Practicality and effectiveness of physics teaching materials based on contextual through inquiry to increase student science literacy

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Abstract. This study aims to determine the feasibility (practicality and effectiveness) of contextually based physics teaching materials through guided inquiry learning to improve scientific literacy of grade X students in the first semester of senior high school. This research method uses research and development (R&D), this physics teaching material was tested on high school students in grade X even in the school year with one-group pretest-posttest design. The instruments of data collection used in the study were sheets, practicality test sheets and effectiveness test sheets in the form of student learning outcomes test sheets. The data analysis technique used was the analysis of practicality, and analysis of effectiveness. Based on the data analysis that has been done, it was obtained, the contextual physics teaching material through guided inquiry learning to improve student scientific literacy was very practical which was characterized by the average value of teaching materials according to teacher responses 93.82 and teaching materials according to student responses 81.5. Then, the use of physics teaching materials based on inquiry learning was effectively used in learning to improve students' scientific literacy skills.

1. Introduction

Physics as a process or method of inquiry (inquiry methods) includes ways of thinking, attitudes, and steps of scientific activities to obtain products of scientific knowledge, such as observation, measurement, formulating and testing hypotheses, collecting data, experimenting, and predicting. In this context, physics is not just a way of working, seeing, and thinking, but science as a way of knowing. That is, as a process, physics also includes the tendency of attitudes or actions, curiosity, habits of thought, and a set of procedures.

Science literacy is one of the important aspects that students must have, according to the OECD, scientific literacy is the ability to use scientific knowledge, identify questions, and draw conclusions based on evidence, in order to understand and make decisions regarding nature and changes made to nature through human activity \([1]\). So, scientific literacy is a person's ability to use his scientific knowledge to solve problems faced by analyzing and identifying the causes so to find solutions of the problem. OECD explains that scientific literacy consists of three competencies, namely 1). explaining scientific phenomena, 2). evaluation and design of scientific investigations, and 3). interpretation of scientific evidence and data \([2]\).
The reality in the field of scientific literacy, especially the level of scientific literacy of students in Indonesia is still low, this is shown from the results of the scientific literacy test held by PISA every 3 years, the last in 2015, Indonesia ranked 62 out of 70 countries with an average of 403. PISA test results shows that the level of science literacy ability of students 42.3% is still below level 2 seen from three (reading, math and science) and 0.8% for level 5 or 6 seen from a little one subject. From these data it can be concluded that scientific literacy of students is still at levels 1a and 1b. The low level of scientific literacy is caused by several factors, including teaching materials that are used yet using learning steps that require students to find out their own concepts of learning and solving problems encountered but only contain material, sample questions and problem solving. One of the lessons that can be used to improve students' scientific literacy is inquiry learning. Inquiry learning is a series of student-centered learning activities through discovery under the guidance of the teacher.

Gormally states that scientific literacy indicators consist of: 1) identifying valid scientific opinions 2), conducting effective literature searches, 3), understanding the elements of research design and how their impact on findings/conclusions 4), graphs precisely from the data; 5), solving problems using quantitative skills, including basic statistics; 6) understand and interpret basic statistics; 7) make inferences, predictions, and draw conclusions based on quantitative data.

Research on inquiry learning has been carried out by Islam which states that generally guided inquiry learning can improve all aspects of scientific literacy. Inquiry learning is one of the discovery-based learning models that requires students to be active in building their knowledge. Inquiry learning has 6 syntax, namely 1) orientation, 2) formulating problems, 3) formulating hypotheses, 4) collecting data, 5) testing hypotheses, and 6) formulating conclusions. But the limitations of inquiry learning have not been supported by teaching materials that can support inquiry learning.

Teaching materials are part of learning devices that are learning resources that support the process of implementing learning. According to Andi Prastowo “Teaching materials are all forms of material used to help teachers/instructors in carrying out learning”. Teaching materials are one of the ingredients that can help students to learn. Available teaching materials should be teaching materials that can optimize students in shaping their own knowledge. The development of inquiry-based teaching materials has also been carried out including by Novia and Aslinda who stated that guided inquiry-based LKPD is valid, practical and effectively used in learning. In addition, research on the development of high-level thinking skills of students has also been carried out as much as the research conducted by Ananda.

Kukla in Wardoyo states that all concepts obtained by each student are the result of the construction process and the reality that is built is the result of the interpretation of each student. So, from the statement it can be concluded that knowledge must be built or formed by students. Therefore, so that knowledge can be formed by students themselves, the available teaching materials should be able to optimize students in shaping their own knowledge. So teaching materials can help educators in conveying learning and helping students to understand the subject matter so that learning objectives can be achieved. The availability of adequate teaching materials in schools largely determines the success of the teaching and learning process in the school.

Based on the problems and background, teaching materials were developed which could facilitate students to improve scientific literacy. In this study contextual physics-based teaching materials were developed through inquiry learning to improve literacy in grade X of semester 2. In this teaching material contains aspects of scientific literacy presented by Chiapetta, namely science as the body of science, science as a way to investigate, science as the way of thinking and the interaction of science, technology and society. The purpose of this study is to determine the practicality and effectiveness of contextual physics based teaching materials through inquiry learning to improve science literacy in grade X semester 2 students.

2. Research Methods
Teaching materials developed in this study are contextual physics-based teaching materials through inquiry learning to improve literacy in class X semester 2. The procedure of this study has several
steps. According to Sugiyono\cite{13}, the steps of research and development are 10 steps, namely: 1). potential and problems, 2). data collection, 3). product design, 4). practicality of design, 5). design revisions. The research data collection instrument, namely, practicality test sheets by teachers and students, which previously carried out practicality carried out by 5 validators. then to test the effectiveness of using a learning outcome test which was first tested to determine good test criteria. The data on the practicality of learning devices are analyzed using formulas.

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\text{Practicality value} = \frac{\text{number of scores obtained}}{\text{maximum score}} \times 100\% 
\]

(1)

Criteria for testing Practices that have been modified from Riduwan\cite{14} can be determined using Table 1.

| No | Percentage | Criteria          |
|----|------------|-------------------|
| 1. | 0% - 20%   | Not practical     |
| 2. | 21% - 40%  | Less practical    |
| 3. | 41% – 60%  | Pretty practical  |
| 4. | 61% – 80%  | Practical         |
| 5. | 81% – 100% | Very practical    |

Practical assessment is determined based on the criteria for interpreting the scores obtained. The classification of practical values used in this study is very valid and valid. Results and Discussion

2.1. Results

The validators of this instrument are 5 physics lecturers. The results of practicality based on practical instruments can be seen in Table 2.

| Validator | assessment aspect |
|-----------|-------------------|
|           | 1 | 2 | 3 | 4 |
| A         | 4 | 4 | 4 | 4 |
| B         | 4 | 4 | 4 | 3 |
| C         | 4 | 4 | 4 | 4 |
| D         | 3 | 3 | 4 | 4 |
| E         | 3 | 3 | 3 | 3 |
| Skor      | 18| 18| 19| 18|
| %         | 90%| 90%| 95%| 90%|
| Very practical | Very practical | Very practical | Very practical |

The results of practicality of practical instruments for teaching materials can be seen in Figure 1.
Figure 1. Indicator values for the feasibility of practical instruments.

Based on the results of the analysis in Figure 1, it is known that the practical instruments of contextual physics teaching materials through inquiry learning to improve literacy of class X students in semester 2 are very valid with an average value of 90%. Furthermore, this practicality instrument is used to practice contextual physics based teaching materials through inquiry learning to improve students' scientific literacy. For the instrument of effectiveness a test of scientific literacy ability is used. Based on the results of the problem test analysis, from 20 essay questions that were tested the problem obtained 12 questions that matched the predetermined criteria, so that it was used as a matter of pretest and posttest.

The results of practicality for physics-based teaching materials are contextual through inquiry learning to improve the literacy of students in class X of the second semester developed. First, the content feasibility component consists of four practicality indicators. The values for each indicator can be seen in Figure 2.

Figure 2. The practical results of the content eligibility component

Where:
1. Teaching material made in accordance with core competencies and basic competencies
2. Content of teaching material
   1. Presentation of teaching materials
   2. Implementation opportunities

Based on the data in Figure 2, it can be seen that the results of the practical assessment of teaching materials by teachers obtained an average value of 93.82%, with very practical criteria. Furthermore, based on student assessment by covering two components, namely Ease of teaching materials and Benefits can be seen in Figure 3.
Figure 3. The Value of the Practical Components of Physics Teaching Materials Based on Inquiry by Students

Based on the data in Figure 3 it can be seen that the value of practicality by students obtained an average value of 81.5% with very practical criteria.

Furthermore, for the value of effectiveness after being given a pretest and posttest to students in two schools namely a private school with 31 students and public schools with 34 students in the city of Padang the results are shown in Figure 4.

Figure 4. Results of students' pretest and posttest

2.2. Discussion
The preparation of contextually based physics teaching materials through inquiry learning to improve literacy in class X semester 2. The practical results of the practical assessment instrument obtained an average score of 91% with very practical criteria. Furthermore, the practical results of contextual physics teaching materials through inquiry learning to improve the literacy of class X students in semester 2 by the teacher, obtained a practical value of 93.82% with a very practical category.

Likewise practicality by students is obtained 81.5% with a very practical category. So this value states that the physics teaching materials developed are very practical to be used to improve science literacy in class X SMA 2 semester.
Furthermore, for the effectiveness of teaching materials developed based on the results of effectiveness tests, there are significant differences between students' scientific literacy after and before the use of instructional materials so that teaching materials are developed effectively to improve students' scientific literacy.

3. Conclusion

In accordance with the research objectives and set targets, namely developing contextually based physics teaching materials through inquiry learning to improve literacy in grade X students in semester 2, the results obtained were for the practicality of teaching materials developed, both those assessed by teachers and by students were very practical in improving student science literacy. Furthermore, for the effectiveness of teaching materials developed based on the results of effectiveness tests, there were significant differences between the scientific literacy of students after and before the use of instructional materials, so that teaching materials were developed effectively to improve students' scientific literacy.

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