



## **PRACTICUM E-MODULE DEVELOPMENT TO IMPROVE DISTANCE LEARNING EFFICIENCY IN BASIC PHYSICS COURSES IN THE PANDEMIC PERIOD**

Metatia Intan Mauliana<sup>1</sup>, Noly Shofiyah<sup>2</sup>, Yunianita Rahmawati<sup>3</sup>, Khoirun Nisa<sup>4</sup>

<sup>1,2,3</sup>Universitas Muhammadiyah Sidoarjo

<sup>4</sup>IKIP Budi Utomo Malang

Email: [metatialiana@umsida.ac.id](mailto:metatialiana@umsida.ac.id)

### **ABSTRACT**

The Covid-19 pandemic has a broad impact on all sectors, including the education sector. Almost all learning from elementary to tertiary level (university) which was originally face-to-face has turned into distance learning (PJJ) or online. This study aims to see the effectiveness of online learning, especially in exact subjects. For example, in learning Basic Physics which has practical aspects, there are several problems during the pandemic, such as, 1) the limitations of the face-to-face implementation of the Basic Physics practicum during the pandemic, 2) the limitations and inconsistencies of conventional modules used in practicum implementation in distance education, and 3) The use of a Content Management System (CMS) in e-learning that has not been maximized is an obstacle that requires immediate handling. Therefore, the researcher tried to develop a practicum e-Module using the Research & Development research method with the Rowntree development model collaborated with the Tessmer evaluation model. The results obtained in the study showed an increase in student positive motivation in doing independent practicum with the help of e-modules. The resulting E-module development can be said to have met the practical criteria, shown from the recapitulation of the percentage results of the questionnaire sheet assessment at the one-to-one stage of 84.66% and the small group stage of 78.22%. The validation results by the validator on the material, media, design and accessibility aspects are on average >80%. So that the feasibility of the e-module that has been made is quite good and feasible to be applied.

**Keywords:** *e-Module, practicum, Basic Physics*



This work is licensed under Creative Commons Attribution License 4.0 CC-BY International license

## **1. INTRODUCTION**

### *1.1. Introduction*

The Covid-19 pandemic has a broad impact on all sectors. This includes the education sector and people's lifestyle. The most striking changes can be seen from the adjustment of social life and the teaching and learning process. Changes in the learning model that was originally face-to-face turned into online or distance learning (PJJ). Online learning makes students learn independently and requires educators to make various adjustments to learning methods and skills

to support full online learning. Most universities have provided a Learning Management System (LMS) component which is sufficient to support the online system. University of Muhammadiyah Sidoarjo (UMSIDA) itself has a Modular Object-Oriented Dynamic Learning Environment (Moodle) as an e-learning facility to support online learning. Moodle is an application program as an alternative to web-based and pedagogical learning media using a content management system (CMS).

Various online learning methods are an alternative for students and educators to continue to carry out the process of teaching and learning activities both theoretically and practically (Jamwal, 2012; Kobayashi, 2017). However, in learnings exact and engineering subjects that have practical aspects, of course online learning is still deemed less effective when compared to face-to-face methods. For example, in Basic Physics learning which has practical aspects. During the pandemic, several problems such as, 1) the limitations of the implementation of the Basic Physics practicum face-to-face during the pandemic, 2) the limitations and inconsistencies of conventional modules used in the implementation of practicum in distance education, and 3) the use of Moodle e-learning that has not been maximized is a problem which requires immediate treatment. In addition, one of the important problems often faced by educators in online learning activities is determining the appropriate teaching materials or learning materials so that learning competencies are achieved.

Teaching materials are one component of the learning system that plays an important role in helping to achieve Competency Standards and Basic Competencies or predetermined learning objectives (Khoiro, 2015). One part of the teaching material is a module. Changing the face-to-face learning system into PJJ certainly requires adjusting the appropriate and efficient learning module. The use of conventional modules in online learning such as in basic physics courses that have practical aspects will certainly be less effective. So it is necessary to develop a module that is in accordance with the current conditions, namely the electronic module (e-module). E-module is one of the teaching materials that is presented systematically so that its use can be studied with or without a facilitator or teacher / lecturer (Prastowo, 2011). The component of e-module composing media that is often used, especially in exact subjects such as Basic Physics, is phet simulation. Phet has several advantages, namely supporting interactive learning, being able to provide dynamic feedback, and supporting constructivism teaching with interesting animations Finkelstein (2006). However, there are also disadvantages, namely: 1) The materials available in the phet simulation are still limited to certain topics, 2) Lack of experience in operating virtual laboratory simulations so that time is wasted explaining how to use them (Rasyidah et al, 2018), 3). The success of virtual laboratory assisted learning depends on independence in following the learning process, 4) the form of simulation is standard, and other variables cannot be added or subtracted.

### *1.2. Research questions*

The research question in this study is how to develop an interesting and interactive practicum e-module that can be used and adapted during distance education due to the covid-19 pandemic?

### *1.3. Significance of the study*

In this study, researchers developed an E-Practicum Module where the preparation technique used the information repackaging technique (Sungkono, et al, 2003). Information Repackaging, where the author does not write the module himself, but makes use of text books,

applications and information that are already on the market to be repackaged into modules that meet the characteristics of a good module. In the e-module that will be created, a virtual laboratory phet will be combined, equipped with appropriate worksheets to make it easier for students to operate and understand how work should be done systematically, besides being equipped with a video tracking analysis application and an interactive video practicum where the whole series is will be systematized and linked to Moodle e-Learning which is available at UMSIDA. The tethering to existing E-Learning facilities is intended to make it easier for students to apply because they are familiar with existing programs. The e-module development is also emphasized so that it can be applied by all educators even with non-IT backgrounds,

## 2. METHOD

### 2.1. Research Design

This study uses the Research & Development method. Research and development (R&D) is a step to develop a new product or improve an existing product and test its effectiveness. The type of R&D applied is the Rowntree development model (Sugiyono, 2011). The Rowntree development model consists of 3 stages, namely the planning stage, the development stage, and the evaluation stage. (Prawiradilaga, 2009). The Rowntree model has a non-compliance with product evaluation so that this research will collaborate with Tessmer's formative evaluation (Wijaya, 2019). The research was conducted at the Faculty of Science and Technology, Industrial Engineering Study Program, Muhammadiyah University of Sidoarjo (UMSIDA). Subjects in research at the one to one and small group stages were Industrial Engineering students who had taken Basic Physics courses. There were slight adjustments that were adjusted to the context of the study, so that this study was limited to the small group test stage. The flow of this research design can be seen in the following figure.

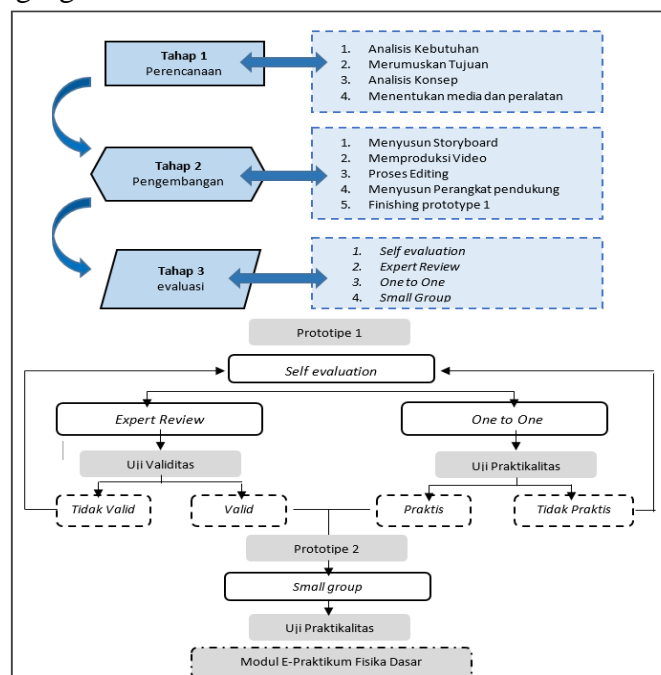


Figure 1. Flow of Research Stages

Based on Figure 1. The research stages are grouped into the planning stage, the development stage, and the evaluation stage. The descriptions of these stages are as follows, (1) The Planning Stage consists of several activities, namely Needs Analysis, Formulation of Objectives, Concept Analysis, Determination of Media and Equipment, (2) The Development Stage consists of Storyboard Compilation, Video Production, Editing Process, Device Arrangement supporting, and Finishing prototype-1, (3) Evaluation phase consisting of self evaluation, Expert Review, One to One, and Small Group. Evaluation of educational media according to Arief S. Sadiman (2006) can be grouped into two types, namely formative evaluation and summative evaluation. Formative evaluation is a process intended to collect data on the effectiveness and efficiency of the media to achieve set goals. The data is intended to improve and perfect the media concerned so that it is more effective and efficient (Sungkono, 2003). The Tessmer evaluation that was applied to this study was included in the formative evaluation, in general, each stage was described as follows,

- a) Self-evaluation, at this stage the researcher self-evaluates the interactive electronic module draft that has been developed before being validated by a team of experts and product trials
- b) Expert evaluation (expert reviews), the draft e-practicum module was tested on 3 experts. Expert validation is carried out to test the validity level of the e-module being developed. Expert validation is carried out by asking for suggestions and comments from experts regarding the indicators to be assessed through a questionnaire.
- c) One-to-one (one-to-one) evaluation, one-on-one evaluation is carried out in conjunction with expert evaluation. This evaluation is carried out to measure the level of practicality of the interactive electronic module being developed. At the time of testing, 2 students were selected who have different levels of ability (low and high).
- d) Small group evaluation (small group), small group evaluations were also carried out to measure the level of practicality of the interactive electronic modules being developed, but the implementation time was carried out after one-on-one evaluations.

## *2.2. Samples/Participants*

In this study, the sample was obtained from second semester students who took the second basic physics course at the Muhammadiyah University of Sidoarjo.

## *2.3. Instruments and Data analysis*

The data collection technique that will be used in this research is to use a questionnaire or questionnaire. The data collection technique is done by giving a set of questions or a written statement from the respondent to answer. The type of questionnaire used in this study is a check list type questionnaire in the form of a Likert scale. The Likert scale used is the positive statement Likert scale, where the numbers 5, 4, 3, 2, and 1 are the weight of the statement from the biggest point 5, namely strongly agree / conform, the weight of point 4 is agree / appropriate, the weight of point 3 is sufficient, the weight point 2, namely disagree / appropriate and the smallest point weight is 1, namely strongly disagree / conform to the statements in the questionnaire given, then averaged and percentage

## **3. FINDINGS AND DISCUSSION**

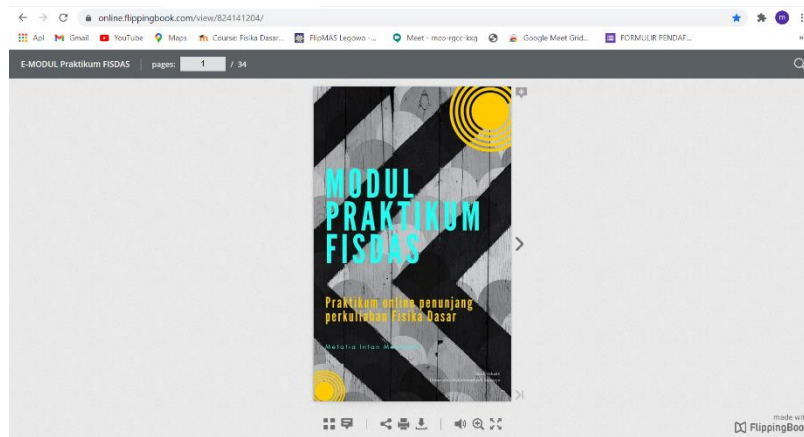
The results of research on the development of practicum e-Module in Basic Physics Subjects in UMSIDA Industrial Engineering use the Rowntree development model. According to the Rowntree model, this development research consists of the Planning, Development and

Evaluation stages. In the evaluation stage, the developed electronic module teaching materials will then be tested for validity by several experts including media experts, material experts, then tested on students to see their practicality. In more detail, each stage of development is described as follows,

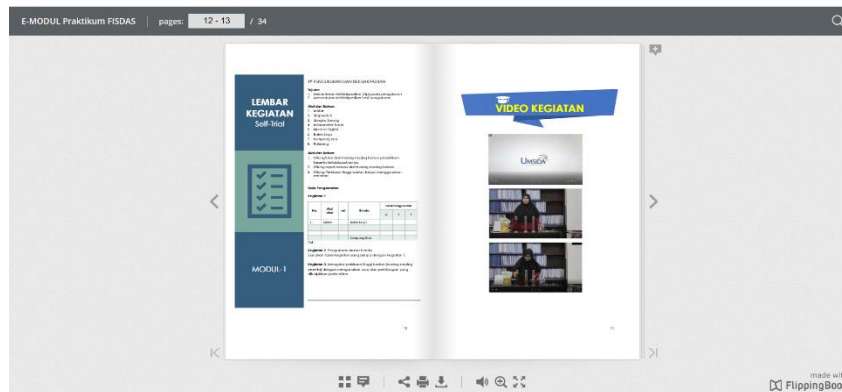
(1) Planning Stage,

The planning stage is the initial stage in this development research. At this stage the researcher carries out a Needs Analysis, Objectives Formulation, Concept Analysis, Determination of Media and Equipment. In needs analysis, namely in the form of material analysis and syllabus to find out basic competencies that require e-module assistance in achieving learning objectives. Based on the results of the syllabus analysis, several practicum titles were identified that can be developed in the form of a virtual lab on the e-module. The titles of the practicum used in the development of this e-module are Measurement Uncertainty, Newton's Law, Fluid Statistics, and Ohm's Law. Furthermore, the results of the analysis of learning objectives are carried out after conducting a needs analysis. The formulation of learning objectives consists of identifying basic competencies and practical goals to be achieved. In the concept analysis section, adjustments to the type of media that will be used are screened so that the formulation of goals that have been made can be fulfilled.

(2) Development Stage, The development stage consists of Storyboard Compilation, Video Production, Editing Process, Supporting Equipment Arrangement, and Prototype-1 Finishing. The results of this development stage, the researcher carried out media development on 4 predetermined practicum materials. The four modules that will be developed into an e-module each have different media types. Media selection is based on basic competencies and practicum objectives to be achieved. At the stage of making and compiling the storyboard, materials will be included in the e-module, both in the form of theory and software that will be used. In the Uncertainty of Measurement and Fluid statistics module, interactive video media are used where students can observe and record data trying to participate in the activities being demonstrated. Therefore the next process is related to video creation and editing. Whereas in the Newton Law e-module, a video tracking analysis application media is given, where students are invited to play an active role in making motion-type videos then analyze them, and finally for the Ohm's Law module, the Virtual Lab Phet media is used which is accompanied by supporting tools in the form of instructions for use and practicum to make it easier. Students perform experimental simulations independently. The entire series is arranged systematically and linked to the UMSIDA LMS into e-modules Prototype 1 and 2. The e-module display is shown in Figure 2 below,



(a)



(b)

Figure 2. Display (a) Cover of e-module and (b) Snippet of Activity Sheet from one of the practicum in the module

(3) Evaluation Stage, The evaluation stage consists of self evaluation, Expert Review, One to One, and Small Group. The overall results of the evaluation phase are described as follows, self evaluation, self-assessment of the prototype psychomotor assessment instrument. If it is considered correct, correct and sufficient, it can be continued at the next evaluation stage. Expert Review, the e-module Prototype 1 that has been devised and deemed sufficient, is then carried out validation based on material validation and media validation by involving relevant lecturers. In this step, prototype 1 is shown to physics education lecturers and media experts, after the lecturer sees and examines the e-learning assisted by the virtual laboratory, the lecturer is given a validation sheet to assess the feasibility of the e-module that has been developed. Data that has been obtained through questionnaires by media experts, material experts and students in the form of quantitative values will be converted into qualitative values. The results of the recapitulation of the validation assessment can be seen in Table 1 below.

Table 1. Results of Expert Validation on Prototype Products

Aspect of Validation	Evaluation (%)	Category
Material	86,0	Valid
Media	89,1	Valid
Accessibility	88,7	Valid

Descriptive analysis was performed with the following calculations: Percentage of eligibility (%) = score observed / expected score x 100%. According to Arikunto (2010: 35), quantitative data in the form of calculated or measured figures can be processed by adding up, compared to the expected amount and the percentage obtained. In addition to the above criteria, comments and criticisms are also obtained to the validator as input revisions for the product at a later stage. The recapitulation of validator comments is shown in Table 2.

Table 2. Results of the validator's comments on the E-module Prototype

Validator	Comments
Validator 1	To be unified and interactive, it is better if the learning video is linked to the e-module
Validator 2	Good. Maybe it can be improved with many case studies and the colors of each material to make it even more interesting to read. Currently, it is very difficult to cultivate students' interest in reading, one of which is indeed having to rely on colors, pictures, and case studies that are attractively packaged.
Validator 3	It is better if videos and other media can be included in the module as well.
Validator 4	It's good enough, maybe the material can be added so that it's not only four

One to One, one-on-one evaluation is carried out in conjunction with expert evaluation. At the time of testing, 2 students were selected who have different levels of ability (low and high). The selection of students is one basic physics school and one ordinary student who has taken Basic Physics courses. The one-on-one evaluation aims to see the practicality of virtual laboratory assisted e-learning, identify and reduce real errors in the use of language contained in the developed virtual laboratory assisted e-learning (Agustine, 2014). In practice, students access e-modules that are already in e-learning and then try to open each material provided independently. After students have finished accessing and trying, the researcher gives a questionnaire to find out the strengths and weaknesses of the e-module being developed. The results of the recapitulation of the average percentage of the practicality questionnaire assessment at the one to one stage amounted to 84.66% so that it can be said to be included in the very practical category.

Small Group, at this evaluation stage the researcher conducted an e-module test on 12 students. With my pattern with one-on-one evaluations, where students are given time to access the e-module then after completing the practicum each student will be given an assessment questionnaire.

Table 3. E-module reliability test data for basic physics practicum

<b>Scale Reliability Statistics</b>			
	<b>mean</b>	<b>sd</b>	<b>Cronbach's <math>\alpha</math></b>
scale	3.911	0.255	0.888

The response value that has been obtained is then tested reliability to determine the accuracy of a questionnaire instrument (Widodo, 2006). The results in Table 3. shows the reliability value using the Cronbach's alpha test for all aspects. The reliability value or internal coefficient  $> 0.7$  indicates that the questionnaire used can be trusted (reliable) (Yusup, 2018). Taber (2018) groups values reliability in more detail, namely the range of values 0.93–0.94 (excellent), 0.91–0.93 (strong), 0.84–0.90 (reliable). Overall, this states that the basic Physics practicum e-module can be used as online learning media. The results of the recapitulation of the average percentage of the practicality questionnaire assessment at the one to one stage amounted to 84.66% so that it can be said to be included in the very practical category. The average percentage value of the practicality questionnaire statement at the small group stage was 78.22%, the result of the e-module practicality value can be said to be included in the practical category.

## 4. CONCLUSIONS

### 4.1. Conclusion

The conclusion from the research results shows that there is a positive interest in the use of e-modules compared to conventional modules. This is indicated by the percentage score of experts on the material aspect of 86.0%, the media aspect of 89.1%, and the accessibility aspect of 88.7%. The resulting E-module development also fulfills practical criteria, as indicated by the percentage results of student questionnaire assessments who do online practicum in the one-to-one stage of 84.66% and in the small group stage of 78.22%. Based on the results of the overall evaluation, it can be concluded that the developed E-module is more efficient and practical than conventional modules.

### 4.2. Suggestions

The suggestion of this research is to improve the quality of the interactive videos made and add more case studies to be developed. If it is continued, it should be upgraded in the form of applications and more practical materials can be added in the future.

## REFERENCES

Arikunto, S. (2010). *Prosedur Penelitian: Suatu Pendekatan Praktik*. Jakarta (Indonesia): Rineka Cipt.



- Prastowo, Andi. (2011). *Panduan Kreatif Membuat Bahan Ajar Inovatif; Menciptakan Metode Pembelajaran yang Menarik dan Menyenangkan*. Jogjakarta: DIVA Pers.
- Sungkono, dkk. (2003). *Pengembangan Bahan Ajar*. Yogyakarta: FIP UNY.
- Sugiyono. (2011). *Metode Penelitian Kuantitatif Kualitatif dan R&D*. Bandung: Alfabeta.
- Agustine, dkk. (2014). Pengembangan E-Learning Berbantuan Virtual Laboratory Untuk Mata Kuliah Praktikum Fisika Dasar Ii Di Program Studi Pendidikan Fisika Fkip Unsri. *Jurnal Inovasi dan Pembelajaran Fisika Vol.1 No 1:33-42*.
- Finkelstein, et.al. (2006). High-tech Tools for Teaching Physics: The Physics Education Technology Project. *MERLOT Journal of Online Learning and Teaching*. Vol (2) No 3:110-121.
- Jamwal, Goldee. (2012). *Effective use of Interactive Learning Modules in Classroom Study for Computer Science Education*. All Graduate Plan B and other Reports. Paper 225. P.1-75
- Kobayashi, Michiko. (2017). Students' Media Preferences in Online Learning. *Turkish Online Journal of Distance Education-TOJDE*. July 2017 18(3), ISSN 1302- 6488.
- Khoiro, T. (2015). *Pengembangan Dan Uji Kelayakan Modul Pembelajaran Microsoft Access 2010 Sebagai Bahan Ajar Keterampilan Komputer Dan Pengelolaan Informasi Untuk Kelas Xi Smk Negeri Bansari [Skripsi]*. [Yogyakarta (Indonesia)]: Universitas Negeri Yogyakarta.
- Rasyidah, Khofifatul.. Supeno., Maryani. (2018). Pengaruh Guided Inquiry Berbantuan Phet Simulations Terhadap Hasil Belajar Siswa Sma Pada Pokok Bahasan Usaha Dan Energi. *Jurnal Pembelajaran Fisika*, Vol. 7 No. 2:129-134.
- Taber, K.S. (2018). *The use of cronbach's alpha when developing and reporting research instruments in science education*. *Res Sci Edu.*, 48:1237-1296.
- Wijaya, J.E, Vidianti A. (2019). Pengembangan Bahan Ajar Modul Elektronik Interaktif Pada Mata Kuliah Inovasi Pendidikan Program Studi Teknologi Pendidikan Universitas Baturaja. *Jurnal Pendidikan Glasser*. Vol.3 No.2:142-147.
- Yusup, F. (2018). Uji validitas dan reliabilitas instrumen penelitian kuantitatif. *Jurnal Tarbiyah: Jurnal Ilmiah Kependidikan*, 7(1):17-23.