

Design of Business and Energy-Based E-Module Problem solving

Rini Lestari ¹, Derlina ², Rita Juliani ³, Nurdin Bukit ⁴, Abd. Hakim ⁵, Sahyar ⁶

{ rinidalimunthe16@gmail.com ¹, derlina.nst@gmail.com ² and ...@gmail.com ^{3,4,5,6} }

Postgraduate Physics Education Study Program, State University of Medan, 20221, Indonesia ¹, Department of Physics, Faculty of Mathematics and Natural Sciences, State University of Medan, 20221, Indonesia ², Department of Physics, Faculty of Mathematics and Natural Sciences, State University of Medan, 20221, Indonesia ³, Department of Physics, Faculty of Mathematics and Natural Sciences, Medan State University, 20221, Indonesia ⁴, Department of Physics, Faculty of Mathematics and Natural Sciences, Medan State University, 20221, Indonesia ⁵, Department of Physics, Faculty of Mathematics and Natural Sciences, Medan State University, 20221, Indonesia ⁶

Abstract. Study this aim for knowing design and results validity from e - module design work and energy based *problem solving* . Study this is e- module design effort and energy validated by 1 media expert for evaluate appearance and suitability of e - modules , as well as 1 expert Theory for evaluate depth the contents of the designed e - module which is lecturer at Medan State University . Instruments used _ in study this is questionnaire validation media expert and questionnaire validation expert material . Results obtained from aspect designed validity _ from input media expert obtained average score 88.3 % in _ category very worth and for evaluation expert Theory average score 90.5% in category very worth . Based on results study concluded that e- module work and energy based designed problem *solving* is valid.

Keywords: Design , e- module effort and energy , *problem solving*

1. Introduction

In the era of the industrial revolution 4.0, there was rapid development in the field of technology in various countries including Indonesia itself. Time has pushed everything to change. Now everything has changed, including the world of education. The development of an all-digital world has made the world of education immersed in digitalization. One thing that cannot be denied from the world of Indonesian education is that the mastery of the material by Indonesian students is still low. It can be seen from the results of PISA that the skills and abilities of students in Indonesia are still relatively average [2]. From the results of the scientific capability assessment conducted by the PISA team in 2018, Indonesia is ranked 71 out of 79 participating countries [3]. In other words, learning is needed that is able to improve problem solving skills, one of which is *problem solving learning*. To support *problem solving learning* carried out in the era of industrial technology 4.0 and in this pandemic era, teaching materials are needed . One of the teaching materials that is often used in applying the *problem solving model* is the module. Several studies have shown that *problem solving -based modules* are practical and

effective in teaching physics such as static fluids [4]. Teaching materials in the form of modules are still available in printed form so that they can be developed into e-modules (*electronic modules*).

Module is prepared teaching materials themselves by educators whose purpose is for make it easy participant educate learn Theory lesson by independent. In the world of education, there are 2 types the developed modules, namely module electronics and modules print. Use module electronics and print based on analysis problems and needs students. Well module electronic nor module print very needed as innovation learning for student. Especially needs module electronic based computerized for answer needs generation millennials [5]. E-modules can contain information in the form of videos, animations, diagrams, and texts so that students can understand more deeply the material being studied [6]. The advantages of applying these teaching materials are that they can be accessed easily, costs are more affordable, study times are flexible, and have broad insights. Then students need to be allowed to improve their understanding of the material by working by formulating procedures, analyzing results, and making decisions independently. Due to current conditions, the COVID-19 pandemic has affected the education sector. The government decided that the implementation of learning in schools was shifted to online *learning*.

This online learning will remain effective even though educators and students are in different places [7]. Online learning is defined as a knowledge transfer experience using video, audio, images, text communication, software [8], so it takes an electronic-based teaching materials such as electronic modules (e-modules). One of the subject matter in the 2013 curriculum that effectively uses e-module in the learning is work and energy.

Work and energy are materials that are quite difficult to understand [9]. This is in line with the research that has been done previously, that in 68 students, the results obtained the average value of students is 50.65 with the minimum value is 35.56 and the maximum is 57.78. The value of students who are still below 75 can be said to be classified as low [9]. In this material, students are required to be able to understand and analyze the concepts in the work and energy material. Based on the results of interviews with teachers obtained by researchers that in learning physics, teachers tend to only use worksheets and *powerpoints* which have not been able to facilitate students to think at a higher level. Students also think that physics is a boring lesson because teachers only use unattractive worksheets so there is a lack of skills and interaction between teachers and students [10]. So we need an electronic-based teaching materials that are integrated with student learning models, especially on business and energy materials. Therefore, to support *problem solving-based learning*, especially on business and energy materials as well as the use of technological advances and support online learning, the researchers proposed an idea in this study with the research title "Design of Business and Energy-Based E-Module Problem solving."

2. Method

Study this implemented in April 2022 until with May 2022, while at the stage composing report carried out in May 2022. Making e-module product work and energy, based on *problem solving*, combine all existing material. _ has made start from design, material, animation, drawing support, simulation videos and follow stages science process skills and mastery Theory students.

Product will validated by 1 media expert for evaluate appearance and suitability of e - modules , as well as 1 expert Theory for evaluate depth the contents of the designed e - module which is lecturer at Medan State University .

Questionnaire for media expert and expert Theory used as guidelines in repair and refinement product . Validation result expert then customized with criteria validation in Table 1 [11].

Table 1. Validation Test Percentage

Scale	Percentage	Category
4	76% - 100%	Very Valid
3	51% - 75%	Valid
2	26% - 50%	Less Valid
1	0% - 25%	Invalid

3. Results and Discussion

3.1. E-Module Design

The initial design of teaching materials in the form of e-modules was compiled using module elements according to the Ministry of National Education, so that an initial design was produced, namely *cover* , preface, table of contents, list of pictures, list of tables, learning instructions for teachers and students, competencies to be achieved , content of materials, work instructions/procedures, worksheets, exercises, and evaluation sheets. The resulting initial design is as follows:

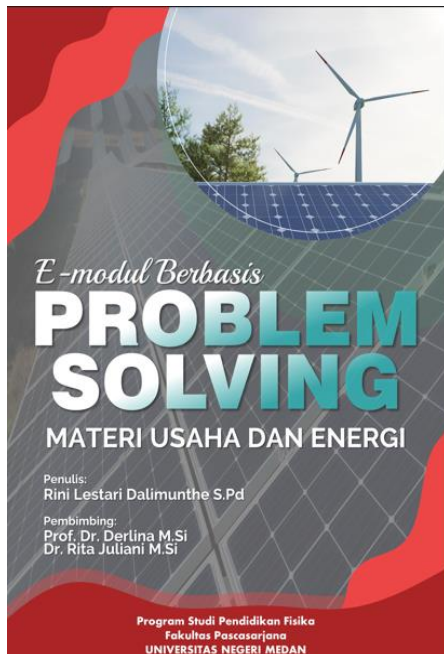


Figure 4.1. Cover Design

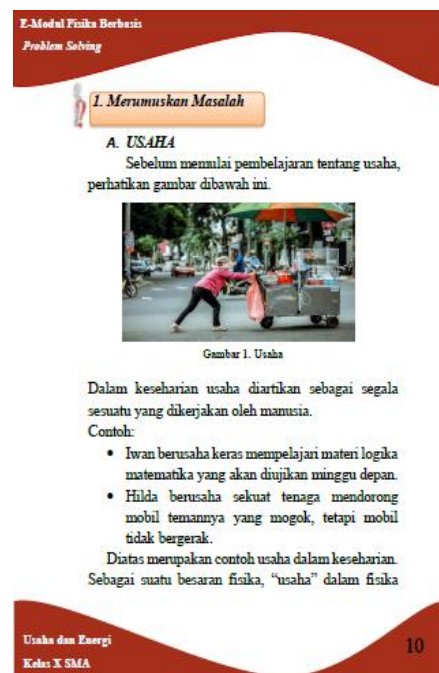



Figure 4. 2 . Design Stage Formulate

E-Modul Fiska Berbasis
Problem Solving

4. Mengumpulkan Data


1. **Usaha dalam bidang Datar**
Pada gambar 3 mengenai usaha dalam bidang datar menunjukkan bahwa terdapat suatu gaya yang diburuhkan untuk menarik suatu benda hingga pindah sejauh s.



Gambar 3. Usaha dalam bidang Datar

Rumus :
$$W = F \cdot s \cdot \cos \theta \quad (1)$$

2. **Usaha pada Bidang Miring**
Pada gambar 4 usaha yang dilakukan benda berada diatas bidang miring.



Gambar 4. Usaha pada bidang miring

Usaha dan Energi
Kelas X SMA

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Figure 4.3. Stage Design Collecting Data

3.2. Media Expert Validation Result Data

Validation media expert on E- module design work and energy based *problem solving* carried out by 1 media expert . Evaluation product meant for get information that will used for upgrade E- module work and energy based *problem solving* .

Average percentage results evaluation learning media expert on the E-Module who has designed could seen in Table 2.

Table 2. Average Percentage of Media Expert Assessment Results

No.	Rating Indicator	Percentage	Criteria
1.	Aspects of Content Quality and Purpose	90%	Highly Valid
2.	Instructional Quality Aspects	83.3%	Highly Valid
3.	Technical Quality Aspect	91.6%	Highly Valid
Average		88.3%	Highly Valid

Assessment results learning media expert to e - module experiment physics on matter Hooke's law and elasticity have the average percentage is 88.3%. It means the average percentage indicator evaluation including category “ Highly Valid” and can used in the learning process as well as worthy for trial _ field based on response learning media expert .

3.2. Material Expert Validation Results Data

After the validation test media experts , planning is also done with validation expert Theory to e- module design work and energy based *problem solving* . Validation expert Theory done by 1

expert material . Average percentage yield evaluation expert Theory to the E-Module which has been designed could seen in Table 3 below this .

Table 3. Average Percentage of Material Expert Assessment Results

No.	Indicator Evaluation	Percentage	Criteria
1.	Aspect language	90%	Highly Valid
2.	Aspect Appropriateness Presentation	91.67%	Highly Valid
3.	Aspect Completeness of Understanding Process Student	90%	Highly Valid
Average		90.5%	Highly Valid

From result evaluation expert Theory of the work and energy E - Module designed in Table 3 above the average percentage evaluation respectively , 90.00% eligibility aspect language , 91.67% aspects presentation , and 90.00% aspects completeness of the scientific process . By whole , third aspect the including in category “Highly Valid” with number the average percentage is 90.50% which means e - module work and energy based *problem solving* can fulfill demands needs learning and worth used .

4. Conclusion

Aspect e - module validity work and energy based *problem solving* design input media expert obtained an average score of 88.30% with category very valid and for evaluation expert experiment average score 90.50% with category very valid.

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