The Implementation of a Project-Based Learning *Jobsheet* in Teaching Electrical Systems of Light Vehicle Bodies

Ajib Afindala[1✉], Samsudin Anis[2], Rini Kusumawardani[2]

[1]SMK Garuda Nusantara Karangawen Demak, Indonesia
[2]SPS Universitas Negeri Semarang, Indonesia

Article Info	Abstract
	One of the challenges faced in the recent learning process is that students have low psychomotor competency in learning job sheets related to the electrical systems of light vehicle bodies, such as in the lighting system, power window, sign lamp system, mirror cleaning system, and AC system. The use of unengaging job sheets led to low learning motivation and a decline in students' psychomotor competencies. This study aimed to investigate the impact of a project-based learning job sheet on enhancing the psychomotor competencies of vocational students in the electrical systems of light vehicle bodies, including components such as the lighting system, power windows, signal lamp system, mirror cleaning system, and air conditioning system. This job sheet incorporated an innovative approach by integrating interactive visuals via QR codes, providing tutorial simulations of electrical systems in light vehicle bodies. This job sheet assisted students in understanding the material while encouraging active participation, collaboration, and high learning motivation. The present study employed research and development (R&D) using the ADDIE model (*Analysis, Design, Development, Implementation, Evaluation*). The research subject of this study is XI grade students of Light Vehicle Engineering at Vocational (SMK) Gardua Nusantara Karanggawen with applied quantitative approach. The data collection technique used a pre-test and a post-test, with the results analyzed using linear regression through the SPSS application. The validation result of the media and material experts showed that the developed job sheet is very feasible with an average score of 4.83 (scale of 5). The practicality test carried out by the teacher achieved 86.55%, or it was declared as very practical. The jobsheet effectivity was proven through N-Gain significant score in the experimental class, which gained 76.94%, while the control class achieved 26.70%. In conclusion, the project-based learning job sheet is effective in enhancing students' psychomotor competencies and has become a feasible medium for instruction.

✉ Correspondence:
Jl. Raya Kuripan No.89, Sengor, Kuripan, Kec. Karangawen, Kabupaten Demak, Jawa Tengah 59566, Indonesia
E-mail: ajiebafindala@gmail.com

INTRODUCTION

Vocational education holds a crucial role in preparing students to face the workforce by giving them practical skills that are suitable for industrial needs. According to Santika et al., (2023), vocational high schools (SMK) have made significant efforts to ensure that their graduates are not only work-ready but also competitive in the job market. Graduates of vocational high school have high flexibility, as students can work directly or continue to the university, and even as employees in vocational high schools (Ariwibowo et al., 2018). This indicated that vocational high schools (SMK) not only prepared graduates to be ready but also provided opportunities for students to develop themselves both academically and professionally.

Learning at SMK has many gaps, such as the limited learning media that are interesting and systematic. In the past four years, the gap between learning methods and practical materials has led to a decrease in students' psychomotor competency. To solve this problem, the researcher proposes a project-based learning (PBL) jobsheet. This job sheet not only can be practical guidance, but it can also integrate project-based learning, so that the students actively solve the contextual problem (Maulana Dongoran et al., 2023). The study focused on job sheet development for the maintenance of Light Vehicle Bodies, Electricity, especially in the lighting system elements, power window, sign lamp system, mirror cleaning system, and air conditioning. The aim is to improve students' psychomotor skills through structural guidance (Hakim et al., 2022).

Performance assessment is a form of authentic assessment, which evaluates students' ability or reflection of their ability to perform tasks in real-life situations (Mudhakiyah et al., 2022). Psychomotor competence reflects students' action-based skills as a result of the integration of knowledge and experience. This ability involves trained physical movements, demonstrating the practical mastery of cognitive and affective competencies. Psychomotor skills embody learning through real-world activities, such as technical expertise or automatic performance, serving as evidence of knowledge application in daily life. These skills indicate an individual's level of proficiency in action (Haristo Rahman, 2020).

Performance assessment is an evaluation in which the teacher observes and makes judgments about students' skills or competencies in performing a task, creating a product, and delivering a presentation. Performance assessment is a form of authentic assessment that evaluates students' abilities or reflections of those abilities to perform tasks in real-life contexts (Mudhakiyah et al., 2022). Psychomotor competence represents students' action-based skills developed through the integration of knowledge and experience. This ability involves trained physical movement, reflecting the practical mastery of both cognitive and affective competencies. Psychomotor skills manifest learning through real-world activities, such as technical expertise or automatic performance, serving as evidence of knowledge application in everyday life. These skills indicate an individual's level of proficiency in action (Haristo Rahman, 2020). Performance assessment is an evaluation method in which teachers observe and make judgments about students' skills or competencies in performing tasks, creating products, and delivering presentations.

This research showed that the available infrastructure that supports practicum activities used a job sheet to improve students' achievement (Haryanto et al., 2023). However, many worksheets remain conventional and unengaging, which reduces their effectiveness in motivating students to learn (Alfia, 2023). PjBL jobsheet-based is designed to assist students in analysing problems, doing research, collecting information, and evaluating a project (Supraptono et al., 2025).

This worksheet is accompanied by a tutorial video that facilitates students' understanding of practical steps through visual demonstration. Primadana & Maksum, (2021) used the PjBL approach, which supports students not only in following instructions passively but also in actively participating in a real project, so that the activities can sharpen critical thinking, problem solving, collaboration, and creativity. Thus, this worksheet not only enhances technical skills but also fosters essential 21st-century soft skills, such as independence and critical thinking.

The research aimed to contribute to enhancing the quality of practicum learning at the Vocational High School. The PjBL-based worksheet is expected to serve as a practical, feasible, and effective learning tool that supports students in mastering technical competencies while also preparing them to navigate the dynamic demands of the workforce. With this innovation, vocational high school graduates are expected to become more competent, adaptable, and competitive in the industry. The graduates are equipped with the skills and qualifications necessary to succeed as professionals, entrepreneurs, or scholars. Furthermore, the development of a job sheet aligns with the vision of vocational education, which aims to produce qualified and relevant human resources that meet the evolving demands of the times.

METHOD

Research Design

This research applied Research and Development (R&D) with the ADDIE model (*Analysis, Design, Development, Implementation, Evaluation*) to develop the PjBL-based jobsheet to improve students' psychomotor skills at Vocational High School, especially in Light Vehicle Engineering.

Place

The research was conducted at SMK Garuda Nusantara Karangawen, Demak Regency. The school has achieved an A-level accreditation as a vocational education institution, which served as the research site for the development of a worksheet on light vehicle body electrical maintenance.

Subject

The research subject of this study is teachers and students of Vocational Students (SMK) Garuda Nusantara Karangawen. The teacher participated in filling out the questionnaire to test the practicality. The students of XI TKR are involved in the job sheet effectiveness test. Furthermore, the feasibility assessment was conducted by six experts who are highly competent in their respective fields.

Research Procedure

The Analysis phase was applied through observation and interviews to identify learning needs, one of which was the lack of engaging and well-structured practical learning media. Based on the results of this analysis, the researcher then designed the framework of the worksheet during the Design phase, which included selecting relevant references and developing validation instruments. In the Development phase, the worksheet was enhanced by integrating tutorial videos and subsequently validated by media and subject matter experts from both academia (lecturers) and industry. The validation outcomes informed the necessary revisions before the product was put into use. In the Implementation phase, the worksheet was tested in two classes: an experimental class (using the worksheet) and a control class (without the worksheet), with effectiveness measured through pre-test and post-test assessments. The final phase, Evaluation, involved analyzing the worksheet's feasibility, practicality, and effectiveness using statistical tests like normality, homogeneity, and t-tests. Data were collected through expert validation questionnaires, teacher feedback, and student performance tests. Through this systematic approach, the study aims to produce an instructional medium that significantly enhances students' practical skills.

This study integrates both theoretical and practical aspects to ensure that the developed worksheet not only meets academic standards but is also aligned with industry needs. Validation by media and subject matter experts guarantees the quality of the content and design, while field testing provides a concrete picture of its impact on student learning. The statistical evaluation results will determine the extent to which the worksheet effectively enhances psychomotor competence and offer recommendations for further development. In addition, this research contributes to the improvement of practical learning quality in vocational high schools, particularly in the field of Light Vehicle Engineering.

RESEARCH RESULT AND DISCUSSION

Research Result

The research data were analyzed based on scientific principles, beginning with preliminary assumption testing to verify feasibility data. A critical phase involved assessing the validity and reliability of each item within the research instrument. This analysis is essential to ensure that the measurement tools employed are accurate and consistent before proceeding to subsequent stages. The results of these tests serve as the foundation for determining the continuation of data analysis in line with the predetermined research methodology.

a) Practicality Test

The analysis result of *Intraclass Correlation Coefficient* (ICC) showed moderate reliability with an average of ICC 0.713, then the validity test that was conducted by 6 experts was stated as 'very valid' with a V score achieved between 0.9 - 1.0. Furthermore, A total of 12 items achieved perfect validity (V = 1.0), and the average validity score of 1.0 reflects a high level of consistency among respondents (Gregory, 2015)

The analysis result of the job sheet feasibility test stated that the average overall aspect was 4.78, which was very feasible. Furthermore, this job sheet on electrical maintenance of light vehicle body systems has been declared valid and highly feasible for use. Based on the validation results, it can be concluded that the job sheet for electrical maintenance of light vehicle body systems is valid with minor revisions and does not require significant modifications. It is deemed suitable for use as a performance test for students in the Light Vehicle Automotive Engineering Study Program.

b) Instrument of Practicality Test

The reliability calculation using the KR-20 formula yielded a coefficient of 0.909 for the jobsheet on electrical maintenance of light vehicle body systems. This score fell into the 'very high' category according to Guilford's criteria (1956). Furthermore, the validity test involving 15 vocational automotive teachers indicated that all items were valid, with calculated correlation coefficients (r) ranging from 0.83 to 0.96, and> r-

table value of 0.30. The average validity score was 0.86, confirming a high level of reliability. These results align with the criteria established by Lewis R Aiken, (1985), which state that V ≥ 0.75 reflects strong expert agreement. Accordingly, the instrument is deemed appropriate for evaluating automotive instructional media without the need for revision.

The practicality test of the job sheet was conducted by involving 15 expert teachers, who completed a questionnaire consisting of 25 statement items. The researcher used two quantitative indicators: (1) the Reproducibility Coefficient (Kr) to measure consistency in product use, and (2) the Scalability Coefficient (Ks) to assess the appropriateness of the material's difficulty level. These coefficients become an objective standard in evaluating job sheet implementation. In this study, the practicality test results were confirmed by a Reproducibility Coefficient (Kr) exceeding the threshold value of > 0.90 and a Scalability Coefficient (Ks) exceeding > 0.60. Specifically, Kr reached a score of 0.91, while Ks achieved 0.88 (Panjaitan, 2017). Based on these results and validation by expert teachers, the job sheet for electrical maintenance of light vehicle body systems is categorized as highly practical and considered effective for use in vocational education settings.

c) Effectivity Test

Tabel 1. N-Gain Test Result

	Eksperiment Class		Control Class
	N-Gain Score %		*N-Gain Score %*
Average	76.94	Average	26.70
Minimum	48.56	Minimum	4.35
Maximum	95.35	Maximum	40.68

The job sheet's effectiveness was validated using the N-Gain test, revealing a significant improvement in the performance of the experimental class that implemented it, with an average score got 76.94% (effective category), while the control class only gained 26,70% (less effective). The highest score obtained by the experimental class was 95.35%, compared to 40.68% in the control class. Based on the N-Gain test in the experiment class, students'

psychomotor competency can improve significantly. It was caused by the job sheet, which provided an interactive visual that helped students master the electricity components of light vehicle engineering.

Table 2. t-result of post test in the experiment and control class

	Levene's test for equality of variances					95% condidence interval of the difference	
	F	sig	T	Df	Sig. (2-tailed)	lower	upper
Equal Variances Assumed	1.644	0.205	36.424	62	0.000	28.974	32.339
Equal Variances Not Assumed			36.424	57.970	0.000	28.974	32.341

The results of the independent t-test confirmed a statistically significant difference between the two groups, with $p < 0.05$. F score gained 0.000 with significance (Sig) of 0.205, which showed that the variance between the groups was homogenous ($p>0.05$), so that the assumption can be accepted. Additionally, the job sheet was enhanced with a tutorial video that supported students in comprehending the material. This study revealed that the PjBL jobsheet is not only feasible and practical, but also effective in enhancing students' practical skills. Furthermore, the tool facilitates the development of competencies that are aligned with both the curriculum and the needs of the automotive industry. In short, this product can be adopted as an innovative learning medium at a vocational high school.

Discussion

The study created a final result in the form of a job sheet on the subject of electricity maintenance of light vehicle engineering. This job sheet was structured through a systematic process to ensure its appropriateness and feasibility. The development process involved validation phases that were conducted by three main validator groups: media experts, material experts, and users (students). This validation specifically aimed to collect empirical data as a basis for refining the final product. The main purpose from validation process is to measure that the developed jobsheet fulfilled three standard feasibilty requirments: (1) The feasibility of the material with respect to the depth and relevance of its content, (2) Media

feasibilty from performance and aspect design, (3) Practicality tets based on users' need in the factual learning environment.

In the context of vocational education, effective learning media hold a crucial role in supporting the teaching and learning process. One of the learning media that has been proven effective is the printed learning source, the *Jobsheet.* The electrical maintenance of light vehicle engineering in this study has been designed to guide students in doing self-learning, in both the conceptual understanding aspect and the direct practicum of maintenance procedures in the light vehicle engineering.

The main advantage of using a job sheet in learning lies in time efficiency and a well-structured instructional system. An effective jobsheet should include several essential components: (1) clear work instructions, (2) detailed practical steps, and (3) a comprehensive evaluation instrument. Through this structured presentation of material, students can develop their technical skills gradually and measurably (Hamdani & Rahmawati, 2021).

Jobsheets possess distinct characteristics that differentiate them from conventional learning modules. The primary difference lies in their focus and approach to content delivery. Jobsheets emphasize practical guidance and the completion of measurable, application-oriented tasks. In the context of vocational education, job sheets function as training tools designed to help students: (1) follow technical instructions accurately, (2) analyze potential technical problems, and (3) complete tasks according to

applicable industry standards (Wadirin et al., 2022).

A concrete example can be seen in the job sheet for electrical maintenance of light vehicle body systems developed in this study. The job sheet covers various essential technical procedures, including lighting systems, power windows, signaling systems, windshield wiper systems, and air conditioning systems. To support students' understanding, the job sheet provided visual aids such as electrical diagrams and technical specification tables of components. In addition to enhancing technical skills, the use of the job sheet plays a significant role in fostering learner independence and problem-solving abilities.

This feasibility study was designed to evaluate the job sheet for electrical maintenance of light vehicle body systems using two assessment approaches: (1) expert evaluation and (2) user testing. The expert evaluation involved two types of specialists with distinct areas of focus: (1) Media Experts (lecturers with expertise in instructional media design), who assessed the design and layout aspects of the job sheet; and (2) materials Experts (automotive specialists), who evaluated the content's alignment with the required vocational competencies.

The job sheet was then tested by end-users (teachers and students) to assess its practicality and effectiveness in real classroom settings. Azwar, (2019) emphasized that the validity of a developed product can only be established through a systematic and comprehensive validation process. This approach served as the methodological foundation for the development of the job sheet in this study

Based on the evaluation by three media experts of the job sheet for electrical maintenance of light vehicle systems, a very high average score was obtained. Media Expert 1 gave an average score of 4.95, Media Expert 2 gave 4.9, and Media Expert 3 gave 4.65. All three scores fall into the 'highly feasible' category, with an overall average score of 4.83, which is also classified as highly feasible.

This evaluation was conducted by lecturers who are experts in instructional media, indicating that the job sheet meets quality standards in terms of: (1) visual design, (2) layout and presentation,

and (3) ease of use. A development product is considered valid if it receives a minimum score of 3.5 (on a 1–5 scale) from expert reviewers. This validation result is also consistent with Pallant (2020), who states that an instructional product is feasible if it meets the criteria of validity, practicality, and effectiveness. The job sheet has met the eligibility criteria as instructional material. Based on the evaluation by media experts, the job sheet for electrical maintenance of light vehicle body systems is considered highly feasible for use in teaching and learning activities. The developed module can be further extended through additional field trials to ensure its effectiveness across various vocational education settings.

Based on the assessments of three material experts specializing in Light Vehicle Engineering, the job sheet for electrical maintenance of light vehicle body systems was declared 'highly feasible' for use. Material Expert 1 gave an average score of 4.59, Expert 2 gave a score of 4.86, and Expert 3 provided the highest score of 4.95. The overall average score from the three experts was 4.80, which remains within the 'highly feasible' category. The high scores indicated that the job sheet meets the material feasibility standards across multiple aspects: (1) content relevance to the curriculum, (2) depth of technical material, and (3) alignment with current automotive industry needs (Malik, 2024).

The jobsheet for electrical maintenance of light vehicle body systems was deemed highly feasible based on evaluations by subject matter experts, with an average score of 4.80. This recommendation is supported by the consistent assessments of all three experts, who affirmed that the job sheet meets vocational competency standards and is ready to be implemented as instructional material in vocational schools.

Akker et al., (1999) explained that developmental research aimed to create products that were not only scientifically sound but also practical for use in educational settings. This approach was highly relevant to the development of vocational job sheets, which must satisfy both of these aspects. Sudjana (2007) defined instructional media as any component of the student's environment that can stimulate the learning process. As an instructional medium, a

job sheet must meet these criteria by presenting content that is both interactive and applicable.

The practicality testing phase was a critical component in the development of vocational job sheets. In this study, the job sheet practicality for electrical maintenance of light vehicle body systems was evaluated by teachers of Light Vehicle Engineering at vocational high schools (SMK). This method ensured that the developed product was not only theoretically sound but also applicable in real-world settings (Faisal & Wahrini, 2023)

The Reproducibility Coefficient (Kr) was calculated using the formula Kr = 1 - (Σe) / (n × k), resulting in a value of 0.91, which exceeds the minimum threshold of 0.90 (Singarimbun & Effendi, 2014), indicating a very high level of consistency in the use of the jobsheet. Meanwhile, the Scalability Coefficient (Ks) was calculated using the formula Ks = 1 - (Σe) / [0.5(n × k) - ΣS], resulting in a value of 0.88, which is well above the standard threshold of 0.60. According to Borg & Gall, (2003), both coefficients are critical indicators for evaluating the practicality of an instructional product, with high values reflecting strong feasibility for field implementation. With Kr = 0.91 (> 0.90) and Ks = 0.88 (> 0.60), this job sheet is considered highly practical for use in vocational education, both in terms of consistency of use and alignment with appropriate levels of difficulty.

The independent samples t-test analysis revealed a significant difference between the post-test scores of the experimental and control groups. The testing was conducted by considering both the assumption of equal variances (equal variances assumed) and unequal variances (equal variances not assumed). The Levene's test result (F = 0.000, p = 0.205 > α = 0.05) indicates homogeneity of variance between groups, thus fulfilling the assumption of equal variances (Pallant, 2020).

The statistic showed the difference between experiment and control with t score t (62) = 36,424 (p<0.001) (Field, 2017). The experimental class demonstrated superior performance, with a mean difference of 30.656 points (SE = 3.365). This result was further supported by the 95% confidence interval, which did not include zero, indicating that the observed difference was statistically significant and reliable (Anugrah et al., 2023). These findings provided strong evidence for the effectiveness of the intervention applied to the experimental group.

CONCLUSION

This research aimed to analyse the implementation of the PjBL job sheet-based approach in improving students' psychomotoric competence of vocational high school students in the Light Vehicle Engineering program, specifically in the subject of Light Vehicle Body Electrical Maintenance, with a focus on lighting systems, power windows, signaling systems, windshield wiper systems, and air conditioning systems. The validation result of the media expert and material expert showed that the developed jobsheet fulfilled the feasibility criteria with an average score of 4.83 (very feasible) and 4.75 (very feasible). The practicality test achieved 86.55% (very practical), which indicated the job sheet provided easy use and relevance in learning.

The job sheet's effectiveness can be proven through N-Gain, where the experiment class significantly improved to 76.94% (effective category), while the control class achieved 26.70%. The Independent t-test showed a significant difference (*p*<0.05) between the two groups. This condition confirmed that the developed job sheet was effective in enhancing students' psychomotor competence.

The effectiveness of the jobsheet in improving students' psychomotor competence can be measured using the N-Gain score and an independent sample t-test. The result of the independent sample t-test showed that before the treatment, the experiment class and control class had the same condition (homogeneous). Following the implementation, the t-test results indicated that the improvement was both statistically significant and educationally effective.

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