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DEVELOPMENT OF ELABORATION MODEL-BASED SCIENCE TEACHING MATERIALS TO IMPROVE STUDENTS' CRITICAL THINKING ABILITY CLASS IV ELEMENTARY SCHOOL

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ABSTRACT
This study aims to produce science content teaching materials based on a valid elaboration model to improve the critical thinking skills of fourth grade elementary school students. Teaching materials were developed using the 4-D model developed by Thiagarajan, et al (1974) which includes define, design, develop, and disseminate stages. The research instrument used was a teaching material validation sheet. The data analysis used is percentage. The results of the study revealed that elaboration-based science teaching materials had fulfilled the validity aspect because they had gone through the validation stage from the validator with an assessment based on 3 aspects, namely the content/material quality aspect on the material suitability indicator with basic competence obtaining an average percentage of 84%, material accuracy obtaining a percentage 78%, stimulating curiosity 93%, critical thinking 91%, use of the term symbol or icon in the material 76%, material presentation techniques 80%, learning support and presentation 88 %. In the aspect of design quality, the indicator size of teaching materials obtains a percentage of 87%, the cover design of teaching materials obtains a percentage of 95%, and the design of the contents of teaching materials 91%. In the aspect of language quality, the indicator for the use of the term symbol or icon obtains a percentage of 100% and conformity with language rules obtains a percentage of 91%. Teaching materials developed can improve critical thinking skills based on validation from validators who have obtained valid criteria.

Keywords: Development of Teaching Materials, Elaboration Models, Science Lessons

INTRODUCTION
Teachers as one of the elements that play a role in improving the quality of education play an important role in realizing the goals of national education. Law No. 14 of 2005 concerning teachers and lecturers is a real form of recognition for the teaching profession in all its dimensions. Teachers are professional educators with the main task of educating, teaching, guiding, directing, training, and evaluating students. One of the efforts made to improve the quality of education in Indonesia, namely the formation of the 2013 curriculum, teachers must design learning in such a way that learning will be better. Human cognitive development is a psychological process which involves the process of acquiring, compiling, and using knowledge and mental activities such as thinking, weighing, observing, remembering, analyzing, evaluating, and solving problems.
Student cognitive development is in line with the interaction between one aspect of development and another and between one student and another. Thus students must be able to increase the potential of their cognitive intelligence which is characterized by thinking skills, one of which is being able to think critically. The teacher's learning process must be able to arouse students' critical thinking processes on a subject matter, meaning that the teacher must help construct students' conceptual understanding of a material. Critical thinking is an integrated process that enables one to evaluate the evidence, assumptions, logic, and language underlying the thinking of others. In addition, critical thinking is a process of thinking deeply about information through investigation, exploration, experimentation, etc. to obtain accurate conclusions so that meaningful knowledge construction occurs. The critical thinking process can be carried out in the following stages: interpretation, analysis, evaluation, inference, explanation, and self-regulation. The material that is more dominant in the process of critical thinking is material in learning science
The science learning process activities of a teacher must be able to plan and carry out learning by having the ability to develop one of the learning tools, namely teaching materials which then implement it. A teacher

needs to organize teaching materials that have been developed into teaching materials related to pedagogic competence and professional competence. Teachers are required to make teaching materials which are part of the development of learning tools that are relevant in the hope of meeting the needs of students in participating in science learning. The development of teaching materials is an important factor in improving the quality of learning and the abilities possessed by students. Teaching materials that are prepared and developed must be adapted to the characteristics and needs of students by containing detailed learning material and evaluation.
Researchers prefer one learning model, namely the elaboration model, because using this learning model can train students to think critically. The elaboration learning model is a model that organizes learning content. Support for learning theory that comes from cognitive psychology which in turn also gave birth to a cognitive learning model. Two fields that support the validity of the elaboration theory, namely: (1) the theory of cognitive representational structures, and (2) encoding, storing, and retelling what has been conveyed, and retelling what has been stored in memory. The feature of the elaboration model learning model is starting learning from presenting content at the general level moving to a detailed level. (Uno, 2011: 142). This elaboration theory prescribes the optimal way to compile and organize the material of a subject with sequences starting with the epitome of one subject matter. Then it is elaborated on the parts in the epitome in stages by showing the links between the parts and providing a summary and synthesis at the level of detail specified in the curriculum (Widodo, 2015: 60)
Based on the results of observations at SDN 8 Tilongkabila it was found that teachers had not developed teaching materials independently, teaching materials used by teachers and students in the learning process in class were in the form of Student Worksheets (LKS) and other supporting books provided by the school. In general, teachers only rely on textbooks from publishers that only contain summaries of material in complex language, difficult to understand, the appearance and color of the images presented in the teaching materials are not attractive, resulting in students having difficulty understanding material that has elements of images, practice questions that are presented does not emphasize students' ability to think critically. Therefore, teachers and students need teaching materials that are good in terms of material and practice questions that can stimulate students to think critically.

RESEARCH METHODS

In this study, the Research and Development research approach was used, or better known as development research. . Research development is aimed at producing teaching materials for science content that have been declared valid by the expert team. The product that has been produced in this study is the Development of Teaching Materials in Science Content based on the Elaboration Model to Improve Critical Thinking Skills of Grade IV Elementary School Students. The development research design is based on the Thiagarajan, Sammel, and Sammel models, which consists of four stages, namely: 1) Define; 2) Design (Design), 3) Development (Develop); and 4) Dissemination (Disseminate).

RESEARCH RESULT

This development research was conducted at SDN 8 Tilongkabila Class IV. This development research aims to produce science teaching materials based on the Elaboration model that meet valid criteria. The criteria for the validity of teaching materials are seen based on the results of the assessment of the validity of teaching materials, namely the validation of several experts which include material experts, design and graphic experts, and language experts. The resulting product is a science teaching material based on the Elaboration model for class IV SDN 8 Tilongkabila.
4D model development research (Four-D). The stages contained in the model include: define, design, devolpment, and dissemination. This research begins with a preliminary study or needs analysis activities that have previously been adjusted to the schedule of activities. but this aims to collect information and an overview of the implementation of science learning which involves the use of teaching materials based on the

Elaboration model in grade IV of Elementary School. In the process of developing science teaching materials based on the Elaboration model, researchers used two stages contained in the 4D development model, namely Define and Design, Devolp

1. Results of the Defining Stage (Define)

This stage carried out several analyzes, such as initial-end analysis, student analysis, material analysis, task analysis and formulation of learning objectives. The activities carried out in this defining stage can be described as follows

a. Beginning-End Analysis

The initial-end analysis aims to obtain information about the fundamental problems faced by teachers and students in the science learning process in the classroom which form the basis for designing products in the form of teaching materials. At the beginning the activities carried out included library research and field studies as well as interviews with class IV teachers, namely Mrs. Yurvil Muksin, S.Pd and one of the class IV Nursyamsia Sule students at SDN 8 Tilongkabila. At the library study stage it was found that the school had used the 2013 curriculum, both teacher and student handbooks, but the numbers did not match the number of students present, while the field study stage was carried out by looking directly at the science learning process in class, where it was found that the problems encountered in the learning process there are science learning resources that the teacher uses are test books from publishers and there are no teachers who have developed teaching materials, because students only study test books from publishers where according to some students the material presented in the books is still difficult to understand properly good.

b. Student Analysis

The stages of this analysis were carried out to analyze the characteristics of fourth grade students who were at SDN 8 Tilongkabila which was the target for using teaching materials, based on the analysis carried out on students, namely in learning science students' academic abilities were still very low. Students feel the material in science learning is difficult and boring because the teacher only refers to books from publishers that do not stimulate students to think critically so from this analysis it is necessary to develop teaching materials that are easy to understand and can attract students' interest so that students can think critically.

c. Task Analysis

The researcher made observations around the learning process in order to analyze it in order to provide an overview of the product design being developed. This analysis is used to facilitate researchers in designing science teaching materials based on the Elaboration model.

This analysis phase includes general tasks and specific tasks for learning, which refer to KI and KD which are specifically developed on the material Sound and the Sense of Hearing, Plants and Animals, Light and Sense of Sight.

1. Design

At this stage, several tools were prepared to design science teaching materials based on the elaboration model. At this stage there are 2 steps that are carried out, namely as follows:

1) Collection of material for science teaching materials based on elaboration. Collection of various materials ranging from sound material and the sense of hearing, plants and animals, light and the sense of sight into teaching materials.

2) Preliminary design of teaching material products. The initial design of the product is a design made in the preparation of science teaching materials for class IV elementary schools based on the elaboration model in general the elaboration design consists of four aspects including: (1) making an epitome, (2) first stage elaboration, (3) making a summary, and (4) synthesis.

2. Results of the development stage (Devolp)

This stage aims to produce valid teaching materials. In the analysis of validity data, namely the validation of teaching materials by experts. The initial draft (draft 1) of teaching materials is given to the validator to be assessed, the assessment is carried out by filling out a teaching material quality assessment sheet in the form of a checklist sheet covering several aspects for each expert then the teaching materials are revised by taking into account suggestions/input from experts/experts the. The results of the design stage in the form of draft 1 (initial) are then tested for validity by looking at the results of the validation of teaching materials by the validators. The validation of teaching materials involves 3 validators for each expert related to the teaching materials being developed.

Table 1 Data Recapitulation of Elaboration-Based Teaching Material Validation Results

No	Aspect	Indicator	Average Score	Percentage	Category
1	Material Expert Validity	The suitability of the material with basic competence	4,2	84%	**Very Valid**
		Material accuracy	3,8	75%	**Valid**
		Stimulate curiosity	4,7	93%	**Very Valid**
		Critical thinking tools	4,6	91%	**Very Valid**
		The use of the term symbol or icon in the material	3,8	76%	**Valid**
		Material presentation techniques	4,0	80%	**Valid**
		Support and presentation of learning	4,4	88%	**Very Valid**
2	Media Design Expert Validity	Material size	4,3	87%	**Very Valid**
		Teaching materials cover design	4,7	95%	**Very Valid**
		Teaching material design	4,5	91%	**Very Valid**
3	Linguist Validity	Use of the term symbol or icon	5,0	100%	**Very Valid**
		Conformity with the rules of language	4,5	91%	**Very Valid**

DISCUSSION

The results of research on the development of teaching materials as described in Chapter IV are directed at answering the formulation of the problem and achieving the research objectives, namely obtaining valid teaching materials as stated in Chapter II regarding the requirements for an appropriate teaching material according to Nieveen (2007). The results of the development in this study have produced a teaching material based on the elaboration model.

1. Comparison of publisher's teaching materials and developed teaching materials

Based on the problems found in the observations, it was found that SDN 8 had not developed teaching materials so it still used teaching materials obtained by publishers in the form of theme books so that these problems became a benchmark in developing teaching materials, namely teaching materials based on elaboration models. The comparison between the teaching materials used in SDN 8 and the elaboration teaching materials that have been developed include:

a. The displayed image has a location and position that is not arranged according to certain rules so that the displayed image is not uniform in position. The arrangement or layout of the images presented by the author still needs attention and better arrangement. Because the images that are displayed are not well organized and have a variety of display models so that for some people the various images make the textbook less attractive.

b. The entire material is still general in nature, the material in teaching materials from publishers covers all subject matter and science material is only partly included in teaching materials, so that the in-depth material in teaching materials is lacking and is still general in nature compared to teaching materials developed which focus more on science lessons so that the material on more complex teaching materials, so that students are enriched with the concepts in each material

c. Teaching materials from publishers are not integrated with learning models, teaching materials come from publishers so that there are no independent student activities compared to teaching materials that have been developed according to an elaboration model that specializes in critical thinking skills.

d. Teaching materials from publishers have not stimulated students to think critically, there are no practice questions that can increase students' critical thinking compared to teaching materials that have been developed

The material validator on science teaching material products was carried out by three material experts. The three material experts are 1 lecturer from Gorontalo State University and 2 material experts from SDN 8 Tilongkabila teachers. In general, the material expert assessment questionnaire consists of 6 indicators, namely the suitability of the material with basic competencies, the accuracy of the material, stimulating curiosity, critical thinking tools, the use of the term symbol or icon in the material, material presentation techniques, support and presentation of learning.

Based on the data from the material expert validation assessment results in Appendix A3, the material suitability indicator with basic competencies shows that the material completeness item gets the highest average score of 4.3 with a percentage of 87% which is categorized as very valid. This implies that the completeness of the material in the teaching materials is very complete and is proven by the absence of suggestions or comments that must be revised by the researcher regarding the items of completeness of the material by the three validators. The material breadth item has an average value of 4.3 with a percentage of 87% and is categorized as very valid so that the material in teaching materials is very broad, this is evidenced by the absence of suggestions or comments regarding the item by the three validators. In the material coherence item, the lowest average value is 4.0 with a percentage of 80% categorized as valid. This implies that the orderliness of the material in teaching materials is coherent, it's just that there is a revision from the validator where the material must be coherent from easy material to difficult material and in teaching materials it is found that there are some materials that are not coherent so that from these revisions the researcher makes improvements

The material accuracy indicator shows that the concept deficiency assessment item gets the lowest average score of 3.7 with a percentage of 73% categorized as Valid. This shows that the item is valid, it's just that there is a revision from the validator who considers that teaching materials need to be added to science concepts that they have never studied in previous teaching materials, so from these revisions the researcher made improvements. In the item accuracy of images, diagrams, and illustrations, an average value of 4.0 is obtained with a percentage of 80% categorized as like, the item is valid, it's just that there is a revision from the validator where in the teaching materials it is found that images still use cartoon images, not colored and not clear so that from the revision the researcher made improvements. In the item lacking notation and symbols, the lowest average value is 3.7 with a percentage of 73%. This indicates that the item is valid, but there is a revision from the validator who considers that the notation and symbols in the teaching materials are not scientific and need to be revised so that the revision This was corrected by the researcher

The indicator stimulates curiosity shows that the assessment items encourage curiosity and the items encourage students' curiosity to seek further information obtaining an average value of 4.7 with a percentage of 93% and is categorized as very valid. This implies that the teaching materials developed can encourage students' curiosity to seek further information, this is evidenced by the absence of suggestions or comments by the three validators.

The indicators for critical thinking tools show that the assessment items invite students to seek information, illustrated images and examples foster critical thinking skills, and present learning that involves students in problem solving obtaining an average score of 4.7 with a percentage of 93 and categorized as very valid. This implies that the three items are able to improve students' critical thinking skills, this is also evidenced by the absence of revisions by the three validators. In the item presenting material that can be applied, students get

an average score of 4.3 with a percentage of 87% and are still in the very valid category. Even though this item has a lower rating than the other three items, this item is very valid for improving students' critical thinking skills as evidenced by the absence of revisions from the three validators.

On the results of the validation of indicators using the term symbol or icon in the material, it shows that the consistency of the use of terms obtains an average value of 3.7 with a percentage of 73% and is categorized as valid. This assessment shows that the item is valid, it's just that there is a revision from the validator who considers that there are several terms that are not appropriate, there are also some writing terms that have writing errors so that revisions are needed so that researchers make improvements to teaching materials. In the item consistency using patterns and layouts, the highest average value is 4.0 with a percentage of 80% and is categorized as valid, this proves that the use of patterns and layout symbols or icons is correct and there are also no comments and revisions from the three validators. for those items.

In the results of the validation of the indicators of material presentation techniques for the consistent use of pattern and layout items, the highest average value is 4.3 with a percentage of 87% and is categorized as very valid, this proves that the use of patterns and layouts in the material is correct and also no comments and revisions from all three validators for the item. In the concept coherence item, the lowest average value is 3.7 with a percentage of 73% and is categorized as valid. This assessment shows that the item is valid, it's just that there is a revision from the validator who assesses that there is a lack of concepts in teaching materials so that it affects the coherence of concepts

In the results of the validation of the supporting indicators and presentation of learning for items of completeness of meaning in chapters/subchapters/paragraphs, the lowest average score is 3.7 with a percentage of 73% and categorized as valid. This proves that the material presentation items presented in one chapter/sub-chapter/paragraph already reflect the title of the material and are related to the entire content in one chapter/sub-chapter/paragraph. In the item clarity of activity instructions, an average score of 5.0 with a percentage of 100% proves that the clarity of activity instructions is good and nothing needs to be corrected and revised. The item for generating motivation to learn and the bibliography obtained a score of 4.7 with a percentage of 93% and was categorized as very valid. This assessment shows that the teaching materials have been able to arouse student learning motivation and the Bibliography section is complete, it's just that the reference list needs to be added to material references and don't just refer to the SD textbook material. competency test questions at the end of each chapter, and introductory items obtaining a score of 4.3 with a percentage of 93% and categorized as very valid, so that the assessment shows that in the teaching materials there are questions at the end of each chapter that can improve critical thinking skills, and in the the introduction is correct and there is no revision of the three validators so nothing needs to be fixed.

b. Media design expert validation

The design validator for science teaching materials was carried out by three design experts. The three material experts are lecturers from Gorontalo State University. In general, the media expert assessment instrument consists of 3 indicators, namely the size of the teaching material, the cover design of the teaching material, and the design of the contents of the teaching material.

Based on the data from the design expert's assessment contained in appendix A4, the teaching material size indicator shows that the item conformity to the ISO standard has an average value of 4.3 with a percentage of 87% and is categorized as very valid. This proves that teaching materials have a size that is in accordance with ISO standards, namely using A4 paper.

The results of the assessment of the three validators on the cover design indicator for the item size of the font title of the teaching material and the color of the title of the teaching material contrast with the back color, the two items obtained an average value of 5.0 with a percentage of 100% and were categorized as very valid. This proves that the teaching materials have appropriate font sizes, not too small and not too large so that students can learn and the colors on the covers of the teaching materials contrast so that for the two items there is no revision of the validator. It is already very valid. In the form item, the color size of the teaching material design obtains an average value of 4.3 with a percentage of 87% and is in the very valid category. This shows that the color, size, and design proportions of teaching materials are very valid, but there is something that needs to be revised, namely the selection of images that are placed on the front of the cover must be related to

the contents of the teaching materials, so that the covers of teaching materials can describe the entire contents of the material. So that from this revision the researcher made improvements by redesigning the cover of the teaching material

The results of the assessment of the three validators on the teaching material content design indicators for the assessment item layout of the teaching material elements are consistent and the printing area is proportional to obtain an average value of 4.3 with a percentage of 87% and is categorized as very valid. This shows that the layout of the teaching materials is correct, it's just that what needs to be revised in the section on giving bullet points is not precise and unscientific, so it is recommended to use bullet point numbers or in the form of letters, and for proportional print area items that need to be revised, namely in the layout of the image must be proportional so that the researcher revises the part of the image that is not in a proportional layout.

In items not using too many fonts and using variations of letters, the average value is 4.7 with a percentage of 93%. This shows that the two items are in the very valid category, but even though they are in the very valid category, the validator suggests that teaching materials use only 1 typeface, namely Times New Roman, and for the use of letter variations it is suggested that terms in foreign languages need to be italicized because some material that did not have time to be italicized so that from the revision the researcher made improvements. Items with normal spacing between lines obtain an average value of 4.3 with a percentage of 87% and are categorized as very valid. this shows that the content of teaching materials that have been developed has a normal spacing of 1.5. Items capable of expressing the meaning/meaning of objects obtain an average value of 5.0 with a percentage of 100%, based on the assessment the item is appropriate and nothing needs to be revised. In all items, matching illustrations obtained an average value of 4.7 with a percentage of 93% and were categorized as very valid. this shows that the teaching material items contain illustrations that are in accordance with the material presented so that with these illustrations students can understand the material.

c. Linguist validation results

The language validator for science teaching materials was carried out by three linguists. The three linguists are lecturers from Gorontalo State University. In general, the linguist's assessment instrument consists of 2 indicators, namely the use of the term symbol or icon and conformity with language rules. Based on the data from the assessment results of language experts contained in Appendix A5, the indicator for using the term symbol or icon for items of conformity with the level of intellectual development of students obtained a score of 5.0 with a percentage of 100%. This proves that the terms used in teaching materials can be understood by students, not too use language that is difficult for students to understand so that the terms used can still be understood by fourth grade students.

The results of the assessment of the three validators on the conformity indicator with language rules for language accuracy items obtained an average value of 5.0 with a percentage of 100% and were categorized as very valid. this shows that the use of language rules in teaching materials is appropriate, teaching materials use good Indonesian language rules, it's just that there are some writing errors that need to be revised, so the researcher then reviews the teaching materials to see writing errors. The item for spelling accuracy has an average value of 4.0 with a percentage of 80% and is categorized as Valid. this shows that the spelling in the teaching materials is correct but in some materials there are spelling words that are not appropriate due to writing errors. And on the item clarity of instructions and directions, it gets an average value of 93% and is categorized as very valid. this shows that the teaching materials have instructions that are correct and appropriate, especially the instructions for using teaching materials are very appropriate, this is evidenced by the absence of revisions from the three validators.

2. The results of the revision of the elaboration-based science teaching material validator

Based on the assessment of the three validators which focused on aspects of the Ministry of Education (2009: 2), namely aspects of content/material quality, language quality aspects, and design/graphic quality aspects, elaboration-based science teaching materials that were developed in general met valid criteria and were valid for use with several revisions and improvements to the editorial according to the suggestions of the validators are listed in table 4.7, namely: 1) Improving sentence redaction to make it short and clear and paying attention to the grammar according to KBBI; 2) Replace images in the form of cartoon images with photographic

images; 3) Adding animal images (lions) to the book cover; 4) Improve indicators by looking back at Bloom's taxonomy levels; 5) Improving the use of letters in accordance with good language rules and by placing punctuation marks correctly

The elaboration-based science teaching materials developed also describe the five characteristics that must be contained in teaching materials. According to the Ministry of Education (2008) these characteristics are: 1) Self-Instructional in this teaching material can be seen by the existence of clear learning objectives, the content of learning material packaged in small, specific activity units so that it makes it easier for students to study thoroughly, there are examples of thinking practice questions critical and summative questions, illustrations that support the clarity of achievement of learning material, using simple and communicative language, there is a summary of learning material; 2) Self Contained, in this teaching material you can see the entire content of the subject matter needed in the teaching material so that students can study the learning material thoroughly, because the learning material is packed into a single unified whole; 3) Stand Alone can be seen in teaching materials where students can carry out independent activities without the help of teaching materials; 4) Adaptive where the teaching materials are developed in accordance with the development of science; 5) User Friendly where the teaching materials developed contain information instructions so that they can help the user by using simple language or terms, easy to understand

4. Ability to think critically

Elaboration-based science teaching materials contain exercises that can stimulate students to think critically which have been adapted to indicators, so that science teaching materials based on elaboration models can improve critical thinking skills. Critical thinking gets an average value of 4.6 with a percentage of 91% which is in the very valid category.

3. The advantages and disadvantages of science teaching materials based on the elaboration model

Science teaching materials based on the elaboration model developed have advantages and disadvantages, namely

a. The advantages of science teaching materials based on the Elaboration model

1) Elaboration-based teaching materials can stimulate students to think critically, the learning process becomes more interesting because students not only listen but observe events occurring through teaching materials and compare theory with reality

2) Elaboration-based teaching materials can be collaborated with other learning models

b. Weaknesses of Elaboration-based Science teaching materials

1) the elaboration-based teaching materials developed only cover 3 materials in odd semesters

2) requires special abilities and skills for teachers so that teachers are required to work more professionally

3) requires a good teacher's willingness and motivation for the success of the student learning process

CONCLUSION

Based on the discussion of the research results that have been described, it can be concluded that the development of elaboration-based science teaching materials for the elementary school level can be categorized as valid by the expert team for use in the science learning process because it meets the validity requirements and suggestions in this study. Science teaching materials based on the elaboration model can be used as a reference for developing science teaching materials for other science materials, besides that this research can also be a reference for developing similar studies.

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