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Development Of Interactive E-Modules for Engineering Aspect Workshop Lessons Household Electrical Installation Material

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Abstract

The existence of teaching materials is important in supporting an effective learning process. For this reason, this study aims to develop an interactive E-Module for engineering subjects in the engineering aspects of household electrical installations. Specifically, this study aims to identify the validity of the developed E-Model and determine student responses to the E-Module. This study follows an interactive multimedia development model with stages that include analysis, design, development, evaluation, and implementation. Research data were collected using observation sheets and questionnaires. The results of this study indicate that the developed E-Module is proven valid from the validity test results from design experts, media experts, and materials experts. The students' responses at the trial stage of the limited test, small group, and large group also showed that the developed E-Module received positive responses from students regarding material content, convenience, and message clarity. The results of this study are described in this article using the latest theory and empirical data related to the development and use of E-Modules in learning.

Keywords
e-modules; craft subjects; research; development; material validity

I. Introduction

Information technology is one of the needs that cannot be denied and seems to be a basic need that penetrates all aspects of life, including education (Guggemos & Seufert, 2021). The development of information technology currently plays an important role in solving various educational problems (Burbules et al., 2020). Education is a complex activity, its dimensions are broad, and various variables heavily influence it. Entering the 21st century, the national education system faces complex challenges in preparing human resources to compete in the global era (Meyer & Norman, 2020; Ramirez, 2020). The right effort to prepare quality human resources and function to build high-quality human resources is through education (Hamdan et al., 2020; Jerzak, 2015). Education is a very important human need because education has a duty to prepare Human Resources (HR) for the development of the nation and state (Pradana et al, 2020). According to Astuti et al (2019) Education is an obligation of every human being that must be pursued to hold responsibilities and try to produce progress in knowledge and experience for the lives of every individual. Education is one of the efforts to improve the ability of human intelligence, thus he is able to improve the quality of his life (Saleh and Mujahiddin, 2020). Education is expected to be able to answer all the challenges of the times and be able to foster national generations, so that people become reliable and of high quality, with strong characteristics, clear identities and able to deal with current and future problems (Azhar, 2018). Education and skills are the main keys in gaining social status in community life (Lubis et al, 2019).

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The success of an educational goal depends on how the teaching and learning process is experienced by students (Chien & Wu, 2020; Gore et al., 2021). In teaching and learning interactions, the elements of teachers and students must be active, and it is impossible for an interaction process to occur if only one element is active. Active in the sense of attitude, mental, and deed. Students must be more active than teachers. The teacher only acts as a guide and facilitator, which means that students must be independent in learning. Teachers are expected to manage classes effectively and efficiently, among others, by selecting learning resources that can make students achieve higher learning achievements. This is because learning resources also have an important role in ensuring the quality of learning (Wang & Tahir, 2020). So far, at SMP Negeri 3 Taman, the variety of learning resources used has not been maximized. It causes students to experience boredom in the learning process so that the concentration and focus of students in learning are reduced. The lack of learning resources makes it difficult for potential learners to emerge and develop (Trinidad, 2020).

To support the learning process, learning media is needed to support the learning that is carried out (Muhaimin et al., 2020). Learning media is an inseparable part and must be integrated into the learning method used. Learning aids are a dynamic element in learning. The position of aids has an important role in learning because they can help students in the learning process (Abdulrahaman et al., 2020; Bernacki et al., 2020). Many learning aids or media have been created, but finding a good choice so that the learning process becomes effective is a problem that needs to be solved. Under the characteristics of household electrical installation materials, various media are needed in conveying material or explanations to students. For students to understand this material requires a fairly high abstraction. It is not enough to describe how electric current flows, but simulation is needed to make it interesting, and students can remember it well. Textbooks and printed modules are less able to present material using simulations. The learning process is less interesting, a bit interactive and has not been able to convey historical messages through pictures and videos, so many have difficulty understanding the subject matter (Alsalhi et al., 2020). Finally, the students assumed that the engineering aspect of household electrical installation materials was a difficult subject. This impacts students' experience tests and practice tests that are not optimal.

Additional references are needed in the form of modules so that students better understand household electrical installation materials because they can learn and do assignments independently. E-Modul learning resources are expected to attract the attention and interest of students, so they are motivated to learn. Thus, E-Modules are thought to increase competence in implementing household electrical installations. For this reason, in this study, the development and development of interactive E-Modules was developed as a learning resource for the engineering aspects of household electrical installation materials for class IX SMP.

II. Research Method

This research was conducted following the ADDED approach development model (Branch, 2009). The stages in this research are analysis, design, development, evaluation, and implementation. The requirements analysis stage is needed in application development to assist the design process. This stage is the stage of collecting data by observing the subject of Crafts at SMPN 3 Taman. The first observation analyzes the basic competencies of the Craft subjects.

Furthermore, at the design stage, the researcher makes a plan that will be carried out after getting the observation data. The design process focuses on the instructional objectives to be achieved and the selection of test methods. At this stage, researchers take four steps as follows: Arrange tasks that can make students achieve learning goals, Develop learning objectives, and Develop test strategies, which is continued at the development stage, which is the process of creating or developing learning resources and validating them, which is continued at the development stage, which is creating or developing learning resources and validating them. This stage is a real stage in working on learning resources. At this stage, the researcher carried out five research steps: learning concepts, media to support learning strategies, instructions for using modules for students, instructions for using modules for teachers, and conducting formative revisions.

After the product is developed, the next stage evaluates or evaluates the product. This stage is a formative evaluation. Evaluation is carried out in trials aimed at material experts, media experts, and users. The last stage carried out in this research is implementation, namely the stage of implementing the product. Implementation is carried out to determine the performance of the Learning Module when applied to teaching and learning activities. There are two steps taken before the implementation step: preparing the supporting teacher and preparing the students.

Data collection was carried out using the help of observation sheets and questionnaires. The data collected from the observations were analyzed qualitatively using an interactive data analysis model. At the same time, the data from the questionnaire was analyzed quantitatively by looking for the average value of the questionnaire, which was then converted based on a conversion table compiled based on the theoretical ideal reference assessment formula.

III. Result and Discussion

3.1 E-Module Validity

Before the design is tested in small, limited or medium group trials and large groups, all design products will be validated by experts using a triangulation validation technique, namely by involving validation from design experts or material experts or media experts and student groups. Expert validation to obtain data on the feasibility of developing an interactive E-Module product as a learning resource for engineering aspects of household electrical installation materials for class IX at SMP Negeri 3 Taman, developed to gain certainty in the application of the product in trials. Material expert trials to obtain data on whether the material developed has complied with the provisions that have been recommended in the applicable learning process or not. Likewise, for colleagues, researchers want to get information from professional friends who have enough experience in the same field to get data about whether the products developed have met the criteria in full implementation, while for students to get initial responses to limited group trials and tests. Try large groups to find out whether the product developed gets a positive response and can be accepted by students from the product design results. In more detail, the results of data analysis starting from the design expert validation test, material expert validation test, media expert test, peer validation test, initial student response test in small groups, limited group trials and large group trials are presented as follows:

a. Design Expert Validation

From the validation of design experts, as shown in Table 1 in the data description, it is categorized into 5 aspects of deepening the Effectiveness of screen design, Ease of program operation, Consistency, Format, and Animation. The validation results from

design expert validators from each measured aspect got a percentage of 96% for the Effectiveness aspect of the screen design, 100% for the Ease of program operation aspect, 90% for the Consistency aspect, 100% for the format aspect, and 96% for the display animation aspect. Overall, each aspect indicates that the results of the assessment can be used as a basis for testing in a limited group and all aspects of product design are said to be significantly feasible. Overall aspects obtained a total percentage of 96.4%. This also concludes that the interactive E-Module development product as a learning resource for Craft subjects engineering aspects of household electrical installation materials for class IX at SMP Negeri 3 Taman, which was developed, is feasible for trials. in small, medium and large groups.

Table 1. Design Expert Percentage

No	Aspect	Number of items	Aspect Percentage	Percentage of Total Aspect
1	The Effectiveness of layout design	5	96 %	96,4 %
2	Ease of program operation	2	100 %	
3	Consistency	2	90 %	
4	Format	3	100%	
5	Animation	3	96%	
	Total	**15**		

b. Media Expert Validation

From the validation of media experts, shown in table 2 in the data description, it is categorized into 5 aspects of deepening the Effectiveness of screen design, Ease of program operation, Consistency, Format, and Animation. The validation results from design expert validators from each of the aspects measured got a percentage of 88% for the Effectiveness aspect of the screen design, 90% for the Ease of program operation aspect, 90% for the Consistency aspect, 93.3% for the Format aspect, and 93.3% for the Animation aspect of the display. Overall, each aspect indicates that the assessment results can be used as a basis for testing in a limited group. All aspects of product design are said to be significantly feasible. Overall aspects obtained a total percentage of 90.9%. This also concludes that the interactive E-Module development product as a learning resource for Craft subjects engineering aspects of household electrical installation materials for class IX at SMP Negeri 3 Taman, which was developed, is feasible for trials. in small, medium and large groups.

Table 2. Media Expert Percentage

No	Aspect	Number of items	Aspect Percentage	Percentage of Total Aspect
1	Screen design effectiveness	5	88%	90,9%%
2	Ease of program operation	2	90%	
3	Consistency	2	90%	
4	Format	3	93,3%	
5	Animation	3	93,3%	
	Total	**15**		

c. Material Expert Validation

The material expert validation, shown in table 3 in the description of the data, is categorized into 4 aspects deepening the aspects of the material's content, aspects of presentation, aspects of language, and aspects of overall appearance. The validation results from the material expert validators got 92.5% for the content aspect of the material, 91.8% for the presentation aspect, 91.2% for the linguistic aspect, and 95% for the overall display aspect. Overall, each aspect indicates that the assessment results can be used for testing in small groups, medium groups and limited groups. All aspects of product design are said to be significantly feasible. Overall aspects obtained a total percentage of 92.6%. This also concludes that the interactive E-Module development product as a learning resource for Craft subjects engineering aspects of household electrical installation materials for class IX at SMP Negeri 3 Taman, which was developed, is feasible for trials. in small groups, medium groups, and large groups.

Table 3. Material Expert Percentage

No	Aspect	Number of items	Aspect Percentage	Percentage of Total Aspect
1	Contents	12	86,6%	88,7%
2	Presentation	11	90,9%	
3	language	8	87,5%	
4	Overall view	2	90%	
	Total	**32**		

3.2 Module Trial

a. Limited Group Trial

This small group trial was conducted on 5 students who were selected on the ability of students who understand the internet and understand learning resources above the average of other friends. From the validation of student responses to the product that will be tested to find synchronization between the validation tests of design experts, material experts and colleagues that have been shown. The description of the data is categorized into 3 in-depth aspects of the design to be measured, namely the aspects of the content of learning materials, aspects of convenience and aspects of message clarity. It is found that the percentage is 78.2% for the content of learning materials, 77% for convenience and 77.3% for The clarity of the message. It also concludes that the interactive E-Modul development product as a learning resource for the Engineering subject of engineering aspects of household electrical installation materials for class IX at SMP Negeri 3 Taman, which was developed, is feasible to be tested in a limited group. It is also proven that the total percentage overall gets 77.5%. In this process, minor revisions were made to obtain more perfect product results from small group trials.

Table 4. Percentage of Student Responses

No	Aspect	Number of items	Aspect Percentage	Percentage of Total Aspect
1	Contents	7	78,2%	77,5%
2	Convenience	4	77%	
3	Message Clarity	9	77,3%	
	Total	**20**		

b. Small-Group Trial

This small group trial was conducted on 15 students who were selected on the ability of students who understand the internet and understand learning resources above the average of other friends. From the validation of student responses to the product that will be tested to find synchronization between the validation tests of design experts, material experts and colleagues that have been shown. The description of the data is categorized into 3 in-depth aspects of the design to be measured, namely the content aspects of learning materials, aspects of convenience, and aspects of message clarity. It is found that the percentage is 85.8% for the content of learning materials, 98.2% for convenience and 82.9 % for the clarity of the message. This also concludes that the interactive E-Module development product as a learning resource for the engineering aspects of engineering subjects for household electrical installation materials for class IX at SMP Negeri 3 Taman, which was developed, is feasible to be tested in a limited group. It is also proven that the total percentage gets a percentage of 88.9%. Small revisions are still being made to get more significant results from student responses.

Table 5. Small-Group Percentage

No	Aspect	Number of items	Aspect Percentage	Percentage of Total Aspect
1	Contents	7	85,8%	
2	Convenience	4	98,2%	88,9%
3	Message Clarity	9	82,9%	
	Total	**20**		

c. Large Group Trial

This large group trial was conducted on 30 students in the actual class group. Groups of students are selected randomly by considering their characteristics and have the same ability in general from the validation of student responses to the product that will be tested to find synchronization between the validation tests of design experts, material experts and colleagues that have been shown. The description of the data is categorized into 3 in-depth aspects of the design to be measured, namely the aspects of the content of learning materials, aspects of convenience, and aspects of message clarity. It is found that the percentage is 90.3% for the content of learning materials, 90.7% for convenience and 90% for The clarity of the message also concludes that the interactive E-Module development product as a learning resource for engineering aspects of household electrical installation materials for class IX at SMP Negeri 3 Taman which was developed is feasible to be tested in a large group. It is also proven that the total percentage overall gets a percentage of 90.3%. From this significant student response, the product developed can be socialized and disseminated to be distributed to teachers. It can be implemented in the learning process to students to be used as a guide in the learning process in the engineering aspects of household electrical installation materials for class IX at SMP Negeri 3 Park.

Table 6. Big Group Percentage

No	Aspect	Number of items	Aspect Percentage	Percentage of Total Aspect
1	Contents	7	90,3%	
2	Convenience	4	90,7%	90,3%
3	Message Clarity	9	90%	
	Total	**20**		

From the presentation of the results of this study, it can be understood that the developed E-Module has been tested to have a good level of validity so that the developed E-Module is feasible to be used in the learning process. In other words, the developed E-Module is by the learning objectives and meets the criteria as good teaching materials. Teaching materials are all forms that can help teachers learn success (Samuel, 2009). Teaching materials are materials or subject matter systematically arranged and used by teachers and students in the learning process. Good teaching materials can create an atmosphere or learning environment that allows students to learn effectively (Liliawati et al., 2018; Sukmahidayanti, 2015).

According to the Directorate of High School Development (2008), the notion of teaching materials in all forms is used to assist teachers in carrying out teaching and learning activities. Based on several definitions of experts regarding teaching materials, it can be concluded that teaching materials are learning components used by teachers to convey learning messages. The types of teaching materials are grouped based on several criteria. The types of teaching materials based on the subject consist of two types: (1) teaching materials that are intentionally designed for learning, such as books, handouts, worksheets and modules; (2) teaching materials that are not designed but can be used for learning, for example, clippings, newspapers, films, advertisements or news—judging from its function, the teaching materials designed to consist of three groups, namely presentation materials, reference materials, and self-study materials (Koesnandar, 2008).

The use of modules requires students' independence and initiative to learn, so the modules need to be arranged attractively. Learning modules are teaching materials that are systematically and attractively arranged, which include material content, methods and evaluations that can be used independently to achieve the expected competencies (Efatmaneshnik et al., 2020). So that the module, in this case, requires material and evaluation that is arranged interestingly and does not cause boredom to students because the module is studied independently by students. One of the innovations in developing the current module is a module compiled using a computer system or digital module, which allows some interesting elements to be added to the module (Sugiani et al., 2019; Wahidah et al., 2019; Wijaya & Vidianti, 2020).

The module has a characteristic that distinguishes it from other teaching materials. A good module must be arranged systematically, interesting, and clear way. Modules can be used whenever and wherever according to the needs of students (Astalini et al., 2019; Gómez et al., 2013). Digital modules are teaching modules that are made electronically or digitally that are interactive or can be bidirectional (Velan et al., 2015). The interactive concept is closely related to computer-based media. Interactions in computer-based learning environments generally follow three elements, namely: 1) sequenced instructional sequences, 2) student answers/responses or work, and 3) adjustable feedback (Kuk et al., 2012). Interactive media usually refers to products and services on digital computer-based systems that respond to user actions by presenting content such as text, graphics, animation, video, audio, and others (Lee & Osman, 2012).

From the product development planned by the researcher, the validation test was carried out by the design expert Dr. H. Rufi'I, S.Si., ST., M.Pd. Getting the assessment results and feasibility is quite significant, namely 96.4%—furthermore, material expert validation conducted by Dr. Drs. Achmad Noor Fatirul, ST., M.Pd got a validation result of 88.7% and concluded that the product developed could be applied to the next group trial. Design validation is important to ensure that the appearance of teaching materials is to the needs and desires of students. In addition, the design of teaching material will affect students' motivation to study the material (Plass & Kaplan, 2016). In other words, the more

attractive the appearance of teaching material, the more interested students will be in learning it (Di Serio et al., 2013; Zohoorian, 2015).

Media expert validation conducted by media expert Dr. Drs. Achmad Noor Fatirul, ST., M.Pd received a validation assessment with a percentage of 90.9%, so this assessment can be said to be feasible for the next group trial. Amin Sugiono carried out the test from 2 colleagues, ST, as the head of the Craft MGMP and Kurniawati, S. Pd, M. Pd as a member of the Craft MGMP teacher. Obtained a total percentage of 92.6%. Tests conducted by media experts showed that the developed E-Module had met the criteria of an electronic learning media. These results also indicate that the product developed is very feasible to be carried out in the next trial.

In a limited group trial called initial validation to determine student responses to 5 students, the percentage was 77.5%. This trial is needed to initially determine the feasibility of the developed material being tested on different groups of research subjects in limited trials and large group trials. In small group trials conducted on students, 15 students received student responses with 88.9%. This indicates progress from the feasibility trial of 5 students who increased student responses to products developed from a percentage of 77.5 % to 88.9%. This indicates that the product can be tested in large groups. In the large group trial, the total percentage yield was 90.3%. This trial was carried out in a large class, namely in the class used as the subject of the trial, amounting to 30 students. There was progress for student responses from the limited group trial or the medium group to the large group trial from the percentage of 88.9% to 90.3%. There was a significant improvement in student responses about the product being developed in the large group trial. So that this product can be produced, socialized, and disseminated to be used by teachers and other students as a reference in fostering student career guidance.

Thus, the researcher concludes that the product that has been developed has been tested for validity and can be used in the implementation of the interactive E-Module development product as a learning resource for the subject of engineering aspects of household installation materials for class IX at SMP Negeri 3 Taman. However, due to time and cost limitations in conducting the research, the researcher did not carry out this research within the scope of field trials. Field trials involved schools other than small group trials, limited trials and large group trials. Field group trials involving schools within the school environment in sub-districts, districts, cities or provinces require very large funds. Therefore, in this study, it was only sufficient carried out in the form of large groups. However, the results of this study can be accounted for because all the validation results show very significant results, so this product can be reproduced to be used by teachers, students or other schools as a guide in developing the learning process. For this reason, research is important next research to ensure the Effectiveness of E-Modules so that the product is ready to be used in the actual learning process and can be mass-produced.

IV. Conclusion

Research aimed at developing interactive E-Modules as a learning resource for engineering subjects in the engineering aspects of household electrical installation materials for class IX at SMP Negeri 3 Taman has proven that the validation results are carried out from the validation of design experts, media experts, material experts, and colleagues. As well as an initial trial of 5 students, a very significant assessment was obtained, so the trial was continued in a limited group trial (15 students) and a large group trial (30 students). The second trial obtained a very significant percentage. Therefore, the

development of interactive E-Modules as a learning resource for the subject of Engineering aspects of household electrical installation materials for class IX at SMP Negeri 3 Taman can be used as a guide in the student career guidance process and can be produced in large quantities to be distributed to teachers and students alike.

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