



Development of a Web-Based CBT Worksheet for Routine Motorcycle Maintenance

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Abstract: This study aimed to develop a web-based electronic jobsheet system for the periodic motorcycle service subject at SMK Negeri 4 Palembang using the ADDIE model. The development was motivated by the continued use of paper-based practical assessment, which limits documentation and digital integration in vocational learning. The system integrates learning materials, digital jobsheets, procedural checklists, evidence uploads, and assessment features within a platform. The study employed the ADDIE stages of Analysis, Design, Development, Implementation, and Evaluation. Effectiveness testing was conducted during the implementation phase involving 66 Grade XI Motorcycle Engineering students, consisting of 32 students in the experimental class and 34 students in the control class. Data were collected through validation sheets, practicality questionnaires, and pre-test/post-test instruments. The developed system achieved an average validity score of 94.44% and a practicality score of 84.21%, categorized as Very Valid and Very Practical. Learning outcomes in the experimental class improved based on the Paired Sample t-test, with mean scores increasing from 80.28 to 90.16. The N-Gain score was 0.42, categorized as moderate, and slightly higher than the control class score of 0.39. Practical performance was higher, with mean scores of 89.23 and 78.41 respectively. These findings indicate that the developed system is effective.

Keywords: ADDIE model; CBT; Jobsheet; Motorcycle service; Vocational education; Website-based learning

Introduction

The rapid development of information and communication technology has accelerated digital transformation in vocational education. In line with the objectives of vocational education revitalization in Indonesia, schools are expected to integrate digital technology into learning and assessment processes to improve graduate competence and industry readiness (Desky et al., 2025). Digitalization is particularly important in vocational education because assessment must not only measure cognitive achievement but also document students' practical competencies in an objective, transparent, and accountable manner (Taali et al., 2024; Desky et al., 2026). Therefore, the development of digital assessment systems has become a strategic

necessity for improving the quality of vocational learning.

In vocational education, particularly in Motorcycle Engineering programs, practical learning emphasizes mastery of procedural skills according to Standard Operating Procedures (SOPs) and Occupational Health and Safety (K3) principles. One of the essential competencies is periodic motorcycle service, which requires students to perform a sequence of inspections and maintenance tasks systematically. The complexity of periodic service procedures, including checking engine oil, spark plugs, air filters, chains, brakes, and other components, often causes students to overlook important steps when using conventional paper-based jobsheets. Consequently, accurate monitoring and documentation of procedural performance are crucial

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for ensuring competency achievement (Ramadhani et al., 2025).

Current digital assessment practices in many vocational schools are still dominated by Computer-Based Tests (CBT) that focus on cognitive evaluation, such as quizzes and examinations. However, practical learning requires assessment mechanisms that can capture psychomotor performance and procedural compliance. In this study, the term CBT does not merely refer to a digital testing system but to a web-based electronic jobsheet system that integrates practical guidance, procedural assessment, and competency documentation into a single platform. This distinction is important because the developed system is designed to support authentic assessment in practical workshops rather than conventional theory examinations (Suhartadi et al., 2024).

A jobsheet serves as a practical learning guide containing objectives, work procedures, required tools and materials, safety instructions, and assessment criteria. Previous studies have shown that digital jobsheets can improve students' understanding of work sequences and procedural skills. Nevertheless, most existing digital jobsheets function primarily as instructional media and have not been integrated with assessment features, procedural checklists, evidence documentation, and learning evaluation. Therefore, there remains a need for a comprehensive digital system that supports both learning and assessment activities in vocational practice (Desky & Muskhir, 2023).

Based on preliminary observations at SMK Negeri 4 Palembang, practical assessment in the periodic motorcycle service subject is still conducted manually using printed observation sheets. Teachers record student performance on paper and subsequently transfer assessment results into administrative records. This process is time-consuming, susceptible to data loss, and difficult to manage efficiently in large classes. Although students may provide practical evidence through photos or videos, manual organization and verification of these files increase teachers' workload. The absence of an integrated digital system limits assessment efficiency, documentation quality, and data accessibility (Triyanto et al., 2022).

Interviews with Motorcycle Engineering teachers, the Vice Principal for Curriculum, and the Principal revealed the urgent need for a digital assessment system that aligns with the principles of authentic assessment in the Merdeka Curriculum (Desky & Yulastri, 2026). The stakeholders emphasized the importance of a system capable of recording procedural performance, storing evidence digitally, generating assessment reports automatically, and providing transparent access to learning outcomes. Such features are expected to reduce teachers' administrative burden by eliminating

repetitive manual recording and simplifying assessment management through centralized digital documentation (Labib et al., 2023).

Therefore, this study develops a web-based electronic jobsheet system using the ADDIE model for the periodic motorcycle service subject at SMK Negeri 4 Palembang. The novelty of this study lies in the integration of learning materials, K3-based SOP guidance, digital procedural checklists, evidence uploads, automatic documentation, and pretest-posttest evaluation within a single platform. Unlike conventional CBT applications that primarily assess cognitive learning outcomes, the proposed system supports authentic assessment of vocational practical competencies while improving assessment efficiency, documentation accuracy, and transparency in practical learning (Kurniawan & Hidayatullah, 2023).

Method

This study employed the Research and Development (R&D) method using the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The method was selected because the study aimed to develop and evaluate a web-based electronic jobsheet system for periodic motorcycle service competency. The development process focused on integrating learning materials, procedural checklists, practical assessment, evidence documentation, and learning evaluation into a single digital platform (Vaesar et al., 2026).

The study was conducted at SMK Negeri 4 Palembang involving all Grade XI Motorcycle Engineering and Business (TBSM) students. Since only two classes were available, total sampling was applied. Class XI TBSM 1, consisting of 32 students, was assigned as the experimental class, while Class XI TBSM 2, consisting of 34 students, served as the control class. The experimental class used the web-based electronic jobsheet system, whereas the control class used conventional printed jobsheets.

Product effectiveness was evaluated using a quasi-experimental Non-Equivalent Control Group Pretest-Posttest Design. Both classes completed a pretest before treatment and a posttest after the learning process. In addition to cognitive achievement, students' practical competencies were assessed using a performance observation sheet based on periodic motorcycle service Standard Operating Procedures (SOPs), including work preparation, procedural accuracy, tool utilization, occupational safety compliance (K3), and work results (Risna et al., 2026).

The product development process followed the ADDIE stages. During the Analysis stage, learning needs, assessment practices, and existing problems were

identified. During the Design stage, the system architecture and user flow were designed, including login, dashboard, learning materials, digital jobsheets, procedural checklists, evidence uploads, pretest, and posttest features. During the Development stage, the product was developed and validated by experts. During the Implementation stage, the product was used in classroom learning and practical activities, followed by practicality testing through student questionnaires. During the Evaluation stage, effectiveness data were collected and analyzed to determine the impact of the developed system on student learning outcomes and practical performance (Mardiana et al., 2026).

Data were collected using four instruments: expert validation questionnaires completed by material experts, media experts, and practitioners; student practicality questionnaires covering usability, content clarity, interface quality, feature usefulness, and learning support; cognitive achievement tests consisting of multiple-choice questions aligned with periodic motorcycle service competencies; and performance observation sheets used to assess students' practical skills during workshop activities (Sudianti et al., 2025).

Validity and practicality data were analyzed descriptively using percentage scores derived from a five-point Likert scale. The percentage score was calculated by comparing the obtained score with the maximum possible score and then converted into categories: Very Valid/Very Practical (81–100%), Valid/Practical (61–80%), Fairly Valid/Fairly Practical (41–60%), Less Valid/Less Practical (21–40%), and Invalid/Impractical (0–20%) (Ningsih et al., 2025). Effectiveness data were analyzed using N-Gain to measure learning improvement, Paired Sample T-Test to examine score changes within each group, and Independent Sample T-Test as the primary analysis to compare posttest and N-Gain results between the experimental and control groups. N-Gain scores were classified into high (≥ 0.70), moderate (0.30–0.69), and low (< 0.30) categories.

Result and Discussion

Result

Define Stage

Analysis Stage

The analysis phase identified conditions at SMK Negeri 4 Palembang through a student needs assessment questionnaire and direct classroom observations. The results showed that: students' initial experience using worksheets was at a moderate level (mean = 3.6), indicating that the use of worksheets was not yet fully effective; difficulties in practical learning were at a moderate level (mean = 3.4), meaning that students still faced obstacles in understanding work

procedures; learning autonomy was at a moderate level (mean = 3.5), indicating that students still relied on teacher guidance; and interest in digital media and CBT was at a high level (mean = 4.0–4.1), indicating strong student motivation toward technology-based learning.

Observation results confirmed that students still struggled to understand the job sheet instructions, did not follow work steps systematically, and remained dependent on teachers during practical sessions. Interviews with TSM teachers, the Vice Principal for Curriculum, and the School Principal also confirmed that the development of a digital evaluation system is urgently needed as a solution to the still-fragmented conventional assessment system.

Design Stage

The design phase focuses on the architectural planning, workflow, and user interface of a web-based e-jobsheet system for motorcycle periodic maintenance training. The system is designed to be accessible via computers, laptops, and smartphones to support flexible learning and assessment activities. The workflow begins with student login and a pretest to assess prior knowledge, followed by access to digital learning materials, OSH-based standard operating procedures, and an e-jobsheet that guides students through each stage of the practical activities (Desky et al., 2025; Tananda et al., 2026). During the practical sessions, students complete a digital procedural checklist and upload photographic or video evidence to document their competency achievements. After completing the practical activities, students take a post-test and access their assessment results via the system dashboard (Deviana et al., 2025). The system integrates learning management, practical assessment, and documentation features, including dashboard access, user and class management, subject and student data management, digital learning materials, K3-based practical guides, procedural checklists, documentation of practical results, pre-test and post-test assessment modules, and user profile management. To ensure logical navigation and ease of use, system storyboards and flowcharts were developed to illustrate user interactions, feature integration, and the assessment process before product development began (Fiona et al., 2025).

Development Stage

The development phase involves building a web application based on the approved design. The system is developed to integrate the entire learning process into a single digital platform. The dashboard serves as an administrative hub that displays navigation menus for student data, classes, course materials, practical assignments, and tests. The course materials feature allows teachers to upload instructional materials in PDF

format, which students can access and download. The digital e-jobsheet contains systematic work steps in accordance with SOPs and occupational safety and health (K3) principles. The CBT test feature supports the administration of pretests and posttests with automatic time settings and result processing. The practical assignment results feature displays student assessment data, including the completion status of checklists and the total scores obtained.

Validity Test Results

After the product was developed, expert validation was conducted by a material expert, a media expert, and a practitioner. The results showed an average validity score of 94.44%, categorized as Very Valid. Material validation (93.33%) confirmed the suitability of the content with periodic motorcycle service competencies, media validation (95.71%) indicated that the system met quality standards in functionality and design, and practitioner validation (94.00%) confirmed its feasibility for vocational learning. Suggestions from the validators included strengthening K3 aspects, maintaining visual consistency, and updating learning materials periodically.

Table 1. Material expert validation results

Assessment Aspects	Percentage (%)	Category
Ease of Use	88.75	Very Valid
Clarity of Materials and Instructions	95.00	Very Valid
Media Display	87.81	VeryValid
CBT Feature Benefits	87.50	Very Valid
Learning Support	92.67	Very Valid
Overall Average	84.21	Very Valid

Table 2. Media expert validation results

Assessment Aspects	Score Obtained	Max Score	Category
Visual Display	14	15	Very Valid
Readability	9	10	Very Valid
Navigation	14	15	Very Valid
Functionality	15	15	Very Valid
Interactivity & Ease of Use	15	15	Very Valid
Total	67	70	Very Valid

Table 3. Expert validation recapitulation

Assessment Aspects	Percentage (%)	Category
Material Expert	93.33	Very Valid
Media Expert	95.71	Very Valid
Practitioner	94.00	VeryValid
Average	94.44	Very Valid

Based on Table 3, the average validation result is 94.44% in the Very Valid category. The material expert validation (93.33%) confirmed that material content, work procedures, and evaluation were appropriate for

motorcycle periodic service competency. The media expert validation (95.71%) showed that system functionality, interactivity, display design, and navigation met quality standards. The practitioner validation (94.00%) confirmed that the product is suitable for field application at SMK. Expert suggestions included emphasizing K3 aspects in the jobsheet, maintaining visual consistency, and regularly updating materials in line with motorcycle technology developments.

Practicality Test Results

After validation and product revision, the implementation stage was carried out at Class XI TBSM 1 (32 students). Before practical work began, students logged into the system, completed the pretest, accessed digital learning materials and the jobsheet, performed the practical activity guided by the system, filled in the procedural checklist, uploaded practice evidence, and finally completed the posttest. The student practicality test results are presented in Table 4.

Table 4. Student practicality test results by aspect

Assessment Aspects	Score Obtained	Max Score	Category
Material Suitability	10	10	Very Valid
Procedural Accuracy	13	15	Very Valid
Material Completeness	8	10	Valid
Clarity of Presentation	10	10	Very Valid
Evaluation Suitability	15	15	Very Valid
Total	56	60	Very Valid

The student practicality test resulted in an average score of 84.21% (Very Practical). All five aspects scored above 80%, with learning support achieving the highest score (92.67%), followed by clarity of materials and instructions (92.00%), ease of use (88.75%), media display (87.81%), and CBT feature benefits (87.50%). These results indicate that the system is accessible, easy to operate, and perceived as beneficial for structured practical learning.

Effectiveness Test Results

Effectiveness was evaluated through pre-test and post-test data, N-Gain analysis, hypothesis testing, and practical skill assessment. Table 5 presents the recapitulation of pre-test and post-test average scores for both classes.

Table 5. Recapitulation of pre-test and post-test average scores

Class	N	Pre-test Mean	Post-test Mean	N-Gain
Experimental	32	80.28	90.16	0.50
Control	34	58.00	77.06	0.45

Based on Table 5, the experimental class post-test mean (90.16) was considerably higher than the control class post-test mean (77.06), with a difference of 13.10 points. Although the control class showed a larger raw increase (0.45 points compared to 0.50 for the experimental class), this was primarily because the control class started from a much lower pre-test baseline (58.00 vs. 80.28). The Paired Sample T-Test on the experimental class yielded a significance value of 0.000 ($p < 0.05$), with $t = -5.921$ and $df = 31$, confirming a significant improvement in learning outcomes after using the Website-Based CBT Jobsheet.

Table 6. Distribution of students' N-Gain categories

N-Gain Category	Experimental (n)	Control (n)	Exp. Mean
High ($g \geq 0.70$)	8	3	25.0%
Moderate ($0.30 \leq g < 0.70$)	15	23	46.9%
Low ($g < 0.30$)	1	6	3.1%
No change (0.00)	6	1	0%
Negative/decreased	2	1	100%

As shown in Table 6, the experimental class achieved a mean N-Gain of 0.42 (moderate), slightly higher than the control class mean of 0.39. More notably, the experimental class had 8 students in the high N-Gain category compared to only 3 in the control class, while having fewer students in the low category (1 vs. 6). The Independent Sample T-Test on N-Gain values showed a Levene's Test significance of 0.065 (> 0.05), confirming homogeneous variance. The Mean Difference was 0.74 indicating that both classes experienced learning improvements, with the experimental class showing a marginally higher gain.

Table 7. Practical skill assessment results

Class	N	Practice Mean Score
Experimental	31	89.23
Control	34	78.41
Difference	-	10.82

Table 7 shows that the experimental class achieved a practice mean score of 89.23, significantly higher than the control class mean of 78.41, a difference of 10.82 points. This demonstrates that the digital jobsheet with its procedural checklist and K3-based SOP guided students more effectively in executing each stage of motorcycle service, resulting in superior practical performance.

Discussion

The development of the web-based electronic jobsheet system using the ADDIE model resulted in a product that is valid, practical, and effective for vocational practical learning. The analysis stage

revealed that practical assessment at SMK Negeri 4 Palembang was still conducted manually using printed observation sheets, making documentation and assessment management less efficient. This finding supports previous studies emphasizing that vocational assessment should comprehensively evaluate work procedures, compliance with Standard Operating Procedures (SOPs), and Occupational Health and Safety (K3) principles rather than focusing solely on final outcomes (Ermawalis et al., 2025).

The validation results demonstrated a high level of feasibility, with an average validity score of 94.44%, categorized as Very Valid. The material expert validation score of 93.33% confirmed the suitability of the content with periodic motorcycle service competencies, while the media expert validation score of 95.71% indicated that the system met quality standards in terms of functionality, interface design, and navigation. The practitioner validation score of 94.00% further confirmed the applicability of the product in vocational practical learning. These findings indicate that the developed system fulfills both pedagogical and practical requirements (Irfan et al., 2025).

The practicality test yielded an average score of 84.21%, categorized as Very Practical. Among the assessed aspects, learning support obtained the highest score (92.67%), followed by clarity of materials and instructions, ease of use, media display, and feature usefulness. These results suggest that the integration of digital learning materials, procedural checklists, assessment modules, and documentation features effectively supported students in performing practical activities in a structured manner.

The effectiveness results showed that students in the experimental class achieved better learning outcomes than those in the control class. The experimental class obtained a posttest mean score of 90.16, whereas the control class achieved 77.06. Furthermore, the experimental class achieved an N-Gain score of 0.50, which was higher than the control class score of 0.45. The N-Gain distribution also showed that eight students in the experimental class reached the high category, compared to only three students in the control class. These findings indicate that the developed system contributed positively to students' cognitive achievement.

More substantial evidence of effectiveness was observed in practical performance. The experimental class achieved a mean practical score of 89.23, whereas the control class obtained 78.41, resulting in a difference of 10.82 points. This finding suggests that the integration of digital procedural checklists, K3-based guidance, and practice documentation features helped students perform periodic motorcycle service procedures more

systematically and consistently in accordance with established standards (Dewantoro et al., 2024).

The novelty of this study lies in the integration of learning materials, digital jobsheets, K3-based procedural guidance, practical evidence uploads, and assessment features within a single web-based platform. Unlike previous studies that focused primarily on digital jobsheets or computer-based testing separately, the developed system supports authentic assessment of vocational practical competencies while improving documentation quality, assessment transparency, and learning management efficiency. The inclusion of photo and video evidence uploads further strengthens the implementation of authentic and process-based assessment in accordance with the principles of the Merdeka Curriculum (Farkhan et al., 2025).

Conclusion

This study successfully developed a web-based electronic jobsheet system for periodic motorcycle service learning at SMK Negeri 4 Palembang using the ADDIE development model. The developed product was demonstrated to be highly feasible, achieving an average validity score of 94.44% based on evaluations from material experts, media experts, and practitioners. The system was also considered highly practical, as reflected by a student practicality score of 84.21%, indicating that the platform was easy to use and effectively supported structured practical learning activities. The effectiveness evaluation showed that students who used the developed system achieved better learning outcomes than those who used conventional jobsheets. The experimental class obtained a higher posttest mean score (90.16) than the control class (77.06), indicating improved cognitive achievement. In addition, the experimental class achieved a slightly higher N-Gain score (0.50) than the control class (0.45), suggesting moderate improvement in learning outcomes. More importantly, students in the experimental class demonstrated substantially better practical performance, achieving an average score of 89.23 compared to 78.41 in the control class. This finding indicates that the integration of digital jobsheets, procedural checklists, K3-based guidance, and digital documentation effectively supported students in performing periodic motorcycle service procedures according to established standards. The novelty of this study lies in the integration of learning materials, digital jobsheets, practical assessment, and documentation features within a single web-based platform that supports authentic assessment in vocational education. However, this study was limited to one school and a relatively small sample size. Therefore, future research is recommended to involve multiple schools, larger

samples, and additional interactive features to further enhance the effectiveness of the developed system.

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Authors Contribution

Conceptualization and methodology, N., A.K., and W.P.; software, formal analysis, investigation, data curation, writing – original draft preparation, N. And A.K.; validation, writing – review and editing, W.P., I.P.D., and A.H.A.D.

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Conflicts of Interest

There is no conflict of interest.

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