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The Validity of Interactive Multimedia on Metal Coating Learning Developed Using the ADDIE Model

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Abstract: The Metal Coating course in Unimed's Mechanical Engineering Education Department only uses learning media in the form of printed textbooks and there is no interactive media that can improve student competence in the affective and psychomotor domains. To increase student competency in metal plating courses, learning media in the form of interactive multimedia that has been validated for its quality is needed. This study aims to validate learning media in the form of interactive multimedia using the ADDIE development model. As for the three acquisitions of interactive multimedia validity, namely analysis of metal plating course requirements, determining learning objectives and designing interactive multimedia, as well as developing interactive multimedia involving several material experts, learning design experts, and learning media experts, as activity validators. Data collection techniques for interactive multimedia validation are carried out by distributing questionnaires. The validation assessment criteria used a Likert scale which was analyzed descriptively. The results showed that the validity of the material expert was 89.7% in the very good category, the learning design expert was 91.58% in the very good category and the learning media expert was 88.3% in the very good category. from these data it can be concluded that the use of interactive multimedia in the teaching and learning process in the metal plating course developed is very valid to be implemented in the teaching and learning process.

Keywords: ADDIE model; Interactive multimedia; Metal coating; Validity

Introduction

Science and technology that continues to develop has led to many changes in all areas of life and learning, including in the development of the world of education. The development of science and technology accompanied by technological advances has begun to enter into aspects of education, especially learning (Atherton, 2019).

In essence, the teaching and learning process in tertiary institutions is a process of communication between lecturers and students that requires learning media intermediaries. The use of learning media as a teaching aid is important in determining the stage of student memory to achieve learning objectives (Salsidu et al., 2018). Using the right media will increase learning motivation, spur students to be more enthusiastic and reduce students' passivity in following the learning process (Rahmi et al., 2019).

The metal coating course is a course consisting of theory and practice that discusses coating techniques on the surface of mild steel metal workpieces to avoid the effects of corrosion and get a better surface appearance. in practice, metal plating courses require practical equipment that is quite diverse and also requires operational knowledge and other working concepts of the equipment, but the practical equipment available is still very simple, making it difficult to convey competencies that are appropriate to the industry

The observation results found that many students experienced difficulties in learning metal plating. Limited practice tools and a lack of understanding of the material because there are not many simulations with tools in each material. In addition, learning still uses printed books, even though learning metal plating requires media that is able to provide simulations and concretize learning material, causing a lack of experience and understanding of the material. Media limitations

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make learning not optimal even though learning media functions as a learning support so that students can learn independently.

The use of media in the current learning process must be associated with technological sophistication (Cloonan et al., 2020). The use of technology in learning media will make it easier for lecturers to explain material. In addition, the sample questions given are more accurate for students (Asyrofi et al., 2016; Auliah et al., 2020). The use of technology in the media serves to stimulate the creativity and intelligence of students in developing knowledge and motivation in learning activities to improve the quality of education. Haslina (2020) in delivering successful and productive learning, one way is to use multimedia media. One of the media used in learning and believed to be able to increase student interest and motivation is interactive multimedia because students can explore skills independently, and are able to adapt to technology (Alim et al., 2020; Sutiman et al., 2020; Wiana, 2018).

Interactive multimedia is a combination of various media from computers, video, audio, images and text interactively that allows users to navigate, interact, create and communicate (Eliza et al., 2023; Nadirah et al., 2020; Saputra, 2023). Interactive multimedia can adapt to student learning styles and deliver adaptive content in a personalized manner that can increase student learning effectiveness (Khamparia et al., 2018). Multimedia-based learning has a positive impact on aspects of memory consistency (Hung et al., 2018), comprehension, skills and achievement (Karaci et al., 2018), and increases student motivation (Yanika et al., 2017). Furthermore, according to Wahdan (2019) the use of interactive learning media has benefits, including that students can study independently according to their level of ability or in small groups, it is more effective to explain material so that students get an interesting learning experience. The application of multimedia has a very positive effect on development in learning, because the learning system can not only be accessed offline or online (Gunawan et al., 2022). Based on the advantages of this use, it is necessary to develop interactive multimedia in metal coating courses. Furthermore, interactive multimedia is expected to increase the use of digital technology by students, which generates ideas of creativity and innovation in education.

The development of interactive multimedia for metal coating courses is developed by translating design specifications into a specific physical form. Therefore, a development model at least contains components of needs analysis, model development objectives, model development systematics, and model development evaluation. Interactive multimedia in metal coating courses will be validated to obtain quality media. According to Creswell in Bujeng (2019), validity refers to the accuracy of a research tool when used to measure the characteristics being studied. In this case, the accuracy and validity of interactive multimedia on metal coating teaching materials will be seen.

The development of interactive multimedia in teaching materials is a planned activity that requires a model, one of which uses ADDIE (Gagne et al., 2005). The ADDIE model is the most popular model used for the development of creations from learning materials (Drljaca et al., 2017). A development model consisting of 5 stages, namely conducting Analysis, Design, Development, Implementation, and Evaluation (Cahyadi, 2019; Jonnalagadda et al., 2022; Stapa et al., 2019).

The advantages of the ADDIE model include that its description appears more complete and describes a systematic approach to instructional development (Sugihartini et al., 2018). In addition, the development involves expert judgment so that before conducting field trials, the teaching materials have been revised based on expert judgment, suggestions and input. Based on the description above, it is necessary to develop interactive multimedia for the Metal Coatings course using the ADDIE development model.

Method

Research Approach and Method

Research is research and development (R&D) as well as module development using the ADDIE development model (analysis, design, development, implementation, and evaluation). Process The validity of interactive multimedia is obtained at three of the five stages of the ADDIE development model, namely Analysis of metal plating learning requirements, determining learning objectives and designing interactive multimedia, as well as Development of interactive multimedia involving material experts, learning design experts, and learning media experts as validators

This development was carried out with the target user of the module, namely students of the Mechanical Engineering Education Department, Faculty of Engineering, Medan State University, who were taking a welding material testing course. The selection of material experts is based on the competence of subjects who are experts in welding material testing, namely lecturers in welding material testing courses. On the other hand, the selection of learning media experts and learning design is based on expertise in learning media technology and learning design, namely Educational Technology Lecturers. The research procedure is shown in figure 1.

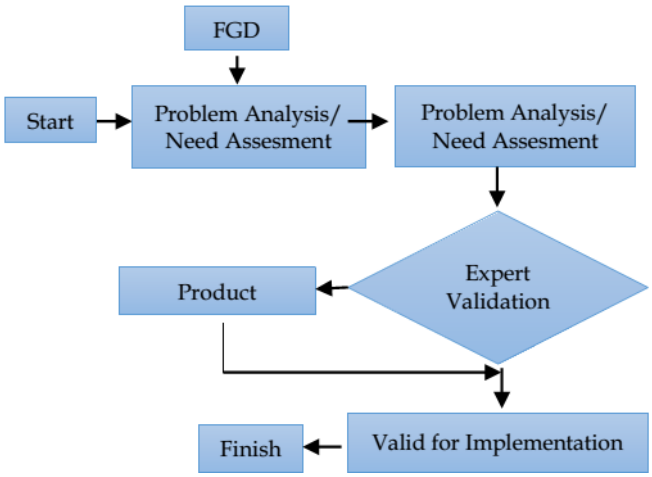

Figure 1. Research procedure

Data Collection Technique

The process of collecting research data was analyzed qualitatively, and instruments using data collection were carried out in several stages of research. The data collection instrument developed in this study relates to data collection techniques carried out at each stage of the research, namely making a list of questions in the form of a questionnaire to serve as observation, development and expert validation using a Questionnaire from Learning Instruments using a Likert scale

Data Analysis Technique

The data analysis technique uses descriptive analysis techniques, namely by analyzing quantitative data obtained from expert test questionnaires and field tests, then interpreted qualitatively using the Equation 1:

$$X = \frac{\sum X}{N} \quad (1)$$

Note: X = Courseware eligibility score, $\sum X$ = Total score of each subvariable, N = Number of subvariables.
Based on the above calculations, the percentage range and qualitative criteria can be determined.

Criteria Validation

The validity criteria are presented as a questionnaire used as a source of research data. This module is said to be valid if the results obtained from the questionnaire are in the criteria of "Very Good," "Good," and "Good Enough." The provision of benchmarks is a significant step for a researcher, but it has yet to be standard practice. Benchmarks or data assessment criteria are essential and must be prepared before the researcher goes to collect field data. Equivalent to the feasibility interpretation with a feasibility score limit of 2.50 because, according to Sriadhi (2018), in multimedia feasibility, data stability can be stated, data processing is more accessible, and media reliability can be carried out if the resulting data analysis obtains 50% of the eligibility performed in the research data processing.

Result and Discussion

This research has produced a product in the form of interactive multimedia on Electroplating material. The three-step development model in this study was adopted from the 5-step ADDIE development model, which includes analysis, design, and development.

Analysis

Analysis, at this stage, is in the form of an analysis of the needs required by the user (user) to obtain the latest information. Information on this need is obtained by carrying out Focus Discussion Groups (FGD) between Lecturers, Students, and Industry users of graduates. The information obtained is about learning content, aspects of validity, as well as software assistance used to develop interactive multimedia. Based on the results of the analysis of learning outcomes, the learning content will be delivered in interactive multimedia, namely electroplating, given the low value of learning outcomes in electroplating metal plating courses.

There are three aspects of the validity of interactive multimedia: learning design, content, and learning media. Validity of learning design aspects includes learning objectives, learning strategies, preparation of materials, and assessment tools. The validity of the content aspect is assessed based on the preparation of the content, the presentation of the participants, and the assessment tools. The validity of the aspects of learning media in the form of navigation settings, covers, and visual illustrations.

Selection of software assistance used to support the running of applications on smartphone devices. It can contain the needs to be presented in the form of text, video, images, and other navigation. The software to be used is Macromedia flash software. The reason for choosing this software is to support the display of text, video, images, and other navigation. In addition, the features available in the Macromedia Flash software are pretty supportive.

Design

The interactive multimedia design stage produces a flowchart design, starting with designing and compiling an interactive multimedia structure in the form of a flowchart as shown in Figure 2.

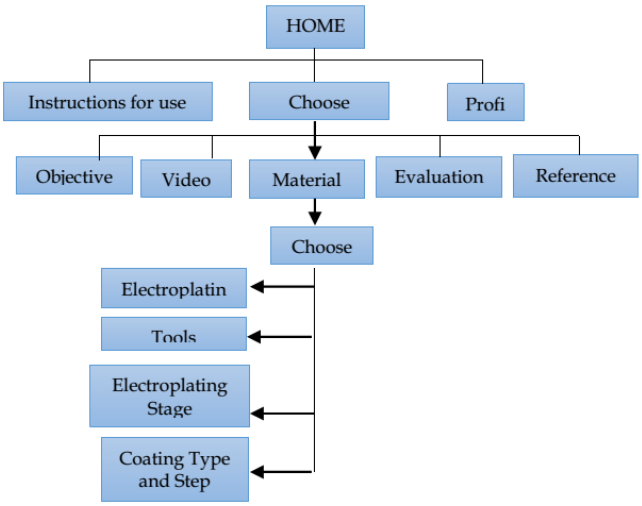

Figure 2. Flowchart of designing interactive multimedia

Development

The Development stage is to realize the designs that have been made before. The steps that need to be taken in developing this interactive multimedia are the preparation stage of the application using Adobe Flash software, the stage of collecting the materials needed and used to fill in content such as materials, videos and images as well as the development stage carried out by the developer based on the design and collected content.

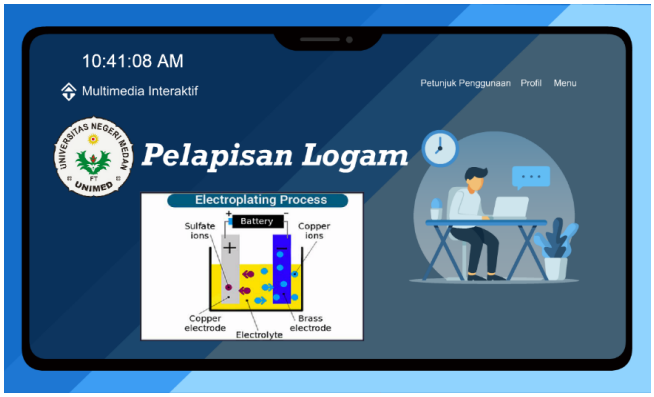

Figure 3. Interactive multimedia opening page

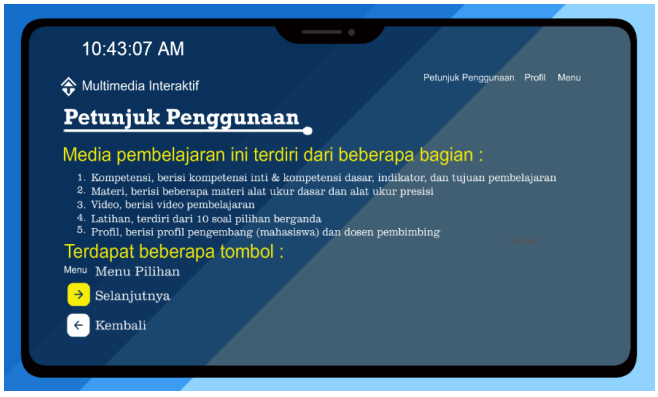

Figure 4. Screen display of instructions for use

Figure 5. Screen learning materials

The interactive multimedia results of the development are then tested for validity by Learning Design experts, Content Experts, and Learning Media Experts.

Learning Design Expert Validation

The validation results obtained from learning design experts are divided into four aspects, namely learning objectives, learning strategies, preparation of materials, and evaluation tools. The learning design expert's assessment is shown in the diagram in figure 6.

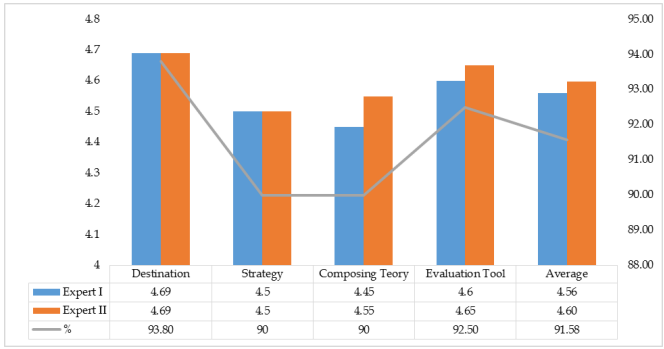

Figure 6. Results of learning design expert validation

The acquisition of the average score in four aspects of the assessment given by the learning design expert is 4.58 or 91.58%, so it can be concluded that the assessment results from the validation of the learning design expert are in the excellent category.

Material Expert Validation

The assessment for material expert validation consists of 3 (three) aspects, namely, aspects of preparing learning materials, aspects of presenting learning materials, and aspects of assessment tools. The results of the assessment are shown in Figure 7. The value obtained from the validation of materialexperts with an average acquisition value of 4.48 or 89.7%, the acquisition of this value is included in the excellent category.

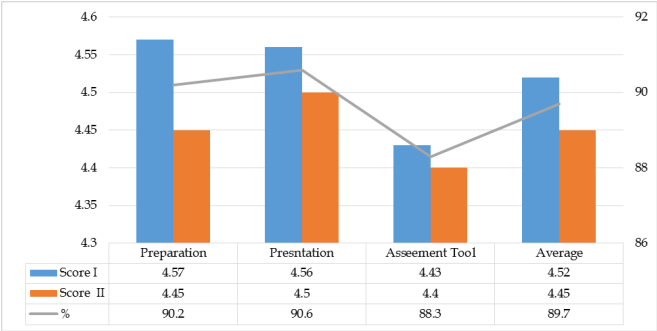

Figure 7. Average material expert validation results

Learning Media Expert Validation

Validation from learning media experts is divided into 3 (three) aspects, namely setting, cover and visual illustration. From the validation of learning media experts, it gives an average score of 4.4 or 88.3% and is included in the very good category. The evaluation of learning media experts is shown in the diagram in Figure 8.

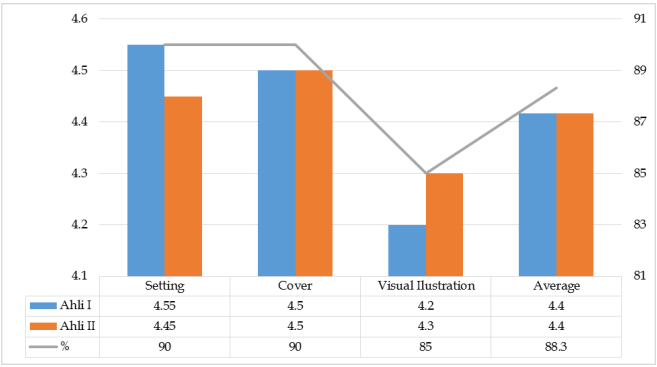

Figure 8. Average results of learning media expert validation

The validation results of learning design experts, material experts and learning media are show in table 1.

Table 1. Expert Validation Score

Expert	Average Score	(%)
Expert Theory	4.58	91.6
Learning Design Expert	4.48	89.7
Learning Media Expert	4.40	88.0

From the data above it can be seen that the validation results of material experts are 91.6% in the very good category, learning design experts are 89.7% in the very good category and media experts are 88% in the very good category, this proves that metal coating interactive multimedia suitable for use in learning.

The results of this study are reinforced by Marsalova (2017) which states that interactive multimedia can improve learning outcomes. Fauzi et al. (2021) also explains that interactive multimedia can attract students' attention so that interactive multimedia is very suitable for use in learning. interactive learning multimedia that is designed in an attractive way will generate motivation and stimulate student learning activities, help students improve their understanding of learning material and foster learning creativity so that it will have an impact on improving the quality of learning (Azira, 2022; Nur, 2023; Nurazizah et al., 2021).

Conclusion

Based on the results of the discussion of research and development of metal coating interactive multimedia, it can be concluded that the development of metal coating interactive multimedia has been validated by learning design experts, material experts, and learning media experts, with an average expert assessment result of 4.5 or 89.8 %. These conclusions indicate that the interactive multimedia developed follows the conditions and needs of students in the Unimed Mechanical Engineering Study Program and is very valid to be used as a learning medium for Lecturers, Students, and Industrial Practitioners.

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Author Contributions
All authors contributed to this research. EY participated in research in the form of data collection and script writing. SR for participating in media research and development design. BN compiled participated in data analysis as well as helped draft the manuscript.

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Conflicts of Interest
All authors in this study stated that they did not have competing interests for all parties.

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