

Feasibility of electromechanical basic work e-module as a new learning media for vocational students

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ABSTRACT

This study aims to develop and determine the feasibility of E-Module learning media in Electromechanical Work Basic Subjects. This research is a development research using ADDIE model. The product developed is e-module learning media on subjects in Electromechanical Basic Work. Data collection is done by means of observation, interviews and questionnaires. The data analysis technique used in this research is descriptive analysis. This research was conducted on 128 students of 10th grade Department Electrical Installation Engineering in Vocational High School in Serang, Banten. The results of the research are Media validation is very feasible with a percentage of 95.3%. Material validation is very feasible with a percentage of 97.9%. The results of the questionnaire evaluation data of small group trials get an average percentage value of 91.7% and in the very feasible category. The results of the assessment in the large group trial data questionnaire received very decent results with a percentage of 92.4%. The results of the exercises carried out an average value of 92.1 before using learning media the average value obtained by students 80.5. The results of the evaluation scores get an average value of 88.5. The e-module learning media in Electromechanical Basic Work subjects can facilitate students in the learning process and facilitate the teacher in teaching.

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1. INTRODUCTION

Education is a planned effort to create a learning atmosphere and process so that students actively develop their potential to have the character, personality, intelligence, and skills needed by themselves, society, nation and country. This is stated in Law No. 20 of 2003 article 1 paragraph (1) on National Education System. According to Dinsyah [1] education is a process to influence students to adjust themselves as best they can to their environment, so that it will cause changes in themselves that are likely to function strongly in social life.

The use of learning media and sources influences the learning process. According to Meyer, Omdahl, and Makransky [2] by using virtual reality and video learning media showed positive results in improving the quality of the learning process. A study by Schneider, Nebel, Beege, and Rey [3] by using digital-based learning media. This is in line with a study by Qamar, Riyadi, and Wulandari who implemented blended learning with WhatsApp application as a learning medium that can improve the quality of learning

for students [4]. The use of learning media in the form of learning modules can also increase student motivation as described by Rufii and Rochmawati [5] in her research.

Learning media in this context is a technology and/or a set of tools that contain learning material; Learning media is a means of communication in the form of text, visual images, audio, video, virtual reality, interactive multimedia, both hardware and software technologies that support the learning process. This is in line with a study by Choi and Baek [6] who used virtual worlds as learning media. Dewi, Wardani, Wijayati, and Sumarni [7] used ICT media as learning media. In addition, social networking websites can also be used as learning media in accordance with a study by Norhailawati [8].

The existence of learning media in the learning process helps students in understanding material that is difficult to explain and understand [9]. This is in line with a study by Sari, Fadillah, Jonathan, and Prabowo [10] who used Interactive Gamification learning media on Android which can increase interest and enthusiasm for learning, and increase understanding of the material presented. This is in line with a study by Saputra, Nasrun, and Wakhinuddin [11] that web-based learning media was effective in improving student learning outcomes. The same results were also obtained from the results of research by Wijaya and Sefriani [12, 13] that the Interactive Module was very effective to be used as a learning resource, including the use of ICT-based assessment instruments [14].

Vocational High School (VHS) is a form of formal education unit that organizes vocational education at secondary education level after Junior High School (SMP/MTs) [15]. Vocational high school is a field of education to prepare students who are ready to work with the knowledge and expertise gained at school. The purpose of the Vocational High School is to prepare students to be able to work in their expertise in the developments and changes that occur in society, nation, and country.

Vocational High School of Pasundan No. 2 Serang is one of the private vocational high schools in the middle of Serang City, which should use modern learning media. However, in reality, the learning media used are still conventional in Basic Electromechanical Work subject. Electromechanical Basic Work is one of the subjects in the Electrical Installation Engineering Department at Vocational High School of Pasundan No. 2 Serang. Electromechanical Basic Work is one of the subjects that support the theory of basic electricity.

The results of observations showed the average score of 10th grade students on Electromechanical Basic Work was 71.7. This score is far from the MPSs (Minimum Passing Standards) of 80.0 with cognitive, affective and psychomotor assessment in accordance with what has been determined by the teacher and has been agreed with all teachers and principals of Vocational High School of Pasundan No. 2 Serang.

The results of observations at the Vocational High School of Pasundan No. 2 Serang showed that 77.2% of 28 students had difficulties in receiving material because the media used by the teacher were less attractive and students wanted more interesting media (multimedia). In addition, observations on the learning process at the Vocational High School of Pasundan No. 2 Serang showed that teachers as instructors still used conventional learning media on Basic Electromechanical Work subject for the 10th grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang. Students that learn by using conventional media in the form of printed modules and lecture stated that the material presented is boring. If students are not equipped with interesting modules on the material presented, the students will have difficulty in repeating the material in the learning process.

Based on the previous research, there are several problems in the Basic Electromechanical Work subject for the 10th grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang, so researchers would develop adobe flash-based e-module learning media in Basic Electromechanical Work Subject for 10th grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang in order to facilitate students in the learning process, this is in line with a study by Jonias [16] which stated that the e-module was feasible and effective for use as a learning medium. In addition, e-module learning media had good responses from material experts, media experts, and students. So it can be concluded that student learning outcomes with E-Module learning media are better than student learning outcomes without E-Module learning media.

Another study by Paska, Wirawan, and Pradnyana [17] showed that 64% of students gave excellent responses, 36% of students gave good responses and none of the students gave fair, poor or very poor responses. The average overall assessment of the field test was 90.04%. After the field test, the response test on the teacher to the development of e-modules in computer system subjects obtained an average of 46, if converted into the response criteria table then it was included in the very positive category.

This is in line with a study by Priandana [18] showed that interactive learning media with Macromedia Flash software on basic competencies for the application of various basic logic gates in Vocational High School No. 2 Bojonegoro was feasible because it was in the good category of 79.75% validated by two lecturers and two teachers who are media and content experts and material experts. So it can be concluded that interactive media was feasible to be used as teaching material. In addition, students' responses to interactive learning media with Macromedia Flash software on the basic competencies for

the application of various basic logic gates received an 83.8% rating. Based on the rating results, interactive learning media had a good response by students. So it can be concluded that interactive multimedia learning media with Macromedia Flash software on basic competencies for the application of various basic logic gates was effective to be used as teaching materials.

This is also in line with the results of research conducted by Perdana, Sarwanto, Sukarmin, and Sujadi [19] with the results of the feasibility test in the feasible category, based on the calculation results with an average of 3.80 or greater than the minimum feasibility of 3.78. The results of the validation by the subject matter experts on the feasibility of content and language were in the excellent category of 3.85. The results of the validation by media experts about the feasibility of the component and graphic presentation showed an excellent category with an average value of 3.84. The results of the validation by the physics teacher showed an excellent category. The results of validation by the peer review showed an excellent category with an average value of 3.72. The results of student questionnaire responses on four aspects produced an excellent category with an average percentage of 3.85. So it can be concluded that the motivation of students to use science process skills based on physics modules was better than conventional learning.

A study by Sutopo [20] stated that students easily understand the concept of selection with visualization. Studying text material is more effective if it is equipped with graphics, animations, or videos for students to learn. Multimedia, especially visualization, increases student motivation in learning algorithms and coding. Adobe Flash is a time-based object-oriented authoring and programming tool that can be used to develop scientific visualization.

A study by Perdana, Sarwanto, Sukarmin, and Sujadi [19] stated that the development process of learning media was carried out in three stages, namely: needs analysis, product development including index design, navigation and content, one-on-one trials, small groups trial and final product implementation; and this multimedia product can be used as a medium for understanding technical measurement material. There were differences in student learning outcomes. Learning technical measurement in interactive media was more effective than conventional media. It can be seen from the difference between the control class (conventional with an average value of 69.78 and the experimental class with an average value of 78.83.

From several studies, it can be seen that the use of multimedia-based learning media makes students more enthusiastic in the learning process based on the percentage of feasibility and some assessments [21, 22]. The adobe flash-based e-module learning media developed by researchers has a difference from other research that is the video on cable jointing practice learning as a tutorial, in addition, there are also several options as a test of students' ability to some of the material they have learned. In addition, there is an evaluation on this adobe flash-based e-module learning media that can measure students' abilities on cable specifications and jointing on Basic Electromechanical Work subject.

2. RESEARCH METHOD

This study used a development research procedure with the ADDIE model [23]. ADDIE model research procedures consist of five stages, namely Analysis, Design, Development & Implementation, and Evaluation. The study was conducted on 128 10th grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang.

The analysis was the initial stage in the development process by performing needs analysis, curriculum analysis, and material analysis. A needs analysis was performed by conducting observations, interviews, and questionnaires to determine the use of instructional media. This is in line with a study by Pradani and Aziza [24]. Curriculum analysis was performed to identify competencies that must be developed by describing Core Competencies and Basic Competencies as Indicators. The material analysis was carried out to analyze the cable specifications and jointing in accordance with the Core Competencies and Basic Competencies in the 2013 curriculum [25].

At the site-map design stage, flowcharts and storyboards were developed which were adapted from the results of the needs analysis. This is in accordance with the design stages carried out by Tegeh and Kirna [26]. Site-map is used to illustrate the relationship between one page to another page to facilitate the operation of learning media. A flowchart is a learning media flow based on the site map to facilitate the arrangement of learning media flow. The storyboard design as a guide in the development of learning media aims to design the learning media interface based on the storyboard and site map.

The development stage is the stage of applying the product framework at the design stage. Steps at the development stage namely, the pre-production stage, the production stage, and the post-production stage and quality inspection with expert validation carried out by media experts and material experts to determine the level of eligibility to revise the quality of learning media before the trial stage. This is the same as the development stage by Putra, Tastra, and Suwatra [27].

At the implementation stage, an Adobe Flash-based e-module was implemented as a learning medium for Basic Electromechanical Work subject for the 10th-grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang by using small group trials and large group trials. Small group trials were carried out on nine 10th grade students of Electrical Installation Engineering to find out their responses on Adobe Flash-based e-module learning media on Basic Electromechanical Work subject while large group trials were carried out on 128 10th grade students of Electrical Installation Engineering to determine responses students on a large scale. This is in line with a study by Masykur, Nofrizal, and Syazali [28] who used the same implementation stages namely testing in small groups and large groups.

The evaluation stage was the final activity carried out after the adobe flash-based e-module learning media had been tested. If deficiencies are found, a revision must be made. Product revision is based on the results of input from material experts, media experts, and users. This is also in line with the study conducted by Hamid, Permata, Aribowo, Darmawan, Nurtanto, and Laraswati [29].

Data collection techniques and instruments used observation, interviews, and questionnaires to determine the feasibility of the media and determine the response of student assessment. This is in line with a study by Hamid, Aribowo, and Desmira [30]. There are three types of questionnaires: material expert questionnaire, media expert questionnaire, and student questionnaire. Table 1, Table 2, and Table 3 are indicator items of questionnaire used as research instruments

Table 1. Indicator items of instrument for material expert

Aspect	Indicator	Item number
Format	Clarity of instructions for use	1
	Content conformity on material	2
Content	The suitability of colors, images and text material on e-module learning media	3,4
	Conformity of cable specifications and jointing procedures with e-module learning media on Basic Electromechanical Work subject	5,6
	Clarity of concepts of cable specifications and jointing procedures with e-module learning media on Basic Electromechanical Work subject	7,8
	Conformity of animation in e-module learning media with the concept of cable specifications and jointing procedures	9
	Clarity of animation in conveying the concept of cable specifications and jointing procedures with e-module learning media	10
Language	The use of standard language	11
	Ease of understanding the language used	12
	The effectiveness of the sentences used	13
	Complete sentences/information needed by students	14
	Word usage in accordance with Enhanced Indonesian Spelling System	15

Table 2. Indicator items of instrument for media expert

Aspect	Indicator	Item number
Display	Simple display of text on e-module learning media	1
	The design of the e-module learning media display is easy to understand	2
	The use of text in the e-module learning media is in accordance with the characteristics of students	3
	The colors and images used in the e-module learning media	4
	Neatness of e-module learning media	5
	Navigation button layout	6
	Display design	7
Design	Animation used on e-module learning media	8
	Images used in the e-module learning media	9
	Text layout on e-module learning media	10
	Navigation buttons used on e-module learning media	11
Usability	Ease of use	12
	Use of navigation buttons	13
	Ease of operation	14
	Operation of all components	15
	Communicative	16
	Interactive	17

Table 3. Indicator items of instrument for student

Aspect	Indicator	Item number
Interest in the media	Readability of texts on learning media	1
	Display on learning media	2
	Color selection on learning media	3
	Selection of images on learning media	4
	Display design on learning media	5
	The difference in teaching material	6
Benefits of e-module learning media	Exercise on e-module learning media	7
	Help students to understand the material	8
	Increase student knowledge	9
	Provide knowledge and experience	10
	Test the ability of students	11
Applications used	Images and animations used	12
	Ease of operation	13
	Communicative	14
	Quality of questions and discussion	15
	Use of navigation buttons	16

Data analysis techniques used descriptive analysis to assess the characteristics of data. Data analyzed descriptively were observation, interview, and development data. This is in line with a study by Prastyaningrum and Imansari [31]. This study used a Likert scale questionnaire with 5 scales namely very feasible, feasible, fairly feasible, less feasible, and not feasible, can be seen in Table 4.

Table 4. Assessment with a Likert scale.

Statement	Score
Very feasible	5
Feasible	4
Fairly feasible	3
Less feasible	2
Not feasible	1

The results of the questionnaire response score were analyzed by calculating the average answer based on the scoring of each answer from the respondents which was calculated by using the formula, [32]

$$P = \frac{n}{N} \times 100\% \quad (1)$$

Description:

P : Percentage of response

n : Total of obtained score

N : Total of criteria score

100% : Constant

The results obtained are then presented in accordance with Table 5.

Table 5. Criteria of feasibility test

Percentage	Interpretation
81%-100%	Very Feasible
61%-80%	Feasible
41%-60%	Fairly Feasible
21%-40%	Less Feasible
0%-20%	Not feasible

Source: [33]

3. RESULTS AND ANALYSIS

The results of research on the development of e-module learning media were carried out based on the development procedures on the ADDIE model or Analysis, Design, Development, Implementation, and Evaluation.

There are three analyzes at the analysis stage, namely requirements analysis, curriculum analysis, and material analysis. In the needs analysis phase, observations, interviews, and questionnaires were conducted to determine the use of instructional media. From interviews conducted with teachers and students,

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it can be seen that teachers still use conventional learning media in the Basic Electromechanical Work subject for the 10th-grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang. Students that learn by using conventional media in the form of printed modules and lectures stated that the material presented is boring. It also used a learning media questionnaire that was filled out by students to find out the percentage of student needs for learning media. Based on the results of the questionnaire distribution, 77.6% of 28 students stated that they had difficulty in accepting the material because the media used by the teacher were less attractive and students wanted more interesting learning media with pictures, videos, audio, and animation.

In the curriculum analysis stage, identification of basic competencies in the 2013 curriculum, understanding of the breadth of the material, and the elaboration of basic competencies into several indicators were carried out. Basic competencies and indicators can be seen in Table 6.

Table 6. Basic competencies and indicators

Basic Competency	Indicator of achievement
1. Determine cable specifications and jointing procedures	1.1 Students can explain the definition of conductor
	1.2 Students can explain the electrical conductor requirements
	1.3 Students can explain the type of conductor
	1.4 Students can mention the function of the conductor
	1.5 Students can explain the nomenclature of cable codes
	1.6 Students can identify the color of the cable
	1.7 Students can explain the cable jointing requirements
	1.8 Students can explain various cable jointing.
2. Check cable specifications and jointing.	2.1 Students can determine the definition of a conductor
	2.2 Students can classify the requirements of electrical conductors
	2.3 Students can classify the types of conductors
	2.4 Students can express the function of the conductor
	2.5 Students can express the nomenclature of cable codes
	2.6 Students can classify the color of the cable
	2.7 Students can analyze the cable jointing requirements
	2.8 Students can demonstrate various cable jointing.

Material analysis was carried out to analyze the specification material and cable connection so that the material in the Adobe Flash-Based E-Module Learning Media is in accordance with the Core Competencies and Basic Competencies on cable specifications and jointing in the 2013 curriculum. In the material on cable specifications and jointing, there are several sub material, including: (1) Definitions and conditions for electrical conductors, types of electrical conductors and their functions, (2) types of electricity conductors based on their construction, (3) types of electrical conductors used in electrical installations, namely NYA cables, NYM cables, NYAF Cables, NYY Cables, NYFGbY Cables, ACSR Cables, and AAAC Cables, (4) Nomenclature of Cable Codes, (5) Identification of cable colors, namely blue cables, black cables, and green-yellow cables, (6) Requirements for cable jointing and (7) Types of cable jointing, namely eyelet jointing, pigtail jointing, twisted cable jointing, Scarf cable jointing and straight married cable jointing.

At the design stage, data collection was carried out from various information. Data collected regarding cable specifications and jointing were images, videos, and Adobe Flash CS5 software that supports the development of adobe flash-based e-module learning media. In addition, the design of the site map, flowchart, and storyboard of learning media was carried out. Adobe Flash Based E-Module Learning Media Site-map can be seen in Figure 1. Flowchart of Adobe Flash Based E-Module Learning Media in the Main Menu section can be seen in Figure 2.

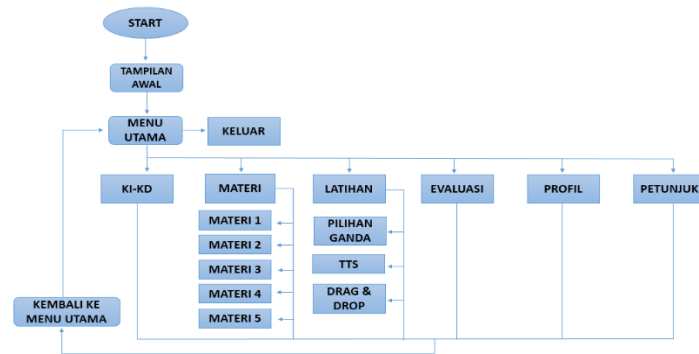


Figure 1. E-Module Learning Media Site-map

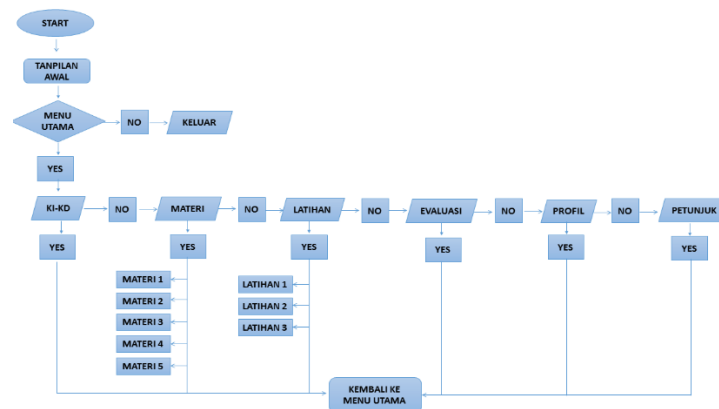


Figure 2. Flowchart of main menu

At the development stage, there are three stages, namely pre-production, production, and post-production. In the pre-production stage, material for e-module learning media was prepared and the Adobe Flash CS5 application was installed. At the production stage, the implementation of a product framework in the form of an e-module learning media application using the Adobe Flash application was carried out. In the post-production stage, a quality check was carried out with expert validation. Expert validation was carried out by media experts and material experts to determine the level of media feasibility in order to revise the quality of learning media. Expert validation was carried out by two media experts and two material experts.

The results of the validation of Adobe Flash-Based E-Module Learning Media had a percentage of 96.6% or in the excellent category. The validation of learning media was carried out by two experts including a media expert with a percentage of 95.3% and a material expert with a percentage of 97.9%.

The results of the feasibility test of media experts and material experts in the Adobe Flash Based E-Module Learning Media can be seen in Figure 3.

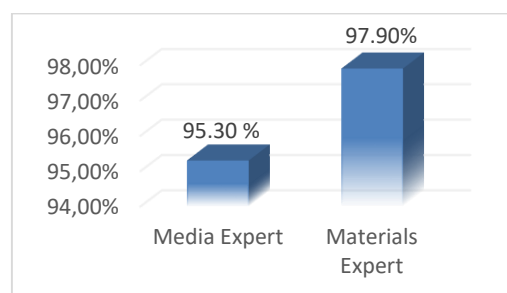


Figure 3. Percentage of learning media feasibility by the expert

From the results of all assessments in the media validation questionnaire, the aspect of media display had a 95% percentage, the design aspect had a 95% percentage, and from the aspects of applications used had a 95% percentage. From these three aspects, the average percentage value of 95.3% was included in the category of very feasible for the development of Adobe Flash-Based E-Module Learning Media in Basic Electromechanical Work subject for the 10th-grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang.

Figure 4 is the result of the feasibility test percentage by media experts on Adobe Flash Based E-Module Learning Media.

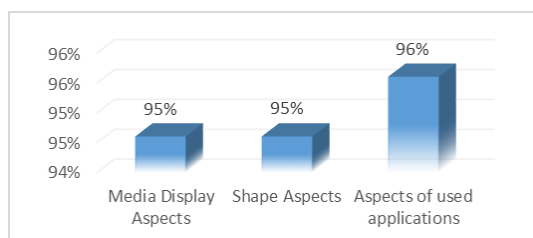


Figure 4. Percentage of learning media feasibility by media expert

From the results of all assessments on the material validation questionnaire, the adobe flash-based e-module learning media from the format aspect had a percentage of 97.5%, the content aspect had a percentage of 98.3%, and the language aspect had a percentage of 98%. Of these three aspects, the average percentage of 97.9% was included in the category of very feasible for the development of adobe flash based e-module learning media on Basic Electromechanical Work subject for the 10th-grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang.

The results of the feasibility test percentage of material experts in the Adobe Flash Based E-Module Learning Media can be seen in Figure 5.

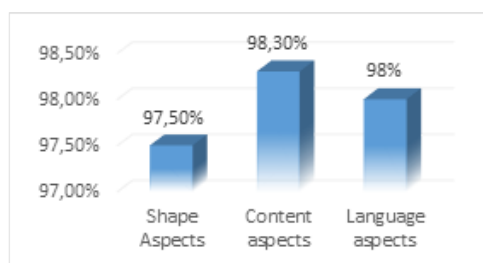


Figure 5. Percentage of learning media feasibility by material expert

Material experts had the highest rating of 97.9% because the average validation gave a large evaluation on several questionnaires and it was stated that the material contained in the adobe flash-based e-module learning media according to the validator was appropriate for Basic Electromechanical Work subject for the 10th -grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang.

Media experts had a percentage of 95.3% and were included in the very feasible category. Media expert validators provided suggestions and input to improve the development of adobe flash-based e-module learning media. The implementation stage was performed to determine the feasibility of Adobe Flash-based E-Module learning media on Basic Electromechanical Work subject for the 10th-grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang conducted with small and large group trials.

This trial was conducted in 10th-grade students of Electrical Installation Engineering in semester 1 of the 2019/2020 school year. The trial process of Adobe Flash-based E-Module Learning Media was conducted by researchers during the learning process and observations were made on how the students responded during the learning process and proved by filling in the questionnaire by students. The results of

all assessments on a small group trial data questionnaire conducted on nine 10th-grade students of Electrical Installation Engineering viewed from the aspect of interest in the media, aspects of the benefits of learning media and aspects of application used had an average percentage of 91.7% and on a large group trial data questionnaire conducted on 28 10th-grade students of Electrical Installation Engineering, viewed from the aspect of interest in the media, aspects of the benefits of learning media and aspects of application used had an average percentage of 92.4% and both including in very feasible category for the development of adobe flash based e-module learning media on Basic Electromechanical Work subject for the 10th-grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang.

The evaluation of large and small group trials on Adobe Flash-Based E-Module Learning Media can be seen in Figure 6.

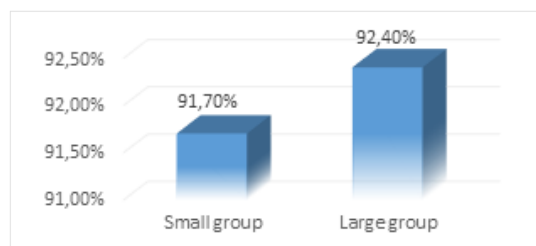


Figure 6. Percentage of students' responses

The results of a large group questionnaire totaling 128 students showed that in the aspect of interest in the media had a percentage with a value of 93.1%. In the first statement "The text used makes it easy for me to understand the material" had a percentage of 92.1%. Students stated that the text in the learning media used makes it easy for students to understand the material because of the appropriate color, font, and size of the text. In the second statement, "I am happy to study material with this teaching material because it looks interesting" had a percentage of 93.5. Students enjoyed the learning activities by using adobe flash-based e-module learning media because of the interesting appearance in the form of animation and images. The third statement, "The choice of colors used in teaching materials makes teaching materials look more attractive" had a percentage of 91.4%. The use of various attractive colors in the adobe flash-based e-module learning media makes students more enthusiastic to learn with these learning media.

The fourth statement, "The figures displayed in the teaching material are very interesting" had a percentage of 91.4%. The figures displayed on the adobe flash-based e-module learning media are the same as the original practice which will make students interested in learning to use these learning media. The fifth statement, "The design used makes teaching materials look more attractive" had a percentage of 91.4%. The design of adobe flash based e-module learning media that displays images, text, animations, navigation buttons, etc., makes learning media more interesting.

The sixth statement, "This teaching material is different from other teaching materials" has a percentage of 95.5%. 10th-grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang who previously only used material from textbooks and learning on the blackboard with the teacher, considered the adobe flash-based e-module learning media to be very interesting and this learning media was different from the learning media commonly used. The seventh statement, "The existence of practice questions on this teaching material makes me interested to try it on this interactive media" had a percentage of 96.4%. The exercises on each sub material in the adobe flash-based e-module learning media make it easy for students to test their abilities after learning from one material.

The results of a large group questionnaire totaling 28 students showed that the aspect of learning media benefits had a percentage of 91.1%. The eighth statement, "Cable specifications and jointing presented in this teaching material are very interesting" had a percentage of 89.2%. The material on the adobe flash-based e-module learning media that displays text, images, colors, and animations makes the material presented very interesting.

The ninth statement, "The contents of this learning media are very useful to my knowledge" had a percentage of 90.7%. The material presented in the adobe flash-based e-module learning media has five sub-materials so that a lot of material can be learned by students. The tenth statement, "This learning media provides a lot of experience and knowledge for me" had a percentage of 92.8%. 10th-grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang who previously only used textbooks and whiteboard learning media were happy to use adobe flash-based e-module learning media because they could use multimedia learning media.

The eleventh statement, "The existence of evaluation is very interesting because it makes me know the results of my learning from the whole material" had a percentage of 93.6%. Evaluation of adobe flash based e-module learning media makes students happy because they can directly test their abilities after learning and can immediately find out the results of their grades. The twelfth statement, "Figures or animations displayed, makes it easy for me to understand the material" had a percentage of 89.2%. Figures and animation on adobe flash-based e-module learning media make learning media look more interesting so that it makes it easier for students to understand the material. The results of a large group questionnaire from 128 students, the aspects of the application used had a percentage of 93%.

In the thirteenth statement, "Interactive multimedia learning media can be operated optimally" had a percentage of 95%. The adobe flash-based e-module learning media have navigation buttons, images, and videos that can be operated properly, making it easier for students in the learning process. In the fourteen statement, "Learning media is very communicative" had a percentage of 90.7%.

The fifteenth statement, "The quality of the questions and discussion is good and easy to understand" had a percentage of 91.4%. The questions and materials contained in the adobe flash-based e-module learning media that use good language make it easier for students when examining the word for word in the learning media. The sixteenth statement, "Navigation buttons are easy to operate" had a percentage of 95%. The navigation buttons on the adobe flash-based e-module learning media are easy to operate and with interesting themes and colors that make students easy during the learning process. A percentage graph obtained from the results of a large group trial questionnaire can be seen in Figure 7.

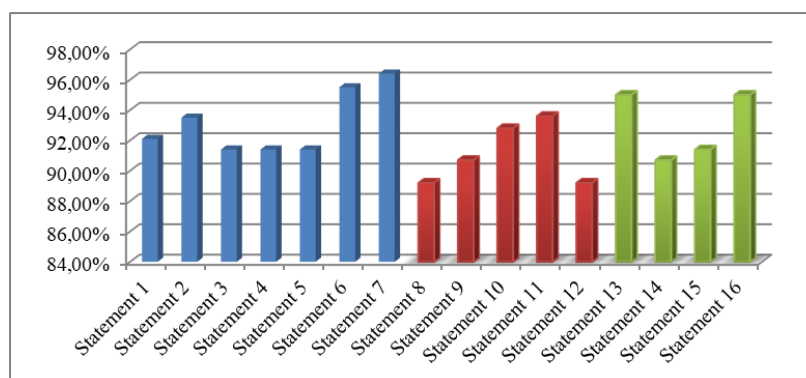


Figure 7. Percentage of large group trial

During the research process and the use of adobe flash-based e-module learning media, the students were very enthusiastic during the learning process. Students were happy because they can use multimedia-based learning media because it is more interactive and more real so students can see figures directly from the material being studied. In addition, students can also perform cable jointing.

This is in line with a study [34] on mathematical learning media with the result that this animation-based learning media is feasible to use and has a positive response.

This is in line with a study [35] which showed that e-learning content based on multimedia can enhance student knowledge. It is also in line with a study [36] which showed that this multimedia-based educational game was feasible to be used as a learning medium for 9th-grade students in preparing for computer-based national exams.

In the Adobe Flash-Based E-Module Learning Media there are also exercises about sub-material questions and there is also the evaluation to find out the overall understanding of the material in the Adobe Flash-Based E-Module Learning Media. After using the adobe flash-based e-module learning media, students performed exercises on each subject matter that they learned and worked on evaluations in the form of ten multiple-choice questions. From the multiple-choice practice exercises conducted by all 10th-grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang, the average score was 92.1. Before using the learning media, the average score obtained by students with the same material and questions was only 80.5. This was very different compared to the exercise scores after using adobe flash-based e-module learning media.

In addition, an evaluation was conducted to test the ability of students from all material and an average score of 88.5 was obtained. Before using the Adobe Flash-Based E-Module Learning Media students only received an average score of 78.5 which was included in the category of not passing MPSs (Minimum

Passing Standards). From the score, it can be seen that students master the material when using Adobe Flash-Based E-Module Learning Media. The score before and after using the adobe flash-based e-module learning media can be seen in Figure 8.

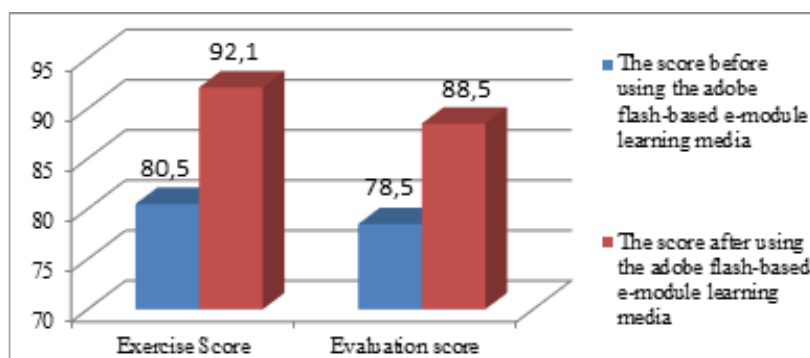


Figure 8. The score before and after using the adobe flash-based e-module learning

From the results of the percentage and score obtained by students, it can be seen if students enjoyed using the adobe flash-based e-module learning media. Students were more enthusiastic when using the adobe flash-based e-module learning media on Basic Electromechanical Work subject on the cable specification and jointing. Students were happy because by using adobe flash-based e-module learning media, students can find out the material being learned in the presence of figures. In the cable jointing learning material, there are also job sheets and cable jointing tutorial videos that make it easy for students to perform cable jointing. Students are happy with the exercise that directly displays the results of the exercise, students become aware of the results after the learning process and can know what is wrong and right.

The evaluation stage was carried out after the Adobe Flash-based E-Module Learning Media was tested. The following are the results of the assessment of media experts and material experts. From validation by media experts, there are several suggestions: (1) Pay attention to fonts and font shapes so students can read and be seen from a distance, (2) Pay attention to the background with other colors, (3) Pay attention to the multimedia elements of text, animation, audio, videos, pictures and (4) Drag & drop exercises are corrected if the answer is wrong.

Apart from the media expert, the material expert also gave the following suggestions: (1) The material should be added about the types of cables, (2) The material for cable nomenclature should be added, (3) The use of the name of the tool should be adjusted and (4) Watch the sentence used, make a sentence more clearly.

4. CONCLUSION

The results of the analysis on the development of adobe flash-based e-module learning media on Basic Electromechanical Work subject for the 10th-grade students of Electrical Installation Engineering can be concluded that the adobe flash-based e-module learning media was feasible with the results of the assessment on the media validation questionnaire which had average percentage value of 95.3% and was included in the very feasible category. From the results of the assessment in the validation questionnaire, the average value of the percentage was 97.9% and included in the very feasible category. From the results of the assessment in the small group trial data, the average percentage score was 91.7% and included in the very feasible category. From the results of the assessment in the large group trial data, the average percentage score was 92.4% and included in the very feasible category. From the evaluation of media validation, material validation, small-scale trials, and large-scale trials, it can be concluded that adobe flash-based e-module learning media on Basic Electromechanical Work subject for the 10th-grade students of Electrical Installation Engineering at Vocational High School of Pasundan No. 2 Serang was in the very feasible category. After using Adobe Flash-Based E-Module Learning Media, students performed exercises about each material they have learned and had an average score of 92.1 and performed an evaluation to test the ability of students from all materials and had an average score of 88.5.

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