category questions as many as 6 questions, 30 questions in the fair category, 14 questions in the good category, and no questions in the good and excellent categories. good and excellent categories.

3. Result and Discussion

In this study, the experimental class applied the Project-Based Inquiry learning model, while the control class applied conventional learning. The following are student learning outcomes from experimental and control classes based on cognitive aspects.

Table 4. Student Cognitive Learning Outcomes

Information	Control Class		Experiment	
	Pretest	Posttest	Pretest	Posttest
Amount	996,9	2663,15	1057,13	3229,05
Average	28,48286	76,09	27,81921	84,975

Student learning outcomes in the cognitive aspect showed that in the experimental class the average pretest result was 27.81 and the average posttest result was 84,98. While in the control class the average pretest result was 28,48 and the average posttest result was 76.09. From these results it shows that the experimental class implemented Project-Based Inquiry learning model.

4. Conclusion

The study aimed to enhance learning quality by employing the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) for instructional design. Data were collected through pretest and posttest scores from 35 students in an electric motor installation class. Instrument validity was confirmed by field experts, and data analysis was conducted using Microsoft Excel and SPSS 27.0. The validity test revealed 42 valid pretest and posttest questions, while reliability tests indicated high reliability (0.876 for pretest and 0.90 for posttest). Difficulty level analysis categorized pretest questions as moderate (37) and easy (13), and posttest questions similarly. The distinguishing power analysis showed most questions were fair to good. The results demonstrated that the experimental class using the Project-Based Inquiry model significantly outperformed the control class, with higher cognitive learning outcomes, validating the effectiveness of the innovative learning model.

Conflict of interest The author declares that there are no conflicts of interest regarding the publication of this dissertation. All aspects of this research, including the design, data collection, analysis, and interpretation, were conducted with full academic integrity and independence.

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