Assessing the Feasibility of Android-Based Learning Media for Common Rail Diesel System Maintenance: Perspectives of Media and Content Experts

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Abstract

The need for mobile and interactive instructional tools is critical in Indonesia's vocational schools, where traditional teaching methods are often insufficient to address the complexity of modern automotive systems. This study evaluates the feasibility of Android-based learning media developed to support the teaching of Common Rail diesel fuel system maintenance in vocational education. The learning media was designed using the ADDIE model and assessed through expert validation involving both content and media specialists from academia, industry, and government. Content experts evaluated the accuracy, completeness, and instructional value of the material, while media experts assessed its usability, navigation, and audiovisual quality. The validation process revealed that the content received a feasibility score of 85%, categorized as "Very Feasible," and the media design scored 80%, indicating it is "Feasible" for instructional use. Suggestions from experts were implemented, including refining learning objectives, expanding assessment items, improving narration clarity, and enhancing user interface functionality. Although the media platform limited certain features such as image zooming, overall usability and pedagogical alignment remained strong. These findings confirm that Android-based learning media is a viable tool for enhancing instructional effectiveness in vocational automotive programs. The study contributes to the growing body of research supporting mobile learning in technical education, highlighting the role of expert validation in ensuring media quality. It recommends further empirical testing with students to evaluate learning outcomes and suggests future integration with technologies like augmented reality and AI-based customization. This work demonstrates the potential of mobile learning to modernize vocational education and better prepare students for industry demands.

Keywords

Android-based learning media, common rail diesel maintenance, vocational education, expert validation, mobile learning

Introduction

Vocational education and training (VET) systems worldwide play a critical role in preparing students for industry-relevant careers, especially in technical fields. As global industries evolve with rapid technological advancements, vocational learning must adapt to ensure graduates are equipped with up-to-date competencies (OECD, 2024). Mobile learning and digital resources are increasingly utilized to enhance flexibility, accessibility, and practical skill acquisition in VET environments (Abd Karim et al., 2022; Douglas, 2020). These innovations are crucial in ensuring that vocational learners meet the dynamic demands of the global labor market.

In Indonesia, vocational education serves as a strategic pillar to improve workforce readiness and reduce the skills mismatch in the labor market. The Indonesian government has prioritized strengthening Vocational High Schools (VHSs) to align education with industrial needs (Ministry of Education and Culture, 2021). However, challenges remain in terms of access to quality instructional media, especially in automotive technology (Cahyono et al., 2021; Setiyawan, Alvindo, et al., 2023; Setiyawan et al., 2025). To improve instructional effectiveness, educators need innovative and context-specific media that integrate both theory and hands-on practice.

One of the essential areas in automotive vocational education is the maintenance of diesel engines, particularly those using Common Rail fuel systems. This system is widely used in modern diesel-powered vehicles due to its fuel efficiency and emission control (Rosdiyanti & Kaharmen, 2020). Vocational students are expected to master the competencies related to Common Rail Diesel Maintenance as outlined in the national curriculum. Mastery of these skills is critical to ensuring that graduates can perform real-world diagnostic and repair tasks in the automotive service industry.

Despite its importance, the availability of Android-based learning media specifically focused on Common Rail Diesel Maintenance remains limited. Most existing instructional tools rely on printed materials or face-to-face demonstrations, which may not be sufficient for today's digital-native learners (Abul et al., 2020; Hidayat et al., 2024). The lack of interactive, mobile-accessible media hinders students from reviewing material independently and practicing procedures outside the classroom. There is a pressing need to develop and validate digital media that align with current vocational standards and learner expectations.

Given this gap, the present study aims to develop and assess the feasibility of Android-based learning media for teaching Common Rail Diesel Maintenance in vocational schools. The research focuses on evaluating the media from the perspectives of content and media experts to ensure its relevance, usability, and educational value. This study contributes to the body of research on mobile learning in technical education by addressing a specific instructional need in Indonesian vocational schools. Furthermore, it provides empirical evidence on the use of expert validation to ensure product quality before classroom implementation.

Literature Review

Common Rail Diesel Maintenance Competencies

Common Rail diesel systems are widely applied in modern diesel engines due to their ability to optimize fuel injection, reduce emissions, and enhance engine performance. In response to these industry advancements, vocational education curricula have incorporated maintenance competencies for Common Rail diesel systems as core content (Achten & Verchot, 2011; Rizky & Nauri, 2020; Rosdiyanti & Kaharmen, 2020; Setiyawan, Fitriyana, et al., 2023). These competencies typically include understanding the structure and function of fuel delivery components, diagnosing system failures, and performing standard maintenance procedures. Students are expected to comprehend both the theoretical and practical aspects of system operation, including the electronic control unit (ECU) (Ajudia et al., 2014; Ghozali et al., 2023; Setiyawan, Suwahyo, et al., 2023), actuators, and sensors. Mastery of these skills is essential for preparing graduates to meet industry standards and employer expectations in the automotive sector.

To effectively teach these competencies, vocational educators must adopt instructional strategies that integrate theory with real-world application. Studies have shown that hands-on learning and contextualized instruction improve student comprehension of automotive systems (Ahmad Arif et al., 2020; Haryanto et al., 2021). However, given the complexity of Common Rail technology, traditional methods such as textbooks and lectures are often insufficient. The use of visual aids, simulations, and digital resources can support students in developing mental models of system operations. Thus, enhancing learning with digital media becomes increasingly important in teaching intricate topics like diesel fuel injection systems.

Android Learning Media

Android-based learning media has emerged as a popular instructional solution in vocational and technical education due to its accessibility, interactivity, and affordability. With the growing popularity of smartphones and mobile devices among students, Android applications offer a practical way to deliver learning materials outside the traditional classroom (Setiawan et al., 2021). These mobile applications can incorporate multimedia features—such as animations, quizzes, and interactive diagrams—to support diverse learning styles. According to Nugroho and Umamah (2021), students perceive Android learning media as engaging and effective in helping them understand complex content. This makes mobile platforms an ideal fit for vocational subjects that require visualization and step-by-step procedural understanding.

Moreover, Android-based learning aligns with the principles of mobile learning (m-learning), which emphasizes learner autonomy, flexibility, and contextual learning. In vocational education, m-learning allows students to revisit complex topics and practice skills asynchronously, which is particularly valuable for technical subjects such as engine diagnostics (Riyadi & Syahputra, 2022). The integration of Android applications into the learning process not only enhances motivation but also improves learning outcomes when compared to conventional methods. Furthermore, Android media can be developed using free or low-cost tools, making it scalable and sustainable in low-resource educational environments. These benefits make Android learning media a strategic choice for expanding access to high-quality vocational education.

Feasibility of Learning Media

Before learning media is implemented in classrooms, it must undergo a feasibility evaluation to ensure its instructional quality, usability, and alignment with curriculum objectives. Feasibility studies typically involve assessments by subject-matter and media experts who review aspects such as content accuracy, user interface, design layout, and pedagogical value (Prasojo et al., 2020). The validation process is essential to identify areas for improvement and to ensure that the media can effectively support learning outcomes. According to research by Ambarita et al. (2021), media that passes expert validation is more likely to be accepted by teachers and students due to its instructional reliability. This approach is consistent with development models such as ADDIE, which include formative evaluation as a core component.

In the context of vocational education, feasibility studies have demonstrated that well-developed media can improve learning efficiency and student engagement. Learning media that is both technically functional and contextually relevant can bridge the gap between theoretical instruction and hands-on skills (Suryani et al., 2020). Studies also show that digital learning tools validated by experts tend to receive more favorable feedback during field testing, leading to greater adoption in instructional practice. The validation process ensures that the media not only meets technical requirements but also aligns with students' cognitive levels and learning environments. Therefore, expert-based feasibility validation is a critical step in developing quality learning materials for vocational settings.

Research Questions

1. How feasible is the Android-based learning media for Common Rail diesel fuel system maintenance from the perspective of content experts?
2. How feasible is the Android-based learning media for Common Rail diesel fuel system maintenance from the perspective of media experts?

Methods

This study involved expert validation to assess the feasibility of an Android-based learning media developed for teaching maintenance of the Common Rail diesel fuel system. This is part of ADDIE design research to develop Android-based learning media. The ADDIE model is a systematic instructional design framework consisting of five phases Analyze, Design, Develop, Implement, and Evaluate (Chang & Mohamad Jafre Bin Zainol Abidin, 2024; Deng et al., 2024). The participants consisted of two categories of experts: media experts and content experts. Media experts included a vocational education lecturer specializing in automotive engineering, a vocational high school teacher in the automotive field, and a representative from the Badan Pengembangan Multimedia Pendidikan dan Kebudayaan (BPMPK) of Central Java Province. Content experts comprised a vocational education lecturer in automotive engineering, a vocational high school teacher in the automotive field, and an industry practitioner from PT. Mitsubishi Motors Krama Yudha Indonesia.

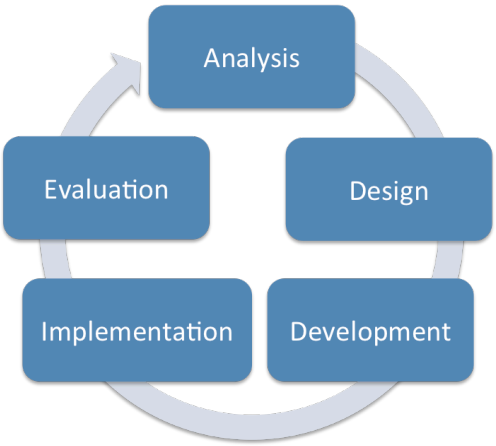

Figure 1. ADDIE model (Branch, 2009)

The validation procedure involved presenting the developed learning media to both categories of experts. Each expert was provided access to the Android-based media and asked to evaluate it based on their area of expertise either media design or instructional content. The evaluation was conducted using a structured feasibility assessment form. Experts were given approximately 60 minutes to interact with the media and complete the evaluation, ensuring sufficient time for exploration and detailed feedback.

The data obtained from the expert assessments were analyzed to determine the feasibility level of the learning media for classroom implementation. The feasibility percentage was calculated using the formula proposed by Sugiyono (2017):

$$P = \frac{\sum n}{\sum N} x\ 100\%$$

Where P represents the percentage of feasibility, ∑n is the total score obtained, and ∑N is the maximum possible score. The maximum score of the score of the content and media assesment are 192 and 300 respectively. The interpretation of the results followed specific criteria: a percentage score of 85–100% is categorized as "Very Feasible," 69–84% as "Feasible," 53–68% as "Moderately Feasible," 37–52% as "Less Feasible," and 20–36% as "Not Feasible." According to these criteria, the Android-based learning media is considered feasible for classroom use if it achieves a minimum score of 69%.

Result

The research on the development of Android-based learning media for the basic competency of diesel common rail fuel system maintenance uses the ADDIE development model, which consists of the stages: Analysis, Design, Development, Implementation, and Evaluation. The first phase we find thet learning media used at SMK Garuda Nusantara consists of several printed materials, PowerPoint slide presentations, and real objects or teaching aids. The use of printed media has several drawbacks, such as being limited to visual perception only. Moreover, printed media can only display static, two-dimensional images. The use of PowerPoint slides requires several supporting facilities, such as a power source, a computer or laptop, a projector, a screen, and adequate lighting. The design phase in this study is the planning and development phase of the Android-based learning media for the basic competency of the diesel common rail fuel system. The design in this study is divided into two parts: material collection and navigation structure, and storyboard creation.

At development stage, the product is developed according to the design from the previous phase and then evaluated by media experts and subject matter experts After the completion of the Android-based learning media for Common Rail diesel fuel system maintenance, validation was conducted to evaluate its feasibility prior to implementation with students. This stage aimed to ensure the quality and suitability of both the content and design of the media from the perspectives of relevant experts. The validation process involved content experts and media experts with established credentials in vocational education and industry practices.

The results presented below are based on quantitative assessments using structured evaluation forms and qualitative feedback provided by the experts. The evaluation considered various aspects including content accuracy, interface usability, visual design, technological compatibility, and pedagogical alignment with automotive curriculum standards. The feasibility results were then interpreted using a standardized scale, with scores categorized into five levels: Very Feasible, Feasible, Moderately Feasible, Less Feasible, and Not Feasible. The design stage in this study is the planning and development phase of the Android-based learning media for the basic competency of the diesel common rail fuel system. The design in this study is divided into two parts: material collection and navigation structure, and storyboard creation. In addition to numerical scores, experts provided specific recommendations for improvement. These

suggestions were reviewed and, where possible, implemented to enhance the overall quality and effectiveness of the learning media. The combination of both quantitative and qualitative data provides a comprehensive understanding of the product's readiness for educational use.

Content Expert Validation

Content expert validation was carried out by three professionals with expertise in automotive education and industry. All three experts were selected based on their practical and pedagogical experience in the Common Rail diesel system.

Table 1. Validation of the media by content expert

Content Expert	Score
Content Expert 1	50
Content Expert 2	56
Content Expert 3	58
Total	164
Maximum Score	192
Percentage	85%

The evaluation was based on criteria such as alignment of content with core competencies, accuracy of the subject matter, completeness of system component explanations, clarity in troubleshooting procedures, and inclusion of technological updates. The scores provided by the three experts were 50, 56, and 58, respectively, totaling 164 out of a maximum score of 192. Using the formula for feasibility analysis, this resulted in a score of 85%, which falls into the “Very Feasible” category as per Sugiyono’s criteria.

The experts also offered constructive feedback, including suggestions to improve learning objectives, refine the clarity of explanations, enhance the troubleshooting section with a detailed table of problems and solutions, and increase the number of quiz items. These recommendations were implemented to ensure that the final product better supports students' understanding and teachers' instructional needs. The updated media is now more comprehensive and pedagogically aligned.

Media Expert Validation

Media validation involved three experts in instructional media development. heir role was to assess the usability, navigation, graphic quality, and software performance of the Android-based learning media.

Table 2. Validation from media expert

Content Expert	Score
Media Expert 1	79
Media Expert 2	82
Media Expert 3	80
Total	241
Maximum Score	300
Percentage	80%

The scores given by the media experts were 79, 82, and 80, respectively, yielding a total of 241 out of a possible 300. This corresponds to a feasibility percentage of 80%, which meets the threshold for the “Feasible” category. This indicates that the media is well-structured and functional, although some technical and design enhancements were required. Overall, the media was seen as a viable tool for supporting self-directed learning and facilitating classroom instruction.

Specific feedback included fixing typographical errors, improving narrator clarity in video content, preventing the smartphone screen from auto-locking during video playback, and checking the navigation system. One suggestion, enabling zoom functionality on images, could not be implemented due to limitations in the software platform used. All other feedback was addressed, resulting in a smoother user experience and a more polished final product.

Suggestions and Revisions

Following the validation, both content and media experts provided targeted suggestions for improving the learning media. The input from content experts primarily focused on educational aspects such as refining learning objectives, correcting typographical inconsistencies, expanding content on troubleshooting, adding material on glow plugs and MIL systems, and updating references to comply with APA style. These suggestions were systematically reviewed and integrated into the final product.

The feedback from media experts concentrated on technical and visual design improvements. They recommended enhancing video narration quality, resolving navigation issues, adjusting background music volume, and fixing screen lock settings during video playback. Although most revisions were successfully implemented, the inability to provide zoom features for images due to platform constraints was acknowledged as a limitation. However, this did not significantly impact the media's overall usability.

Overall, the suggestions from experts contributed significantly to improving the functionality, clarity, and pedagogical effectiveness of the Android-based learning media. The revisions enhanced user experience for both students and teachers, ensuring that the media is not only informative and accurate but also intuitive and engaging. The final product is therefore ready for implementation in vocational education settings, especially in automotive subjects involving diesel fuel systems.

Discussion

The results of this study indicate that the Android-based learning media developed for the maintenance of Common Rail diesel fuel systems is both feasible and suitable for use in vocational education settings. The content validation yielded an average feasibility score of 85%, categorized as "Very Feasible," while the media validation achieved 80%, which is considered "Feasible." These findings suggest that the media aligns well with pedagogical and technical standards for instructional use, particularly in the field of automotive education.

These results are in line with prior studies that emphasize the importance of expert validation in the development of digital learning tools. According to Arfianti et al. (2022), validation by both content and media experts is essential to ensure that digital instructional materials meet curriculum standards and support meaningful learning experiences. In the present study, the learning media was validated by experts from academia, industry, and vocational education, echoing the recommendations of Volg et al. (2019), who highlighted the importance of triangulating expert input to enhance instructional design quality.

Moreover, the feasibility of this media supports findings from Mayasari et al. (2021) and Iman et al. (2022), who demonstrated that mobile learning platforms improve student

engagement and learning outcomes, particularly in technical and vocational subjects. The interactivity and portability of Android-based applications make them especially suitable for vocational learners who benefit from contextualized and hands-on learning. In addition, the integration of multimedia elements—such as video tutorials, interactive navigation, and visual diagrams aligns with Mayer's Cognitive Theory of Multimedia Learning, which posits that students learn better from words and pictures than from words alone (Mayer, 2009).

The suggestions from experts also led to meaningful revisions that strengthened the media's effectiveness. Enhancements such as refining the learning objectives, expanding the quiz component, and improving audiovisual quality reflect the iterative design process advocated by development models like ADDIE (Branch, 2009). Notably, while one technical limitation image zooming could not be resolved due to software constraints, the overall functionality and pedagogical alignment remained strong.

In conclusion, this study confirms that integrating mobile-based learning media in automotive vocational education is a viable and effective approach. Future research should focus on implementation in real classroom settings to evaluate student learning outcomes and engagement, as well as compare the effectiveness of mobile learning media with traditional methods.

Conclusion

This study aimed to evaluate the feasibility of Android-based learning media designed to support the teaching of maintenance procedures for Common Rail diesel fuel systems in vocational education. The validation process involved media and content experts with backgrounds in vocational education, industry, and instructional media development. Based on the data analysis, the content experts rated the media with an average feasibility score of 85%, categorized as "Very Feasible," while the media experts assigned an average score of 80%, falling under the "Feasible" category. The high feasibility scores indicate that the learning media is well-aligned with curriculum standards, technically sound, and pedagogically appropriate for use in classroom settings. Feedback from the experts contributed significantly to enhancing the quality of the product, especially in terms of learning objective clarity, content completeness, navigational structure, and audiovisual elements. Although there were limitations in terms of certain technical features, such as zoom functionality, these did not significantly affect the overall usability

of the application. In conclusion, the developed Android-based learning media is considered suitable for supporting self-directed and teacher-facilitated learning in automotive vocational education. It offers a flexible and interactive platform for enhancing students' understanding of diesel fuel system maintenance. Future studies should focus on empirical testing with students to measure learning outcomes and engagement, as well as explore potential integration with other emerging technologies such as augmented reality or AI-based personalization.

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