Development of Science Textbooks Based on Science Process Skills to Improve Students‘ Critical Thinking Skill of Class V SDS PAB 25 Medan

Desy Crismas Silaban[1], Retno Dwi Suyanti[2], Wawan Bunawan[3]

{ silabandesycrismas@gmail.com[1] }

Basic Education Study Program of Postgraduate School of Universitas Negeri Medan, Indonesia[1]
,Chemistry Education Study Program of Postgraduate School of Universitas Negeri Medan, Indonesia[2] ,
Physics Education Study Program of Postgraduate School of Universitas Negeri Medan, Indonesia[3]

Abstract. The limitation of student textbooks is an obstacle to KPS-based learning. Teacher companion books and student textbooks that are used as guides in learning are not yet fully complete, this limitation causes KPS not to be effectively evenly distributed, especially for learning with independent learning patterns. This study aims to determine the feasibility and effectiveness of the developed science process skills-based science textbooks. This study uses a 4D (four D) Thiagarajan model development procedure. Data collection using assessment instruments for material experts, design experts, learning media experts and learning outcomes tests. The results of this development research are in the form of textbooks that meet the eligibility requirements with the results of material validation declared feasible, design experts declared feasible and learning media experts declared suitable for use in the field. The results of the study for improving learning outcomes obtained an average pre-test of 62.24 while the post-test was 78.8. This shows that science textbooks based on science process skills are more effective in improving students' critical thinking than conventional textbooks on the subject of Energi dan Perubahannya.

Keywords: Textbooks, Science Process Skills, 4D Model.

1 Introduction

The quality of education in Indonesia greatly affects the process of development of existing education. The low educational process affects the declining learning outcomes. The weak learning process is one of the problems faced in the world of education because students are not encouraged to develop thinking skills. One of the causes of the low quality of education in Indonesia is the low competence of teachers. In addition, student achievement is an indicator of the quality of education in Indonesia which is still in the low category so it can add to problems in the education process in Indonesia. The learning process in the classroom is directed at the child's ability to memorize information, the student's brain is forced to remember hoarding various information without being required to understand the information it remembers to be able to connect it with everyday life.

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The abilities possessed by students are not only in terms of knowledge but also skills and attitudes. Skilled in carrying out school assignments indirectly, increasing student knowledge, and training psychomotor abilities. Teachers have an important role to teach skills in the classroom to students, including Science Process Skills (KPS) through planning and regulating teaching and learning activities [1]. Science process skills are a learning approach designed so that students can find facts, and build concepts, and theories in the learning they receive. Students are directed to involve themselves in scientific activities in the learning process. Science process skills are one of the skills used to understand any phenomenon.

Bruner stated that if an individual learns and develops his mind, then in fact he has used his intellectual potential to think and he agrees that through the means of science process skills children will be encouraged internally to form intellectually correctly. Walking with this process builds critical thinking skills in children.

Several things that affect science process skills are a must for students to have. Things that affect science process skills include differences in students' genetic abilities, teacher quality, and differences in teacher strategies in teaching. Science process skills become a learning unit when applied with students being invited to think about finding answers to the problems being studied. One of the subjects that were introduced at the elementary school level to the high school level, among others, is Natural Sciences (IPA).

Science is a science that studies events that occur in nature by observing, experimenting, inferring, and formulating theories so that students have organized knowledge, ideas, and concepts about the natural environment, which are obtained from experience through a series of scientific processes including investigation, compilation, and presentation of ideas [2].

Science learning at the elementary school level emphasizes providing direct learning experiences through the use and development of process skills and scientific attitudes. The learning process so far in schools, especially elementary schools, is more often done passively, meaning that the teacher explains the material and the students listen. Currently, Science Process Skills (KPS) are important for students in learning activities to solve various science problems.

[3] argues "that by developing science process skills students will be able to find and develop their facts, concepts, and principles of science as well as grow and develop the attitude of sila that is demanded". The more active students handle their learning tasks, the more effective the learning will be and the impact on classical student learning completeness.

2 Research Methods

This research is a development research (Development Research). Research and development (Research and Development) is a research method used in order to produce certain products. The teaching materials developed in this research are in the form of science textbooks on Energy and its Changes based on science process skills. The subjects in this study were students of class V SDS PAB 25 Medan.

3 Results and Discussion

Define

Student analysis can be used as a reference in developing science learning textbooks based on science process skills and student ability test questions, so that learning tools and questions developed are in accordance with contextual problems. The results of the analysis of tasks carried out in this development are tasks related to the material of Energy and its Changes. Student activity sheets in the form of finding concepts or knowledge, solving daily problems related to comparative material together in a group, and with teacher guidance.

Design

Activities at this stage are preparation of tests, selection of media, selection of formats, and initial design of learning devices. The developed test is adjusted to the level of cognitive ability. Media selection is carried out to identify the right media according to the characteristics of the learning material. The format used by researchers in compiling textbooks based on science process skills has been adapted to the curriculum used in the school which is useful in improving student learning outcomes.

Develop

Validation is the first step in the development stage. Expert validation focused on the format, content, illustrations, and language of the developed learning tools.The results of the validation of the experts are used as the basis for revising and improving the learning tools. After the learning tools developed have met the criteria for validity according to experts. Then the learning device in the form of draft II was tested in the field where the research was conducted, namely the fifth-grade students of SDS PAB 25 Medan. Overall, the results of the first trial data analysis are that the learning tools developed have not been effective, because there are still several indicators of effectiveness that have not been achieved, such as the post-test results of mathematical problem-solving abilities in the first trial that have not met the criteria for achieving mastery classically, while the effectiveness indicators what is achieved is the achievement of learning objectives to achieve the specified criteria and the achievement of learning time, namely the learning time used during the trial I is the same as ordinary learning.

Material Expert Validation Results

Science textbooks based on science process skills validated by material experts aim to get criticism, suggestions, and information so that the developed textbooks become quality products in terms of learning material aspects and learning delivery systems based on science process skills. The results of the validation at the first meeting conducted by material experts showed that the textbooks that had been compiled were not yet fully validated. Several aspects need to be revised, such as correcting text that does not match the EYD, list of tables, list of pictures, glossary, and captions on pictures. So that the researchers made revisions, the researchers returned to submit the results of product improvements to be further validated. The validation results in stage II show better validation results. The result material expert validation can be seen in Table 1.

Table 1. Material Expert Validation Results

Aspect	Average Percentage	Description
Content Eligibility	93,75	Very Good
Presentation Eligibility	90	Very Good
Average Amount	91,87	Very Good

Based on the results of the validation carried out by material experts, the feasibility of the content in the development of science textbooks based on science process skills obtained an average percentage score of 93.75% with very good criteria while in the aspect of presentation feasibility an average percentage score of 90% with very good criteria.

Learning Media Expert Validation Results Data

Learning media experts validate textbook products based on two aspects that are assessed, namely aspects of graphic feasibility and canvas-shaped text themes. The result of learning media validation can be seen in Table 2.

Table 2. Validation Results of Learning Media Experts

Aspect	Average Percentage	Description
Graphic Eligibility	93,7	Very Good
Canva Shaped Text Theme	92	Very Good
Average Amount	92,85	Very Good

Based on the results of the table above, the assessment on the aspect of agricultural feasibility obtained an average percentage score of 93.7% with very good criteria and the Canva-shaped text theme aspect obtained an average score of 92% with very good criteria. Thus, the science process skills-based textbooks that have been developed meet the eligibility requirements for use in the field as science textbooks in class V SDS PAB 25 Medan.

Learning Design Expert Validation Results Data Learning Design Experts Validate Textbook Products On Aspects Of Learning Design.

Learning design experts validate textbook products on aspects of learning design. Learning design experts validate textbook products based on the assessed aspects, namely aspects of the feasibility of presentation, presentation, language, and image selection. The result of the learning design expert can be seen in Table 3.

Table 3. Validation Results of Learning Design Experts

Aspect	**Average Percentage**	**Description**
Serving Eligibility	100	Very Good
Presentation	87,5	Very Good
language	91,66	Very Good
Image selection	100	Very Good
Average Amount	94,79	Very Good

Average Score of Students' Critical Thinking Ability

Before learning is done, first the students in the experimental class do a pretest to determine the student's initial critical thinking skills. After applying learning using teaching materials based on science process skills, students are given a post-test that aims to evaluate students final critical thinking skills using validated questions. The results of the pretest and post-test data in the form of scores can be seen in Table 4.

Table 4. Pretest and Posttest Frequency Distribution of Critical Thinking Ability

Pretest		Postes	
15-22	1	65-70	8
23-30	6	71-76	4
31-38	6	77-82	8
39-46	3	83-88	5
47-54	2	89-94	4
55-62	8	95-100	1
Sum	1010	Sum	1950
Average	40,4	Average	78
Std. Deviation	11,895	Std. Deviation	7,638

Critical Thinking Ability Gain Test

The gain test aims to see the improvement of critical thinking skills after using the development of science textbooks. The results of the calculation of the gain test can be seen in Table 5.

Table 5. N-Gain Score Critical Thinking Ability

Total students	Pre-test	Post-test	N-Gain
25	62,24	78,8	0,43

Based on the N-Gain value of 0.43 then the increase in student learning outcomes is classified as moderate and can be used by students in individual trials.

Disseminate

The dissemination stage is the final stage in the 4-D development model. At this stage, the learning tools that have been tested in the research class will be re-tested by comparing the developed learning tools with those commonly used by classroom teachers at SDS PAB 25 Medan. This research is a research and development (Research and Development) so that the product of this research is a product that meets the criteria of being feasible and effective. The main purpose of this study is to describe the results of product development of science

textbooks and to describe the differences in student learning outcomes using textbooks developed with conventional textbooks.

Discussion

Product Feasibility of Science Textbooks Based on Science Process Skills

Validation was carried out on the product development of science textbooks to determine the feasibility of the developed book so that it could be used in learning on the subject of Energy and its Changes. According to [3] "to test the construction validity (construct validity) can be done by asking the opinion of the expert (judgment expert).

Based on the results of material expert validation, an average score of 91.87% was obtained in the very good category. According to [4] that is the main point in validating the content of teaching materials with SK and KD. This is because the material in the developed textbooks is following the substance of knowledge, SK, and KD, the accuracy of the material is by the facts of concepts, principles, and truths of science. The textbooks that have been developed have excellent presentation completeness, this is due to the consistent appearance design with clear pictures and writing.

Based on the results of expert validation of learning media obtained an average score of 92.85% with a very good category. based on the results of the learning design experts obtained an average score of 94.79% with a very good category. The acquisition of the three expert assessments, it shows that the products that have been developed are suitable for use in research.

Product Effectiveness of Science Textbooks Based on Science Process Skills on Learning Outcomes

In testing the effectiveness of the results of developing science textbooks based on science process skills, it is carried out in the learning process between teachers and students. [5] argues "that by developing science process skills students will be able to find and develop their own facts, concepts and principles of science as well as grow and develop the required value attitudes".

This means that the teaching materials developed have met the effective criteria. So it can be concluded that the students' learning mastery shows the use of the developed textbooks that meet the effectiveness criteria.

The more active students handle their learning tasks, the more effective the learning will be and the impact on classical student learning completeness. Based on the results of the pretest showed that the initial ability of students obtained an average value of 62.24 and the results of the posttest showed that the initial ability of students obtained an average value of 78.8. This proves that there are differences in student learning outcomes taught by science process skills-based textbooks with students taught using conventional textbooks, this is in line with research.

From the results of the research obtained, it can be stated that science textbooks based on science process skills developed have higher effectiveness than textbooks. So it can be concluded that with science learning based on science process skills students are easier to understand to learn the material.

4 Conclusion

The conclusion of this study is based on the research data by taking into account the formulation of the problem and the research objectives that have been formulated. Feasibility of science textbooks based on science process skills developed based on validation results with very high feasibility. Based on the data obtained from the validation results, the process skills-based textbooks developed are included in the criteria for use. The effectiveness of science textbooks based on science process skills based on learning achievement tests. Based on the results of the data obtained, it is concluded that there is a difference in effectiveness between those who use textbooks and the effectiveness of student learning using textbooks that have been developed

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