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RESEARCH ARTICLE

THE DEVELOPMENT OF SCIENCE TEACHING BOOK BASED ON IMAGE OF THE PROCESS FOR LEARNING IN JUNIOR HIGH SCHOOL

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Abstract

The purpose of this study was to test the validity, effectiveness and practicality of a process image-based science textbook for learning science in junior high schools. This study used a Research & Development (R & D) modified from 4-D by Thiagarajan (et al. 1974) which consists of Define, Design, Develop, and Dissemination. The stages of this research procedure: Define Stage, Design Stage, Development Stage (Develop) Table 4.1 shows that each component of the assessment gets almost the same score from the four validators. The mean score for content feasibility was 3.46, the mean graphical score was 3.58, the language mean was 3.38, and the mean presentation was 3.45. The mean score obtained shows that based on the validator's assessment of the science textbook based on the process of the wave vibration material is very valid and suitable for use in learning in junior high school. Natural science textbooks based on images of the process of wave vibration material which are practically known are based on data from trial I and trial II. Data were collected through observation, response questionnaires, and interviews with students. The implementation of learning and user responses are indicators of practicality. The results of the learning implementation analysis showed an increase in the percentage of learning implementation at each meeting. At the first meeting, the percentage of learning implementation was 79.24%, because students were not used to analyzing the process image of the wave vibration material. At the next meeting students became accustomed to using textbooks based on the process of wave vibration material so that the percentage of learning implementation increased. Consecutively the percentage of the implementation of learning is the second meeting of 81.34%, and the third is 83.34%, and the average result of the implementation of learning is 83.18%. The effectiveness of textbooks based on images of the process of wave vibration material is known based on the increased understanding of the concept of wave vibration which is measured based on the pretest and posttest values, and is analyzed through normalized gain. The N-gain index with the criteria "medium" to "high" and classical learning completeness are indicators of effectiveness. Classical mastery of learning is achieved when 85% of students meet the specified minimum completeness criteria (KKM).

Based on the results of the pretest and posttest, it was found that the N-gain value was 0.599 which was in the medium criteria, and the number of classical completeness was also complete, namely 85.71%.

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Introduction:-

Preliminary

The results of observations in 20 State Junior High Schools in Lumajang Regency, the teacher learning process is still dominant, while students do not have access to develop independently through meaningful learning. Teachers have not facilitated students to learn independently. The results of interviews and questionnaires to 25 junior high school science teachers at MGMP Lumajang Regency, show that the teachers have not made their own teaching materials and are still using existing textbooks. The interviews also revealed the teacher's lack of awareness of the importance of compiling learning materials according to their needs, facilities, and benefits in learning. Teachers use existing textbooks for the following reasons: 1) no need to bother making and compiling textbooks, 2) lack of mastery of computer programming related to textbook making, 3) teaching 24 hours per week and additional assignments given to teachers are confiscating time so that there is no opportunity to make textbooks

The results of interviews with junior high school students revealed that students complained that they did not like science lessons, especially physics material, because there were many calculations and formulas. Students stated that they preferred natural science material that was often found in everyday life. Critical students always ask questions and want answers not with formulas, but with logical and practical natural laws and rules. This fact is in accordance with the expressions of Marks & Eilks (2009) that many science lessons do not relate the material being studied to phenomena in real life, so that students are less interested in learning. Students want learning that does not only prioritize problem solving but the meaning of the process that occurs in learning science.

From the above problems, the researchers conducted research to develop science textbooks based on images of the process of wave vibration material with the aim of this study was to test the validity, effectiveness and practicality of process image-based textbooks for science learning in junior high schools.

Research Methods:-

This study used a Research & Development (R & D) modified from 4-D by Thiagarajan (et al. 1974) which consists of Define, Design, Develop, and Dissemination. In this study, simplification from 4-D to 3-D models, namely Define, Design, and Develop. The stages of this research procedure are: Definition Stage (Define), Design Stage (Design), Development Stage (Develop)

The aim at the development stage in this research is to produce a draft of the development of a textbook with a picture of the science process and good supporting instruments (valid, practical and effective). Activities carried out at this stage include validation by lecturers of the FKIP Postgraduate Program at Jember University and science teachers at SMP Lumajang, East Java. Expert validation was carried out to complete draft 1. The results of the validation were in the form of improvements from the revised draft 1 based on suggestions from the validator. Draft 1 which has been revised is called draft 2. Draft 2 is then tried out in the first trial in learning and its supporting instruments to evaluate and reflect on draft 2.

Trial I or program implementation test that has been designed and validated is called a practicality test. Trial 1 aims to test and check whether all designs can be implemented or implemented according to the scenario or not. Trial I draft 2 was conducted to obtain input from teachers, students, and observers. If there are still deficiencies, it will be revised again by asking for opinions from experts. The results of the first trial simulation will be analyzed and revised to obtain draft 3.

Trial II draft 3 or effectiveness test was carried out on research subjects by giving pre-test and post-test. At the end of the meeting, students were given a questionnaire on their responses to the implementation of the development of the Textbook for drawing the science process. During the implementation of learning, researchers are accompanied by observers who observe the learning process. Reflection after learning is used as the basis for revision of draft 3 which will produce a product in the form of development textbook of science process pictures. The effectiveness of

the development of Natural Science Textbook images of the Science process is determined based on the students' learning outcomes of science concepts.

$$\text{average score} = \frac{\text{the total score of the validators in each aspect}}{\text{number of aspects of the assessment}}$$

Table 3.2:- Criteria for Textbook Validation Scoring Process drawings.

No	Interval Mean	Criteria
1.	3,40 < mean	Very Valid
2.	2,80 < mean ≤ 3,40	Valid
3.	2,20 < mean ≤ 2,80	Quite Valid
4.	1,60 < mean ≤ 2,20	Less Valid
5.	< mean ≤ 1,60	Invalid

Textbook of process drawings and supporting instruments is considered valid if at least it meets the criteria "valid enough" so that it is suitable for use.

Result And Discussion:-

Validation Results of Draft I of Science Textbook Based on Image Process of Wave Vibration Material.

NO	Assessment Aspects	interval score				Interval mean	Criteria
		Validator 1	Validator 2	Validator 3	Validator 4		
1	Content eligibility	3,00	3,36	3,71	3,78	3,46	Very Valid
2	Graphic Components	3,10	3,50	3,70	4,00	3,58	Very Valid
3	Language	3,00	3,67	3,42	3,42	3,38	Valid
4	Serving Feasibility	3,20	3,20	3,60	3,80	3,45	Very Valid
Average score		3,08	3,43	3,61	3,75	3,47	Very Valid

Table of Results of Student Response Questionnaire Recapitulation in Trial I

Percentage of responses	Average score	Response Criteria
70 %	3,76	Good
20 %	3,19	Pretty Good
10 %	2,69	Not Good
-	-	Not Good

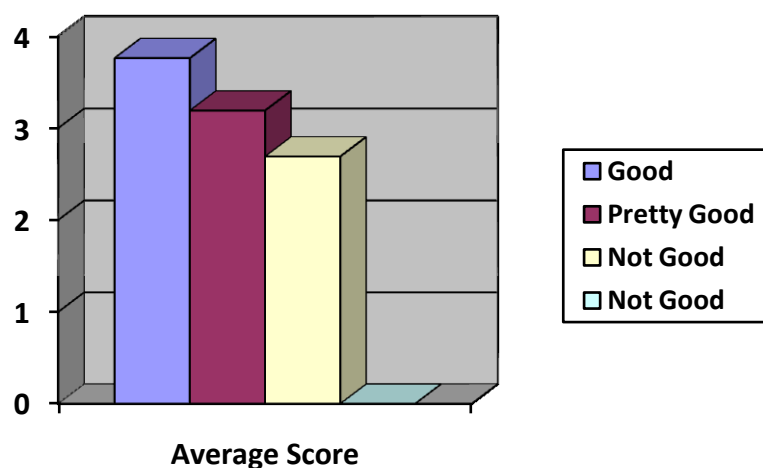
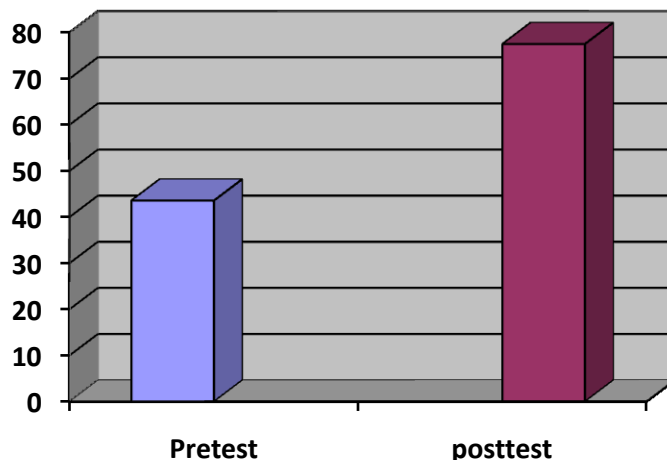


Figure Average Score of Student Response Questionnaire in Trial I

Table 4.6:- Recapitulation of Pretest and Posttest Values in Trial II.

No.	I. DESCRIPTION	Pretest	Posttest
1.	Average	43,54	77,50
2.	The highest score	58	92
3.	Lowest score	32	57
4.	Number of students with scores \geq KKM	0	24
5.	The number of students with a value of $<$ KKM	28	4
6.	Classical Completeness (%)	0	85,71

Image of Mean of Pretest and Posttest Values in Trial II



The mean of the four validators for textbooks based on the process of wave vibration material is 3, 47 and is in the "very valid" criteria (Tables 3.3 and 4.1). The assessment components include the feasibility of content, graphics, language, and presentation. These four components determine the quality and feasibility of the worksheet (Hartono, et al., 2013).

Table 4.1 shows that each component of the assessment received almost the same score from the four expert validators. The mean score for content feasibility was 3.46, the mean graphical score was 3.58, the language mean was 3.38, and the mean presentation was 3.45. The mean score obtained shows that based on the validator's assessment of the image-based textbook the process of wave vibration material is very valid and suitable for use in learning in SMP. In addition to providing numerical assessments, expert validators also provide notes and suggestions / input as material for improvements or revisions to textbooks based on the process of wave vibration material as shown in Table 4.2. Suggestions for improvement include unclear chart drawings and deviations that apply to small angles so that the image needs to be confusing. The validator stated that the textbook based on the image process of the wave vibration material developed was quite interesting and suitable for learning in junior high schools. The process image that is presented can represent something abstract that becomes more concrete, contextual and sticky to real life.

Textbook based on images of the process of practical wave vibration material is known based on data from trial I and trial II. Data were collected through observation, response questionnaires, and interviews with students. The implementation of learning and user responses are indicators of practicality. The results of the learning implementation analysis are presented in Table 4.6 showing an increase in the percentage of learning implementation at each meeting. At the first meeting, the percentage of learning implementation was 79.24%, because students were not used to analyzing the process image of the wave vibration material. At the next meeting students became accustomed to using textbooks based on the process of wave vibration material so that the percentage of learning implementation increased. Consecutively the percentage of the implementation of learning is the second meeting of 81.34%, and the third is 83.34%, and the average result of the implementation of learning is 83.18%.

The effectiveness of image-based textbooks on the process of wave vibration material was analyzed based on the data from the pretest-posttest trial II in class VIII-A SMP Negeri 2 Kunir in the 2019/2020 academic year as many as 28 students. Learning in the second trial was carried out in 3 meetings (6 JP) which were supervised by a class VIII science teacher and observed by the observer. Learning uses a student center learning approach and methods of lectures, discussions, questions and answers, and presentations. Figure 4.7 shows that the textbook based on the image process of the wave vibration material developed is effective for improving student learning outcomes. The mean pretest score of 43.54 increased to 77.50 (mean posttest) with an N-gain of 0.599 (attachment 10) in the medium category. The effectiveness of the textbook based on the process of the wave vibration material is also shown by the classical student learning completeness of 85.71% and the posttest mean of 77.50 which is above the KKM.

The developed textbook based on the process of wave vibration material has the effectiveness to improve student learning outcomes. The average N-gain test score for learning outcomes of the wave vibration material was 0.599 on moderate criteria and student learning completeness was 85.71% with a mean value of 77.50 with good criteria.

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