

Development of Interactive Multimedia-Based Learning Media for Periodic Maintenance Competencies to Improve Learning Outcomes of Ma'arif Vocational School Students

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Abstract

This research aims to produce interactive learning media for the periodic maintenance competency at SMK Ma'arif 6 Ayah, assess the feasibility of interactive multimedia learning media for the periodic maintenance competency, and measure the improvement in student learning outcomes following the use of interactive multimedia learning media for the periodic maintenance competency. The development of the interactive learning media employed a Research and Development (R&D) research method. Small-scale field trials were conducted with 12 students, and large-scale field trials were conducted with 32 Grade XII students of the Light Vehicle Engineering study program at SMK Ma'arif 6 Ayah. The trial results fell within the very feasible category, with the following details: material expert evaluation yielded a score of 88.25% (very feasible); media expert evaluation yielded a score of 87.75% (very feasible); small-scale student trials yielded a score of 89% (very feasible); and large-scale student trials yielded a score of 89.75% (very feasible). Based on these results, it can be concluded that the interactive multimedia-based learning media for the periodic maintenance competency is very feasible for use as a learning medium and is effective in improving student learning outcomes. This medium can therefore serve as an alternative solution in automotive practical learning, particularly at SMK Ma'arif 6 Ayah, and may be adapted for other subjects requiring practice-based procedural understanding.

INTRODUCTION

Education is the primary foundation for building quality and competitive human resources. In the context of vocational education, learning is oriented not only toward the mastery of theory but also toward the development of practical skills applicable in the workplace. Vocational High Schools (SMK) play a strategic role in producing skilled and work-ready graduates suited to industry needs. However, the quality of learning in SMK continues to face various challenges, particularly in terms of the effectiveness of material delivery and active student engagement in the teaching and learning process (Devega & Suri, 2019).

Learning is an activity carried out by teachers and students within a learning environment that requires several components, including learning objectives, materials, educators, students, methods, learning media, situational context, and evaluation (Abdullah et al., 2021; Agustian & Salsabila, 2021; Asmita et al., 2022; Wati & Nugraha, 2020). Learning will be better

understood and retained by students when supported by the use of appropriate learning media (Andrizal & Arif, 2017; Harsiwi & Arini, 2020; Tuwoso et al., 2021). Whether or not the objectives set in the learning process are achieved depends on the delivery strategy and the media employed. One of the competency standards for Grade XII, Semester 5 of the Light Vehicle Engineering program at SMK Ma'arif 6 Ayah is the periodic maintenance competency.

In the current learning process for this competency at SMK Ma'arif 6 Ayah, classroom instruction is less than conducive. The learning process relies on a lecture method supported by printed modules whose images are unclear and insufficiently engaging, resulting in the delivery of teaching materials that students find difficult to follow (Kurtis & Irfan, 2024; Radhitya et al., 2025; Rosa et al., 2023). Teachers tend to be more active than students, as instruction is predominantly lecture-based with students in a passive listening role, making the teaching and learning process less effective. This is particularly notable given that each classroom is equipped with an LCD projector that has not been fully utilized, and the teacher responsible for the subject lacks sufficient capacity to develop learning media suited to its requirements (Marzalius, 2026). The lack of variety in the delivery of teaching materials may thus be a contributing factor to the failure to achieve the desired learning objectives.

Previous research has demonstrated that the use of multimedia-based interactive learning media has a positive influence on improving student learning outcomes. Research conducted by Devega & Suri, (2019) shows that the development of interactive learning media for vocational school students can significantly increase understanding and motivation to learn. Similarly, (Widikda et al., 2018) found that tutorial-based interactive learning media for automotive electrical subjects at vocational schools are effective in improving student learning outcomes by presenting material in a visually and aurally engaging format supported by interactive simulations. Research by (Zaini & Nugraha, 2020) also demonstrates that interactive multimedia developed using Adobe Premiere Pro can increase the effectiveness of learning and students' comprehension of the material taught.

The urgency of this research lies in the pressing need to address the low learning outcomes of students in the periodic maintenance competency at SMK Ma'arif 6 Ayah, stemming from a lack of innovative and interactive media. Vocational school students are required to master technical skills in depth, yet the conventional learning process — reliant on printed modules — creates a gap between competency demands and actual learning outcomes. Although research on interactive learning media has been widely conducted, most of it focuses on general or theoretical subjects, while research on the development of interactive media specifically for the periodic maintenance competency within the Light Vehicle Engineering program remains very limited, and no study has specifically developed such media using Macromedia Flash at SMK Ma'arif 6 Ayah. The novelty of this research lies in the development of interactive media specifically designed for the periodic maintenance competency — covering component names, locations, functions, and maintenance procedures in the form of interactive audio-visual content using Macromedia Flash — employing an R&D approach with simultaneous validation by material and media experts as well as small- and large-scale trials. Additional novelties include the integration of interactivity elements that allow students to control the pace of their learning and conduct independent simulations, as well as the adaptation of the media to the characteristics of students and the facilities available at SMK Ma'arif 6 Ayah, ensuring that the resulting product is genuinely contextual and applicable.

In relation to the need for learning aids and media that can create a enjoyable, engaging, interactive, and effective learning process and assist students in comprehending teaching materials so that learning outcomes are achieved effectively, the present study was developed on the basis of the foregoing background under the title "Development of Interactive Multimedia-Based Learning Media for the Periodic Maintenance Competency at SMK Ma'arif 6 Ayah."

Based on this title, the theoretical framework draws on the concept of media — a word derived from the Latin *medius*, literally meaning middle, intermediary, or messenger — while learning media refers to a tool that functions to convey learning messages and is one of the supporting components for the success of the teaching and learning process. Interactive multimedia is multimedia equipped with control tools that can be operated by the user, enabling the user to select what is desired for the subsequent process. The Research and Development (R&D) method is a research method used to produce specific products and test their effectiveness. In the development research procedure, researchers identify the characteristics of components at each stage of development, analytically explain the function of components at each stage of product development, and clarify the relationships between components within the system. This study therefore aims to: produce interactive learning media for the periodic maintenance competency at SMK Ma'arif 6 Ayah; determine the feasibility of interactive multimedia learning media for the periodic maintenance competency; and determine the improvement in student learning outcomes following the use of interactive multimedia learning media for the periodic maintenance competency. This research is expected to provide both theoretical and practical benefits for the development of vocational and technology education, as well as for students, teachers, schools, and future researchers.

METHOD

This research uses the R&D (Research and Development) approach. R&D research is a basic research activity to obtain information on user needs (needs assessment), then continued with development activities to produce products and test the effectiveness of the product. In this study, the R&D approach was used because in this study, a product will be produced in the form of interactive learning media for periodic maintenance competencies. Borg and Gall revealed that there are 10 steps in the research and development process. The study was conducted at SMK Ma'arif 6 Ayah, located in Kebumen Regency. The time of the study was carried out in January 2025.

The research subjects in this development research consisted of 3 media experts, 3 material experts, 12 students in the small-scale field trial and all 32 students of class XII in the Light Vehicle Engineering expertise program in the large-scale field trial. The data collection techniques used in this study were observation, interviews, and questionnaires. Observations were conducted during the research to obtain data as a basis for conducting research and development. Interviews were conducted with teachers in charge of static promotion subjects and students to obtain data regarding research and development needs.

Questionnaires were used to obtain data on the quality assessment of the feasibility of the media developed according to media experts, material experts, and students in the small-scale field trial and large-scale field trial. The development research procedure according to Borg and Gall can be carried out more simply involving 5 main steps, namely: (1) Conducting

analysis of the product to be developed; (2) Developing the initial product; (3) Expert validation and revision; (4) Small-scale field trials and product revisions; (5) Large-scale field trials and final products. The steps in the development procedure can be described as follows:

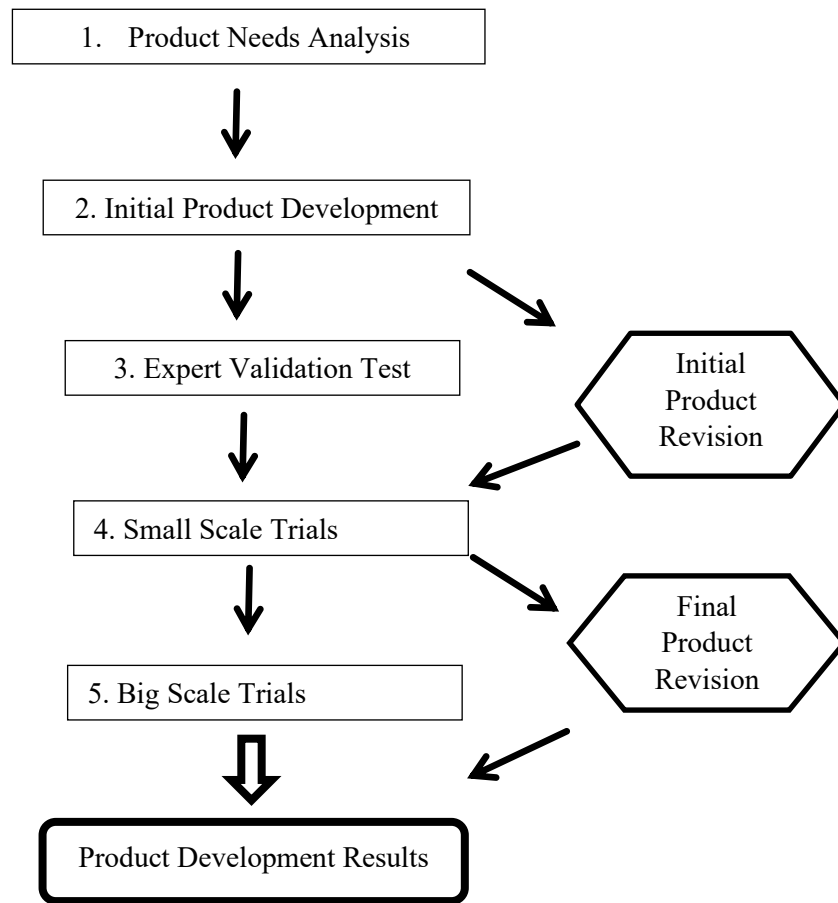


Figure 1. Development Research Procedures

Source: Adapted from Borg & Gall (1983) in (Siregar, 2016)

RESULTS AND DISCUSSION

The product of this research is an interactive learning media for periodic maintenance competencies, covering the names, locations, and functions of components of the periodic maintenance competency for grade XII students in the Light Vehicle Engineering program at SMK Maarif 6 Ayah. This interactive media is presented in audio-visual form using Macromedia Flash application software, packaged as a video application containing static promotional learning materials, and its feasibility was tested through expert testing, small-scale field testing, and large-scale field testing. Based on the overall product trial results by experts and users to assess the feasibility of the interactive learning media for Periodic Maintenance Competencies, the following results were obtained:

1. The material expert test results obtained a score of 3.53 or 88.25% → Very Appropriate.
2. The media expert test results obtained a score of 3.51 or 87.75% → Very Appropriate.
3. The feasibility test results according to student use are as follows:
 - a. Small-scale testing yielded a result of 3.56 or 89.00% → Very Feasible
 - b. Large-scale testing yielded a result of 3.59 or 89.75% → Very Feasible

The results of the feasibility study of interactive learning media for periodic maintenance competencies at SMK Ma'arif 6 Ayah can be seen in the diagram below:

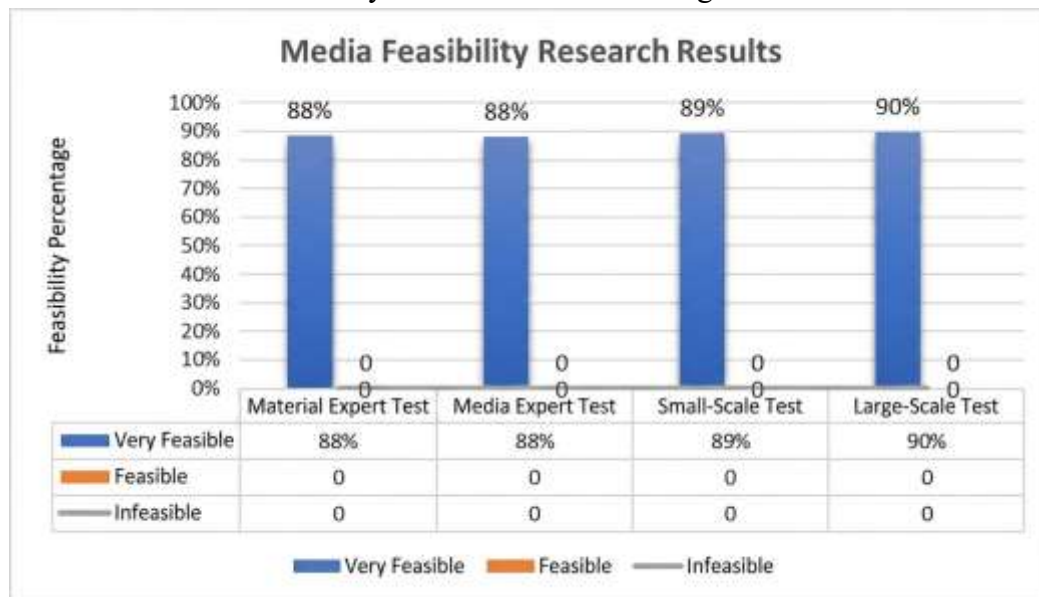


Figure 2. Diagram of the results of media quality assessment by experts and users

Source: Primary Research Data, 2025

Based on the results of the feasibility of the following media, there is an increase in student learning outcomes:

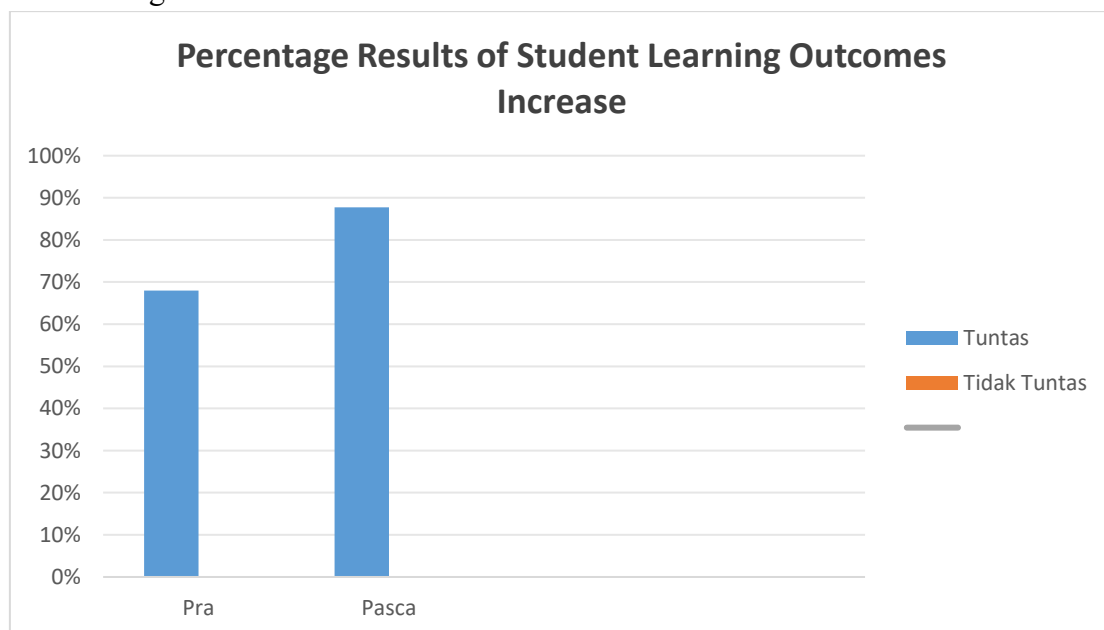


Figure 3. Diagram of the results of media quality assessment by experts and users

Source: Primary Research Data, 2025

The product developed in this research is an interactive multimedia-based learning medium for periodic maintenance competencies for 12th-grade students in the Light Vehicle Engineering program at SMK Ma'arif 6 Ayah. This medium was developed using Macromedia

Flash software, presenting interactive audio-visual materials, including explanations of the names, locations, and functions of vehicle components related to periodic maintenance.

The learning medium was piloted through several stages: expert testing, media expert testing, small-scale testing, and large-scale testing. The goal was to determine the feasibility and effectiveness of the medium in improving student learning outcomes.

1. Media Eligibility Results

The assessment results from the material experts showed an average score of 3.53 (88.25%), categorized as Very Appropriate. This indicates that the content presented aligns with the basic competencies of periodic maintenance and is able to help students understand procedural concepts.

Furthermore, the results from the media experts obtained an average score of 3.51 (87.75%), categorized as Very Appropriate. This means that the display design, navigation, interactivity, and ease of use meet the criteria for effective and engaging learning media for students.

Meanwhile, the results of the small-scale field feasibility test obtained an average score of 3.56 (89.00%), and in the large-scale field test, this score increased to 3.59 (89.75%). Based on the assessment criteria by Arikunto (2013), a score above 80% is considered very appropriate, ensuring widespread use of this media in the learning process.

This finding is in line with Sadiman's opinion, which states that interactive learning media that integrates elements of text, images, sound, and animation can strengthen students' memory and improve their understanding of complex concepts. Thus, the media developed is not only technically feasible, but also effective in supporting the achievement of learning objectives.

2. Results of Improving Student Learning Outcomes

The results of the effectiveness test showed an improvement in student learning outcomes after using interactive media. Based on the test results, there was a significant increase from pre-learning to post-learning scores, with the learning completion percentage increasing from approximately 65% to 90%.

This improvement indicates that the use of interactive learning media can help students better understand the material through engaging visual and audio presentations. This aligns with Mayer's (2009) cognitive learning theory, which states that students learn more effectively when information is presented through a combination of text and images integrated within a single multimedia context.

Furthermore, the results of this study support Munir's findings that the use of interactive multimedia-based media in automotive engineering learning can increase student motivation, attention, and active engagement during the learning process.

Overall, the results of this study indicate that the interactive multimedia-based learning media developed is highly feasible and effective for use in teaching periodic maintenance competencies. This media assists teachers in delivering technical material and provides opportunities for students to learn independently through interactive simulations.

The main factor contributing to the effectiveness of this media is the presentation of the material in engaging animations and audio-visual forms, in accordance with the principles of Paivio's dual coding theory, which explains that the human brain processes verbal and visual information simultaneously, thus facilitating long-term information retention.

Therefore, this media can be an alternative solution in automotive practical learning, particularly at SMK Ma'arif 6 Ayah, and can be adapted for other subjects requiring practice-based procedural understanding.

CONCLUSION

Based on the results of the research and development that has been carried out, the following conclusions can be drawn. The development research was conducted to produce a new product in the form of interactive learning media for the periodic maintenance competency for Grade XII students of the Light Vehicle Engineering program at SMK Ma'arif 6 Ayah. The results of the material expert and media expert evaluations, conducted to measure the quality and feasibility of the interactive learning media for the periodic maintenance competency, yielded a very feasible category. The responses of students as users of the interactive learning media for the periodic maintenance competency likewise yielded a very feasible category, as reflected in the values obtained from both small-scale and large-scale student trials.

Based on the foregoing conclusions, the researcher offers the following suggestions. For students, it is recommended to maximize the use of this interactive learning media as a self-learning tool, both at school and at home, by revisiting difficult material and engaging with the available simulations to deepen understanding of the periodic maintenance competency. For teachers, particularly those teaching the periodic maintenance subject, it is recommended to adopt this interactive learning media as an innovative and engaging alternative, and to further develop it for other competencies that require procedural visualization, so that the learning process becomes more varied and less monotonous. For schools, it is recommended to support the development of information technology-based learning media by providing adequate facilities and offering training to teachers in developing interactive learning media, as well as adopting this media as a reference in efforts to improve the quality of learning at SMK Ma'arif 6 Ayah. For future researchers, it is recommended to develop interactive learning media for other, broader competencies, to test the effectiveness of the media at different educational levels, and to develop media based on more modern platforms that can be accessed online in order to reach a wider student audience.

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