



Development of a Laboratory-based Physics Module with a Science Process Skills Approach to enhance the interest of High School Students

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ABSTRACT

This study aims to develop a laboratory work-based physics module with a Science Process Skills approach to increase the interest of high school students. The research model used was ADDIE development and the research design used was research and development. The subjects in this study were 2 physics teachers and 20 class X students at SMA Negeri 1 Meulaboh. Research data was obtained through expert lecturer validation sheets, teacher and student response questionnaires. The feasibility of the module is measured by the validation of expert lecturers and questionnaire responses by research subjects. The overall result of the module validation shows a score of 95.07% which falls into the very feasible category, the teacher's response is 79% and the student's response is 74.5%. Data processing was carried out through statistical analysis using a Likert scale. The validation results show that the module is suitable for use and the teacher and student response questionnaires show the subject's response is to agree. From the two measurements, it was found that the Laboratory Work-based Physics Module with the Science Process Skills approach could increase the interest of high school students.

Keywords: physics modules based on laboratory work, science process skills, student interest

INTRODUCTION

Education is all the influence that schools have on children and adolescents given to them so that they have perfect abilities and full awareness of their social relationships and tasks (Hermawan & Rochmawati, 2019). The content of education is structured and programmed in the form of a curriculum. The curriculum works as a tool to achieve the goals to be achieved by certain educational institutions or schools. One of the efforts that can be done is by implementing a set of plans, objectives, learning materials, and even teaching methods that are used as guidelines by teachers to achieve the ultimate learning objectives.

The 2013 curriculum requires students to be active in participating in a learning process called the student center. The learning process is an effort to teach students. Implicitly in learning there is choosing, establishing, and developing methods to achieve the desired learning outcomes based on existing learning. Learning is carried out within the framework of realizing competence in a comprehensive manner. Emphasis on competence means that the orientation of learning activities in class should be given more to students to

be active in learning, actively seeking information, exploring alone or with friends in learning activities in pairs or groups, learning to use a variety of learning resources and printed materials, electronic media, as well as the environment. This explains that learning must be centered on student activities (Handayani, 2015).

To create student-centered learning, teachers must be able to design learning strategies that can increase student activity in the learning process, one of which is through learning modules. The learning module as a form of learning media is an important part of the implementation of learning so that the implementation of learning can be more optimal. The module will spur the independence of students in receiving learning materials and evaluating them, thereby helping to create quality learning (Handayani, 2015). Modules are also very necessary in practicum activities, apart from being a practicum guide, modules can also be designed to direct students to be able to work with scientific steps that can increase their activity. Module teaching materials must be arranged in a systematic and interesting way so that students can learn independently, learning modules are teaching materials that are arranged systematically and interestingly which include material content, methods, and evaluations that can be used independently to achieve the expected competencies (Furqan, et al, 2016).

One of the objectives of preparing modules is to provide teaching materials that are following curriculum demands by taking into account the needs of students, namely teaching materials that independently achieve the expected competencies (I. Dewi & Lisiani, 2015; Nafaida, Halim, & Rizal, 2015; Subekti, 2018). Development modules based on science process skills still need to be developed to hone students' science process skills (Dewi & Primayana, 2019; Sumiati, et al., 2018). Students have the ability and speed in absorbing learning material so it takes more than books to be able to guide students to actively study independently. The learning process in the classroom also does not involve student interaction due to several things, one of which is due to time constraints so educators tend to use the teacher-centered. Meanwhile, the demands of the current curriculum require educators to use a student-centered approach which takes time. Limited time in class can be met with a learning process that is carried out independently by each student with the help of learning modules that have been designed according to learning objectives (Puspita, 2019).

Problem of Research

The quality of learning will be optimal if the learning process is student-centered (student-centered instruction), not teacher-centered (teacher-centered instruction). However, based on initial observations with physics teachers and several Mathematics and Natural Sciences students at SMAN 1 Meulaboh, by conducting interviews about physics learning that is commonly applied in schools, researchers obtained information that physics learning based on laboratory work is very rare and almost never done in schools so that physics lessons are less interesting and seem difficult in the eyes of students. Teaching methods carried out with a monotonous learning process such as listening, taking notes, asking a few questions, discussing and the lack of active student roles tend to result in students becoming passive learners.

Research Focus

To overcome this, in learning physics it is necessary to choose the right method or strategy in teaching so that the learning process can take place effectively and pleasantly both in terms of the process and the resulting product. This can be overcome by inviting students to do practical activities or laboratory work that requires students to work actively and increase students' interest in learning physics. If the student likes a lesson and is interested in learning the lesson, then the student will understand, understand, and will get satisfactory learning outcomes after he learns with high interest. In addition to learning methods, it is also necessary to support learning activities, one of which is in the form of modules. Laboratory learning requires a physics module based on laboratory work as a support in the learning process.

Therefore, the authors developed a practicum-based physics module to increase high school students' interest. Practicum-based physics modules can increase student interest in learning as found in several previous studies, one of which is Sukardiyono (2013) who found that laboratory-based work modules with a science process skills approach can improve student learning outcomes. In addition, Puspita (2019) in her research stated that one way to achieve this goal is to use teaching materials that are appropriate and following the nature of learning and the curriculum used. In this case, the researcher uses science process skills as the basis of making modules because these skills are very relevant to the demands of the curriculum which demands student-centered learning. In the learning process, many science activities require science process skills (Fithriyyati & Maryani, 2018; Rosa, 2015).

METHODOLOGY OF RESEARCH

General Background of Research

The type of research used in this research is research and development or commonly abbreviated as R & D with the research model used in this study refers to the ADDIE development model which consists of 5 (five) steps, namely: (1) analyze, (2) design, (3) development, (4) implementation and (5) evaluation, then using quantitative and qualitative approaches.

Subject of Research

The research subjects in this research were expert lecturers as a validator team consisting of 2 people, 2 physics teachers, and 20 class X students at SMA Negeri 1 Meulaboh.

Instrument and Procedures

The instruments used in this study were module validation sheets given to the validator, teacher response questionnaires and student response questionnaires. In this study, the Physics Module will be validated first to determine the value of the validity of the

learning module developed based on the design and content aspects of the material by validators who are experts in their fields. Furthermore, after the module has been validated by experts who are experts in their field, the module is tested on students to obtain student response data and teacher responses.

Data Analysis

Data obtained from data collection is divided into two types of data, namely quantitative and qualitative data. Quantitative descriptive analysis technique, which describes the results of product development in the form of learning modules that are tested for validation and feasibility. Data that has been obtained through validators and teachers as respondents in the form of quantitative values will be converted into qualitative values. The data analysis used is as follows:

1. Learning Module Assessment Sheet

The assessment sheet is used to obtain data on the validity of the learning module. Validity data is obtained from validators or material expert lecturers. The step developed in analyzing data from the learning module assessment sheet is to convert qualitative data into quantitative data by using the provisions of the Likert scale. The assessment criteria for the feasibility of learning modules are expressed in percentages calculated using a formula such as the following equation:

$$\text{Percentage of eligibility scores} = \frac{\text{Total score obtained}}{\text{overall score}} \times 100\%$$

Based on this formula, the range of the percentage value of the eligibility criteria is:

Table 1. Percentage of eligibility criteria

Score (%)	Rating Category
0-20	Not feasible
21-40	Less feasible
41-60	Decent feasible
61-80	Feasible
81-100	Very feasible

2. Questionnaire

This technique is used for data analysis carried out according to Sudijono (2008: 43) by using the formula:

$$P = \frac{f}{N} \times 100\%$$

Information:

P: The percentage figure you are looking for

f : the frequency sought by the percentage

N : Number of respondents/number of individuals

Questionnaire assessment criteria can be seen in Table 2 below:

Table 2. Score Assessment Criteria

Achievement Level (%)	Qualification
80-100	Very well
66-79	Well
56-65	Enough
46-55	Not enough
0-45	Fail

RESULTS AND DISCUSSION

The development of this laboratory work-based physics module uses the Research and Development (R&D) method and uses five stages of development. The development used in this research is the ADDIE model which consists of Analysis, Design, Development, Implementation, and Evaluation.

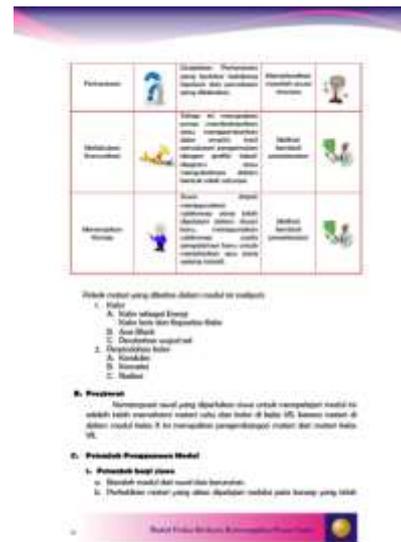
1. Analysis

The analysis stage is used to obtain information about the needs or one of the reasons behind the need for developing a laboratory work-based learning module with a Science Process Skills approach to increase the interest of high school students. This analysis stage is carried out to find out how the teaching materials are in school so that it is necessary to develop authentic assessment in learning. The potential and problems raised in research must be demonstrated with empirical data. In this case, potentials and problems are shown through the results of a needs analysis (Sartika, et al, 2020).

At this stage the results of the analysis obtained that in the learning process at school students very rarely carry out practicum activities, students are not actively involved in the learning process so students are less interested in participating in the physics learning process because they are only given material and questions when learning activities take place. This happens because the teaching materials used in schools do not involve the activeness of students. Based on the results of this analysis, a teaching module based on the science process skills approach was produced. The appearance of the initial module that was developed can be seen as follows:



Page 1 Module



Page 2 Module

Figure 1. Display of the initial module developed

This module consists of 84 pages without a cover which contains part I, part II, part III, part IV, and closing with the following details. Part I, an introduction that contains a description of the module, prerequisites, instructions for using the module, objectives, and parts of the module. Part II, learning that contains Core Competencies, Basic Competencies, indicators, learning objectives, and concept maps. Parts III and IV contain material on heat and transfer, laboratory work steps using the Science Process Skills approach, and evaluation questions. The closing, contains bibliography, glossary, and note sheets.

2. Design

The module that has been developed consists of 35 pages with an attractive cover containing part I, part II, part III, and closing with the following details. Part I, an introduction that contains a description of the module, prerequisites, instructions for using the module, objectives, and parts of the module. Part II, learning that contains Core Competencies, Basic Competencies, indicators, and renewable learning objectives, as well as concept maps. Part III contains material on heat and laboratory work steps using the Science Process Skills (SPS) approach. The closing contains bibliography, glossary, and note sheets.

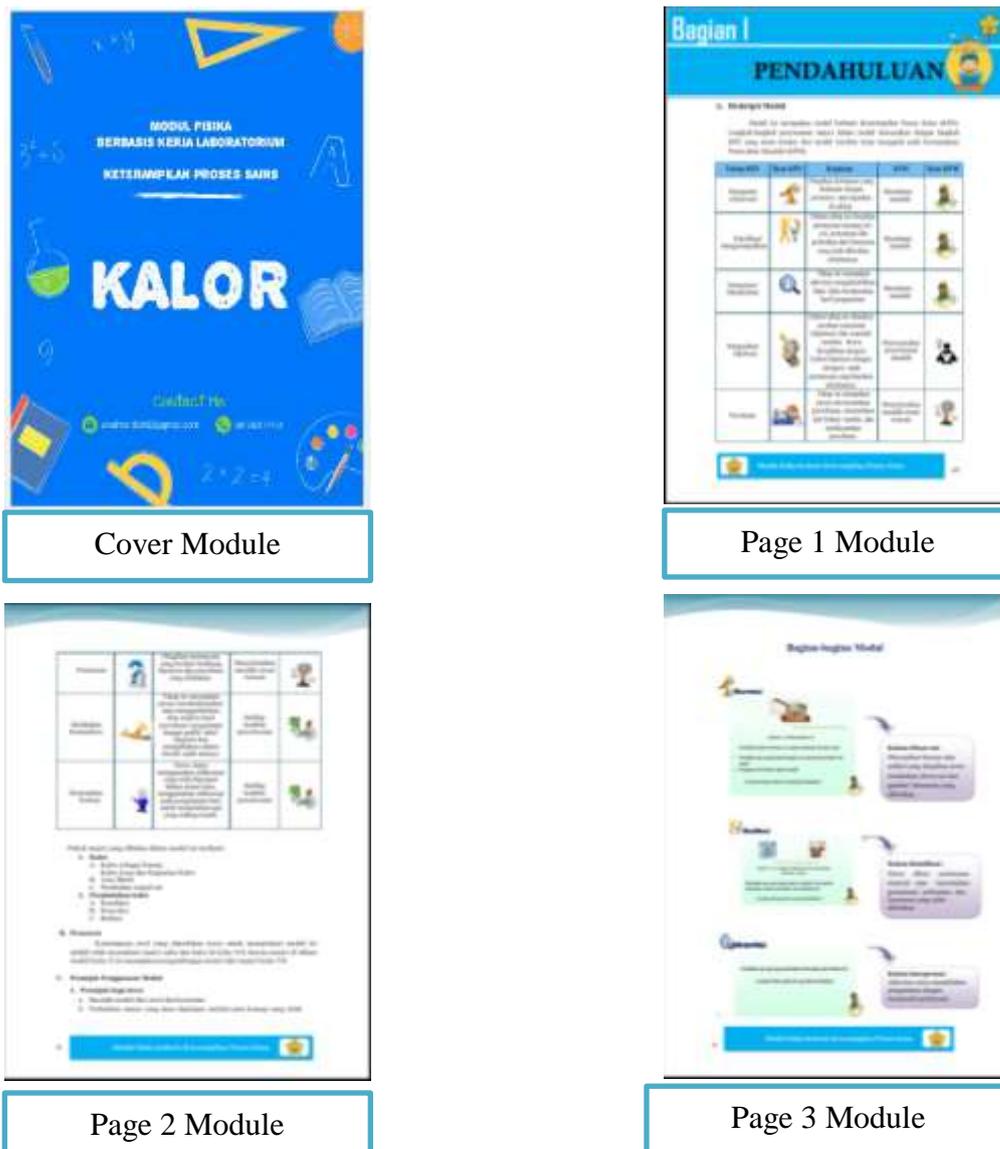


Figure 2. Display of the Module Design that has been developed

3. Development

This development stage is carried out based on the assessment of the validator of material expert lecturers and media experts, namely Drs. Abdul Hamid, M.Si and Mr. Drs. Agus Wahyuni, M.Pd. The results obtained from the validation results are without revision. The results of the validation of learning modules by experts in this study were reviewed from two aspects of the assessment, namely material assessment and design. The results of the validation of the learning module by experts in this study were reviewed from two aspects of assessment, namely the assessment of material and design as shown in Table 3 below:

Table 3. Validator Assessment Results

Aspect	Validator I	Validator II	Average	Criteria
Material	96,25%	92,50%	94,37%	Very feasible
Design	97,72%	93,18%	95,45%	Very feasible
	Average		94,91%	Very feasible

Based on the table, it is known that the percentage of material assessment results from validator I is 96.25% and validator II is 92.50% with an average percentage of material assessment is 94.37% which is included in the very feasible criteria. The result of the design percentage is 95.45% which is included in the very feasible criteria with the assessment of Validator I is 97.72 and Validator II is 93.18. From the two assessments, it was obtained that the percentage of the total feasibility of the learning module was 94.91% which was included in the very suitable category for use without revision.

4. Implementation

The learning module that has been developed and has been validated by experts shows that the module is very feasible to be tested with a response questionnaire on a predetermined subject, namely two Physics teachers and 20 MIPA class X students at SMA Negeri 1 Meulaboh.

a. Teacher Response Questionnaire Results

The physics teacher response questionnaire at SMA Negeri 1 Meulaboh obtained an average score of alternative answers for each statement item 3.16. The results were presented again so that a final score of 79% stated that the physics module was based on laboratory work to increase student interest in obtaining good results.

b. Student Response Questionnaire Results

The data obtained from the results of the response questionnaire that has been filled in by each research respondent amounted to 20 students. The questionnaire data in this study contained 20 questions from four indicators of interest, namely feelings of pleasure in teaching and learning activities, a sense of interest in learning, the emergence of a sense of the attention in the learning process, and involvement in the learning process individually and in groups.

The responses of class X MIPA students at SMA Negeri 1 Meulaboh obtained an average score of alternative answers for each statement item 2.98. The results were presented again so that they got a final score of 74.5% which stated that the physics module was based on laboratory work to improve student interest and get good results.

5. Evaluation

Based on the results of the validation and scoring of the response questionnaires above, the overall percentage per aspect assessed is the researcher knows that the physics

module based on laboratory work with the Science Process Skills approach is feasible to be applied to learning and can increase the interest of high school students. The results of this study are following research conducted by Rosita (2022) which states that the Laboratory Work-Based Physics Module with the Science Process Skill Approach is suitable for use as a learning resource because it meets valid and effective criteria. Rosa (2015) found that KPS-based modules were very much needed by students as study guides complemented by simple experiments to help students learn independently. The KPS-based module is considered effective because it can improve learning outcomes, interests, and skills in the science process itself. Physics learning modules based on science process skills apart from being able to increase student interest in learning found that Science Process Skill based modules can also improve students' critical thinking skills and problem-solving (Marrysca, 2017; Jumadi, et al, 2018; Yulia, et al, 2015).

CONCLUSIONS

Based on the results of the research that has been done, it can be stated that the physics module based on laboratory work with the Science Process Skills approach is very feasible to be used in the learning process without revision with an average validation value of 94.75% and can increase the interest of high school students with good categories based on the results of the teacher's response questionnaire with an average of 79% and the results of the student response questionnaire with an average of 74.5%. The results of this research indicate that teachers can apply laboratory teaching modules based on a science process approach to increase students' interest in learning, this is because through this module students are actively involved in the learning process through practicum activities so that students are interested in following the learning process properly.

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