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Physics Module Design of Wave Subject for Secondary School

Pengembangan Modul Pembelajaran Fisika Sekolah Menengah Pada Materi Gelombang

Zulherman (*)
Universitas Muhammadiyah Prof. DR. Hamka
Jl. Tanah Merdeka, Kp. Rambutan, Ciracas, Jakarta Timur

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Abstract

This research is aimed to develop high school physics teaching materials that can provide independent learning to high school students in Physics learning, in accordance with the demands of the curriculum. The research applied research development methods. It is implemented in FKIP Universitas Muhammadiyah Prof. DR. HAMKA and the trial and implementation are done in a number of high schools in Jakarta in 2017.The development of physics learning module with contextual approach was implemented in several stages, the first is analysis, the second is feasibility test, and the last is field trial. The instruments consisted of needs analysis questionnaire, validation sheet of feasibility test, and validation sheet of the test results.The module developed was validated by senior physics teachers in several high schools in Jakarta. The validation shows interpretation score of 73% - 93%. Physics learning module with contextual approach on wave material already has correct components, and it is feasible to be used as a companion module.

Keywords: source of high school physics, learning module, contextual.

(*) Corresponding Author: zulherman@uhamka.ac.id@gmail.com

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INTRODUCTION

Human Resources (HR) is an indicator of the progress of a nation. Therefore, improving the quality of human resources is an absolute prerequisite for the achievement of the nation's progress. The most important way to build and improve the quality of human resources is through education. The quality of education in Indonesia nowadays is quite alarming, it can be seen based on data obtained from Kopertis 12, according to data from the Educational for All (EFA) global monitoring report 2011: The Hidden Crisis, Armen conflict and education issued the organization of education, science and culture united nations (UNESCO), which was launched in New York on Monday (1/3/2011), the educational development Index based on 2008 data is 0.934. The value puts Indonesia ranked to 69 of 127 countries in the world. According to the United Nations Development Program, Human Development Index (HDI) of Indonesia in 2011 on the order of 124 out of 187 countries surveyed, with a score of 0.617. This ranking fell from 108th in 2010.

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Based on existing data, it can be seen that education is a sector that determines the quality of life of a nation, since the data of average duration of school is used to obtain HDI. Therefore, to improve the quality of life of a nation, it must be started from the arrangement in all aspects of education, ranging from the aspect of educational goals, educational facilities, learning process, managerial and other aspects that affect education. Judging from the aspect of goals in education, parents and educators agree that the primary goal of 21st century education is to prepare children to be independent, productive, and responsible. High academic excellence is the key to be skilled citizens, clever in making wise decisions, and responsible.

The learning process in schools empirically in Indonesia today mostly still refers to classical learning, and is still very much dependent on the information provided by teachers (teacher center). However, with the learning of Education Unit Level Curriculum (KTSP), it is expected to provide guidance to educators towards the need to study learning strategies to prepare a model of learning. And Thus it is very wrong if the teacher teaches the existing science in textbooks only, because what is in the text book is only one dimension of science that is "the dimension of the product" (the knowledge) (Bhakti & Astuti, 2018). Effective learning, efficient and guided by KTSP becomes a learning that is needed by learners in increasing knowledge, and learners' skill in everyday life. Learning process based on KTSP will stimulate learners to put forward their potential so that learners will not just wait for teacher-centered information but will be centered on the students (student center) since students activate their potential to search for various information to solve the problem it is facing

According to Anwari (2014) "PAIKEM in learning the teacher feels easy because the teacher can activate student learning and ultimately learning objectives can be achieved with complete. Some learners do not seem to be able to collect the various information needed independently. This indicates that learners are still not proficient in utilizing the various sources of learning that have been available.

According to the Association for Educational Communications and Technology (AECT, 1997) in Rusman et all (2008) "learning resources are everything or power that teachers can utilize, either separately or in combination, for the purpose of teaching and learning with the aim of improving the effectiveness and efficiency of learning objectives."

According to Dick (1996) "Teaching material is a set of material / substance of learning which is systematically arranged, and it is displaying a whole figure of competence that will be mastered by the students in learning activities. Packaging of teaching materials such as this lacks in providing opportunities for learners to develop their potential. Since learners have considered the teaching material is boring, it does not arise interest of learners to actively learn independently, with the incidence of inactivity of learners it will not arise also ideas of innovative and creative learner ideas. Therefore, learners become less skilled at developing skills in formulating problems, solving problems, developing understanding and reflecting on learning in society.

Based on Permendiknas Number 22 of 2006 that at the level of SMA / MA, in the basic framework of the curriculum there are subjects of science and technology and on the structure of the curriculum there is a subject of physics. The subject of physics is considered important to be taught as its own subject. According to Giancoli (2001) "physics is not just a collection of facts and principles; Physics is a process that leads us to general principles that describe how the behavior of the physical world. Physics studies all dead matter as well as living things that are related to nature (Astuti, 2016).

Based on the needs analysis conducted in some schools in Jakarta, 72% of respondents (students) interested in physics subject but 60% of students stated that they

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sometimes get difficulties to learn some material of physics, because only 60% of teachers use varied methods in learning, while 40% of other teachers still use lecture methods in learning. And 80% of respondents said using printed materials, whether in the form of textbooks, modules or worksheets in the process of physics learning, 66% of respondents stated that in school there is a learning module but 75% of all respondents stated that the modules in the school are less attractive, and 71% respondents stated that they did not understand how the procedure of using the module is because they have never got a tutorial of learning mechanism of physics module as independent material. And 95% of respondents (students) and 100% of respondents (senior teachers) agreed to develop a physics learning module that can present contextual physics material to support self-learning and 70% expressed their expectation toward the development of physics learning module with contextual approach.

Based on the results of the analysis it is necessary to implement contextual and conceptual teaching material, which the presentation uses language and illustrations that are easily understood learners, and capable of displaying up to date phenomena. In accordance with the packaging of the desired teaching materials through the presentation of refreshing ideas that can stimulate learners to actively learn independently, the development of modules with contextual approach is expected to overcome the problems that already exist. It is expected that learning done by using physics learning module with contextual approach makes it easier for students to learn independently, to help physics learning becomes easier, and learners able to understand the concept of material and interpret it in everyday life. Contextual module not only contains the material but also comes with a simple experiment that allows learners to find their own concepts so that learning will be centered on the students (student center). In addition, learners can also learn from the events that may be experienced in everyday life and can reflect on learning in the community.

The module according to Rosa (2015) "Modules are teaching materials that can be used by students to study independently with minimal help from others." The module as a teaching and learning package deals with one unit of instructional material. With the module students can learn individually to reach the stage of completion (mastery). Students cannot continue the next lesson before reaching the end and through the module, students can control the ability and intensity of learning (Puti & Jumadi, 2015).

Heinich, et.al. (2005) The basic components in the presentation of modules, namely a) students are explained the overall contents of the module and explanation of why students need to learn with the module, b) it is presented the purpose to explain to the students the things that are obtained after the students learn the module, c) it is used a variety of media to engage students actively, d) it has different methods and media to increase student appeal, e) self-evaluation, f) final module tests.

The US Department of Education in 2001 stated that the Contextual Teaching and Learning (CTL) approach is a learning concept that helps teachers connect between materials taught to the real-world situations of students and encourages students to make connections between their knowledge and application in their lives as family members and community.

According to Hall (2000) contextual learning is an educational process that aims to help students see meaning in the lesson material they learn by connecting with the context of their daily life, with the context of their personal, social and cultural environments to achieve the goal of contextual learning.

According to Muchith (2008) one of the keys to success in the learning process is nothing else to do through contextual learning that is learning process designed in a more humane way and always adjust to the dynamics of student development and science and

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technology dynamics. Contextual learning is based on the four pillars of education proclaimed by UNESCO, 1) learning to do, 2) learning to know, 3) learning to be, and 4) learning to live.

Referring to the various problems that have been described earlier, the researcher felt necessary to develop learning resources in the form of high school physics learning module with a contextual approach as a teaching material physics.

METHOD

The research method used in this research is research development which refers to Borg and Gall formulation. According to Borg & Gall (1983) research development is a process used to develop and validate the package of educational materials, such as instructional materials, textbooks, instructional methods, instructional design, and others conducted in a research and development cycle.

Referring to Borg & Gall (1983), the overall research is carried out in ten steps consisting of: (1) research and information collecting which includes literature study, field observation; (2) Planning, including the establishment of appropriate learning materials, preparation of module design with contextual approach, and module trial under study; (3) The development of preliminary form of product design, including the making of module design with contextual approach; (4) Preliminary field testing of developed modules. At the time of trial conducted data analysis of observations, and questionnaires; (5) Revision of the main product revision, make module improvements based on test results; (6) Operational field testing, conducting trials conducted in the classroom to determine the effectiveness and efficiency of the module; (9) The final product revision, performing module improvements based on operational trials.

The research was conducted in FKIP Laboratory of Universitas Prof.Dr.HAMKA. While the operational trials conducted in a number of high schools in Jakarta.

Presentation scores on each aspect contained in the module, is calculated in the following way:

$$\text{Presentasi Skor} = \frac{\text{Jumlah skor yang diberikan oleh guru}}{\text{Skor Maximal setiap aspek}} \text{ x } 100\%$$

(Note: max score = total score of each item x 4)

RESULT AND DISCUSSION

The research on the development of high school physics learning module that has been done gives a very valuable experience for researcher as student of physics majors. One of the activities of the researcher is the observation to the school (high school) which aims to determine the interests of learners of the subject of physics, methods that is often used in learning, the availability of learning modules, physics teacher constraints in implementing KTSP, and the importance of the development of physics learning module SMA with a contextual approach.

At the beginning of the observation, the researcher gave questionnaires on respondents consisting of high school seniors and senior physics teachers in several high schools in Jakarta. There are five aspects that will be seen in the observation, the five

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aspects are translated into 18 indicators. Based on the results of observation, obtained data in table 1.

Table 1. Interpretation of Observation

Aspect	Interpretation of Observation Result Score
Physics learning process	72 %
Availability of modules and other teaching materials	60 %
Learning module	60 %
Alternative solutions to physics learning problems that are difficult to understand	80 %
Expectations on learning modules to be designed by researcher	70 %

After making the observation, the researcher prepares the module with the steps that are: 1) describing the indicators according to the basic competence; 2) preparing the mind maps; 3) collecting contextual images of wave phenomena; 4) describing the material by referring to the picture in accordance with the concept to be conveyed; 5) completing the other module components.

Validation was done with several high school physics teachers as respondents. Five aspects which had been validated were module components, module contents, module writing language, layout, and module benefits as alternative materials. These five aspects were translated into 50 items of instrument. The validation results are shown in Figure 1.

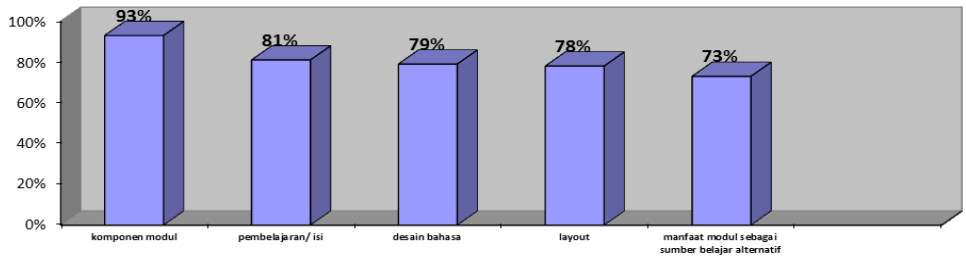

Figure 1. Validation result

Validation is done by senior high school physics teacher in some schools in Jakarta. The validation results show that the module component obtains a score of 93% indicates that the module component is excellent, the contents of the score of 81% indicates that the contents of the module is very good, the design language used scored 79% indicates that the design language used is very good, 78% score shows very good used layout, module benefit as alternative learning source get score 73% show module good use and have benefit as teaching material. However, based on the input given by teachers, the size of the module initially A4 size divided by two, in the end the researcher decided to change the size of the module to B5.

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Generally based on the validation score provided by the teacher, the module aspects are in accordance with ideally. Therefore, the existing modules do not need improvement and is feasible to be a companion learning resource.

CONCLUSION

Based on the results of the validation of senior physics teachers in some high schools in Jakarta, it is obtained a range of validation score of 73% - 93%. Physics learning module with contextual approach on wave material already has the correct components, and it is feasible to be used as a companion module.
The researcher suggests that these existing modules are redeveloped with different approaches to enrich alternative learning resources for students, and are used in high school learning.

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