Validation analysis of physics teaching materials based on contextual through inquiry to increase student’s science literacy

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Abstract. This study aims to determine the validation, of contextual based physics teaching materials through inquiry to increase the science literacy of high school students of grade X of semester two in Padang City of Indonesia. This research method uses research and development (R & D), a data collection instrument using a validity sheet, previously validated by five validators. Based on analysis of instrument validation data obtained value with several criteria is very valid. Furthermore, to test the validity of teaching materials based on contextual physics through inquiry to increase science literacy grade X semester two obtained an average value of 88 % with criteria very valid, so it can be used in learning activities

1. Introduction
Science literacy is one of the important aspects that students must have in dealing with the rapid development of the times at this time. 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 the changes made to nature through human activities. So, scientific literacy is the ability of a person to use the science knowledge he has to solve the problems faced by analyzing and identifying the causes so that later they are found to be resolved. The OECD also explained that scientific literacy consists of three competencies, namely 1) explaining scientific phenomena, 2) evaluation and design of scientific inquiry, and 3) interpretation of evidence and scientific data [1].

The reality in the field of scientific literacy level especially the level of student scientific literacy in Indonesia is still low. The low level of students’ scientific literacy is shown from the results of scientific literacy tests conducted by PISA every 3 years, the last in 2015, Indonesia was ranked 62 of 70 countries with an average of 403. The PISA test results showed that students’ scientific literacy skills 42.3 % is still below level 2 seen from three subjects (reading, mathematics and science) and 0.8% for level 5 or 6 seen from at least one subject [2]. From these data it can be concluded that student literacy is still at level 1a and 1b.

Low level of science literacy is caused by several factors. First a learning activities in school more focused upon concepts and formulas of physics while learning activities involving science is still lacking. Second, the materials used are not yet using the learning steps demanded of students to find their own concept of learning and problems encountered but only contains material, examples of problem and solution of problem. One of learning that can be used to enhance students science literacy
i.e. Inquiry based learning. Inquiry based learning is a series of learning activities based on students through the discovery under the guidance of a teacher. Sanjaya [3] generally presents the learning process using the inquiry model following the steps: 1) Orientation, 2) Formulating problems, 3) proposing hypotheses, 4) collecting data, 5) testing hypotheses, 6) Formulating conclusions. So, it is with inquiry-based learning, students will be facilitated to enhance science literacy. Literacy is understood as a set of abilities to process information, far above the ability to analyze and understand reading materials. So, literacy isn’t just about reading and writing, but also includes other fields, such as economics, mathematics, science, social, environmental, financial, even moral (moral literacy). So the science literacy is the ability to use scientific knowledge to identify the problems and draw conclusions based on the evidence in order to understand and make decisions about the nature and the changes that were made to the nature through human activity [4]. Science literacy according to National Science Education Standards (1995) [5] is: Scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity. It also includes specific abilities. According to the Organization for Economic Cooperation and Development [6] literacy Science (scientific literacy) is defined as the capacity to use scientific knowledge, identify questions and draw conclusions based on facts to understand the universe and make decisions from the changes that occur because of human activity. Next Rizkita. [7] States science literacy is a person’s ability to distinguish the facts of science from an assortment of information, recognize and analyze the use of the methods of scientific inquiry as well as the ability to organize, analyze, interpret quantitative data and information science.

Gormally [8] stated that indicators of scientific literacy consists of: 1) identifies a valid scientific opinion 2) performs an effective literature search, 3) to understand the elements of design research and how their impact on the findings/ conclusion 4) create charts from the data appropriately; 5) solves the problem of using quantitative skills, including basic statistics; 6) understand and interpret basic statistics; 7) perform inference, prediction, and the withdrawal of the conclusion based on quantitative data.

Research on inquiry based learning has been carried out by Islami, at al [9] stating that in general inquiry based learning social interactions can improve all aspects of science literacy. Inquiry learning is one of discovery-based learning model that demands students to be active in building knowledge. Inquiry based learning has 6 learning syntax IE 1) orientation, 2) formulated the problem, 3) formulate hypotheses, 4) collect data, 5) test the hypothesis, and 6) formulate conclusions. But its limitations have not been supported by Inquiry based learning teaching materials.

Development of physics teaching materials for inquiry-based learning of have many of them done among others Novia[10] and Aslinda[11] which states that LKPD based guided inquiry valid, practical and effective use in learning. In addition research on the development of higher-order thinking ability of students has also been done by Ananda [12] that is LKS is oriented to critical thinking skills the influence means against the results of the study of physics students of class X SMAN 2 Padang. In addition, the development of contextual-based teaching materials has also been carried out by Hufri [13] also has been able to improve student learning outcomes.

Teaching materials are part of learning tools which are learning resources that support the learning process. According to Andi Prastowo [14] ”Teaching materials are all forms of material used to assist teachers / instructors in carrying out learning”. Teaching material is one of the materials that can help students to learn. Available teaching materials should be teaching materials that can optimize students in shaping their own knowledge.

Kukla in Wardoyo [15] that all concepts obtained by each student are a result of the construction process and the reality that is built is the result of the interpretation of each student. So, from this statement it can be concluded that knowledge must be constructed or
formed by students themselves. Therefore, so that knowledge can be formed by students themselves, the available teaching materials can optimize students in shaping their own knowledge. So, teaching materials can help educators in conveying learning and helping students in understanding the subject matter so that learning objectives can be achieved. The availability of adequate teaching materials in schools greatly determines the success of the teaching and learning process at the school.

Based on the problems and background, teaching materials are developed that can facilitate students' scientific literacy. In this study researchers developed contextual based physics teaching materials through inquiry learning to improve the literacy of class X semester two students. In this teaching material contains aspects of scientific literacy presented by Chiapetta, et al[16] namely science as the body of science, science as a way to investigate, science is a way of thinking and the interaction of science, technology and society. The purpose of this study was to determine the validity of contextually based physics teaching materials through inquiry learning to improve the literacy of class X semester 2 students.

2. Research Methods
The teaching materials developed in this study are contextual-based physics teaching materials through inquiry learning to improve the literacy of class X semester two students. This research procedure has several steps. According to Sugiyono [17], the steps of research and development are limited to: 1) potential and problems, 2) data collection, 3) product design, 4) design validation, 5) design revisions. Instrument for collecting data is the validity test sheet. For validation, 5 validators are done. Data from the validation test of learning devices were analyzed using formulas. The criteria for the modified validation test from Riduwan [18] can be determined using Table 1.

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

Table 1. Validation Test Criteria

| No | Percentage | Criteria |
|----|------------|----------|
| 1. | 0% - 20%   | Very invalid |
| 2. | 21% - 40%  | Invalid |
| 3. | 41% – 60%  | Less valid |
| 4. | 61% – 80%  | Valid |
| 5. | 81% – 100% | Very valid |

Validity assessment is determined based on the interpretation criteria obtained. The validity value classification used in this study is very valid and valid. The validator of this instrument is 5 physics lecturers. Each statement in the instrument assessment sheet is given a choice of scores from 1–4. Score 1 means strongly disagree, score 2 means disagree, score 3 means agree, and score 4 means strongly agree. The statement to validate the validity instrument is, 1. Instructions for filling in the validation sheet, 2. The statements made on the validation sheet are in accordance with the learning objectives, 3. The format of the assessment sheet on the validation sheet is made simple, 4. Format the assessment sheet on the sheet validation is easy to understand, and 5. items in the validation sheet are in accordance with the rules of good and correct language. The validation results of the validity instrument for teaching materials can be seen in Figure 1.
Based on the results of the analysis in Figure 1, it is known that the instrument of validity of contextual-based physics teaching materials through inquiry learning to improve the literacy of class X semester two students is very valid with an average value of 90%. Furthermore, this validation instrument is used to validate contextually based physics teaching materials through inquiry learning to improve students' scientific literacy.

3. Results and Discussion

3.1 Results

The results of validation for contextual-based physics teaching materials through inquiry learning to improve the literacy of grade X students in semester two that are developed can be seen in Table 2.

| Aspect                          | Average value of each aspect | Criteria |
|---------------------------------|-----------------------------|----------|
| Feasibility of content         | 88%                         | Very valid |
| Construction Feasibility        | 90%                         | Very valid |
| Components of Inquiry           | 93%                         | Very valid |
| Language eligibility           | 88%                         | Very valid |
| Feasibility of Science Literacy in Teaching Materials | 88%                         | Very valid |
| Feasibility of Display of Teaching Materials | 84%                         | Very valid |
| **Average**                    | **88%**                     | **Very valid** |

In Table 2, the average value of instructional materials developed is 88% with very valid criteria. This shows that the instructional material developed can be used in the learning process. Each component consists of several indicators and each indicator is assessed for each feasibility. First, the content feasibility component consists of four validation indicators. The values for each indicator can be seen in Figure 2.
Figure 2. The results of the validity of the content feasibility component

Where:
1. Instructional materials made in accordance with Core Competencies and Basic Competencies
2. The substance of the material in the teaching material is correct
3. Teaching materials made according to the latest issues
4. Teaching materials can increase knowledge

Based on the data in Figure 2 it can be seen that the component feasibility indicator content with the highest value is 92% and the lowest value is 76%. Second, the construction feasibility component which consists of five indicators. The results of the analysis on the construction feasibility component that has been assessed by experts can be seen in Figure 3.

Figure 3. Results of analysis of construction feasibility components
where:
1 Systematics of writing in teaching materials is good
2 The order of the structure of the teaching material is correct
3 The objectives in the teaching material are clear
4 Interactivity in teaching materials is clear
5 The information submitted in the teaching material is complete

Based on Figure 3 it can be seen that in the construction feasibility component, the highest value is 96%. While the indicator that gets the lowest value is 84%. Third, the component of inquiry consists of seven indicators. The results of the analysis on the components of inquiry that have been assessed by experts can be seen in Figure 4.

![Feasibility Inquiry Components](image)

**Figure 4.** Results of analysis of the inquiry component.

Where:
1 The orientation used in teaching materials is appropriate
2 Teaching materials used have been able to make students formulate problems
3 Teaching materials used have been able to make students make hypotheses
4 Teaching materials used have been able to guide students to search information / data
5 Teaching materials used have been able to make students process and analyze data
6 Teaching materials that have facilitated students to test hypotheses
7 Teaching materials have been able to guide students to make conclusions

In Figure 4 it can be seen that of the seven components of inquiry, the highest score is 100%. While the lowest value is 84%. Fourth, the language feasibility component consists of four indicators. The results of indicator analysis on the component of inquiry can be seen in Figure 5.
Figure 5. Results of indicator value analysis on the language feasibility component

Where:
1. The sentence used in teaching materials is clear and easy to understand
2. The relationship between paragraph one and other paragraphs in teaching material is clear
3. Writing in teaching materials is in accordance with Indonesian language rules
4. The use of language in teaching materials is effective and efficient

Based on the data in Figure 5 it can be seen that the language feasibility component indicator gets the lowest value with a value of 84%. While the highest value is 92%. Fifth, the component of scientific literacy feasibility in teaching materials consisting of twenty-one indicators. The results of the analysis for indicators on the feasibility component of scientific literacy can be seen in Figure 6.

Figure 6. Results of indicator analysis on the integration component of scientific literacy
Where:
1. Teaching materials have provided facts in accordance with the subject matter.
2. Teaching materials have presented all concepts related to the subject matter.
3. Teaching materials have presented the principles and laws relating to the subject matter.
4. Teaching materials have presented theories of subject matter.
5. Teaching materials have presented models for a sub-material that cannot be observed directly.
6. Teaching materials already contain exercises or evaluations that ask students to remember factual knowledge or information.
7. Teaching materials have facilitated students to learn through the use of material materials.
8. Teaching materials have facilitated students to use graphics.
9. Teaching materials have facilitated students to use tables.
10. Teaching materials have facilitated to teach students to make calculations.
11. Teaching materials have facilitated to require students to explain answers.
12. Teaching materials already contain an overview of how scientists do experiments related to a concept and law.
13. Teaching materials contain historical developments from an idea according to the subject matter.
14. Teaching materials have emphasized the empirical nature and objectivity of science in the presentation of subject matter.
15. Teaching materials have illustrated the use of assumptions.
16. Teaching materials have shown how science runs with inductive and deductive development.
17. Teaching materials already contain exercises or activities to discuss facts and evidence in accordance with the material being studied.
18. Teaching materials facilitate to present scientific methods and problem solving.
19. Teaching materials already describe the usefulness of science and technology for society.
20. Teaching materials have facilitated to discuss social issues related to science and technology.
21. Teaching materials have facilitated to practice interaction with the public or collaboration with peers.

Figure 6 shows that the scientific literacy component has the lowest value of 68%. While the highest value of the scientific literacy integration component is 98%. The last component assessed is the feasibility component of the display of teaching materials consisting of four indicators. The results of the analysis on the component feasibility of the display can be seen in Figure 7.
Figure 7. Results of indicator analysis on the component of feasibility of the display

Where:
1. The layout of the titles and subtitles in learning teaching materials is good
2. The type and size of the font used in teaching and learning materials is appropriate and interesting
3. Layout on the cover and between parts in teaching learning materials is interesting
4. The placement of illustrations, graphics, and images in teaching learning materials is interesting

In Figure 7 it can be seen that the component feasibility of the display has the lowest value of 80%. While the highest value is 88%.

3.2. Discussion
Contextual physics-based teaching materials through inquiry learning to improve literacy in class X semester 2 students, which were developed in this study are in accordance with the structure of teaching materials according to the Ministry of National Education 2008 and the 2013 curriculum both KI, KD, adapted to the latest issues and related to student environments to accommodate contextualism. In this teaching material, students have also participated in inquiry learning by facilitating students to improve student science literacy. So this teaching material contains indicators of the scientific literacy aspect of the subject matter. The results of the validity of physics-based teaching materials through inquiry learning to improve literacy in class X students of semester two, have been declared very valid by validators.

4. Conclusion
In accordance with the research objectives and set targets, namely developing contextual based physics teaching materials through inquiry learning to improve the literacy of students class X semester two, it is feasible in terms of validity aspects with very valid criteria so that it can be used to determine practicality and effectiveness in learning.

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