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DEVELOPMENT OF VIRTUAL PREVIEW MODULE WITH SCIENCE PROCESS SKILL APPROACH ASSISTED ELECTRIC CIRCUIT STUDIO (ECSTUDIO) IN DYNAMIC ELECTRICAL MATERIALS

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Abstract

The research aims to design a virtual preview module with a Scientific Process Skill (SPS) approach with a dynamic electrical circuit application on electric matter. This research method uses descriptive research methods with quantitative approaches, on ADDIE development models with the sat analysis stages (data and information collection), design (product planning), early product development, implementation (initial field test), evaluation (revision of test results). The research subject is a virtual preview module with a scientific process skill approach. The object of research is dynamic electrical matter. The product developed was validated by 6 validator experts made up of 3 validator experts, 3 validator media experts. Also seen the response of two physics teachers. Initial field trials were carried out by passing an engagement sheet to 8 students. Research shows that virtual preview modules with a scientific process skill approach with a dynamic electrical circuit application on the electric circuit studios are declared worthy after validation by materials experts, media experts, teachers, and student responses. Assessment of material experts with an average percentage of 81.93% in valid/ worthy categories, media with an average percentage of 85.92% in valid/ worthy category, teacher response rate 86.33 % with dancing well and an 80.32% with the attractive category and the final trial in the large class obtained a percentage of 85.11% with the very interesting category

Keywords: Module, Science Process Skills, Electric Circuit Studios

Part of science (IPA) one of which is physics, Physics is a combination of ways of thinking, investigation, and knowledge in the form of facts, concepts, principles, laws, theories, and models. According to (Supiyanto, 2007) "Physics is an essential science which is the backbone for the development of knowledge and technology". (Kanginan, 2002) revealed that: "Physics is the study of natural phenomena and the interaction of natural phenomena. In physics, studying the symptoms of natural objects, both those that occur in observable objects (matter) and unobservable (micro) objects.

In the learning process, student activity is needed, student participation is very influential in the process of emotional, thinking, and social development to improve student achievement in school. In increasing student activity and interest in learning by providing motivation and with the support of learning media. According to (Kinasih & MARTINsa, 2018) "teaching materials are all materials (information, tools, and texts) that are systematically arranged, which shows a complete figure of competence that will be mastered by students and used in the learning process with the aim of planning, implementing and evaluating learning". The use of teaching materials in the form of modules that integrate active students in cognitive, psychomotor, and affective aspects. The use of modules to facilitate and facilitate teachers in interacting with students, with the module can help in achieving learning objectives. Modules serve as supplements to students or books for autonomous learning and support additional learning resources.

The 2013 curriculum program changed the physics learning process in the classroom which had been instruction-focused to become scholar-focused. The use of science process skills greatly supports K-13 learning activities, in addition to making students active, they can also familiarize students with being scientific. Process skills are a series of activities carried out by students in observing or observing to obtain results which in turn the acquisition becomes new knowledge. With the observation stage; grouping; interpret; predict; carry out communication; submit questions; hypothesis; designing experiments; determine tools and materials; apply concepts, and do the experiment.

According to (Sani, 2018) the practicum method offers students the opportunity to find out for themselves a fact they want to know. This method emphasizes activities that must be carried out by students, such as searching for data and finding relationships between variables. Practicum is an activity that cannot be separated from the physics learning process. Practicum in the laboratory allows students to explore, analyze, collect, and communicate the results of their observations.

The problems that occurred due to the Corona Diseases-19 Virus (COVID -19) that hit the world have also changed the world of education, ranging from learning methods, budgeting, targets, to assessments. So that learning is carried out online (in a network). Online learning is learning that is done without face-to-face through an available platform. Online learning is one of the alternative policies from the government to provide convenience in the learning process to continue to be carried out, but teachers have not prepared all forms of learning to balance online learning activities.

With the development of Lab–Vir technology, it is possible to interact and visualize phenomena that occur or are experienced by students in experiments in real laboratories (Martinez-Jimenez, P., Pontes - pedrajas, A., Polo, J., & Clement - Bellid, 2003). Then (Tatli & Ayas, 2012) that Lab-Vir as a facilitator to motivate and enrich students' interactive experiences and develop activities of experimenting skills in the implementation of experiments. So that Lab-Vir can improve skills in the science process needed in problem-solving. There are many advantages to using an android-based practicum, including 1) a virtual laboratory equipped with tools and materials to perform simulations or experiments like a real laboratory; 2) very practical, which can be used anywhere; 3) does not depend on data networks (offline). (Suryaningsih et al., 2020).

From the results of interviews conducted in an unstructured manner to 2 teachers of Madrasah Aliyah Swasta 4 (MAS 4) Medan, the teacher carried out the learning process by writing an explanation of the material and uploading several pictures (photos) and occasionally the teacher attached several websites links that students could visit for information. Support material on the Edulink application. For practicum activities, the teacher does not carry out assignments because it is difficult to access both materials, tools, and so on. Based on the results of research by Zulaiha, Hartono, A. and Rachman Ibrahim with the title "Development of a hydrocarbon chemistry practicum guide book based on science process skills in high school". The results of the study obtained a validity score of 128 which was included in the very practical category, a practicality score of 1337 which was included in the very practical category, and based on the results of the student's final test showed that this science process skill-based practical guide book had affect potential of 81.21%. The results showed that the chemistry practical manual based on science process skills on the subject of hydrocarbons produced was valid, practical, and had potential effects (Zulaiha et al., 2014).

Based on the background that I have explained, the researcher is interested in conducting research entitled "Development of a Virtual Practicum Module with a Science Process Skills Approach Assisted by Electric Circuit Studio (ECStudio) Applications on Dynamic Electrical Materials.

METHOD

This type of research is quantitative descriptive research, in product development using the ADDIE method which consists of five stages, namely analysis, design, development, implementation, and evaluation. The population used in this study were all students of class XII MAS 4 Medan TP. 2021/2022. The sample of the small class trial as an initial test in the development of the module consisted of 8 students. While the large class trial sample in the study was the implementation of the module with a total of 30 students. The research design used was a design according to the ADDIE research method, namely (1) observation with needs analysis, interviews, and task analysis; (2) designing a virtual practicum module according to the indicators of science process skills on dynamic electrical materials according to the syllabus; (3) the development of a virtual practicum module with an analysis of the feasibility of the material, media, and teacher responses as well as limited trials on students; (4) implementation or application of the modules that have been developed in class XII students of MAS 4 Medan; (5) evaluation of the developed module.

RESULT AND DISCUSSION

Phase Analysis

This stage is carried out to determine the needs of teachers, and determine the development of student learning resources and material limits. In this stage it is divided into several steps:

Needs Analysis

At this stage, the researcher identifies the essential problems faced by students and teachers in learning through interviews and observations at MAS 4 Medan. Based on questionnaires distributed to students and interviews with teachers. Researchers found the essentials that need attention in learning can be seen in Figure 1. and Table 1.

Table 1. Results of Student Needs Analysis

Aspects Of Assessment	Average Percentage (%)
Student interest	74,44
Learning	53,73
Student understanding	56,67

Needs for development	80

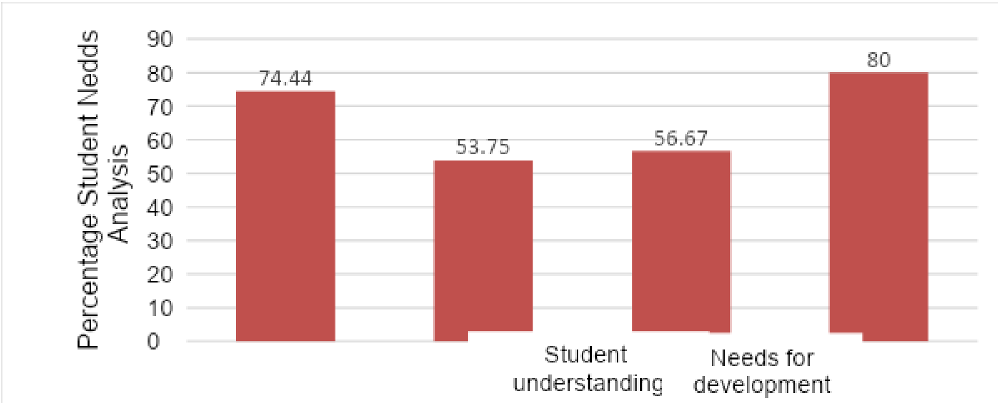

Figure 1. Diagram of Student Needs Analysis

Based on Figure 1 and Table 1 above through the distribution of questionnaires to students and observations made by researchers, it was found that student's interest and understanding in physics learning, especially dynamic electricity material was still low, namely 74.44% and 56.67 % while learning activities using learning models are still 53.75% and the need for module development is 80%. Based on the data, it is known that there is a gap between students' interests and understanding of dynamic electricity. Meanwhile, based on the results of interviews with physics teachers, the following problems are found in table 2.

Table 2. Results of interview analysis

No.	Problems Faced
1.	Practical learning was not carried out during the covid 19 pandemic
2.	Teachers did not find facilities that could support practical activities
3.	The use of teaching materials from publishers but with the KTSP curriculum book series
4.	The modules used cannot be used for learning at this time
5.	Teachers do not understand how to create teaching materials by the needs and circumstances of students

Task Analysis

Analysis was performed on core competence and basic competencies as a reference module development. The results of the task analysis can be seen in Table 3. and Figure 2.

Table 3. Results of Student Need

Aspects of assessment	Average percentage (%)
Form of implementation	55
Usefulness	84,66
Type of work	72
Place and time	68

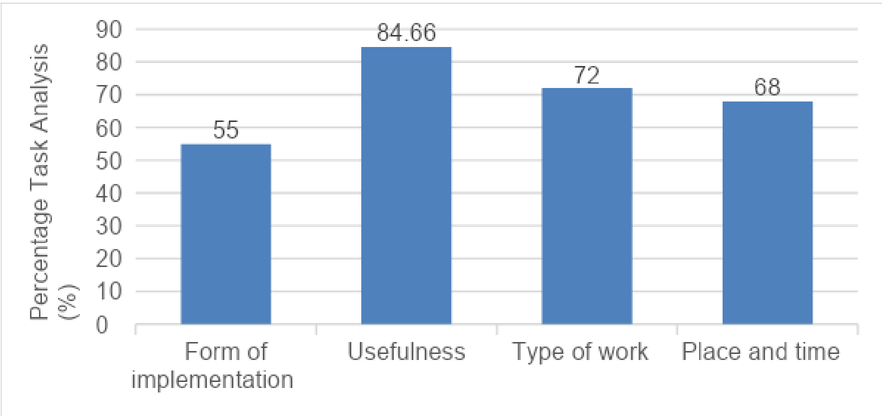

Figure 2. Diagram of the results of task analysis

Based on table 3 and Figure 2 above it is known that the form implementation of tasks is still low with a percentage of 55%. However, for usefulness which is classified as high, namely 84.66%, and for the type of work carried out by students, it is quite high, namely 72%, this shows that the tasks in the descriptor column are rarely carried out by students and for indicators of the place and time of task implementation are also still being done. With a percentage of 68%. This happened because the dynamic electricity material was never given group assignments to students. While the individual assignments given by the teacher only contain evaluation questions and do not help students in solving problems of applying dynamic electricity. By treating the 2013 curriculum which emphasizes learning *scientific,* the module is designed so that students actively construct concepts, laws, or principles through the stages of observing, interpreting, predicting, asking questions, asking hypotheses, designing experiments, identifying tools and materials, applying concepts, and carrying out experiments and communicate.

Stage design

At this stage, the researchers chose the material by the syllabus used in MAS 4 Medan. The material presented and developed in the virtual practicum module with a science process skills approach is the material for class XII dynamic electricity. The next step is to collect material from various accurate sources to enrich the information in the book.

The material contained in the dynamic electric virtual practicum module consists of several chapters including Ohm's law, resistance circuits, and Kirchhoff's law. Then the selection of the preparation of the module used is a science process skills approach. Next, selecting applications based on needs analysis, the researchers used the application *Electric Circuit Studio (ECS studio)* to assist in the preparation of virtual practicum modules with a science process skills approach. *Electric Circuit Studio (ECStudio)* is a set of tools used to build electronic circuits simulation *PSPICE and* circuit calculations.

Module development format on paper type, typeface, and font size. Which is used in the manufacture of dynamic electrical modules with a science process skills approach is A4 (21 x 29.7). The typeface used for the content is "Times New Roman '' with a size of 12 pt and 14 pt. While the types for cover and chapter titles are "Belleza '' and "Open Sans Light" with a size of 40 pt, 18 pt for the size of the introductory text for each chapter. The content of the material power modules dynamically with the approach of science process skills include a preface, table of contents, user guide modules, KI, KD, and learning objectives, as well as a step-by-step process of activity with the approach of science process skills with assisted application *Electric Circuit Studio (ECS*tudio).

Development

Material Expert Validation Results

Validation of the module material aims to determine the subject matter expert assessment of the products developed by the researchers, as the data is then converted into a percent value and then adjusted to the proper or improper criteria. These criteria will be used to improve product quality. The results of material validation are shown in Table 4. and Figure 3.

Table 4. Results Material validation

Aspect of assessment	Average percentage (%)			Average (%)
	V1	V2	V3	
Feasibility of content	77,5	82,5	85	81,67
Feasibility of presentation	82,22	80	84,44	82,22
Average (%)				**81,93**
Interpreted percentage				**Very high**
Validation criteria for percentage analysis				**Valid/feasible**

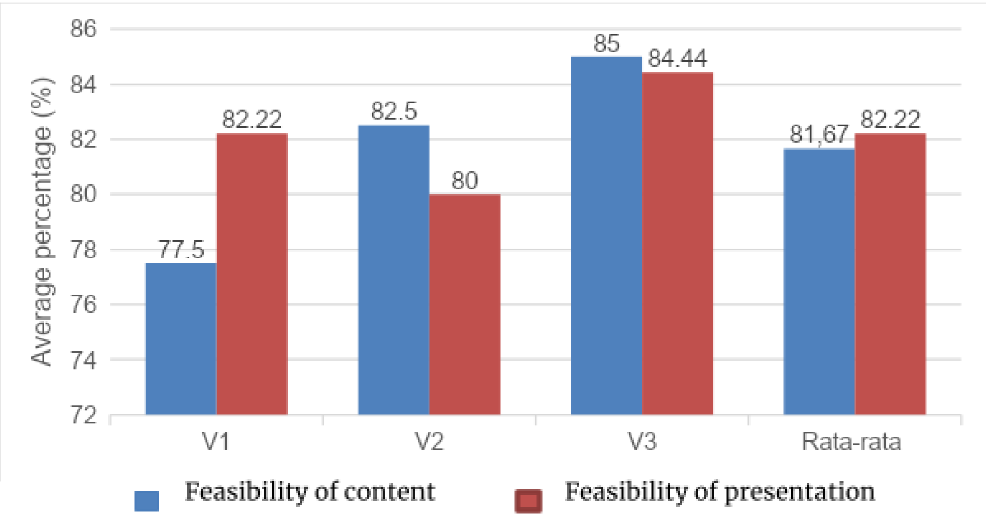

Figure 3. Diagram of the results of material validation

The research for this module was carried out using an assessment sheet in which some aspects should be in the module. 77,5%, in the aspect of the feasibility of presenting 82.25%. The average percentage result by validator I is 79.86%. With a high category and valid/feasible. The results of validation by validator II are 82.5% in the aspect of content feasibility and the percentage of 80% in the presentation feasibility aspect. The average percentage result by validator II is

81.25%. It belongs to the very high category and is valid/feasible. The result Validator III is 85% percentage on the content feasibility aspect, and the percentage 84.44% on the k aspect Feasibility of presentation for the average by validator III is 84.72%. The average percentage result of the three validators is 81.93% with a valid/very feasible category.

Media Expert Validation Results

The results of the assessment are in the form of a useful score as data for evaluation which is then converted into a percent value and then adjusted to the criteria. The criteria for the assessment results of media expert lecturers are used to improve product quality. The results of the validation of the feasibility of the media on the product are shown in Table 5 and Figure 4.

Table 5. Media validation results

Aspect of assessment	**Average percentage (%)**			**Average (%)**
	V1	**V2**	**V3**	
Feasibility of graphics	89	87,27	88,18	88,15
Feasibility of language	86,67	82,22	82,22	83,7
Average (%)				**85,92**
Interpreted percentage				**Very high**
Validation criteria percentage analysis				**Valid/feasible**

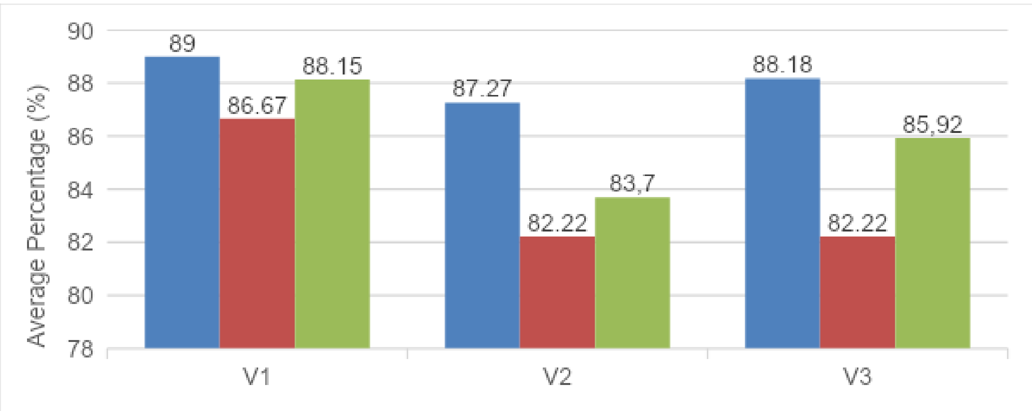

Figure 4. Diagram of material validation results

On module evaluation by validator Media, experts use an assessment sheet in which there are aspects of the feasibility of graphics and aspects of language feasibility. Based on the results of the validation carried out by validator IV, the obtained percentage of 89% in the aspect of the feasibility of graphics, and the percentage of 86.67% on the aspect of the feasibility of the language was. The results of validation by validator V are obtained by the percentage of 87.27% in the aspect of the feasibility of graphics, and the percentage of 82.22% in the aspect of the feasibility of the language. The results of the validation by validator VI the percentage of 88.18% on the aspect of the feasibility of graphics, and the percentage of 82.22% on the aspect of the feasibility of the language. The average percentage result for the three validators is 85.92% with a valid/very feasible category.

Results of Teacher Responses in the Field of Physics Studies

After revising and producing the product declared valid by material and media experts, the product was then given to the teacher to be given a response to the product being developed. The teacher's response serves to obtain information that will be used to improve the quality of the dynamic electrical module that has been developed.

Table 6. Result of teacher response results in the field of physics Studies

Aspect Of Assessment	**Average Percentage (%)**		**Average (%)**
	G1	**G2**	
Feasibility of material	96	92	94
Feasibility of presentation	80	90	85
Feasibility of language	80	80	80
Average (%)			**86,33**
Criteria for interpretation of questionnaire result			**Very interesting**

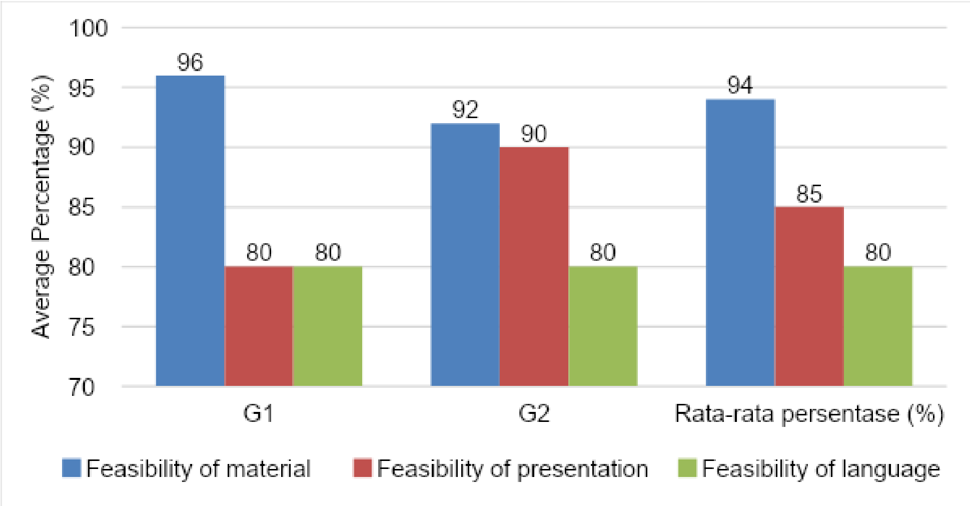

Figure 5. Diagram of teacher response results in the field of physics Studies

Based on the results of the responses of 2 physics teachers, the average percentage is obtained, namely 86.33%, categorized in very attractive qualifications. This proves that the module that was developed and has gone through the validation stage is a module that, if used as a learning resource, is very interesting for students.

Response Results for Small Class

Trials Module testing in small classes was carried out at MAS 4 Medan with as many as 8 people with different levels of ability. The results of the small class responses are shown in Table 7 and Figure 6.

Table 7. The results of trials of small class

Aspect of Assessment	**Average percentage (%)**
Eligibility of material	84,5
Eligibility of display	81,96
Components of SPS indicators	70,5
Benefits	80,83
Average (%)	**80,32**

Interpreted percentage	**Very high**
Criteria validation analysis of the percentage	**Interesting**

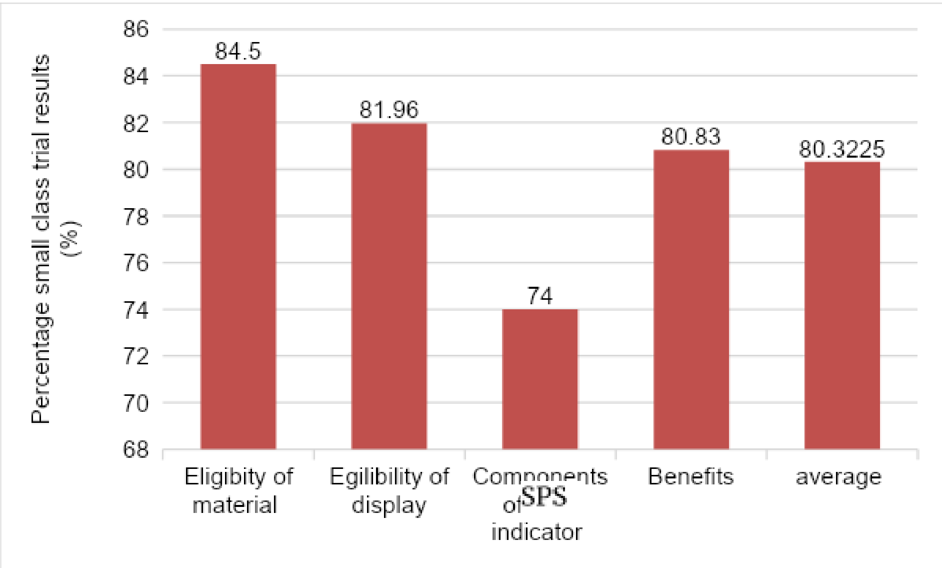

Figure 6. Diagram of small class trial results

Dr. H. Amka, M.Si (2018) There are three types of formative evaluation, namely one-on-one evaluation, small group evaluation, and field evaluation. The one-on-one test stage for 8 students of class XII science with the help of the teacher where the teacher shows the module developed through the social media *WhatsApp group.* Furthermore, students are given a questionnaire or questionnaire through a *google form* to assess the attractiveness of the product, then students are asked to provide an assessment by filling out the questionnaire or questionnaire. The results of the average percentage of the scores of this student questionnaire sheet are 80.32%. This shows that the developed module is very interesting for students.

The trial was carried out in a large class with a total of 30 students by giving a questionnaire that aims to determine student responses to the product developed by the researcher. The results of the implementation are shown in Table 8.

Table 8. The results of the large class trial

Aspect of Assessment	Average Percentage (%)
Eligibility of material	85
Eligibility of display	84,58
Components of SPS indicators	81,75
Benefits	89,33
Average (%)	**85,11**
Interpreted percentage	**Very high**
Criteria validation analysis of the percentage	**Interesting**

Based on Table 8 above, it can be seen that the response to the material feasibility aspect is 85%, the module display feasibility has increased by 2.42% from the small class trial with the acquisition of 84.38%, the SPS indicator component has increased by 7.73% with the acquisition of 81.73 %, and for usefulness, it increased by 8.5% to 89.33% with an average of 85.11%. This indicates that the module developed is very interesting for students and can be used as a source of learning materials.

After getting input and suggestions from expert lecturers with a very decent category, then it is given to teachers and students (small class) to see the response by obtaining interesting response results to the module, and also continuing with large class trials to get a percentage increase in aspects assessment with an attractive category then the product developed has been obtained.

CONCLUSION

Based on the results of the data analysis that has been carried out in this study, it can be concluded that the virtual practicum module has been well structured and made marked by the average percentage of each assessment criteria in a very high criteria range, this indicates that the module is suitable for use in supporting virtual practicum activities. Furthermore, The attractiveness level of the virtual practicum module on dynamic electrical materials with the application of electric circuit studio (ECStudio) based on the teachers and students are very attractive. This shows that the developed module is very interesting for both teachers and students, so it can be used as one of the supporting media in learning.

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