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Development of Practical Tools Using Computer Power Supply for Light Vehicle Electrical System Learning

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Abstract

A common issue in the practical learning of light vehicle electrical systems is the inadequate availability of voltage sources, particularly batteries, in terms of quality and quantity. As a result, most students, after being assessed, receive scores that do not meet expectations. To address this issue, an alternative voltage source is needed to replace the battery, ensuring that the practical learning process for the light vehicle electrical system runs smoothly. This study aims to develop a practical tool using a computer power supply to improve the learning outcomes of the light vehicle electrical system. The research employs the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation). The experimental method used involves a pretest and posttest group, comparing the experimental class and the control class, consisting of 72 students. The results show that the practical tool using a computer power supply has a significant impact on the learning outcomes of the light vehicle electrical system, as analyzed through a one-tailed t-test. Based on N-Gain Score calculations, the tool is effective in improving learning outcomes, achieving high-level results. The conclusion of this research is that the practical tool using a computer power supply can replace the role of a battery as a voltage source in light vehicle electrical system practices..

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INTRODUCTION

The Light Vehicle Electrical System is an element of the Light Vehicle Engineering subject. One of the learning outcomes is for students to be able to carry out maintenance and repairs, covering the battery, electrical network, lighting and signaling systems, wiper and washer systems, power window and central lock systems, electric mirrors, starter system, charging system, ignition system, Air Conditioning (AC) system, and audio-video systems (Decision of the Head of BSKAP Kemendikbudristek number 032 of 2024 on Learning Outcomes in Early Childhood Education, Basic Education, and Secondary Education within the Merdeka Curriculum).

Media technologies play a crucial role in modern education, serving as vital tools for knowledge transmission and enhanced student participation in learning activities (Supraptono et al., 2025). In vocational learning, practical facilities play an important role in achieving learning outcomes, as stated by Febrianda et al. (2023), who noted that optimal learning outcomes require adequate learning facilities. A common issue in practical learning facilities, especially in light vehicle electrical system practice, is the inadequate availability of power sources (batteries) in terms of both quantity and quality. The quantity of batteries is often limited due to their high cost, which causes two practice groups to share a single battery alternately. The existing batteries sometimes lose quality due to frequent use without regular maintenance, so students often have to charge the batteries before starting the practical session, which consumes valuable time.

This issue with learning facilities also occurs at SMKN 1 Kedungwuni. The lack of adequate practical tools reduces the learning hours, leading to low learning achievements. Based on the results of an electricity-related test for class XI TKR 1 student in the second semester of the 2023/2024 academic year, conducted using the available practical tools, 52.8% of students scored below the Minimum Mastery Criteria.

In response to the issues related to learning facilities, many researchers have attempted to develop various media and teaching tools, such as Wayan (2023), who developed an automotive electrical trainer kit, and Wibowo et al. (2024), who developed a demonstration tool using a Triac-based light sensor. Even practical tools such as power supplies have been developed to address these issues, such as Robbani (2018), who developed a digital power supply assisted by Arduino for basic electronics learning with an output voltage of 0 – 14 Volts. Muhammad et al. (2021) developed a Thermoelectric-based Adjustable Current power supply with an average output voltage of 7.4 Volts and a maximum current of 3 A. This study focuses on developing a practical tool using a computer power supply for learning, as it provides an output voltage suitable for light vehicle electrical system practice, which is 12 V.

The objective of this study is to develop a practical tool using a computer power supply for light vehicle electrical system learning, analyze the feasibility and practicality of the computer power supply tool in improving learning outcomes, test the influence of the computer power supply tool on learning outcomes, and analyze the improvement in learning outcomes using the computer power supply tool.

Previous studies have attempted to create practical tools as power sources in learning, such as Munaruzzikri (2018), who built a power supply using components like a step-down transformer, capacitors, diodes, resistors, and wires for electrolysis practice. Robbani (2018) also developed a digital power supply assisted by Arduino for basic electronics learning with an output voltage of 0 – 14 Volts. Muhammad et al. (2021) developed an Adjustable Current power supply based on thermoelectric principles, with an average output voltage of 7.4 Volts and a maximum current of 3 A. However, none of these studies address the development of an alternative power supply tool that can replace batteries with a voltage suitable for light vehicle electrical system practice.

The results of this research are expected to address the issues faced during the practical learning of the light vehicle electrical system. Additionally, the findings could serve as a reference for teachers to innovate in solving similar problems and help improve the competencies of students in light vehicle electrical system learning.

METHODOLOGY

This research is a Research and Development (R&D) study using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The research design uses a two-group pretest-posttest with control group design.

Tabel 1. Pretest posttest with control group design.

Group	Pre test	Treatment	Post test
(R) E	O1	X	O2
(R) K	O3	-	O4

Information: R = Random, E = Experiment Group, K = Control Group, X = Treatment, - = Without Treatment, O1 = Pretest of Experiment Group, O2 = Posttest of Experiment Group, O3 = Pretest of Control Group, O4 = Posttest of Control Group.

The subjects of this research are 72 students from class XI of the Light Vehicle Engineering (TKR) program at SMK N 1 Kedungwuni, divided into two classes: XI TKR 1 and XI TKR 2, each consisting of 36 students. XI TKR 1 is designated as the experimental class, while XI TKR 2 is the control class. Data collection is carried out through assessment rubrics from subject matter experts, media experts, and test instrument experts to measure how usable the designed product is, along with pretest and posttest.

The results of the media and subject matter experts assessments are analyzed using the Content Validity Ratio (CVR) and Content Validity Index (CVI) to calculate their validity, and the Percentage of Agreement to calculate their reliability. Meanwhile, the instrument assessments from the test instrument experts are analyzed for validity using Aiken's V and reliability using the Interrater Correlation Coefficient (ICC). The practicality test is conducted by fellow teachers who use the practical tool, using a response questionnaire. The results are analyzed to calculate the reproducibility coefficient (Kr) and scalability coefficient (Ks) to determine the practicality of each aspect. To test the effectiveness of the product, it is validated from the results of the pretest and posttest through descriptive analysis, right-tailed t-test, and N-gain test.

RESULTS AND DISCUSSION

Result

a) Development of the Practical Tool from Computer Power Supply

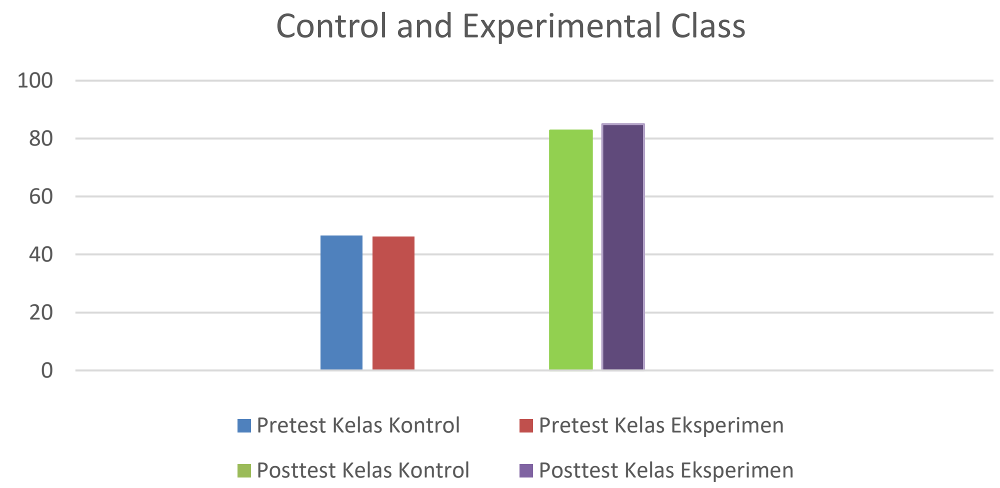
This research is a development and evaluation study of a practical tool using a computer power supply to improve the learning outcomes of the light vehicle electrical system. Based on the analysis of the validation rubric from the subject matter expert, the Content Validity Index (CVI) calculation is 0.91, and the reliability test using the Percentage of Agreement (PA) is 91%, which is categorized as "very feasible." Meanwhile, the validation score from the media expert shows a Content Validity Ratio (CVR) of 0.83, with a PA reliability of 83%, also categorized as "very feasible." Therefore, the evaluations from both the subject matter expert and media expert indicate that the practical tool using a computer power supply is very suitable for use, both in terms of content and media.

Furthermore, the feasibility analysis was also conducted by five test instrument experts, with a total of 20 items in the test. The validity analysis using Aiken's V showed that all items are valid, as the V score is ≥ 0.77. The reliability of the test items, analyzed using the IBM SPSS Statistics 29 application and the Interrater Correlation Coefficient (ICC) method, showed an Intraclass Correlation Coefficient (ICC) of 0.799, which is considered reliable as it is greater than 0.70. Overall, it can be concluded that the test instrument is usable because it meets the criteria of being both valid and reliable.

For the practicality test, the results can be seen from the calculations of the reproducibility coefficient (Kr) and scalability coefficient (Ks). The calculations showed that the Kr score is 0.92 (greater than 0.90), and the Ks score is 0.81 (greater than 0.60). Based on the practicality test, as seen from the values of the reproducibility coefficient and scalability coefficient, it can be concluded that the practical tool using a computer power supply for light vehicle electrical system learning is categorized as "practical."

b) Improvement of Competencies in Learning Outcomes for the Light Vehicle Electrical System

To determine the difference in learning outcomes between the control and experimental classes, a descriptive analysis was conducted, and the results are shown in the following table:



The results, illustrated in the diagram, show a difference in improvement between the control and experimental classes. In the pretest, both classes, the control class and the experimental class, had nearly identical average scores of 46.53 and 46.25, respectively, indicating that both classes had the same ability before the treatment. The posttest results showed that the control class achieved a score of 82.78, while the experimental class scored 85.00. The learning improvement in the control class was 36.25, while the experimental class showed an improvement of 38.75. This indicates that the learning outcomes for the light vehicle electrical system in the experimental class, using the developed practical tool, were higher than those in the control class, which used conventional tools.

Further analysis using a right-tailed t-test was performed to determine if there was any significant difference in the effect of using the developed practical tool in the experimental group compared to the control group. The results showed that the calculated t-value of 1.702 is greater than the t-table value of 1.667. Therefore, the alternative hypothesis (Ha) is accepted, and it can be concluded that there is a significant difference in the learning outcomes between the control and experimental classes after the treatment.

To determine the effectiveness of the computer power supply tool, a comparison of the pretest and posttest results was conducted using the N-Gain Score calculation. Based on calculations using SPSS, the average N-Gain Score for the experimental group was 0.73 (high category), which corresponds to 73.44% (fairly effective). The average N-Gain Score for the control group was 0.67 (moderate category), which corresponds to 67.67% (fairly effective). The N-Gain Score calculations show that the experimental group, using the computer power supply practical tool, achieved a higher level of effectiveness in improving learning outcomes compared to the control group. This indicates that the computer power supply practical tool is an important facility in electrical practice. As stated by Febrianda et al. (2023:73), practical facilities are very effective in improving automotive electrical learning outcomes.

The positive impact of using the computer power supply practical tool can also be observed during the learning process. Teachers reported that students in the experimental class appeared more enthusiastic about learning compared to before. Students were more active and engaged because the tool was easy to use and practical. It made the learning experience more enjoyable by reducing boredom, allowing students to learn more effectively and achieve better results.

Additionally, using this practical tool stimulated the creativity of students in problem-solving. The learning time previously affected by inadequate voltage sources was now addressed with the computer power supply tool.

Discussion

The practical tool using a computer power supply implemented in this study aims to improve the cognitive abilities of students in achieving learning outcomes for the Light Vehicle Electrical System. The implementation process follows the ADDIE model, which includes five stages: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation (Suryani et al., 2024). The analysis stage involves identifying needs and characteristics, as well as reviewing the curriculum and technology (Nurrokhman et al., 2025). The needs analysis yielded data on the learning tools required for the light vehicle electrical system practice, including a power supply that functions as a source of power to operate lights on the electrical trainer.

The practical tool using a computer power supply received a suitable assessment from evaluators to be applied in electrical system learning. Factors influencing this feasibility include the tool functionality, which aligns with the needs of students, and the involvement of experts in the development process. This feasibility indicates that the practical tool using a computer power supply has great potential to be implemented in various practical subjects requiring a 12V power source. This is consistent with Munaruzzikri's (2018) research, which states that power supply learning media is considered suitable for use in electrical practice activities. Robbani (2018) also concluded that a digital power supply is very suitable for basic electronics practice.

The assessment instrument used in this study involved multiple-choice test items, which were first assessed by experts to determine their validity and reliability. The results of the item assessment using Aiken's V indicated that all items were valid, while the reliability assessment using the ICC method confirmed that the test items were reliable, making them suitable for data collection. This aligns with Yusup (2018) research, which states that if an instrument meets the criteria for validity and reliability, it can be considered valid and used in research. Validity and reliability of instruments are crucial to ensure that the results reflect the abilities of students.

Based on the practicality test, as shown by the reproducibility and scalability coefficients, it can be concluded that the practical tool using a computer power supply for light vehicle electrical system learning is "practical." The term "practical" refers to being easy and enjoyable, with indicators such as having an attractive appearance, being easy to maintain, easy to operate, portable, and making the learning process enjoyable. This is supported by Asy'ari et al. (2025), who stated that the power supply trainer is categorized as highly practical for use in electrical subjects.

To compare whether there is a difference in the effect of using the developed practical tool in the experimental group versus the control group in improving learning outcomes for the light vehicle electrical system, a right-tailed t-test was conducted. The results showed that the calculated t-value of 1.702 is greater than the t-table value of 1.667. Therefore, the alternative hypothesis (Ha) is accepted. This is because the practical tool using a computer power supply complements the practice media as a learning facility for students. This is consistent with Handrayani et al. (2023), who stated that there is an effect of learning facilities on learning outcomes. The impact of complete practical tools on learning outcomes was also discussed by Prasetyo et al. (2020), where the completeness of practical tools had a positive and significant effect on learning outcomes.

The effectiveness of the practical tool using a computer power supply was determined through the N-Gain Score calculation. The results showed that learning in the experimental class, using the computer power supply tool, had a higher effectiveness category compared to the control class. According to the Kamus Besar Bahasa Indonesia (KBBI), the word "effective" means useful or able to produce results, so the computer power supply tool can be considered effective in improving learning outcomes for the light vehicle electrical system. The effectiveness of the developed practical tool is also due to the series of feasibility and practicality tests conducted by experts. Additionally, observations during the learning process showed that students were able to maximize the use of the media without being hindered by the limited power source during practical sessions. This shows that the practical tool using a computer power supply is an essential facility that can replace the function of a battery in electrical practice. The practical tool has been developed using the ADDIE model, and the results indicate that it is suitable for use in learning. This is in line with Febrianda et al. (2023), who stated that practical facilities are very effective in improving automotive electrical learning outcomes. Similarly, Muhammad et al. (2021) emphasized the importance of power supplies in electrical systems, as a system will not operate without a power supply.

Overall, the development of the practical tool using a computer power supply has proven effective in improving the learning outcomes of students in the light vehicle electrical system. This improvement is highly relevant to Prosser's theory, which suggests that effective vocational education can be provided when practice tasks are carried out using the same tools and machines as those set in the workplace.

CONCLUSION

Based on the results and discussion of this research, it can be concluded that: (1) The practical tool using a computer power supply developed is highly suitable for use in the learning process of the light vehicle electrical system. (2) The practical tool using a computer power supply developed is categorized as practical for use in the learning process of the light vehicle electrical system. (3) The practical tool using a computer power supply has an impact on learning outcomes in achieving the learning outcomes of the light vehicle electrical system. (4) The practical tool using a computer power supply is quite effective in improving learning outcomes in achieving the learning outcomes of the light vehicle electrical system.

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