Development of Guided Inquiry-Based Instructional Materials to Improve Students' Science Process Skills

Ayu Sri Menda Br Sitepu1*, Karya Sinulingga2*, Eva Marlina Ginting2

1Department of Postgraduate Physics Education, Universitas Negeri Medan, Indonesia
2Department of Physics, Universitas Negeri Medan, Indonesia Jl. William Iskandar, Ps. V, Medan, 20221, North Sumatra,

*Correspondence author: ayusrimendasitepu@gmail.com

Abstract. This study aims to determine the improvement of students' science process skills by using guided inquiry-based physics teaching materials. This research is a research development (Research & Development) using the Borg and Gall design. This research was conducted at the Smart Nation Private High School with a sample size of 30 students. This research was conducted until the development stage, namely expert validation. The results of the needs analysis and material analysis show that physics teaching materials are needed by teachers and students to support physics learning activities in schools. The teaching materials developed were temperature and heat teaching materials. The results of the validation of the three validators, namely material expert lecturers and media expert lecturers, show that the quality of teaching materials is in the very good category and can be used in the learning process after a long revision, besides that the students' responses to teaching materials develop in a positive category. The average result of the validation of teaching materials by material experts was 87.5%, and the average validation of media experts was 86.5% with the very good category.

1. Introduction

Development in the learning process is needed. This is supported by a curriculum change that gives teachers flexibility to develop a curriculum in accordance with student characteristics, conditions and potentials of schools and their respective educational units. This is supported by Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System (Chapter II / Article 3) states that national education functions to develop capabilities and shape the character and civilization of a nation with dignity in order to educate the nation's life, aiming at developing the potential of students to become human who believe in and fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens. Therefore, the teacher exposes students' ideas to be something valuable and useful for themselves.

The problem faced in learning physics is the weakness of the learning process in the classroom where students are required to memorize physics formulas and solve physics problems without understanding the basic concepts. In addition, teachers also use teaching materials that are not relevant to the provisions contained in the curriculum, not in accordance with the stated learning objectives, which do not develop students' science process skills (Siregar, 2020)
Research can be said to be successful if the teaching materials meet validity aspects, including: (1) valid, (2) practical, and (3) effective (Nieveen, 2007). So it can be stated that quality teaching materials are those that fulfill these three aspects. Validity is obtained from the validation of tools by experts and peers containing validation of content, constructs and language. Practicality means that teaching materials can be applied by the teacher as planned and easily understood by students. While effectiveness is seen from the results of authentic assessment which includes an assessment of the learning process and learning outcomes.

Based on the results of observations of physics learning at the Smart Nation Private High School, the teacher has not yet optimized the use of modules as teaching materials. Teachers are still more dominant in using textbooks from the publishers of Marthen Kanginan, and Erlangga. The teaching materials used by the teacher emphasize more on physics problems using mathematical equations. The teaching materials used by the teacher cannot improve students’ science process skills and are unable to solve physics problems that are presented in the form of pictures. Researchers also observed a tendency for students to wait for an explanation from the teacher first. This shows that the learning process is still teacher-centered and does not involve students to be active. In addition, it is also seen from the results of interviews with researchers with physics teachers at the school that physics learning is more often with conventional learning, namely the lecture, discussion, and question and answer method. Physics problems that are often given by teachers are more to mathematical physics, not in examples that can be considered in everyday life. Such learning also does not train students’ science process skills. In the learning process the teacher also uses teaching materials that do not train students to carry out the process of scientific investigation.

2. Literature Review

Teaching materials are materials or materials or learning resources that contain the substance of certain abilities to be achieved. Broadly speaking, instructional materials include the knowledge, skills, and attitudes learned (Dikmentum in Trianto, 2012). According to (Abdul, 2011) teaching materials are all forms of materials used to assist teachers / instructors in carrying out teaching and learning activities. Teaching materials are a set of materials arranged systematically, whether written or not, so as to create an environment or atmosphere that allows students to learn. Textbooks can be accompanied by pictures that are closely related to student life, independent assignments that can be done individually or in groups of each material, summaries of material for each chapter and final chapter tests.

So it can be concluded that the teaching material is a book that is used to study or deepen a subject of knowledge and science and technology that can demand learning to be active in learning that is prepared based on national education standards.

Guided inquiry learning model is learning that emphasizes the development of cognitive, affective, and psychomotor aspects in a balanced manner, so that learning through this model is considered more meaningful. Psychomotor is related to the learning outcomes achieved by students through student learning activities with practicum while the affective aspect is seen from students' interest in learning (doing practicum).

Science process skills (KPS) emphasize to students how students learn and use their acquisition, so that they are easily understood and used in community life. In the learning process students can gain experience and knowledge on their own, scientific investigation, and practice their intellectual abilities. Process skills are a driving force for the discovery and development of facts and concepts, attitudes and values. This is done through experimentation with the scientific method. Students are trained to read experimental data objectively and from this data a conclusion can be drawn. Through the experiment, students carry out an active learning process by gaining direct experience that can develop students' cognitive, attitudes, and psychomotor. (Ulfah, 2018)
3. Research Method

This research can be classified into the method of research and development (Research and Development). Research and development in question is research carried out to produce guided inquiry-based teaching materials whose development refers to research and development (Research and Development) according to Borg and Gall (1987).

The teaching materials developed only use the validation of a team of material experts, namely two validators (2 lecturers). The validity of teaching materials is an assessment of academics and practitioners on the format and content of teaching materials, measured by an assessment / validation sheet and declared as very good, good, adequate, poor, or not good. The assessment was carried out by two validators (Rajagukguk et al. 2018).

| Table 1. Validation Score Criteria |
|-----------------------------------|
| **No** | **Percentage** | **Category** |
|-------|----------------|-------------|
| 1     | 81%-100%       | Very Good   |
| 2     | 61%-80%        | Good        |
| 3     | 41%-60%        | Pretty Good |
| 4     | 21%-40%        | Isn’t Good  |
| 5     | 0%-20%         | Not Good    |

4. Results and Discussion

The teaching materials developed have been validated by the validator and tested for their feasibility. The results of the assessment in the form of a questionnaire analyzed are as follows:

4.1. Results of the Material Expert’s assessment

Assessment of Physics Teaching Materials by a team of material experts, namely two physics lecturers at the State University of Medan. The results of the validation data analysis of each material expert can be seen in the table:

| Table 2. Results of Validation Recapitulation by the Material Expert Team |
|---------------------------------------------------------------|
| **No** | **Assessment Components** | **∑ Indicator** | **∑ Components** | **Percentage (%)** | **Category** |
|--------|--------------------------|----------------|-----------------|-------------------|-------------|
| 1      | Content Eligibility      | 15             | 3               | 88                | Very Good   |
| 2      | Feasibility of Presentation of Teaching Materials | 10             | 3               | 80                | Good        |
| 3      | Aspects of Guided Inquiry Activities | 20             | 2               | 90                | Very Good   |
| 4      | Aspects of Letters Amount | 55             | 9               | 87.5              | Very Good   |

The assessment carried out by material expert validators on teaching materials is shown in table 4.1 with a percentage obtained of 87.5% in the very good category. The graph of the percentage acquisition of the assessment of material expert aspects can be seen in Figure 1 below:
Material experts assess that the physics teaching materials developed are suitable for use as teaching materials for learning in schools because the teaching materials are in accordance with the curriculum and the placement of problems at the beginning of the presentation is a characteristic of inquiry.

4.2. Results of the Media Expert's Assessment (product)

Assessment of physics teaching materials by a team of media (product) experts, namely two physics lecturers at the State University of Medan. The results of the validation data analysis of each media expert can be seen in Table 3:

| No | Assessment Components                      | ∑ Indicator | Percentage (%) | Category   |
|----|------------------------------------------|-------------|----------------|------------|
| 1  | Leather Design                           | 5           | 85             | Very Good  |
| 2  | Skin Topography                          | 3           | 83             | Very Good  |
| 3  | Content Design of Teaching Materials     | 8           | 91             | Very Good  |
| 4  | Illustration of Teaching Material Content| 4           | 87             | Very Good  |
|    | Amount                                   | 20          | 86.5           | Very Good  |

The assessment carried out by the media expert (product) validator on physics teaching materials is shown in Table 3 with the percentage of the validation result assessment by the design expert team obtained by 86.5% with the very good category. The graph of the percentage acquisition of the assessment of the media expert aspect (product) can be seen in Figure 2 below:
5. Conclusion
The validity level of physics teaching materials as teaching materials developed with the Borg and Gall design based on material experts with the aspect of content feasibility is 88% with the very good category, the feasibility of presenting teaching materials is 85% with the 85% category, the aspect of guided inquiry activities is 90% with good category and linguistic aspect is 92% with very good category. The total percentage of the material expert's assessment regarding the development of physics teaching materials in high school was 87.5% with the very good category.

The validity level of physics teaching materials as teaching materials developed with the Borg and Gall design based on media experts with the leather design aspect is 85% in the very good category, the topography of the skin is 83% in the very good category, the design of the content of teaching materials is 91% with the very category good, and the illustration of the teaching material content is 87% in the very good category. The total percentage of the media expert's assessment regarding the development of physics teaching materials in high school was 86.5% with the very good category.

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