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DEVELOPMENT OF E-MODULE INTEGRATED WITH VIRTUAL LABORATORY ON DYNAMIC ELECTRICITY MATERIALS FOR SCIENCE LEARNING CLASS IX SMP

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ABSTRACT

The objective of this research is to produce an integrated virtual laboratory e-module for teaching dynamic electricity to 9th-grade students in junior high school. The study is categorized as development research, and the output is an e-module that includes a virtual laboratory. The research procedure in this study is guided by the 4D development model which is only limited to the development stage. The effectiveness and usage of the e-module's virtual laboratory are evaluated using quantitative analytical methods. The findings demonstrate that the product satisfies the validity criteria, with a score of 93.12%, and is considered practical based on feedback from students and teachers, with scores of 77.13% and 79.01%, respectively.

Keywords: Electronic Module, Virtual Laboratory, Science Learning

INTRODUCTION

Education is a continuous and never ending process (never ending process), so that it can produce sustainable quality, which is aimed at the realization of a future human figure, and is rooted in the nation's cultural values (Sujana, 2019). Government regulation (PP) number 57 of 2021 states that there are 8 education standards, namely graduate competency standards, content standards, process standards, education and education staff standards, facilities and infrastructure standards, management standards, education financing standards, and education assessment standards.

The 2013 curriculum gives priority to teaching junior high school pupils about science

and nature. In order for students to freely discover scientific concepts, science education is instruction that offers direct, applicable, and student-centered experiences.

Engaging in practicum activities is crucial for enhancing students' abilities in areas such as problem identification, effectively communicating research findings through work reports, and gradually becoming more adept in utilizing laboratory equipment. As a result, practicum activities have a significant role to play in the realm of science education. Learning science is the most effective way to achieve learning objectives. Experiential learning is crucial in scientific education as it helps students acquire the necessary skills to be honest, meticulous, and absorb the knowledge provided (Novitasari et al., 2017).

There are two main problems in scientific education: insufficient facilities for conducting experiments and ineffective learning materials. Teachers report that the focus is more on theoretical learning rather than practical application, and they often face obstacles in accessing necessary resources. In Sungai Penuh City, we gathered feedback from multiple sources at a school and found that the science curriculum was ineffective due to a lack of autonomy given to teachers and a lack of interest from students.

Practicum activities need to furnish students with chances to implement scientific approaches and participate in practical exercises that enhance comprehension of scientific concepts and cultivate innovative thinking. Due to the obstacles encountered in conventional laboratory setups, it is vital to include electronic modules linked to virtual laboratories as instructional aids to support hands-on activities.

E-modules refer to online learning tools that include various resources, assessments, and evaluations for self-directed learning purposes (Syahiddah et al., 2021). Developing an integrated virtual laboratory e-module is a potential solution to address the challenges of teaching natural sciences in schools. A virtual laboratory offers an interactive environment to conduct simulated experiments (Aripin & Suryaningsih, 2020).

The laboratory functions as a place that is equipped with simulation tools and materials to carry out observations and experiments with or without internet access so that it does not require face-to-face meetings with the teacher (Adi et al. 2015). This supports independent and effective learning to overcome the problem of lack of time allocation in learning.

Incorporating a virtual laboratory into e-learning courses enables self-directed learning, which is advantageous for students with limited study time. A virtual lab provides access to a wide range of equipment, such as measuring devices, cameras, microphones, electrical circuits, and chemical processes, from a remote location. (Jaya, 2012). The e-module's interactive components, such as graphics, animations, and simulated practicum assignments, allow students to independently enhance their learning. Developing an integrated virtual laboratory e-module is a promising solution to address this educational challenge.

The researchers carried out the study entitled "Development of E-Module Virtual Laboratory Integrated Dynamic Electrical Materials for Class IX Middle School Science Learning" to create a dependable and valuable virtual laboratory module that is suitable for use by 9th-grade junior high school students.

METHOD

This research is a design research and development, using development Four-D model. According to Thiagarajan (1974) the 4D development model consists of define, design, develop and disseminate. However, in this study it was limited to 3 stages, namely define, design,

and develop. The product resulting from this research is an integrated virtual laboratory e-module on dynamic electricity material for science learning for class IX in junior high school. The 4D development paradigm was employed, involving three key stages of defining, designing, and developing.

In order to collect data, the teaching team at the Department of Natural Sciences in FMIPA UNP designed a validation questionnaire and practicum sheets for instructors and 9th-grade students. The study followed a systematic procedure that entailed establishing learning goals, performing a definition phase analysis (which included basic, student, concept, and task analyses), selecting appropriate resources, and designing the format and template. The third stage involved producing the e-module. The validity analysis results were calculated using the formula:

$$\text{Validity} = \frac{total\ score\ obtained}{highest\ total\ score} x100\% \quad (1)$$

With the following eligibility criteria:

Table 1. Validity Criteria

Validity Value	Information
90%-100%	Very Valid
80%-89%	Valid
65%-79%	Valid Enough
55%-64%	Invalid
≤54%	Totally Invalid

(Lestari et al. 2018)

Additionally, the results of the practicality analysis are calculated using the method below:

$$\text{Practicality} = \frac{total\ score\ obtained}{highest\ total\ score} x100\% \quad (2)$$

With practical criteria as follows:

Table 2. Practicality Criteria

Practical Value	Information
86%-100%	Very Practical
76%-85%	Practical
60%-75%	Pretty Practical
≤54%	Very Impractical

(Lestari et al. 2018)

RESULTS AND DISCUSSION

This project aims to create an e-module that highlights dynamic electrical content and integrates a virtual laboratory, specifically tailored for 9th-grade students in junior high school.

1. Defining Stage

Following a preliminary study of the course material by the instructor, the students will analyze the data in further depth. The instructor will then carry out a content analysis with a focus on the particular topic being taught. The instructor will create learning objectives in accordance with the findings of the analysis. The initial step of the investigation shows that the curriculum and reliable literature are the main learning resources for instructors in 2013. Alternative learning methods must be taken into consideration if utilizing printed books does not aid students in comprehending the course material or in completing assignments that adhere to the 2013 curricular requirements.

Additionally, neither the electronic modules offered in the virtual laboratory nor the conventional printed teaching materials are successful in piqueing students' interest in studying dynamic electricity. Even though scientific education can be difficult owing to its abstract character, which causes a drop in students' interest in the topic, lecturing is a typical teaching style.

Additionally, it is clear from the students' analysis phase that they have difficulty with independent learning as a result of their weak reading comprehension abilities and a dearth of learning support materials. Therefore, it is crucial to offer online courses that let students study wherever they choose, freely.

According to what was discovered during the analysis stage, the three essential elements of dynamic electricity are electric current, electrical conductivity, and electric circuit. Task analysis was conducted to determine the most effective system for organizing educational activities and to facilitate understanding of the steps necessary to acquire a new skill. The learning objectives were refined into more appropriate targets through an analysis of the basic competencies (KD).

2. Design Stage

The planning stage encompasses preliminary preparations and the selection of suitable media and formats. Canva, Microsoft PowerPoint 2019, and Flip PDF Business Edition were utilized to create the integrated virtual laboratory e-module. For 9th-grade junior high school students' KI, KD, and grades, the curriculum design procedure involves choosing dynamic electrical materials and establishing criteria for success. Additionally, educational resources such as e-modules with built-in virtual laboratories were intended to be used as instructional tools.

The integrated virtual laboratory module's initial design, which includes elements like the cover, prologue, table of contents, instructions on how to use the program, study techniques, concept maps, learning materials, worksheets, quizzes, exercise sheets, assessments, and bibliography, was created after the format and medium were decided upon.

3. Development Stage

In this phase, the focus is on developing the integrated virtual lab e-module based on the previous blueprints that were created using the Flip PDF Corporate Edition tool. The goal is to provide an interactive online learning tool that is specifically tailored for the high school class IX curriculum.

A validity test was performed by three professors from the Science Education Study Program at FMIPA UNP to evaluate the precision and appropriateness of the e-content, language, presentation, and graphics of the integrated virtual laboratory module. The outcomes of the validity test are presented in the following table.

Table 3. Validity Test Results

Aspect	Evaluation	Category
Content Eligibility	94.17%	Very Valid
Language Eligibility	91.67%	Very Valid
Appropriate Presentation and Graphics	93.52%	Very Valid
Average	**93.12%**	**Very Valid**

The results of the validity test, which achieved an average score of 93.12%, indicate that the e-module falls within the high validity category and is suitable for use.

The data collected from the student feedback survey, which was used to select the practicum test, is presented in the subsequent table.

Table 4. The Practice Test Results are Calculated Using the Students' Answers to the Questionnaire.

Aspect	Evaluation	Category
Ease of Use	79.50%	Practical
Learning Time Efficiency	74.38%	Pretty Practical
Benefit	77.50%	Practical
Average	**77.13%**	**Practical**

The practicality category was evaluated using a survey of student responses, which yielded an average score of 77.13%. The practicality test results were also determined using the data from a survey of teacher responses, as shown in the following table.

Table 5. Results of Practice Exams Determined by Teachers' Responses to Questionnaires

Aspect	Evaluation	Category
Ease of Use	89.19%	Practical
Learning Time Efficiency	75.00%	Pretty Practical
Benefit	76.85%	Practical
Average	**79.01%**	**Practical**

The outcome of the evaluation indicates that the practicality value of the practical category, which is 79.01%, is incorporated.

This means that from the aspect of content feasibility, the material in the e-module is in accordance with the demands of the Core Competencies (KI) and Basic Competencies (KD) which are translated into learning indicators. The valid criteria for the eligibility of the content in the e-module also show the correctness of the substance in the e-module which is correct (Aprilia and Suryadarma, 2020).

From the aspect of linguistic feasibility, the developed e-module is very valid which shows that the language used is clear (does not create confusion) and the sentences used are effective. The language used is clearly and effectively presented in the e-module which will make it easier for students to learn (Afriyanti et al., 2021). From the feasibility aspect of presentation and graphics, it can be concluded that the developed e-module is very valid, which means that the presentation component of the e-module contains clear indicators and learning objectives, the design of the e-module is attractive, the layout of each component of the e-module is good and interestingly, the material in the e-module is also presented in full according to the sequence of indicators developed and the clarity of the indicators and learning objectives will help students so that student learning becomes directed (Komikesari et al., 2020).

CONCLUSION

The integrated virtual laboratory e-module with dynamic electricity content for junior high school science class IX was deemed highly valid and suitable for use, as it obtained a score of 93.12% on the validity scale by expert validators. Furthermore, based on the practicality test results, both students (77.13%) and teachers (79.01%) gave the e-module extremely high practicality ratings.

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