Lembaran Ilmu Kependidikan
Vol. 53 No. 2(2024): 275-283

e-ISSN 0216-0847
https://journal.unnes.ac.id/journals/LIK

Development of Interactive Learning Media Using Adobe Flash on the Subject of Electronic Control Systems

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Article info:
Submited: July 10, 2024. Revised: August 23, 2024. Accepted: September 24, 2024.
Publish: September 22, 2024

Abstract

At the vocational school level, pneumatic basic competency is one of the basic competencies in the Electronic Control Systems subject. This basic competency is fundamental and must be mastered by class XI SMK students in the Industrial Electronics Engineering Skills Competency. This research aims to produce basic pneumatic interactive learning media in the form of an interactive CD that is suitable for the Electronic Control Systems subject for class XI students at SMKN 1 Jetis Mojokerto. This research is a type of Research and Development (R&D) research to produce a learning product that suits your needs. The research steps refer to the Borg and Gall model to produce systematic and structured research. Meanwhile, the steps for developing interactive learning media using Adobe Flash in electronic control system subjects, pneumatic basics material refers to the ADDIE model to produce quality learning media that suits learning needs. Interactive Learning Media Using Adobe Flash in the Subject of Electronic Control Systems, this pneumatic material was validated by design experts, media experts, material experts, colleagues and students. The design expert validation results obtained a percentage of 88.18% in the very valid category, media expert validation obtained a percentage of 85.71% in the very valid category, material expert validation obtained a percentage of 89.23% in the very valid category, peer assessment obtained the percentage was 92.5% with a very valid category, small group product trials involving 5 students were 90%, medium group trials of 9 students were 90.22%, large group trials by 36 students got a percentage of 91.00 %, while for field trials involving 70 students with a percentage of 91.04%. So this media is said to be very valid and feasible and can be used as an alternative media in learning. This study contributes to improving vocational education by developing interactive learning media for pneumatic basics, which enhances student engagement and competency in electronic control systems.

Keywords: interactive learning media, basic pneumatics, vocational school level

Recommended citation:
Hariyanto, A., Fatiratul, A.N. & Harwanto H. Development of Interactive Learning Media Using Adobe Flash on the Subject of Electronic Control Systems. (2025). *Lembaran Ilmu Kependidikan*, *53*(2). https://doi.org/10.15294/lik.v53i2.9264

INTRODUCTION

The development of science and technology has progressed very rapidly over time (Bentley et al., 2025). In the world of education, an educator is required to make reform efforts related to the use of technology in teaching and learning activities (Akpan et al., 2024). One effort to utilize

technology in the learning process is the development of learning media(Abdulrahaman et al., 2020). The use of learning media in the teaching process is highly recommended to improve the quality of teaching (Med, 2024). Media in the learning process can be in the form of software and hardware which are small parts of learning technology that must be created or developed, used and managed for learning needs in achieving effectiveness and efficiency in the learning process(Devega et al., 2022).

One of the obstacles faced by Vocational High School (SMK) students is understanding and applying theoretical subject matter (Nopriana et al., 2023). Vocational school students tend to like practical activities rather than theoretical activities in class. Understanding theory is the basis for use as a provision for practical activities(Mukhalalati et al., 2022). If the basic theory is still weak, it is likely that the practical application will experience many difficulties(Campbell, 2024). Choosing an inappropriate method can also cause students to lack theoretical understanding. One method that is often used by teachers is the conventional learning method. Conventional learning is teacher-centered learning, where the teacher's role is to control most of the learning presentation or can also be called the lecture method (Aharonian et al., 2024). When implementing conventional learning methods, the learning process is dominated by the teacher and students tend to passively listen, pay attention and take notes.

At the Industrial Electronics Engineering Competency Vocational School, there is one subject related to control technology, namely the subject Electronic Control Systems. As we know, the development of control technology is increasingly rapid, especially in processes and manufacturing in industry (Zhao, 2021). This control technology is a combination of various scientific disciplines such as pneumatics, mechanics, electric control, computers and information technology (Ahrar et al., 2023). Design of modern production equipment and machines in mechanical construction using pneumatic, hydraulic and electronic actuators and motors as the driving force, while PLC as the controller (Marques et al., 2020).

Pneumatic Basic Competency is one of the basic competencies in the Electronic Control Systems subject (Chen et al., 2025). This basic competency is fundamental and must be mastered by class XI SMK students in the Industrial Electronics Engineering Skills Competency. Applying a control circuit with electro-pneumatic components can be in the form of digital open loop control or digital closed loop control in an automatic control system (Drotman et al., 2021).

The rapid advancement of technology in education demands innovative approaches to improve teaching and learning processes, particularly in vocational education, where understanding theoretical concepts is critical for practical application (Li, 2024). At SMKN 1 Jetis, the use of conventional teaching methods and PowerPoint presentations has proven ineffective in helping students grasp Pneumatic Basic Competency, a fundamental skill in the Electronic Control Systems subject. To address these challenges, this study develops interactive learning media using Adobe Flash, providing a visual and engaging tool to enhance students' understanding of pneumatic systems. By bridging the gap between theory and practice, this research not only improves the quality of teaching and learning but also equips students with the competencies needed for industrial demands, offering a model for integrating interactive media in vocational education.

METHODS

This research is a type of Research and Development (R&D) research to produce a learning product that suits the needs, material characteristics according to KI/KD (Core Competencies/Basic Competencies) (Nurjanah & Suprihatin, 2023), and characteristics of class XI students in the concentration of industrial electronics engineering expertise at SMKN 1 Jetis Mojokerto. The research steps refer to the Borg and Gall model to produce systematic and

e-ISSN 0216-0847
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structured research (Untoroseto & Triayudi, 2023). Meanwhile, the steps for developing interactive learning media using Adobe Flash in electronic control system subjects, electro-pneumatic material refer to the ADDIE model to produce quality learning media that suits learning needs (Sa'idah & Saefudin, 2024).

Conceptually, the research and development approach includes 10 general steps, as outlined by Borg and Gall as in the model below (Untoroseto & Triayudi, 2023):

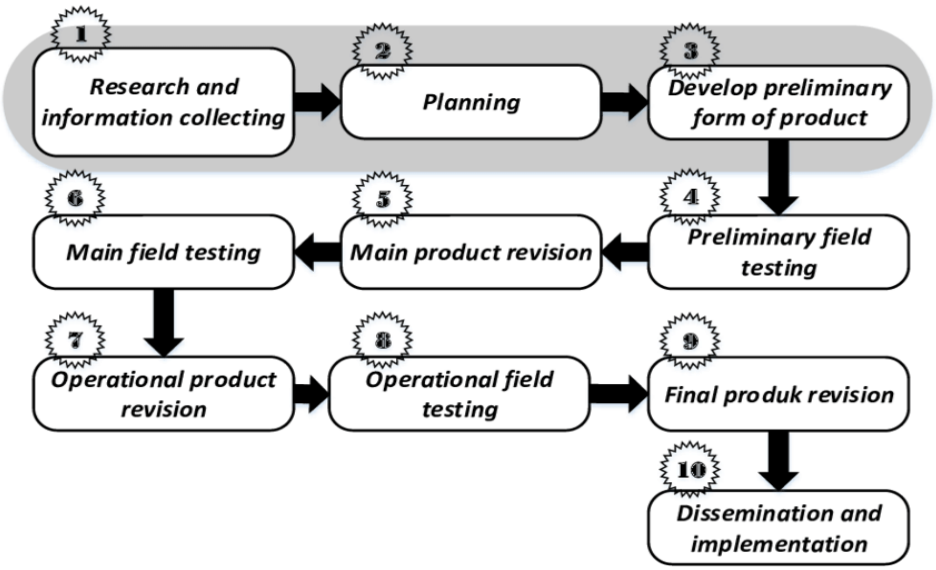

Figure 1. Step Research *Borg and Gall*

The data collected came from material experts as material validation, media experts as media validation, then students of SMK Negeri 1 Jetis Mojokerto, class XI Industrial Electronics Engineering as respondents to the feasibility test of the media being developed. The data collection technique in this research is observation first to find out the conditions or situations that exist at the school, then to find out the conditions or situations that exist at the school, then to collect data using a closed questionnaire, where on the back page there is a suggestion column. The instrument used in this research was a questionnaire sheet. The questionnaire used in this research is a closed questionnaire.

This type of research data is qualitative and quantitative data, which is analyzed descriptively statistically. Qualitative data in the form of comments and suggestions for product improvements from media experts and material experts are then analyzed and described qualitatively to revise the product being developed (Eakin & Gladstone, 2020). Quantitative descriptive analysis techniques are used to process data in the form of numbers and obtained from questionnaires in descriptive form (Cooksey, 2020).

RESULTS AND DISCUSSION

This type of research data is qualitative and quantitative data, which is analyzed descriptively statistically. Qualitative data in the form of comments and suggestions for product improvements from media experts and material experts are then analyzed and described qualitatively to revise the product being developed. The data presented is as follows:

Design expert validation data, in the evaluation instrument there are 3 aspects that we use as indicators of the suitability of the interactive learning media that we create. Overall design

expert analysis can be seen in the graph below:

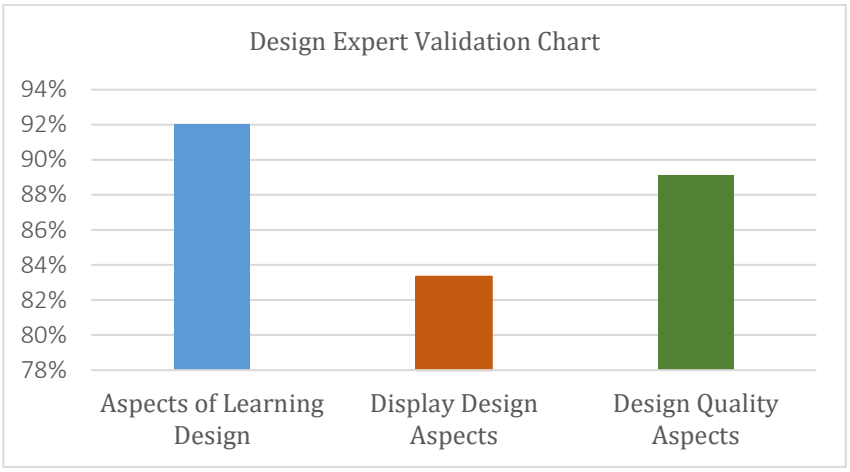

Figure 2. Design Expert Validation Chart

The overall percentage of interactive learning media material experts on pneumatic material is 88.18%. Based on the score results, the percentage results obtained are then converted into table 3.4 of the eligibility level criteria. So Interactive Learning Media Using Adobe Flash in the Subject of Electronic Control Systems is classified as a very valid qualification so it can be said to be worthy of a design expert with a little improvement.

Media expert validation data, in the evaluation instrument there are 4 aspects that we use as indicators of the suitability of the interactive learning media that we create. Overall, the Media Expert Analysis can be seen in the graph below:

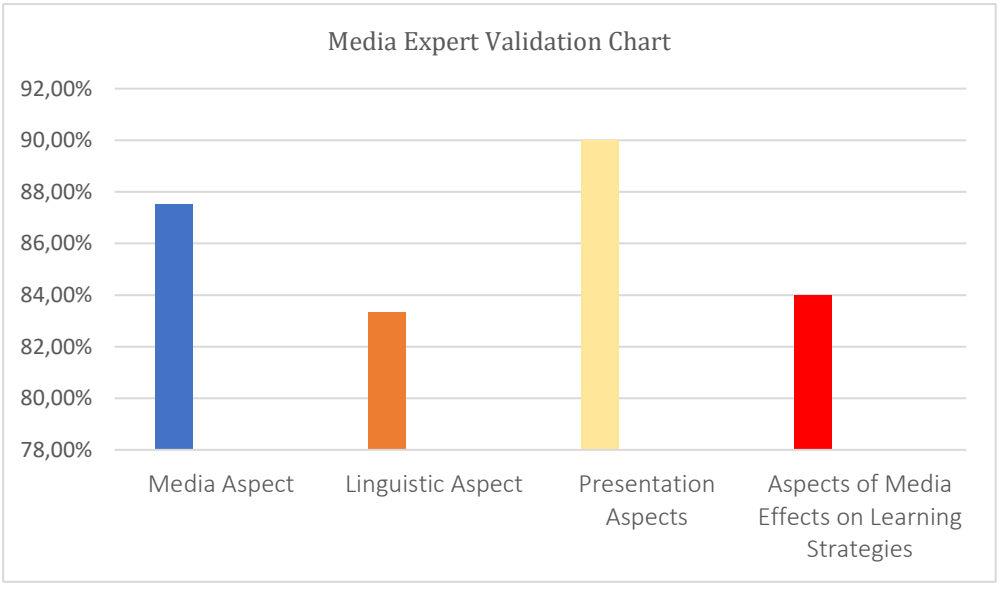

Figure 3. Media Expert Validation Chart

The overall percentage for media expert validation based on the total scores in the table above, can be calculated using the following formula: So the overall percentage of interactive learning media material experts on pneumatic material is 85.71%. Based on the score results, the percentage results obtained are then converted into table 3.4 of the eligibility level criteria.

e-ISSN 0216-0847
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So Interactive Learning Media Using Adobe Flash in Electronic Control Systems Subjects is classified as a valid qualification so it can be said to be worthy of a design expert with a little improvement.

Material expert validation data, in the material expert validation instrument, there are 4 aspects that we use as indicators of the suitability of the interactive learning media that we create. Overall Material Expert Analysis can be seen in the graph below:

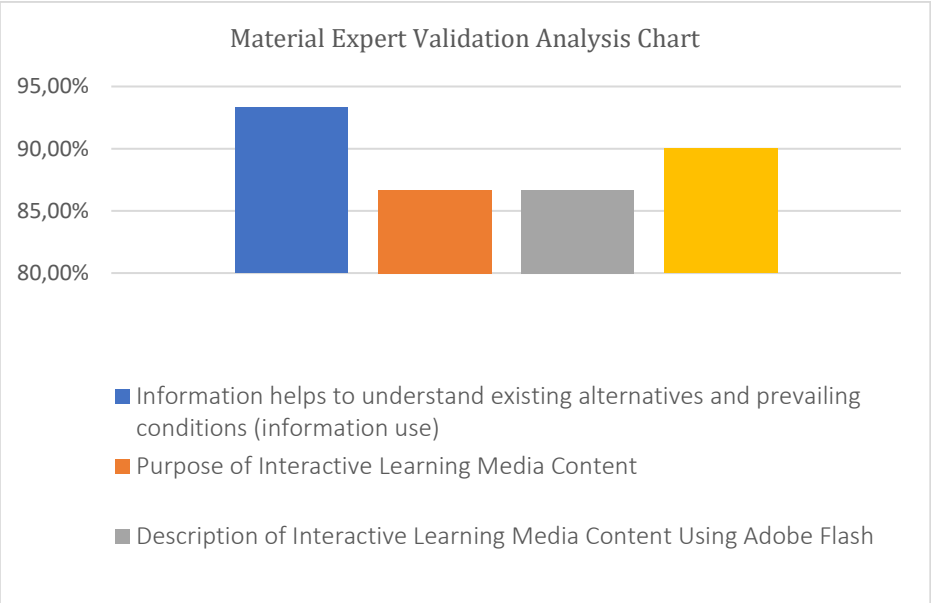

Figure 4. Material Expert Validation Analysis Chart

The overall percentage of interactive learning media material experts on pneumatic materials is 89.23%. Based on the score results, the percentage results obtained are then converted into table 3.4 of the eligibility level criteria. So Interactive Learning Media Using Adobe Flash in the Electronic Control Systems Subject is classified as a Very Valid qualification so it can be said to be worthy of a material expert.

Peer validation data, in the evaluation instrument there are 5 aspects that we use as indicators of the suitability of the interactive learning media that we create. Overall analysis of peer assessments can be seen in the graph below:

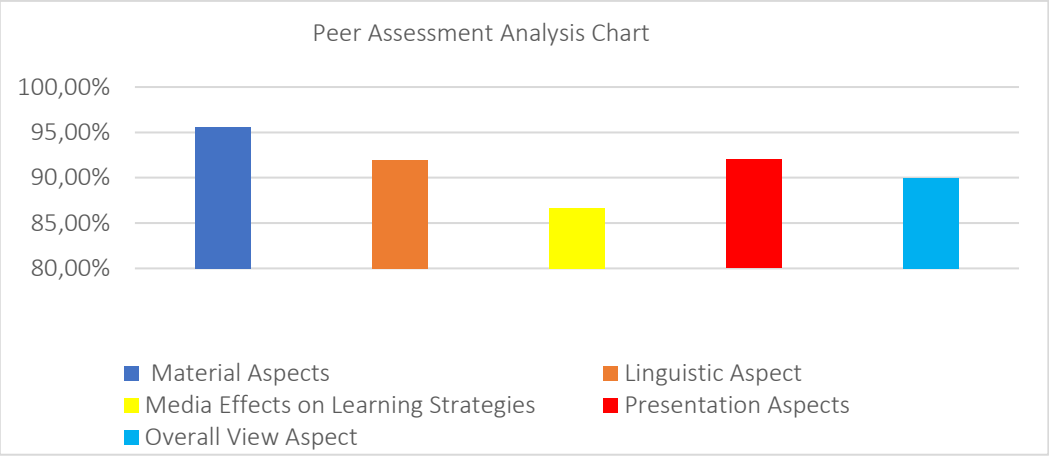

Figure 5. Peer Assessment Analysis Chart

The overall percentage of Peer Assessment for interactive learning media on pneumatic

material is 92.5%. Based on the score results, the percentage results obtained are then converted into table 3.4 of the eligibility level criteria. So Interactive Learning Media Using Adobe Flash in the Electronic Control Systems Subject is classified as a Very Valid qualification so it can be said to be worthy of Peer Assessment.

Usage evaluation data, apart from expert and peer validation, the author also carried out a media suitability assessment consisting of: a) small group (5 students), b) medium group (9 students), c) large group (1st class students/36 students), and d) Field Trial (2 Class students). Small group, overall analysis of the results of small group trials can be seen in the graph below:

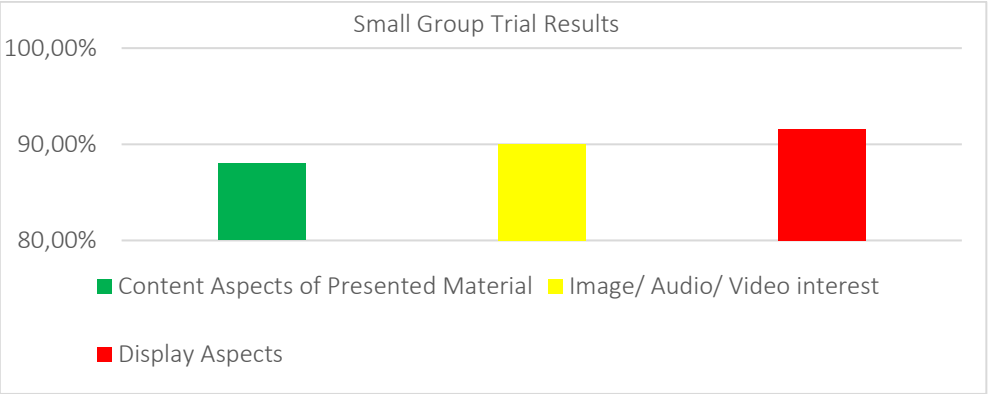

Figure 6. Small Group Trial Results

The overall percentage of small group trials of interactive learning media on pneumatic materials is 90%. Based on the score results, the percentage results obtained are then converted into eligibility level criteria. So Interactive Learning Media Using Adobe Flash in the Electronic Control Systems Subject is classified as a Very Valid qualification so it can be said to be suitable for small groups. Medium group, overall analysis of the results of the medium group trial can be seen in the graph below :

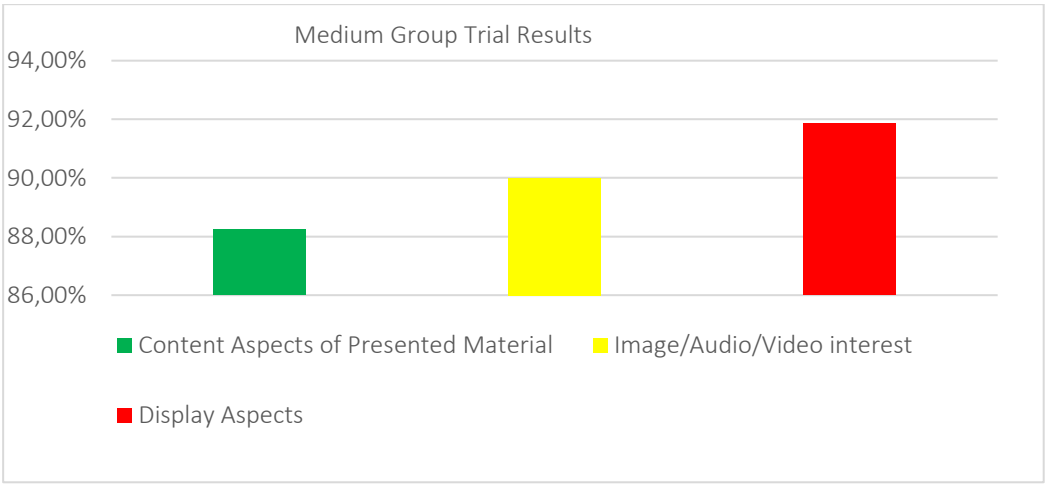

Figure 7. Medium Group Trial Results

The overall percentage of group trials using interactive learning media using pneumatic material was 90.22%. Based on the score results, the percentage results obtained are then converted into table 3.4 of the eligibility level criteria. So Interactive Learning Media Using Adobe Flash in the Electronic Control Systems Subject is classified as Very Valid so it can be said to be in the medium group. Large group, overall analysis of the results of large group trials can be seen in

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the graph below:

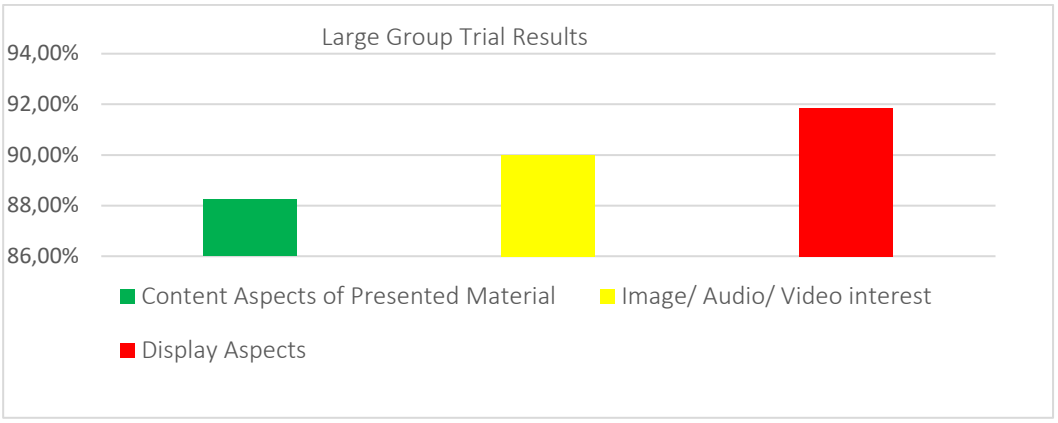

Figure 8. Large Group Trial Results

The overall percentage of large group trials of interactive learning media with pneumatic material was 91.00%. Based on the score results, the percentage results obtained are then converted into table 3.4 of the eligibility level criteria. So Interactive Learning Media Using Adobe Flash in the Electronic Control Systems Subject is classified as a Very Valid qualification so it can be said to be worthy of a large group. Field trials, overall analysis of the results of the field group trials can be seen in the graph below:

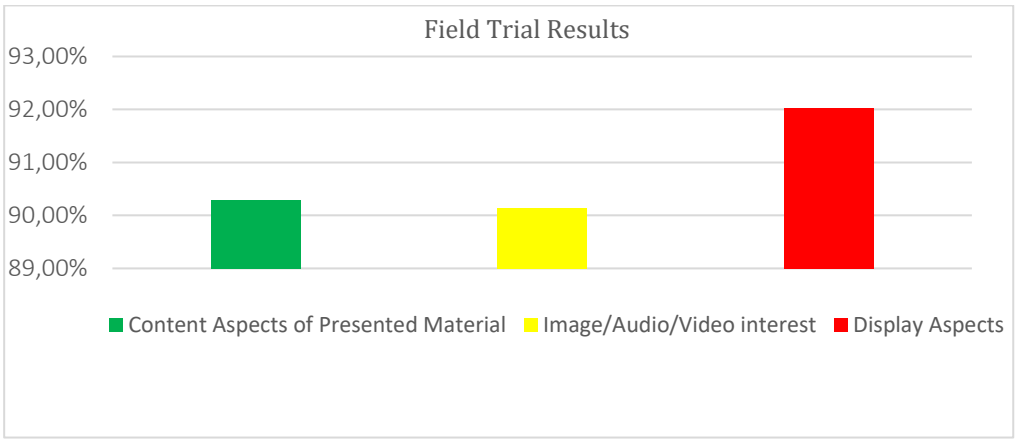

Figure 9. Field Trial Results

The overall percentage of field trials of interactive learning media on pneumatic materials was 91.04%. Based on the score results, the percentage results obtained are then converted into table 3.4 of the eligibility level criteria. So Interactive Learning Media Using Adobe Flash in Electronic Control Systems Subjects is classified as Very Valid so it can be said to be feasible from field trials.

CONCLUSION

The development of interactive learning media using Adobe Flash for the Electronic Control Systems subject, specifically on pneumatic material, was successfully carried out following Sugiyono's research and development framework, adapted to the Brog and Gall model.

This process included identifying potential and problems, collecting data, designing and validating the product, conducting product trials, and revising the product through various stages. The development was guided by the ADDIE model to ensure the media meets educational objectives effectively. The feasibility of this learning media was validated by experts in design, media, and material, as well as peer assessments and student trials. Validation results showed high percentages in the "very valid" category, with design experts scoring 88.18%, media experts 85.71%, and material experts 89.23%. Peer assessments scored 92.5%, while trials involving small, medium, large groups, and field trials consistently demonstrated high feasibility with scores above 90%. These results affirm that the media is valid and suitable as an alternative tool for enhancing the learning process. This study contributes significantly to vocational education by introducing an innovative tool that integrates technology into the learning process, thereby improving the understanding of theoretical concepts critical for practical application. It is recommended that schools adopt this interactive learning media to complement traditional teaching methods, making the learning process more engaging and effective.

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