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Android-Based Learning Media Designed with Figma for Mechanical Measuring Instruments in Vocational Automotive Education

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Abstract

Repetitive and conventional learning can make mechanical measuring instrument topics difficult for vocational students to understand. This study developed and initially evaluated Android-based learning media designed with Figma for Mechanical Measuring Instruments. The research used the ADDIE development model with a pre-experimental one-group pretest–posttest design involving Grade X TKRO students. Product feasibility was assessed by media and material experts, while learning outcomes were examined through pretest, posttest, t-test, N-Gain, and student responses. The media expert score was 85.4%, and the material expert score was 90.8%, both in the very feasible category. The average score increased from 43.6 in the pretest to 80.2 in the posttest. The reported t-test value was 44.892 > 2.026, with an N-Gain of 0.67, indicating moderate improvement. Student responses reached 86.5%, categorized as very good.

Keywords
Android-based learning media; Figma prototyping; Mechanical Measuring Instruments; vocational automotive education; ADDIE development model.

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INTRODUCTION

Digital technology has become an increasingly important component of contemporary education because it enables teachers to present learning materials in more flexible, visual, and interactive formats. The expansion of mobile devices has also changed how students access learning resources, allowing instructional content to be used not only in the classroom but also beyond formal learning time. Recent reviews of mobile learning show that mobile-based learning environments can support accessibility, interaction, collaboration, and self-directed learning when they are designed with clear pedagogical objectives and appropriate instructional strategies [1], [2]. Therefore, the use of mobile technology in learning should not be understood merely as the transfer of printed materials into digital form, but as an effort to create learning experiences that are more structured, engaging, and responsive to students' needs.

In vocational education, digital learning media are particularly relevant because students are expected to understand both conceptual knowledge and procedural skills. Learning in technical and vocational contexts often requires visual representation, repeated practice, and clear step-by-step explanations so that students can connect theory with workshop-based activities. The ADDIE model has been widely used as a systematic instructional design framework because it guides developers through analysis, design, development,

implementation, and evaluation stages [3]. Several recent studies in vocational and automotive education have also shown that Android-based learning media can be developed and evaluated through expert validation, user response, and learning outcome measurement [4]–[6]. These studies indicate that mobile learning media can serve as a practical support tool for vocational learning, especially when conventional classroom media are insufficient to explain technical content clearly.

Mechanical Measuring Instruments is one of the important topics in automotive vocational learning because students must understand the function, accuracy, reading method, and practical use of various measuring devices. In automotive and mechanical practice, instruments such as rulers, vernier callipers, micrometers, torque wrenches, compression testers, feeler gauges, cylinder bore gauges, dial test indicators, nozzle testers, and valve spring testers are closely related to measurement accuracy and product or service quality. Previous work on Android-based measuring instrument learning media emphasized that digital applications can support introductory practice activities by presenting measurement concepts and tool operation in a more accessible format [7]. Training-oriented studies on measuring instruments in vocational contexts also highlight that students and teachers need clear learning support to improve their understanding of tool functions, reading procedures, and measurement accuracy [8]. This makes the Mechanical Measuring Instruments topic suitable for mobile-based instructional media development.

The need for Android-based learning media in automotive vocational education has also been supported by previous studies on different technical subjects. Android-based media for basic automotive engineering, motorcycle electrical maintenance, and automotive battery maintenance have been reported as feasible, practical, or supportive for technical learning when the media contain structured materials, visual content, exercises, and user-friendly navigation [4], [9], [10]. However, most prior studies focused on other automotive topics, while Android-based learning media specifically designed for Mechanical Measuring Instruments remains relatively limited, particularly in the context of Grade X TKRO students at SMK IPT Karang panas Semarang. This gap is important because measuring instrument material requires not only textual explanation but also visual guidance, procedural clarity, and interactive access that can help students review the material independently.

In developing mobile learning media, interface design is also an essential consideration because the quality of navigation, layout, visual hierarchy, and interaction can influence how students access and understand learning content. Figma is a web-based design and prototyping platform that allows developers to create user interface layouts, organize application frames, connect interactive prototypes, and revise designs collaboratively. Prior studies have used Figma as a prototyping tool in educational and UI/UX learning contexts, showing its usefulness for designing interactive interfaces and supporting user-cantered digital product development [11], [12]. In this study, Figma was used to design the interface structure and prototype of the Android-based learning media. Figure 1 presents the Figma workspace used in the design process, illustrating the initial interface frame for the Android learning media prototype.

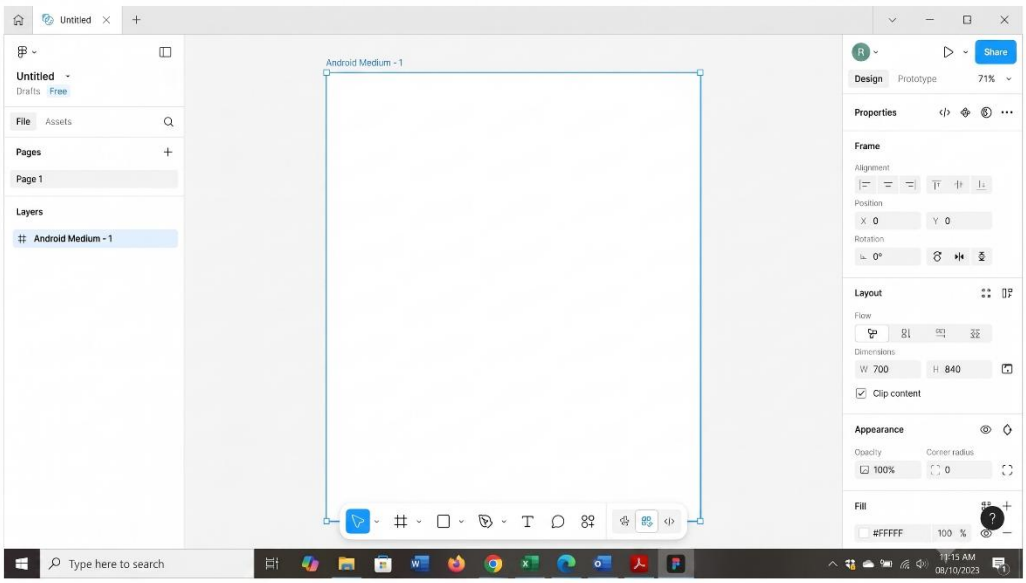


Figure 1. Figma workspace for designing the Android-based learning media prototype

Based on the identified learning problem, the characteristics of Mechanical Measuring Instruments material, and the need for accessible instructional media in vocational automotive education, this study developed Android-based learning media using Figma for the Mechanical Measuring Instruments topic. The study aimed to identify the feasibility of the developed media through expert validation, examine students' learning outcome improvement through pretest and post-test scores, and describe student responses after media implementation. The contribution of this study lies in providing a Figma-assisted Android learning media product and an initial evaluation of its feasibility and learning-support potential for Mechanical Measuring Instruments learning in a vocational automotive education setting.

METHOD

This study used a Research and Development (R&D) approach to develop and evaluate Android-based learning media for the Mechanical Measuring Instruments topic. The development process followed the ADDIE model, which consists of five systematic stages: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model was selected because it provides a structured instructional design sequence for identifying learning needs, designing instructional content, developing learning products, implementing them with users, and evaluating the results [3], [13]. In the context of digital and vocational learning media development, ADDIE can also be combined with prototyping procedures to support iterative product design, expert validation, and user-oriented evaluation [13], [14]. The procedural flow of the ADDIE model used in this study is presented in Figure 2.

The analysis stage was conducted to identify the needs of users, learning content, and development resources. User needs analysis focused on the characteristics of the prospective users, namely Grade X students of the Automotive Light Vehicle Engineering program at SMK IPT Karang panas Semarang. This analysis was used as the basis for determining the interface design, navigation structure, readability level, and ease of use of the Android-based learning media. Content analysis focused on the Mechanical Measuring Instruments topic in the Basic Automotive Engineering subject. The selected content was aligned with the relevant basic competencies and included common mechanical measuring instruments used in automotive practice. In addition, hardware and software needs were identified to determine the tools required for designing and developing the learning media.

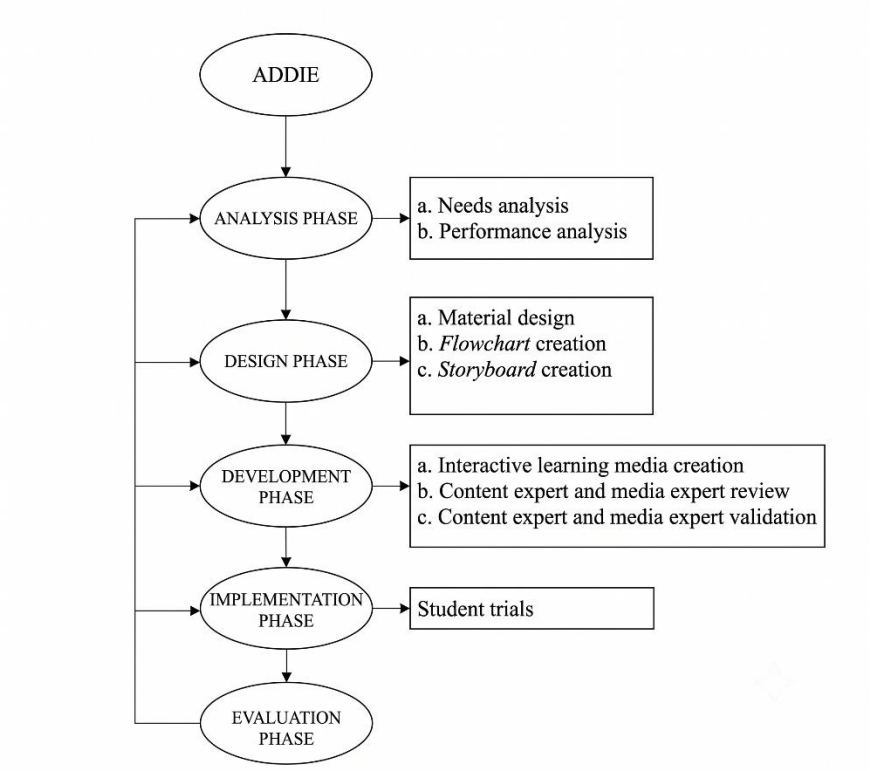


Figure 2. ADDIE development flow for Android-based learning media design and evaluation

The design stage focused on transforming the results of the needs analysis into a structured learning media plan. At this stage, the learning topic, content sequence, menu structure, flowchart, and storyboard were prepared. The storyboard served as a design guide for arranging the visual layout, navigation pattern, learning materials, and evaluation components. The user interface was designed using Figma because this platform supports frame-based interface design, interactive prototyping, and visual organization of application screens [11], [12]. The design stage produced the initial prototype structure of the Android-based learning media before it was developed into a product for validation and implementation.

The development stage involved converting the storyboard and interface design into an Android-based learning media product. The product contained learning menus, usage instructions, learning objectives, Mechanical Measuring Instruments materials, evaluation items, and reference information. After the product was prepared, it was reviewed to check the consistency between the developed media and the initial design plan. Product feasibility was then evaluated by media experts and material experts. The media expert validation focused on the quality of interface design, navigation, usability, visual presentation, and media function. The material expert validation focused on content accuracy, relevance to the learning objectives, clarity of explanation, and suitability for Grade X vocational automotive students. Before being used for product assessment, the validation instruments were checked to ensure that the items were appropriate for evaluating the developed media. Instrument quality is important in learning media studies because validation and reliability procedures help ensure that the collected data reflect the intended construct being measured [15], [16].

The implementation stage was conducted after the developed media had been declared feasible by the media and material experts. The product was implemented with 38 Grade X students of the Automotive Light Vehicle Engineering program at SMK IPT Karang panas Semarang. The learning material focused on Mechanical Measuring Instruments in the Basic Automotive Engineering subject. Before using the media, students completed a pretest to obtain

initial learning outcome data. The students were then guided to use the Android-based learning media and study the available Mechanical Measuring Instruments materials. After the learning activity, students completed a post-test to obtain data on learning outcomes after media implementation. This design followed a pre-experimental one-group pretest and post-test design, in which the same group of students was measured before and after the learning intervention. This design can describe changes in student scores after implementation, but it should be interpreted carefully because it does not include a control group [17], [18].

The evaluation stage was conducted to assess product feasibility, student learning outcome improvement, and student responses to the developed media. The study was conducted at SMK IPT Karang panas Semarang, located on Jalan Dr. Wahidin No. 110, Jatingaleh, Candisari, Semarang, Central Java. The research was carried out from January to March 2026. The data consisted of quantitative data obtained from expert validation sheets, pretest and post-test scores, and student response questionnaires. Documentation was also used to support the development and implementation process. The instruments used in this study included a media expert validation sheet, a material expert validation sheet, multiple-choice pretest and post-test items, and a student response questionnaire.

The data were analyzed using descriptive quantitative analysis and statistical testing. Expert validation data were converted into percentages to determine the feasibility category of the developed media. Student response data were also converted into percentages to identify the response category after media implementation. Pretest and post-test data were analyzed to describe changes in student learning outcomes. The statistical analysis included validity testing, reliability testing, normality testing, homogeneity testing, a t-test, and N-Gain analysis. Normality testing was used to examine whether the pretest and post-test data were normally distributed, while homogeneity testing was used to examine the similarity of variance. The t-test was used to examine the difference between test scores, and N-Gain was used to describe the level of learning outcome improvement from pretest to post-test [18]. The analysis was performed using SPSS 25.

RESULT AND DISCUSSION

Results

The product developed in this study was Android-based learning media for the Mechanical Measuring Instruments topic. The media was designed using Figma and organized into several main interface pages, including the intro page, main menu, user guide, profile, learning objectives, material menu, evaluation menu, and reference menu. These interface components were designed to provide students with structured access to learning materials, operational guidance, and evaluation activities.

The first display of the application is the intro page, as presented in Figure 3. This page appears before users enter the main menu and contains a “Start” button that allows users to continue to the next page.

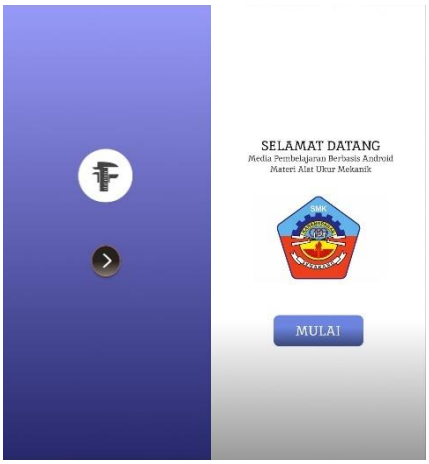


Figure 3. Intro page of the Android-based learning media

The main menu page is presented in Figure 4. This page contains the main navigation buttons, including the user guide menu, profile menu, learning objectives menu, material menu, evaluation menu, and reference menu. These buttons function as the main access points for the learning media.

Figure 4. Main menu page of the Android-based learning media

Figure 5 presents the user guide menu. This page provides operational instructions to help students understand how to use the Android-based learning media and access each available feature.

Figure 5. User guide menu page

The profile menu is shown in Figure 6. This page presents the identity of the learning media developer and information related to the school context in which the media was implemented.

Figure 6. Profile menu page

Figure 7 displays the learning objectives menu. This page presents the learning objectives of the Mechanical Measuring Instruments material so that students can understand the expected learning targets before accessing the content.

Figure 7. Learning objectives menu page

The material menu is presented in Figure 8. This menu contains learning materials on mechanical measuring instruments, including rulers, vernier callipers, micrometers, compression testers, dial test indicators, cylinder bore gauges, feeler gauges, torque wrenches, valve spring testers, and nozzle testers. The material page also includes subtopics on instrument parts, types, reading methods, usage procedures, and supporting videos. When students select one of the material buttons, the application displays the corresponding learning content.

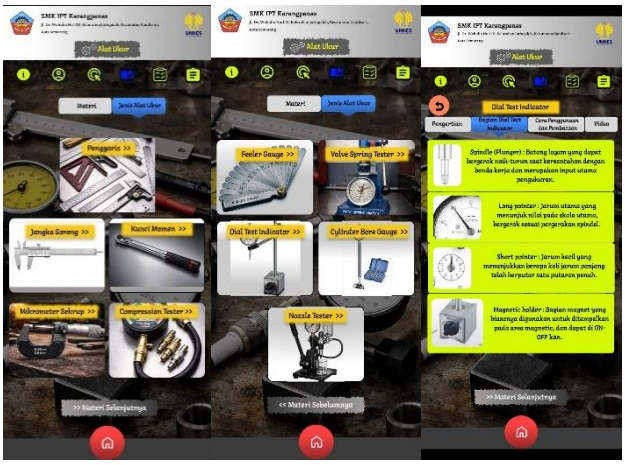


Figure 8. Material menu page of the Mechanical Measuring Instruments learning media

The evaluation menu is shown in Figure 9. This page contains evaluation questions based on the learning materials presented in the material menu. The evaluation feature was designed to help students review their understanding of the Mechanical Measuring Instruments topic.

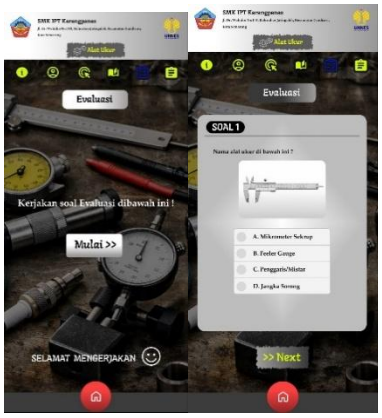


Figure 9. Evaluation menu page

The reference menu is shown in Figure 10. This page lists the sources used in developing the learning materials and allows users to identify the references supporting the content presented in the application.

Figure 10. Reference menu page

After the learning media product was developed, expert validation was conducted to determine the feasibility of the media. The media expert validation results are presented in Table 1.

Table 1. Media expert validation results

No.	Media Expert	Score
1	Febrian Arif B, S.Pd., M.Pd.	60
2	Dwi Prayitno, S.Pd.	63
	Total score	123
	Maximum score	144
	Percentage	85.40%
	Category	Very feasible

Based on Table 1, the total score obtained from the media experts was 123 out of a maximum score of 144. The resulting percentage was 85.4%, which was categorized in this study as very feasible.

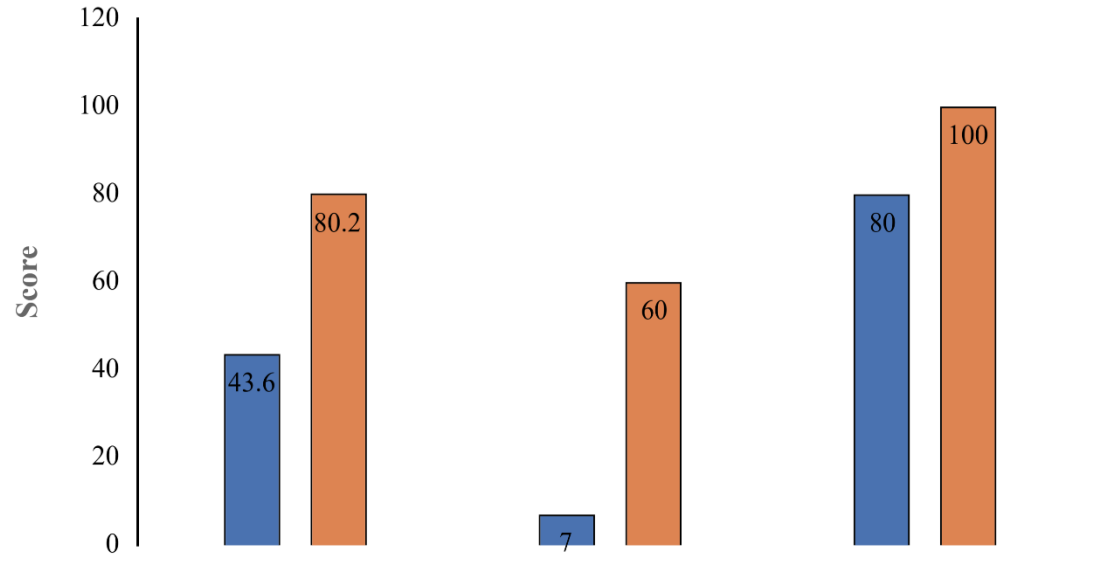
The material expert validation results are presented in Table 2.

Table 2. Material expert validation results

No.	Media Expert	Score
1	Ninda Kurniadi, S.Pd., M.T.	57
2	Rinno Setiadi, S.Pd.	52
	Total score	109
	Maximum score	120
	Percentage	90.8%
	Category	Very feasible

As shown in Table 2, the material expert validation produced a total score of 109 out of a maximum score of 120. The percentage obtained was 90.8%, which was categorized in this study as very feasible.

Student learning outcomes were measured using pretest and post-test scores from 38 Grade X TKRO students at SMK IPT Karang panas Semarang. The descriptive comparison of pretest and post-test scores is presented in Figure 11 and it shows that the average pretest score was 43.6, with a minimum score of 7 and a maximum score of 80. The average post-test score was 80.2, with a minimum score of 60 and a maximum score of 100. These descriptive results indicate an increase in the average score after the implementation of the Android-based learning media.



	Mean	Minimum	Maximum
Pretest	43.6	7	80
Posttest	80.2	60	100

Figure 11. Pretest and post-test score comparison

The normality test was conducted using the Shapiro–Wilk test in SPSS 25. The results are presented in Table 3.

Table 3. Normality test results

Variable	Shapiro–Wilk Statistic	df	Sig.
Pretest	0.96	38	0.195
Posttest	0.948	38	0.076

Based on Table 3, the significance value for the pretest was 0.195, while the significance value for the post-test was 0.076. Both values were greater than 0.05, indicating that the pretest and post-test data were normally distributed according to the criterion used in this study.

The homogeneity test was conducted using Levene's test. The result is presented in Table 4.

Table 4. Homogeneity test result

Test Basis	Levene Statistic	Sig.
Based on mean	0.339	0.564

Table 4 shows that the significance value of the homogeneity test was 0.564. Because this value was greater than 0.05, the pretest and post-test data were categorized as homogeneous according to the testing criterion used in this study.

The reported t-test output is presented in Table 5.

Table 5. Reported t-test result

t	df	p-value
44.892	37	< 0.001

Based on Table 5, the reported t-value was 44.892 with df = 37 and p < 0.001. According to the testing criterion used in this study, this result indicates a statistically significant result for the tested score data. This statistical result supports the descriptive finding that the post-test average was higher than the pretest average after the implementation of the Android-based learning media.

The N-Gain analysis was conducted to identify the level of learning outcome improvement after media implementation. The result is presented in Table 6.

Table 6. N-Gain test result

Variable	N	Mean
N-Gain score	38	0.6783
N-Gain percentage	38	67.8304

Table 6 shows that the mean N-Gain score was 0.6783, rounded to 0.67, while the mean N-Gain percentage was 67.8304%, rounded to 67.8%. Based on the normalized gain classification used in this study, the N-Gain score was included in the moderate improvement category. The classification is presented in Table 7.

Table 7. Normalized Gain classification used in the study [18]

N-Gain score	Category
0.70–1.00	High
0.30–0.70	Moderate
0.00–0.30	Low

Student responses to the Android-based learning media were collected using a questionnaire. The result is presented in Table 8.

Table 8. Student response result

Total score	Maximum score	Percentage	Category
2631	3040	86.50%	Very good

Based on Table 8, the total student response score was 2631 out of a maximum score of 3040. The percentage obtained was 86.5%, which was categorized in this study as very good.

Discussion

The Android-based learning media developed in this study demonstrates that digital instructional products for vocational automotive learning need to be organized not only as content repositories but also as structured learning environments. The interface sequence shown in Figures 3–10 indicates that the media provides a complete navigation structure, starting from the intro page, main menu, user guide, profile, learning objectives, material menu, evaluation menu, and reference menu. This structure is important because vocational students require clear access to procedural and visual information when learning technical topics. Similar Android-based learning media in vocational education have emphasized that mobile applications should present technical content through organized menus, accessible navigation,

and learning activities that support independent study [19], [20]. The present media extends this approach to Mechanical Measuring Instruments, a topic that requires students to understand tool functions, reading procedures, and measurement accuracy.

The product interface also shows that the media was designed to connect learning objectives, content, and evaluation activities within one application flow. As shown in Figure 8, the material menu covers several mechanical measuring instruments, including rulers, vernier callipers, micrometers, compression testers, dial test indicators, cylinder bore gauges, feeler gauges, torque wrenches, valve spring testers, and nozzle testers. The availability of instrument parts, types, reading methods, usage procedures, and supporting videos indicates that the media attempts to combine conceptual and procedural content. This feature is relevant to vocational learning, where students need visual and step-by-step support to connect theory with workshop-related practice. Previous studies on Android-based interactive media and mobile learning in vocational automotive contexts have similarly highlighted that digital media can help present technical materials in a more accessible and interactive format [21], [22]. However, the present study should be interpreted as an initial product evaluation because it did not directly measure long-term skill mastery or practical workshop performance.

The expert validation results in Tables 1 and 2 indicate that the developed media was categorized as very feasible from both media and material perspectives. The media expert validation reached 85.4%, while the material expert validation reached 90.8%. These findings suggest that the product met the feasibility criteria used in this study, particularly in relation to media presentation and learning content suitability. This result is important because expert validation is a necessary stage in learning media development before implementation with students. In vocational digital learning, the quality of interaction, visual presentation, usability, and content relevance can influence how students experience the learning process. Research on blended e-learning and vocational education also shows that engagement and motivation are strongly related to how learning environments are structured and experienced by learners [23]. In addition, digital technology use in vocational education is more meaningful when it improves learning experience and engagement rather than merely adding technology to instruction [24]. Therefore, the feasibility scores in this study provide initial support that the media design and material content were acceptable for classroom implementation.

The descriptive comparison of pretest and post-test scores in Figure 11 shows an increase in the average student score from 43.6 to 80.2 after the implementation of the Android-based learning media. This pattern indicates that students obtained higher scores after learning with the developed media. The result is in line with broader findings that Android-based learning media are often associated with improved learning outcomes when they provide visual, interactive, and accessible learning support [25]. Similar development studies using digital learning media have also reported that expert validation, student responses, and pretest–post-test comparisons can be used to evaluate the feasibility and learning-support potential of instructional products [26]. Nevertheless, the present finding should be read proportionally because the research design used one group without a comparison class. Therefore, the score improvement can be described as learning outcome improvement after implementation, but it should not be interpreted as definitive causal proof that the media alone produced the improvement.

The statistical results provide additional support for the descriptive score difference. The normality test in Table 3 showed that both pretest and post-test data met the normality criterion used in this study, while the homogeneity result in Table 4 showed that the variance assumption was also met according to the stated criterion. The reported t-test result in Table 5 showed $t = 44.892$ with $p < 0.001$, indicating a statistically significant result for the tested score data. This statistical pattern supports the observation that post-test scores were higher than

pretest scores. However, the interpretation must remain cautious because the manuscript reports a one-group pretest–post-test design. Recent digital learning media studies using ADDIE-based development and learning outcome evaluation commonly combine expert validation, student response, and achievement testing, but the strength of the claim depends on the appropriateness of the statistical test and the availability of a comparison group [27]. Therefore, the statistical result in this study is useful for indicating score improvement, but it should not be used to make broad causal claims beyond the tested class and learning context.

The N-Gain result in Table 6 provides a clearer picture of the level of improvement. The mean N-Gain score was 0.6783, rounded to 0.67, and was categorized as moderate according to the classification used in Table 7. This result indicates that the learning outcome improvement was meaningful but had not reached the high category. This finding is academically important because it prevents overclaiming the media as fully effective or optimal. A comparable Android-based project-based learning media study also reported a moderate N-Gain level, showing that digital media can support learning improvement while still requiring instructional refinement, repeated use, and broader implementation to achieve stronger learning gains [28]. In the present study, the moderate N-Gain may be related to the nature of Mechanical Measuring Instruments material, which requires not only reading and visual recognition but also practical measurement experience. Therefore, the Android-based media should be viewed as a learning support tool rather than a complete substitute for direct practice with mechanical measuring instruments.

Student responses in Table 8 further indicate that the developed media was positively received, with a response percentage of 86.5%, categorized as very good in this study. This result suggests that students considered the media acceptable and engaging after implementation. The positive response may be related to the structured menu, visual presentation, and accessibility of the Android-based format. However, student response data represent user perception and should not be interpreted as direct evidence of learning achievement. When combined with expert validation, pretest and post-test improvement, and moderate N-Gain, the student response result strengthens the position of the developed media as a feasible and promising instructional support product for Mechanical Measuring Instruments learning.

Overall, the findings indicate that the Android-based learning media designed with Figma was feasible according to expert validation, supported higher post-test scores than pretest scores, produced a moderate N-Gain, and received very good student responses. The main contribution of this study lies in providing a Figma-assisted Android learning media product for Mechanical Measuring Instruments in vocational automotive education. Practically, the media can help teachers present tool-related material in a more structured and accessible way. Methodologically, the study provides an initial development and implementation evaluation using the ADDIE model, expert validation, pretest and post-test data, N-Gain, and student response analysis. However, future research should involve a control group, paired-samples statistical testing when the same students are measured before and after learning, instrument validity and reliability reporting, and practical performance assessment to determine whether the media also improves students' actual measurement skills in workshop settings.

CONCLUSION

Conclusion

This study developed and initially evaluated Android-based learning media designed with Figma for the Mechanical Measuring Instruments topic in vocational automotive education. The expert validation results indicate that the developed media was categorized as very feasible from both media and material perspectives, with a media expert score of 85.4% and a material

expert score of 90.8%. These results show that the product met the feasibility criteria used in this study and could be implemented in the learning process. The implementation results showed an improvement in students' learning outcomes after using the Android-based learning media. The average score increased from 43.6 in the pretest to 80.2 in the post-test. The reported t-test result supported the difference in the tested scores, while the N-Gain score of 0.67 indicated a moderate level of improvement. Student responses also showed a positive perception of the media, with a response score of 86.5%, categorized as very good.

Overall, the developed Android-based learning media can be considered a feasible and promising instructional support tool for Mechanical Measuring Instruments learning. The media may help teachers present technical material in a more structured, visual, and accessible format. Future development may expand the product into both web-based and mobile-based formats, enrich the depth of the material, and add audio features and interactive animations to support students' understanding of component names, measurement procedures, and tool operation.

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