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The Development of Interactive E-Module based on Problem Solving in Physics Learning

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ABSTRACT

Objectives of this research are: (1) Producing an Interactive E-Moodle based on problem solving and analysis:(2) validator and teacher assessment results; (3) pupils perception result; (4) the effectiveness of use interactive E-Moodle based on problem solving in physics learning toward of student problem solving ability at Senior High School (SMAN) 5 Soppeng that has been developed. This is research and development using 4D model which steps are defining, designing, developing and disseminating. Trial subjects of research was using 9 pupils which held on SMAN 5 Soppeng. This research uses several instruments such as validator assessment sheets, teacher assessment questionnaire, student perception questionnaire, and *Problem Solving* test which was designed with an essay model. The average of validator and teacher assessments results are percentages of 77.60 and 81.89, respectively. Both percentages show good and very good category. The trial was done twice. First trial result shows that the average score of student test is 18.89 meanwhile, the average score of second trial is 19.67. Generally, the score of students is 19.00. Based on the test score we found that student categories in good and very good categories. In addition, student perceptions result of interactive *E-Moodle* shows in good and very good category. We can conclude that an Interactive *E-Moodle* based on *Problem Solving* is appropriate for use in physics learning.

Keywords: E-Module, Problem Solving, Moodle, Physics Learning

INTRODUCTION

Physics learning is a process that seeks students to learn related to physics concepts with nature. Physics is both a concept and a product (Indrawati, 2011, p.5). Minister of Education and Culture Regulation No.70 of 2013 regarding the Basic Framework and Curriculum Structure generally provide a change of mindset on the process learning, such as: (1) changes in learning patterns one way (teacher-student interaction) becomes interactive learning (interactive teacher-student community-natural environment, other sources/media); (2)learning patterns are saved into continuous learning network (students can gain knowledge from anyone and from anywhere that can be contacted and obtained the internet); (3) single tool learning patterns become multimedia tool-based learning; (4) Pattern of Problem-based learning is a customer need (users) by strengthening the development of special potential that every student has. Change in mindset, The learning process requires technological tools so that learning objectives can be achieved.

One of the characteristics of 21st century learning According to Ragwan Alaydrus in Wahyuni & Yuliandrasari (2018, p. 7) is implementing student centered. This is one of the keys to contemporary classroom learning. Class Nowadays, in this case, students have an active role in learning so that the teacher only acts as facilitator. Curriculum 2013 and 21st century learning has a very good correlation so it is expected the 2013 curriculum can be

implemented in 21st century learning. One of the things that can be reflected in 21st century learning according to Wahyuni & Yuliandrasari (2018, p. 6) is Problem Solving. Students use their abilities that they have to try solving the problem which they face independently. Students have the ability to organize, express, analyze, and solve the problems. Meanwhile, Problem Solving is one very important aspect of learning physics

The author's initial study was through a distributed questionnaire at several high schools in South Sulawesi. The result shows that 48.42% of students think that physics is a set of formulas so that 25.56% of students also answered that physics material was difficult to understand. Only 2.10% who answered that physics is fun and did not encounter any significant difficulties. While 6.31% students answered that there were obstacles in learning physics is the use of inappropriate media. The example of media like media for practicum, animation, internet involvement such as Google Classroom. As well as other interactive media is suggestion from students to study Physics can be more optimal. This is in line with Purnamasari & An'nur (2016) and Rahayu, et al (2017) wrote Abstract physical phenomena or symptoms requires additional media to explain the concept. Difficulty understanding physics lessons in general caused by a lack of innovation in teaching materials used by educators in the learning process. Other data obtained by the author through initial studies in the field shows that 78.94% of learning media are used by schools in South Sulawesi are still text book. It leads that learning still tends to be in nature monotonous

Physics learning at SMAN 5 Soppeng still uses learning media limited. Learning resources are from text books and modules. Learning resources only comes from educators so students are limited in accessing learning resources. This condition resulted in students' ability to complete problems in learning Physics are limited and resulted in physics learning outcomes of only 63.50% reach the minimum score standard. Currently, students need the ability to solve problems in order to understand concepts correctly in learning physics. Solution Problems are the process of applying knowledge that a person or individual has owned for solving a problem (Sari, 2019, p. 78). Constraint students at SMAN 5 Soppeng are almost the same with the results of the author's initial study in several schools in South Sulawesi. these reason leads to be developed learning in the form of Interactive E-Modules based on Problem Solving in the form of an LMS (learning management system).

Learning Physics in Century 21

The 21st century brought popular changes viz rapid development of Science and Technology. This results in a paradigm shift learning that is marked by changes in the curriculum, media, and technology. Inside and outside school. (Yusuf et al., 2015) These 21st century competencies have been adapted in education system in Indonesia through the 2013 Curriculum. Learning developed in the 21st century is learning that is able to develop competence as a whole, not only equipping students with a number of core subjects according to specialization, but also necessary equip with more non-academic competencies interpersonal and intrapersonal (Anggraeni & Sole, 2018, p. 58) Developing these 21st century skills can be carried out in all scientific disciplines, one of which is in learning physics which is a subject in science family. Learning that can be applied effectively improve quality and at the same time be able to develop 21st century skills are problem solving.

Interactive E-Module

A module is a teaching and learning program unit the smallest, which is learned by students themselves individually or taught by students to himself (instructional self) (Wingkel, 2009). Module as a kind of planned, designed learning activity to help student complete goals certain (Wijaya, et al., 2016)

A proper module assembly must be in accordance with criteria set by the Ministry of National Education in 2008, in (Asshahar, 2012, pp. 155-156)

a. Instructional self (Students are able to learn yourself, not depending on others). What this means is that students are considered to be independent in learning lessons by acquiring minimal assistance from educators
b. Contained Self (all learning material from one the competency units studied are contained in one complete module) means the contents in the Module contains all materials (materials, worksheets, evaluations) from a competency that students must learn.
c. Standing alone (The module developed is not depending on other media or not should be used Together with other media) The meaning is in use the Module can be used as complete media without using other media as a medium complement.
d. Adaptive (Modules should have adaptive level high capabilities of science and technology) the meaning is Modules are adapted to the characteristics of student.
e. User friendly (Modules should comply with the rules familiar/friendly with the user
f. Consistency (consistent in the use of fonts, spacing and layout) on letter writing, use of spaces and the arrangement of layouts between one another must be equal and balanced.

Priowirjanto (2010) in (Anggraeni & Sole, 2018) explains that there are several reasons why Moodle is one of the LMS used by many educational institutions, among others. (1) Free and open source; (2) Small size, maximum capability. Size The capacity in Moodle is small (around 15 MB) however able to carry out academic activities and learning up to 50,000 people; (3) Based by Educational Philosophy. Moodle capable accommodate almost all educational needs conventional which is transferred in the form of online learning; (4) Have a large community and share with each other.

E-Module Interactive based Problem Solving

Problem Solving is a learning model which involves students to solve something problems through the stages of the scientific method. Students can learn knowledge related to these problems and at the same time have the skills to solve the problem. Problem-based teaching is a learning approach for participants students develop thinking skills and problem-solving skills, learning adult roles and becoming an independent learner (Arends, 2012)

Table 1. Stages And Indicator *Problem Solving* Physics

Stage	Indicator
Recognizing problem	Identify problems based on concepts basic (deep feature) Create a list known quantity Determine the amount requested
Planning Strategy	Make free body diagrams/sketches which describes the problem Determine the correct equation for solution to problem
Appling Strategy	Substitute the value of the quantity known to the equation Perform calculations with using the selected equation
Evaluating solution	Evaluate conformity with the concept Evaluate units

Compiled problem solving ability test based on the stages of problem solving then created reference for determining the effectiveness of interactive E-Modules. Effectiveness refers to (Trisnaning, et al., 2017, p. 195) who wrote that classical completeness was 75%. This can be interpreted that if 75% of students have achieve the predetermined standards then the E Module can be declared effective.

METHODS

This is research and development or Research and Development (R&D). The research model uses the 4D model (define, design,develop, and disseminate (Thiangrajan, et al., 1974 p.5) The Define stage consists of initial-final analysis, student analysis, concept analysis, task analysis and specification of learning objectives, while the design stage has 3 steps, namely format selection, media selection and specification of learning objectives.

The instruments used in this study were the interactive E-Module validation sheet based on Problem Solving, practitioner assessment questionnaire, problem-solving ability test in the form of essays, and student perception questionnaire.

RESULTS AND DISCUSSION

Expert and practitioner assessments are purposeful perfecting the E-Module prototype into draft 0. E-Module Draft 0 which has been refined later tested on students to obtain Student responses to interactive-based E-Modules Problem Solving.

Table 2. Results Evaluation Expert to E-Module Interact based Problem Solving

No	Aspect	Amount Score	Percentage (%)
1	Material	36	75.00
2	Characteristics of *E*-Module	99	77.34
3	Design Learning	67	76.13
4	Engineering Device Soft	65	80.00
5	Appearance Interface	46	82.14
6	Communication Visual	36	75.00
Average			77.60

Table 3. Results Assessment Practitioner to *E*- Module Interactive based *Problem Solving*

No	Aspect	Amount score	Percentage (%)
1	Attractiveness	282	80.57
2	Contents	362	77.62
3	Language	182	74.29
4	Benefit	231	94.29
Average			81.69

Expert and practitioner assessments are carried out for corrected the initial design of the Problem-based E-Module Solving. Expert and practitioner assessments are carried out with provide expert assessment sheets and assessment sheets practitioners accompanied by an E-Module prototype. Expert assessment carried out by 2 Physics Education experts while the assessment The practice was carried out by 7 practitioners.

Table 4. Results Test the Ability of Students Problem Solving

No	Descriptive analysis	Stage I	Stage II	Average Stage
1	Ideal Score	24	24	24.00
2	Maximum Score	20	20	
3	Minimum Score	11	19	
4	Average	18.89	19.67	
5	Variance	16.11	0.25	

Student response scores in stages I and II shows the number of students approaching the ideal score. The number of students who are in the high category and very high has the same quantity, namely very high and high respectively are 3 and 6 but in total scores in stage I and stage II were higher.

Table 5. Results of student responses to the E-Module interactive based on Problem Solving

No	Aspects	Ideal Score	Total Score		Average Stage
			Stage 1	Stage II	
1	Format	450	357	363	360.00
2	Content	540	418	430	424.00
3	Language	315	240	347	243.50
4	Beneficial	315	257	263	260.00

Problem-based E-Module development procedures Solving uses a 4D model consisting of defining, designing, development (develop), and dissemination (disseminate). This research was only carried out until the development stage due to time and cost limitations to provide greater capacity on the website used. An interactive e-module based on Problem Solving was tested in class XI Science at SMA Negeri 5 Soppeng in 2020/2021 teaching totaling 9 students. This matter due to limitations in reaching students more due to the learning process carried out online due to the Covid-19 pandemic.

Practitioner assessment results from 7 practitioners regarding Problem Solving based interactive e-Module aspects of format, content, language and benefits are in categories good and very good. In general, practitioners' comments are: adding animation features to the E-Module to make it more interesting attract students' attention

Interactive E-Module based on Problem Solving. This can have a positive impact on students seen in the results of responses and ability results student problem solving. This is in line with research was conducted by Hamid, et al (2017, p.156) wrote that implementing the module Problem Solving based learning is known to be possible improve student learning outcomes due to modules Problem Solving-based encourages students to directly to solve problems and train students to think critically. Website use Moodle is also very helpful for writers to do this research because it is easy to access and provides responses or evaluations to students in distance learning conditions as now. Besides that for students, this is the right axis for learning in line with other research conducted by Herayanti (2018, p.204) wrote that development Learning materials using Moodle are effective for learning physics.

CONCLUSION

Based on the research results, it can be concluded that Interactive e-Module based on problem solving is feasible for used based on the judgment of experts, practitioners and participants educate. Effectiveness of Problem-based interactive E-Modules solving can be seen in the solving ability test problems of students in the high and very high categories

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