Validity of Interactive Learning Media Static Strength of Materials Based on Case Methods

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Abstract. The purpose of this study is to validate the interactive learning materials for the course on material strength statistics using case studies and the four-D development model. Three phases of the four-D development model define, design, and develop are used to determine the validity of interactive learning materials. Experts in learning design, learning media, and material conduct media validity assessment. Distributing questionnaires is the method used to collect data for validity assessment. A Likert scale with category values of 5 (very good), 4 (good), 3 (pretty good), 2 (poor), and 1 (very poor) is used by experts to evaluate the validity of interactive media. The results are descriptively analysed. 89.17% of material experts, 85.30% of learning design experts, and 90.83% of learning media experts have a validity value, according to the study's findings. It can be concluded that the interactive learning media developed is very valid for dissemination.

Keywords: validity, learning media, interactive, statics, material strength, case method.

1 Introduction

The success of formal education is certainly greatly influenced by the quality of the learning process. This learning process cannot be separated from the application of understanding in learning activity patterns, teaching methods, classroom management, use of appropriate learning models and media and learning outcomes. Educational components, such as objectives, students, teachers, learning materials or materials, approaches and methods, media or technologies, learning resources, and evaluation, also have an impact on how well the educational process goes [1].

The demands of college graduate competencies coveted during the Industrial Revolution 4.0 are those who have received education and training. where today's students are the generation in the industrial revolution 4.0 era marked by the increasingly rapid development of digital technology [2]. The industrial revolution 4.0 is controlled by digital physical frameworks and artificial intelligence, which broadens the scope of human-machine interactions [3]. Meanwhile, to face the challenges in the industrial revolution 4.0 era, there are 4 aspects of

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competency that students must have, namely how to work, how to think, instruments for labour and abilities for survival [4]. The learning process can be used to attain these competencies, including learning in higher education.

Higher education's learning process is essentially a communication process between instructors and students, who require learning media as a bridge. One of the things that helps students reach their learning objectives is media. This has to do with how using relevant and different media in the classroom can boost student desire for learning and decrease their passive attitudes. The purpose of educational media is to support learning so that students can study on their own. Students' creativity and intelligence are stimulated in the process of learning. All kinds of communication, including printed and audio-visual materials, as well as their apparatus, are considered media. The ability to manipulate, hear, see, and read should be included in the media [5]. Good learning media must be designed according to student needs so that learning goals can be achieved. Engaging educational materials will facilitate pupils' assimilation of knowledge. Learning media can be printed or digital.

Digital learning media will provide benefits to student learning, including (1) can boost student motivation for learning since learning will capture their interest more; (2) the material will be simpler for students to comprehend, enabling them to master it and achieve the learning goals; (3) teaching methods will be more varied; and (4) students will be more involved and take part in more activities during learning activities, such as both listening and direct observation, demonstration, doing, and acting.

Activity of student in the process of learning is strongly encouraged by the application of valid media in achieving learning objectives, [6]. Students as learners in higher education are the millennial generation who are considered more technologically literate than previous generations. The current generation is a generation that is familiar with technology which is marked by the use of gadgets from an early age, so that this habit can indirectly influence their personality, [7].In order for the competency demands of college graduates to be achieved, universities must innovate in the process of learning. To realize innovation in the process of learning, digital technology is needed, including the use of smartphones which are familiar to lecturers and students [8] (Bukhori et al., 2019).

Computer networks and the internet can be used to leverage information and technology to enhance the quality of education [9]. A student will be simpler to accept and remember learning using images or videos than just using writing or reading, [10]. The use of technology and information learning outcomes in learning media can be enhanced with the use of supplementary resources, such as application software [11]. [12].

According to Asrul Huda and Noper Ardi [13], a form of media that blends text, images, video, animation, and sound is called interactive multimedia. Using computers and other electronic devices to transmit information and a message is the goal of interactive multimedia. The use of multimedia includes learning media, games, films, medical, military, business, sports, advertising/promotion, and others.

The case method is an effective pedagogical approach to connecting theory with practice. In the context of Material Strength Statics, this method can help students understand how the principles learned are applied in real situations. However, the reliability of the learning resources utilised has a significant impact on how well the case approach works. The media

must be able to present realistic cases and give pupils chances to put the knowledge they've gained into practice.

The activity of developing interactive learning media is an organised task that calls for a model.

The four steps of the four-D development model are define, design, develop, and disseminate. The four-D model represents a dynamic and flexible guideline for building an effective learning system and supporting tool performance. While the advantages of developing this four-D model are that it is simpler and more suitable for module development, the description looks complete and systematic, [14]. Engineering education particularly in the Statics of Material Strength course in higher education, has challenges in conveying complex and abstract concepts to students. Often, traditional teaching methods such as lectures are less effective in helping students understand the practical application of the theories being studied.

The Statics of Material Strength course is a compulsory course in the Mechanical Engineering Education Department, Faculty of Engineering, Unimed with a load of 2 credits. At the end of the learning, the learning objectives of this course are expected to be able to calculate and analyze the stress that occurs in a construction. Based on initial observations in class, the learning outcomes of the Statics of Material Strength course showed that 50% of students got grades below 50 (grades D and E). Interactive educational materials are thought to enhance the understanding because it allows students to interact directly with the material, conduct simulations, and see the results of various scenarios in real time.

Based on this and the advantages of learning using interactive multimedia, the development of interactive multimedia is essential in the Statics of Material Strength course in accordance with the case method. By using the developed interactive multimedia, it is expected that the learning outcomes of the statics and material strength courses will increase and learning objectives can be achieved.

2 Research Methods

Type of Research

The research and development (R&D) method is used in this kind of study. The R&D method is a research technique used to create a specific product and evaluate its viability. An interactive learning medium for the statistics of a material activity course based on the case method was the product whose validity was examined in this study. The study was carried out at the Mechanical Engineering Education Department, Faculty of Engineering, Universitas Negeri Medan.

Research Stage

The four-D development paradigm is applied in this research phase. One of the approaches frequently utilised in the creation of instructional materials or learning media is the four-D development model. The four primary phases of this methodology are Define, Design, Develop, and Disseminate. Three of the four phases of four-dimensional development—define, design, and development, are used to determine the validity of interactive learning materials.

a. Define

The purpose of the define stage is to define and identify the needs, problems, and scope of the teaching materials or learning media to be developed. The steps taken at this stage include preliminary analysis, learner analysis, task analysis, and conceptual analysis.

b. Design

Based on the outcomes of the define stage, interactive learning media are designed at the design step. The steps include selecting media and learning formats and compiling scripts and prototypes:

c. Develop

The develop stage is the creating and refining process of interactive media of learning according to the design that has been made. The steps taken include: Prototype development, Expert Validation, Field Trials, Revisions.

Subject of Research

Experts in the fields of statistics, learning media, and learning design are the subjects of the study on the validity of interactive learning materials. Students in the Department of Mechanical Engineering Education at the Univeristas Negeri Medan, Faculty of Engineering are the intended audience for interactive learning materials who take the statics of material strength course. The ability of the subject who is an expert in statics—that is, the lecturer in charge of the statics of material strength course, is the basis for identifying material specialists. The lecturer of learning technology, who specialises in learning media technology and learning design, is the basis for identifying learning media and learning design professionals. Figure 1. shows the stages of the research.

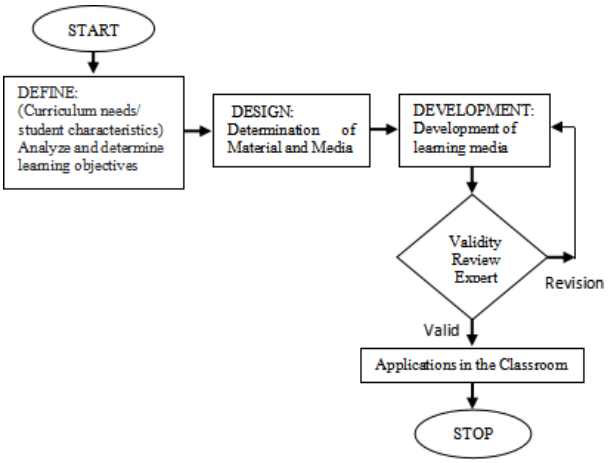

Fig. 1. Research Steps

Data Analysis Methods and Techniques

This study's data collection method was qualitatively analysed, and the tools used were specific to each stage of the investigation: (a) a questionnaire consisting of a list of questions used for observation (b) a questionnaire from the Learning Object Review Instrument (LORI) version 1.5 with a Likert scale used for the development and expert validation stage [15].

Descriptive analysis approaches were used to analyse the data, including examining quantitative information gathered from field testing and expert test questionnaires and then interpreted in a qualitative sense. Analysing the data comes next after it has been collected. To analyze data from the questionnaire, by calculating each sub-variable's score with the formula:

$$X = \frac{\Sigma x}{n} \quad (1)$$

Information :

X = Validity Score
Σx = Total score for each sub variable
N = Total sub variables

The percentage range and quality requirements can be ascertained using the computations above, as indicated in Table 1.

Table 1. Interpretation of Learning Media Validity
Score Range 0 – 5

No.	Score Interval	Interpretation
1	1.00 – 2.49	Invalid
2	2.50 – 3.32	Quite Valid
3	3.33 – 4.16	Valid
4	4.17 – 5.00	Very Valid

Validity Criteria

Validity in the media of learning development with the four-D model must be considered at every stage of the process, from definition to distribution. Validity criteria include suitability to learning objectives, relevance and accuracy of materials, clarity and integration of design, effectiveness of implementation, and acceptance by users. These criteria ensure that the media of learning developed will be effective in helping students achieve the desired learning outcomes. Validity criteria are presented in the form of a survey that provides researchers with information. This e-module is said to be feasible if the questionnaire produces results that are in the criteria of "Very Good", "Good" and "Quite Good" [16].

3. Result and Discussion

3.1 Result

This study produces a product in the form of interactive learning media for material strength statics. The three steps of the development model in this research were taken from the 4 steps of the 4-D development model which include; define, design, and development.

a. Define

DefineThis step takes the shape of an examination of the user's requirements for accessing the most recent data. Focus Discussion Groups (FGDs) with lecturers, students, and the sector that employs graduates are used to gather information on these needs. The data gathered pertains to software support for creating interactive learning materials, validity considerations, and learning media.

Considering the outcomes of the learning analysis, the learning content that will be delivered in the interactive learning media is material strength statics, considering the still low learning outcome value of the material strength statics course. The validity of interactive learning materials can be divided into three categories: learning design, content, and learning media. Learning objectives, learning tactics, material preparation, and evaluation instruments are all part of the validity of the learning design component. Content preparation, content presentation, and assessment techniques are used to evaluate the validity of the content component. Validity of learning media features such as covers, navigation options, and visual aids.

Choosing software support that can load the requirements that will be displayed in the form of text, video, photos, and other navigation is used to help applications run on smartphones. The program that will be utilised, particularly the macromedia flash software, was chosen for a reason: it can display text, graphics, videos, and other navigation options. Additionally, the macromedia flash software has some really helpful functions.

b. Design

The first output of the interactive learning media design stage is (1) flowchart design, which begins with creating and assembling the interactive learning media's structure as a flowchart, as shown in Figure 2.

c. Development

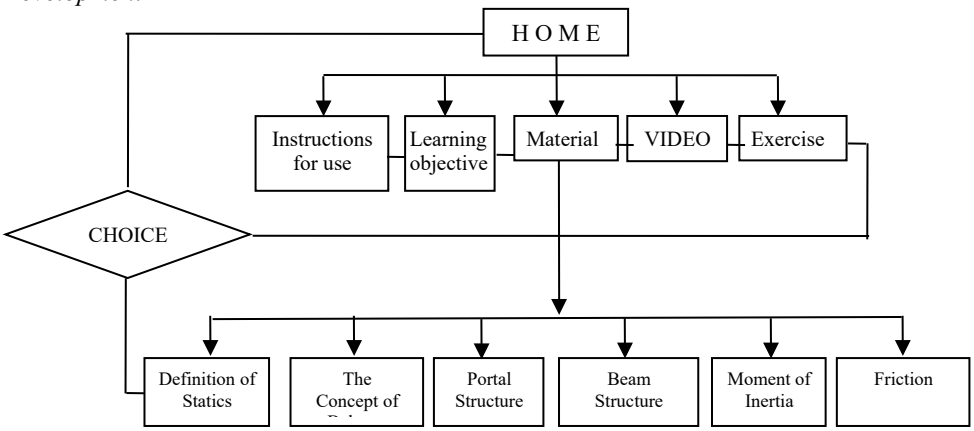

Fig. 2. Interactive Learning Media Design Scheme

The goal of the development stage is to bring the previously created design to life. The first step in creating interactive learning materials is to prepare the application with Adobe Flash software. The second step is to gather information about the material strength required to fill content, including images, videos, and materials. The content is either created by you or sourced from many sources; (3) the developer performs the compilation step using the gathered design and content. Figure 3 displays the interactive learning media's opening slide; Figure 4 displays the menu; Figure 5 displays the usage instructions; Figure 6 displays the learning material; and Figure 7 displays the learning video.

Fig. 3. Interactive Learning Media Opening Slide

Fig. 4. Interactive Learning Media Menu Slide

Fig. 5. Instructions for Use Slide

Fig. 6. Learning Material Slide

Fig. 7. Learning Video Slides

The interactive learning media developed was then examined for validity by specialists in learning media, learning design, and content.

Learning Design Expert Validation

Learning objectives, learning techniques, material preparation, and evaluation instruments are the four (four) components of validation from learning design specialists. The diagram in Figure 8 displays the assessment made by the learning design expert.

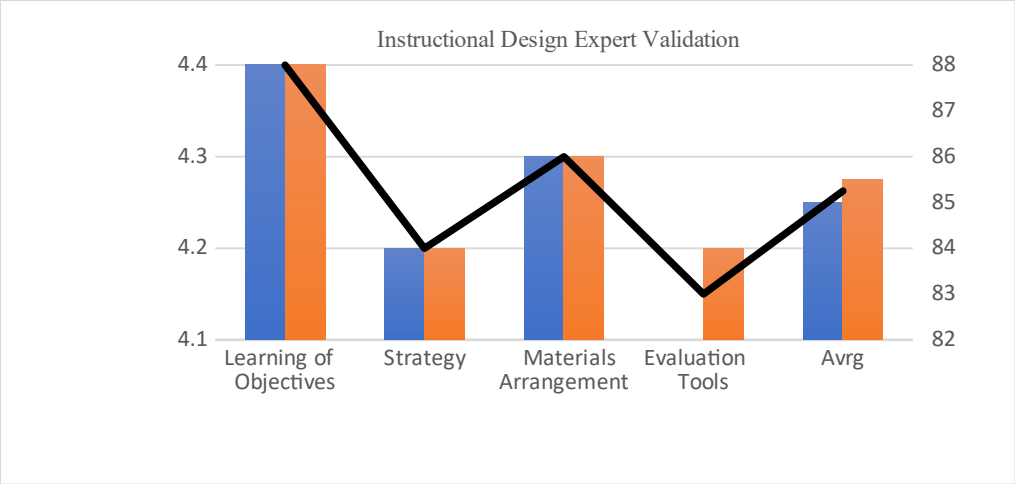

Fig. 8. Average Validation Results from Learning Design Experts

Learning design experts' validation evaluation falls into the very good category since they gave an average score of 4.45, or 89.0%, for the four (four) assessment components.

Material Expert Validation

Three (three) components make up material expert validation: the learning material's content, presentation, and evaluation instruments. Figure 9 displays the results that were achieved.

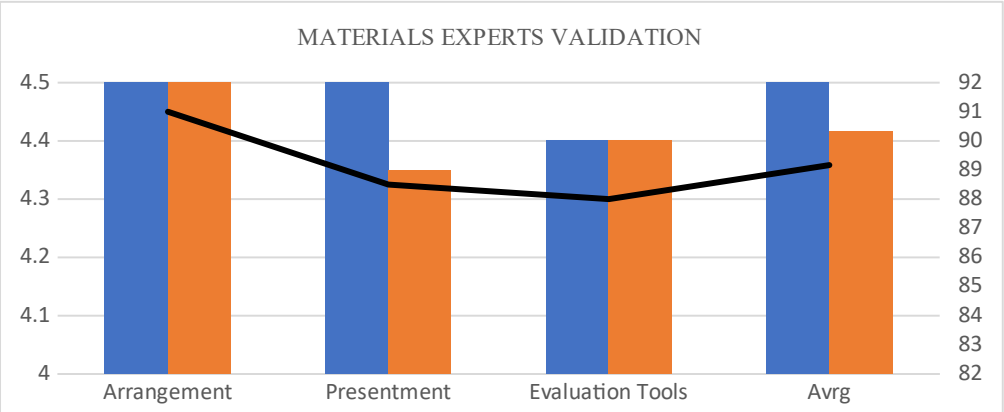

Fig. 9. Average Material Expert Validation Results

Media expert validation

Setting, cover, and visual illustration are the three (three) components of media experts' validation. The assessment of media of learning experts is shown in diagram figure 10.

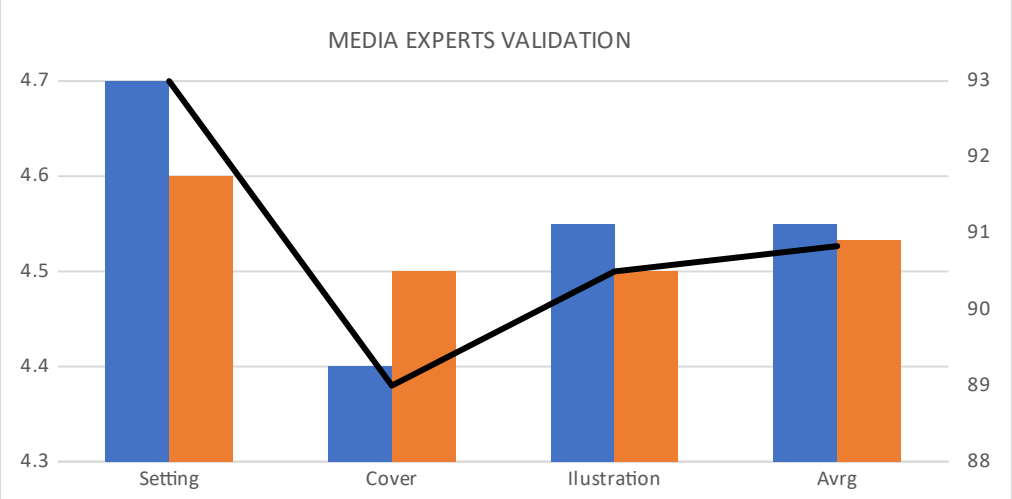

Fig 10. Average Learning Media Expert Validation Results

From validation, Experts in learning media awarded it an average score of 4.5, or 90.0%, and it falls into the category of very valid. Table 4 displays the validation findings from specialists in learning design, materials, and media.

Table 4. Validation Score from Experts

No	Expert	Average Score	(%)
1.	Materials Expert	4,46	89,17 %
2.	Learning Design Expert	4,26	85,3 %
3.	Learning Media Expert	4,54	90,83 %

3.2. Discussion

The development of media of learning based on the case method is an approach designed to help students understand and apply theoretical concepts in real situations through the use of practical cases. By using case studies, students can see how theoretical concepts are applied in real contexts, which helps them understand the relevance of the material under investigation.

In line with research [17], the case method encourages students to analyze problems, identify important variables, and consider various potential solutions, which hone critical and analytical thinking skills. This method often involves group discussions, where students work together to explore cases, exchange ideas, and reach common conclusions.

The case-based interactive learning materials that was developed involves students in building communication skills and teamwork. By facing situations that resemble the professional world, students can better prepare themselves for the challenges they will face in the workplace after graduation, in line with the opinion of Ersoy, A., & Başer, N, [18]

The validity of developing interactive learning media for teaching with the 4-D model must be considered at every stage of the process, from definition to dissemination. Validity criteria include suitability to learning objectives, relevance and accuracy of the material, clarity and integration of design, effectiveness of implementation, and acceptance by users. These criteria ensure that the learning media developed will be effective in helping students achieve the desired learning outcomes, in line with the opinions of Sofyan, H., & Jannah, M.[19] and Hidayati, N., & Wibowo, S.[20]

4. Conclusion

The following conclusions can be made in light of the goals established and the findings presented in the study and creation of interactive multimedia metal coating: (1) The results of preliminary research show that, learning media for statics of material strength needs to be developed in the form of interactive media of learning. (2) Learning design experts, material experts, and learning media experts have validated interactive learning materials for material strength statistics, with an average expert evaluation of 4.42 or 88.4%. This conclusion shows that the interactive learning media created satisfies the requirements and circumstances of the students of Mechanical Engineering Unimed and is highly suitable for usage as educational resources by instructors, students, and industry professionals.

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