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# Development of a Practicum Learning Module to Enhance Competence in Car Air Conditioning Maintenance at SMK Al Asror Semarang

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## Abstract

This study aims to improve the automotive air conditioning (AC) maintenance competency of students at SMK Al Asror, in the Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) vocational program. The research method employed is a development research approach using the ADDIE model, which consists of Analysis, Design, Development, Implementation, and Evaluation. In the analysis phase, the researcher identified a lack of facilities and infrastructure as a key factor contributing to students' low competency scores. During the design phase, a maintenance module was developed based on the Indonesian National Work Competency Standards (SKKNI). The development phase involved validation testing by subject matter experts and media experts, who provided input for revisions. This study was conducted at SMK Al Asror Semarang, with a total population of 29 students, all of whom were used as the research sample. A pre-vocational competency test (pretest) was conducted

before the intervention, followed by a posttest after the intervention. The practicality of the module was also analyzed based on aspects such as ease of use, clarity, design, usefulness, and relevance. In the final evaluation stage, a practical competency test in automotive AC maintenance was conducted with external assessors from industry partners. The findings indicate that the use of the maintenance module is effective in enhancing students' competency in automotive AC maintenance.

**Keywords**

*Learning Module, ADDIE, Competency Test, Automotive AC Maintenance*

## Introduction

Graduates of vocational education are expected to become job-ready graduates with specific and professional skills, as well as entrepreneurial abilities, so that they can meet the workforce needs in Indonesia and contribute to driving the national economy forward. Therefore, vocational education institutions should take responsibility for producing graduates who meet the required standards. Vocational education institutions must remain relevant to the developments in the business and industrial sectors. The provision of infrastructure and facilities in vocational schools, particularly in SMKs, is still insufficient, especially in private schools, due to the rapid technological advancements, particularly in the case of car air conditioning systems, where the AC control has shifted from analog to digital. Furthermore, for sophisticated CBU (Completely Built Up) cars imported from abroad, there are even automatic heating and cooling features.

Vocational education learning is carried out in two forms of learning activities: theoretical learning and practical learning activities. By providing varied learning resources, including using representative media such as PowerPoint and video, schools with limited practical facilities can still maximize other forms of learning to ensure they are not left behind compared to schools that already meet the standards.

The competency test for students is a process of assessment through the collection of relevant evidence to determine whether someone is competent or not in a specific qualification. The following data shows the results of student tests where many students have not yet met the standards. For class 11, the minimum passing grade (KKM) is 75. Of the 29 students, only 4 achieved scores above the minimum. This means only 13.79% of students passed, and the remaining 86.2% have not yet reached the required standard. The average test results for the car AC system are still below the KKM, indicating that the learning outcomes in the competency of Car AC Electrical Maintenance are still very far from being considered "completed." The material on car AC systems is extensive, while the allocated time is very limited. The teacher only has the opportunity to cover the general cycle of the AC system, without going into detail about each component needed for the car AC system or its maintenance, let alone its repair. This directly impacts student learning outcomes, as the competency is still not met due to a lack of facilities, with student motivation being strongly influenced by the availability of learning resources.

Therefore, the competence in maintenance and overhaul of the car AC electrical system is addressed by developing a differentiated learning module for car AC electrical subsystem maintenance. With this module, it is expected that better and more effective learning outcomes will be achieved. The researcher

has chosen the title "Development of a Practicum Learning Module to Enhance Competence in Car Air Conditioning Maintenance at SMK Al Asror."

## Research Method

The research technique used in this study is a qualitative approach with descriptive research, in accordance with the title, which is the development of a practicum learning module to enhance the competence in analyzing car AC damage in light vehicle electrical maintenance. The qualitative approach is applied in the model development process, from the initial analysis to the evaluation stage, while the descriptive approach is used to explain the applied module and observe its influence or results at the end of the study, which will be presented in the conclusion.

According to Benny A. (2009: 128-132), there is a generic learning design model called the ADDIE model (Analysis-Design-Develop-Implement-Evaluate). ADDIE emerged in the 1990s and was developed by Reiser and Mollenda. One of the functions of ADDIE is to serve as a guide for building effective, dynamic training programs and infrastructures that support the performance of the training itself. This model uses five development stages, namely:

a. Analysis
b. Design
c. Development
d. Implementation
e. Evaluation

The ADDIE model was developed by Dick and Carey (1996) to design learning systems. Practicum learning is applied starting from the needs and performance analysis stage, followed by the design stage, development of ATP (Learning Tools), etc.,

implementation in the field, and evaluation using formative and summative formats. From the data, which initially showed that many students had not yet achieved mastery, appropriate interventions were provided, namely practicum learning, with the expectation of an increase in the percentage of students who achieve mastery.

The theme of this research is the development of a practicum learning module for light vehicle electrical systems, specifically car air conditioning maintenance, to enhance competence in maintenance and overhaul (disassembly, inspection, repair, and installation) of car AC systems according to the Standard Operating Procedure (SOP) for the use of Personal Protective Equipment (PPE) and applicable safety regulations.

The data analysis in this study was conducted using descriptive quantitative analysis techniques. This research focuses more on the impact of the maintenance module in improving students' competencies, so the data was analyzed using a descriptive quantitative system.

## Results and Discussion

Research and development is an effort to find or develop an existing product. As it is a development process, there must be a previous product that requires further development, which will lead to a better product. Therefore, previous relevant research is necessary in this study as a reference source for developing a product.

There are many terms related to vocational education, such as vocational education, technical education, professional education, and occupational education. According to Hughes, in Soeharto (1988: 1), vocational education is specialized education

in which the programs or subjects are selected for anyone interested in preparing themselves to work independently or as part of a group work system. Vocational education is a part of the education system that prepares individuals to work in a specific field or occupation, rather than in other fields of work.

In the research by Syarifuddin & Nurmi (2022), the study was conducted with 29 students, where the classical completeness achievement in cycle I was 62.07%, indicating that 18 students scored above 75, and 11 students did not meet the completion standard. In cycle II, the completeness achievement increased to 89.66%, with 26 students meeting the completion standard, and only 3 students not meeting the minimum standard. The implementation of practicum learning in mathematics has been shown to improve student learning outcomes through classifying students' abilities, using varied learning materials according to students' abilities, and applying individualized approaches.

Faiz et al. (2022) also explain that the results of conceptual research reveal that the goal of differentiated learning is to coordinate learning by considering students' learning interests, readiness, and preferences. It helps all students learn so that learning objectives can be achieved by everyone, increases motivation and student learning outcomes, fosters harmonious relationships between teachers and students, and encourages students to be more enthusiastic about learning. It also helps students become independent learners who are accustomed to and respectful of diversity. This approach improves teacher satisfaction as it challenges them to develop their teaching skills, making them more creative. In conclusion, differentiated learning provides opportunities for students to learn naturally and efficiently, with teachers who are able to collaborate with the required methods and approaches.

Soeharto (1988: 3) presents four theoretical arguments regarding the necessity of vocational education. First, humans are motivated to work due to the need for activities, freedom, power, social recognition, and pleasure. Second, humans are driven to work by three aspects: material needs, cooperation, and identity (ego). Third, the motivation to work is influenced by psychological factors such as security, belonging, love, interest, respect, self-esteem, freedom, the desire for information, understanding, love, beauty, and self-actualization. Fourth, the urgency for work is so critical that it can also be interpreted as the pressing need for vocational education to prepare individuals for employment.

The process of developing this practicum learning module uses the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). This development model is chosen because ADDIE is rational, systematic, easy to learn, and comprehensive. The ADDIE model is organized systematically so that its implementation is sequential. Each stage follows the previous one, always referring back to the previous stage that has undergone data revision or improvement, ensuring that the next stage results in an effective learning module product.

In the analysis stage, the problem to be solved is formulated, which is the low level of student competence in car air conditioning maintenance. This deficiency is caused by the lack of supporting facilities for practical learning. Meanwhile, car air conditioning is a local content subject that is not included in the curriculum for Air Conditioning and Refrigeration Engineering. Based on the problems identified and analyzed, a module design was created as the teaching medium needed. Learning objectives, the learning structure, and assessment instruments at the end of the lesson were also designed.

The development of the module based on the design results was followed by writing and evaluation by experts. From the assessment by 10 subject matter experts, a score of 94.52% was obtained, indicating that the module is highly suitable from the perspective of the subject matter experts.

From the media experts, a score of 72.26% was obtained, which also indicates that the module meets the eligibility criteria. When errors or suggestions from the experts were found, revisions were made. Subsequently, the module, deemed suitable, was implemented in the learning process.

The implementation was observed as a baseline to be analyzed with the final results later. The treatment was conducted in formal classroom learning according to the lesson hours. Data collection was carried out, and if further revisions were needed, a second round of improvements was made. The practicality of the module was also analyzed using a questionnaire data collected from students, evaluating aspects such as ease of use, clarity, appearance, benefits, and relevance of the module. The results of the practicality test showed an average score of 91.21%, indicating that the module is highly practical for use in learning.

The final stage is the evaluation of the module implementation by conducting an overall review. Revisions were made as a form of module improvement. In the class where the implementation was carried out, data collection on learning outcomes was also performed at the end, using a competency test as an indicator of the module's success in improving students' competence. The competency test was conducted in stages over four sessions. The examiners, who were car AC practitioners, were invited to ensure the independence of the assessment. A report was then compiled as the final result and analyzed based on the initial observation results.

The N-gain test results from students' competency scores at the beginning and end of the course showed a score of 52.87, which falls under the moderate category. The average student competency score increased from 52.87 points at the beginning to 80.60 points at the end.

The data obtained from both the pretest and posttest were also subjected to a paired sample t-test. Based on the calculations, a P-value below 0.05 was obtained, which allows the conclusion that there is a significant difference between the pretest and posttest scores for the car air conditioning maintenance competency test.

Although the module has been deemed valid and significant, the author is still open to feedback for further improvement of the car air conditioning maintenance module to make it even more perfect. It is hoped that this car air conditioning maintenance module will be beneficial not only for SMK Al Asror but also for all schools or competency-based educational institutions that offer car air conditioning courses, especially in Central Java and throughout Indonesia.

## Conclusion

Based on the research and development of learning media, it can be concluded that the development of the practicum learning module needed by students and teachers is one that can enhance students' competencies, especially in car air conditioning maintenance, by considering each student's learning style and facilitating learning media for each student to achieve the learning objectives. The design of the car air conditioning maintenance module has been adjusted to the Car Air Conditioning Maintenance Competency Standards in the Learning Objectives (ATP) for Light Vehicle Electrical Maintenance.

Based on the research and development conducted, it is expected that, despite several challenges encountered during the process, these challenges did not hinder the researcher from continuing the study. The challenges faced during the research process are as follows:

1. The researcher had not yet mastered the specific air conditioning system used in the vehicles for this research
2. The researcher faced difficulties in presenting the work diagrams that align with the car air conditioning maintenance practicum material.

The solutions to overcome these challenges are as follows:

1. The researcher gathered information and collected resources such as guidebooks, manuals, and specific Toyota service manuals that align with the car air conditioning maintenance material.
2. The researcher collected documentation during the practicum sessions to ensure the module created aligned with the car air conditioning maintenance material.

Through this research and development of the learning module, it is hoped that it will be beneficial and provide new knowledge to students about the car air conditioning maintenance practicum, enhance students' competencies, and offer a reference for a learning module that is suitable for use in teaching activities for both teachers and students.

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