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DEVELOPMENT OF SCIENCE TEACHING MATERIALS BASED ON CONTEXTUAL LEARNING ON CRITICAL THINKING SKILLS ON THE TOPIC OF CLASSIFICATION OF MATERIALS AND ITS CHANGE

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Abstract:
Science learning that is carried out by educators so far still separates formal science knowledge from everyday experience, so students assume that science lessons have no connection with their lives. Teaching materials presented in these teaching materials are rarely associated with actual objects or events in the real world that are familiar with students. Problems presented contain idealized objects and events that are not related to the reality of students. This study aims to: describe the effect of the results of developing contextual-based teaching materials on students' critical thinking skills and student learning outcomes. The research design used was the research and development of the Dick & Carrey model. The research subjects were class VII students from several junior high schools in Paringin. The experimental class accepts learning using contextual based teaching material, while the control class accepts conventional learning on the topic of material classification and its changes. The results showed that: (1) contextual-based teaching material proved to have a positive influence on student learning outcomes this was seen from the completeness obtained, and (2) contextual-based teaching materials influence the improvement of students' critical thinking skills.

Keywords: development of teaching materials, contextuals, critical thinking, learning outcomes

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1. Introduction

The education curriculum gives freedom to schools to organize educational programs in accordance with (1) the condition of the school environment (2) the ability of students (3) available learning resources and (4) regional characteristics that can involve parents of students and the community (Depdiknas, 2006). The 2013 curriculum emphasizes that each region can make education in accordance with regional characteristics and daily life experiences. In other words, the curriculum must contain this diversity to produce graduates that are relevant to regional development needs (Depdiknas, 2006). The concept in the 2013 curriculum book aims to accommodate local content. This is felt important because in the process of delivering material sometimes the teacher needs an explanation that is easily understood by students. Learning that accommodates local content will increase students' insight into the local potential in their area.

The substance of science subjects in the structure of the SMP/MTs curriculum is integrated science. The implementation of integrated science aims to improve the efficiency and effectiveness of learning. Widhy (2013) suggested that the science learning process must refer to and implement educational standards set by the government to equip students with body of knowledge, scientific skills, thinking skills, and strategy of thinking (process standards), critical and creative thinking (scientific inquiry standards), and authentic assessment (standard assessment). One of the goals of science learning can be achieved by using integrated science teaching materials as a good and right reference, both for teachers and students (Sukardjo, 2013).

The results of interviews with several science teachers in Balangan District stated that the science learning process so far tended to focus on teaching materials that had existing teaching materials that had been used tend to be incomplete and not in accordance with the characteristics related to the students' contextual conditions. The learning process that is not in accordance with the conditions of everyday life cannot foster the needs and interests of students to pay attention to the maintenance and utilization of the surrounding natural environment. The learning process that is not in accordance with the conditions of the students certainly contradicts the objective of science learning which does not only emphasize the mastery of a collection of knowledge in the form of facts, concepts or principles, but also a process of discovery.

Teaching materials that are commonly used in schools today, the preparation is often without considering the conditions of students designed for learning purposes. The contents of teaching materials are mostly compiled using a scientific discipline approach that prioritizes wealth or completeness of content, not a learning methodology approach. The material presented in the printed teaching material is more abstract and complicated so students are reluctant to read it, let alone learn it.

The competency achievement of the results of the national examinations for science subjects at Paringin 3 Junior High School in the 2015/2016 school year shows the topic of substance classification having the lowest average score of only 32.18. The low achievement of students' competency on the topic of substance classification due to the science learning process carried out by educators has still separated formal science knowledge from everyday experience, so students assume that science lessons have no connection with their lives. The results of the review of researchers on class VII odd semester teaching materials used by educators in science learning activities in the classroom found that the teaching material presented is rarely associated with actual objects or events in the real world that are familiar with students. The teaching material presented is only in the form of a definition of a concept, a set of formulas, sample questions, and problem training. The problems presented in the teaching material are also academic in nature. The problems presented do not contain objects and events and is not related to the reality of students.

The teaching pattern that has not yet linked factual events in the environment around students is because most science learning in Balangan is still transmissive. Teachers transfer and convey concepts directly to students. Transmissive learning makes students passively absorb the structure of knowledge given by the teacher or contained in the textbook (Fahmi dan Irahsyuarna, 2017). This situation results in learning just conveying facts, concepts, principles and skills to students. It seems that science is still calculated by the teacher as material that only learns about theoretical matters that often burden students with the amount of material that must be memorized. This situation causes participants not to know what is gained from learning. As a result, students have difficulty in solving analysis questions related to solving a problem.

Science learning will be more meaningful if the science learning process in the classroom is not separated from the experience of everyday environment (Fahmi dan Irhasyuarna, 2017). Libman (2010) states that there is no context-free learning. Knowledge is situated and bound by context. The information learned must be connected to a real situation, where students tend to use it. Allsopp (2003) and Fahmi (2016) state that learning that makes the experience and environment around students in the learning process will greatly help stimulate thinking skills.

Science learning resources that have not been able to stimulate patterns of thinking will result in students not being able to criticize every phenomenon that occurs in people's lives, so that students cannot understand the meaning of each event that occurs (Af'idayani et al., 2018). Science education applied in every school should be able to make someone respond to the phenomena around their place of residence. Facts on the ground show different things about science education currently available. Science education has not been able to stimulate thinking patterns to be able to criticize every phenomenon that occurs in people's lives so that students cannot understand the meaning of each event that occurs (Rahayu et al., 2018). Both physical and socio-cultural environments can make certain contributions to the learning experience. These experiences can be in the form of mindset (cognitive domain), attitude patterns (affective domain), and behavior patterns (psychomotor domains) (Suastra, 2009). Science in general if it is made in harmony with the daily culture of students, then learning science will have a tendency to strengthen the views of students on the universe, and the result is inculturation (Hawkins and Pea, 1987 in Suputra, 2013). If inculturation occurs, students' scientific thinking about daily life will increase.

The low learning experience results in low critical thinking skills in students. Normala (2014) states that students '*critical thinking skills in one school in Banjarmasin are still low due to the lack of science learning processes that support students'* critical thinking skills. In the 2011 Trends of the International Mathematics and Science Study (TIMSS), only 3% of Indonesian students who became respondents reached high levels, and 54% of Indonesian students achieved low level skills (Wasis, 2015). The 2012 PISA report states that the average science score of Indonesian students is 382, of which Indonesia is ranked 64th out of 65 participating countries or in other words the second lowest ranking of all PISA participating countries (OECD, 2013). The PISA and TIMSS results show that on average Indonesian students are only able to recognize a number of basic facts but have not been able to communicate and associate various scientific topics, let alone apply complex and abstract concepts. This shows that many students in Indonesia have difficulty working on high-level thinking skills.

Thinking skills are obtained through practical activities in the learning process (classroom activity) while the learning process in schools tends to be oriented towards student worksheets or worksheets that do not contain thinking skills. One way to improve thinking skills is by improving teaching materials. So far, the teaching materials used in schools have many obstacles, both in limited numbers and in the scope of the material that is not concrete so that the teacher must make his own compilation. One way to overcome this is by providing or developing independent learning materials in the form of learning teaching materials. The practical value of teaching materials is to make it easier for teachers to measure thinking skills and be based on the lives of everyday students (contextual). The development of contextual based teaching materials is expected to help students develop thinking skills. Critical thinking skills need to be trained continuously, so that there is a need for further research on the development of teaching materials in order to produce teaching materials that can train students' critical thinking skills and are valid, practical and effective.

The development product in the form of teaching material prototypes is carried out through procedural steps to improve the product. Each step is a micro cycle which ends with a revision (Ploomp & Nieveen, 2007). In this way, it is expected to produce valid, practical and effective teaching materials. Various studies on the development of teaching materials have been reported. Sudarno (2015) in his research stated that the science-based contextual module has an influence that can improve science learning achievement. Rusmiati, et al. (2013) stated that the learning outcomes and interests of students increased after using the development module. Research on contextual science based modules as described has indeed been done, but it is still rare to associate them with critical thinking skills.

2. Methods

This study uses a research and development model adapted from Dick & Carey (2005) that has been adapted itself to the needs in development. The research subjects for product trials developed in this study were VII grade students with 79 students involved. The type of data about the quality of teaching materials developed is qualitative data and quantitative data. Qualitative data obtained from observations and interviews, while quantitative data obtained from material experts, media, and language and the attractiveness of students about the use of products developed. The flow of research on the development of contextual based teaching materials can be seen in the following Figure.

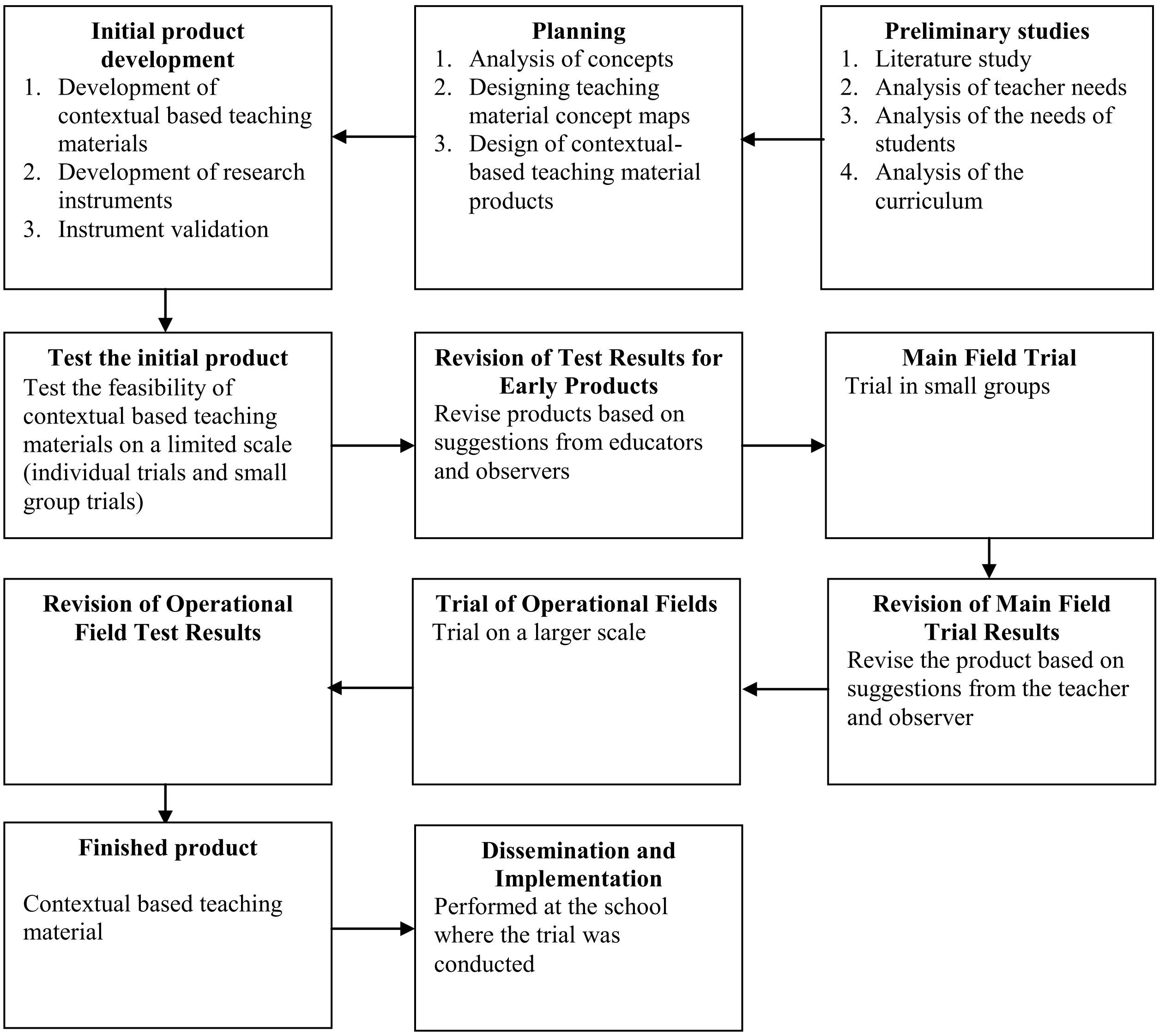

Figure 1: Research Flow of Contextual Based Learning Materials Development

3. Results and Discussion

3.1 Results of Basic Science Process Skills Analysis

The assessment of critical thinking skills is obtained in learning activities when working on student worksheets (LKPD) in groups and adapted to indicators of critical thinking skills which include interpretation, analysis, evaluation, inference, and explanation skills. The results of a review of critical thinking skills on the effectiveness of contextual-based teaching materials are presented in the following Figure.

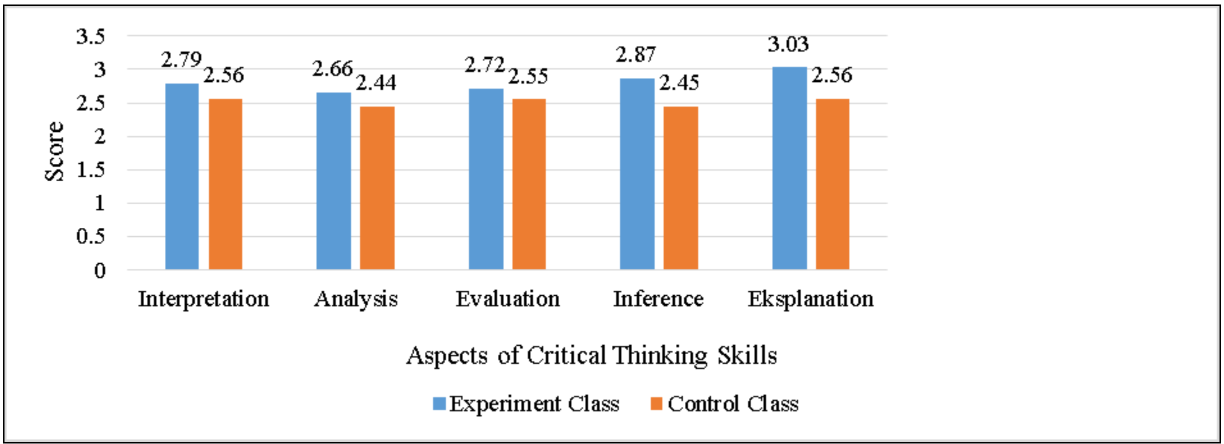

Figure 2: Comparison of Average Experimental Critical Thinking Skills and Control Classes

Figure 2 shows that the activities of students who have an active and very active average influence students' critical thinking skills. Critical thinking skills in the field test obtained the results of all aspects in each meeting in the good category. This is because in the field test all obstacles that previously appeared in the small group test have been overcome. All aspects of critical thinking skills in the field test are only in the good category. This is a challenge because critical thinking skills are skills that must be continuously trained so that students are accustomed to learning activities that develop critical thinking skills. The use of contextual-based teaching material in field tests shows that it helps train students' critical thinking skills. If the learning process is carried out innovation and involves students actively, will motivate and develop reasoning power concretely and independently.

3.2 Results of Analysis of Learning Outcome Test

The results of the mean analysis of the test results in the field test in the control class and experimental class can be seen in Figure 3 below.

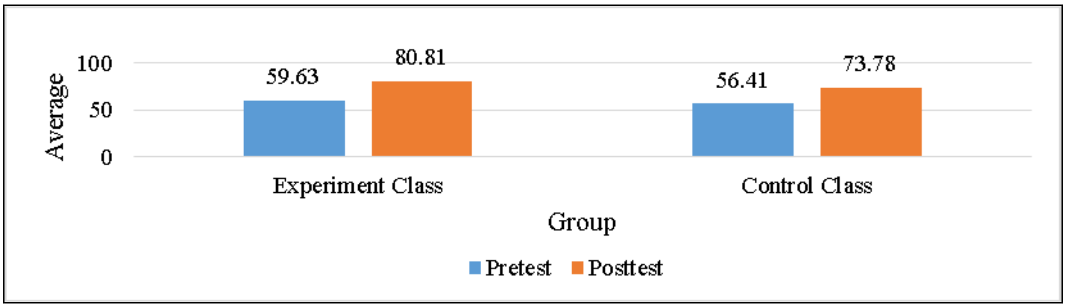

Figure 3: Average Learning Outcomes Test Results in the Control and Experimental Classes

The average value of learning outcomes for the experimental class and the control class at the pretest and posttest showed a different increase. Figure 3 shows the experimental class has a higher score than the control class. To measure the increase in learning outcomes tests in the control class and experimental class used standard gain. The gain calculation of the learning outcomes test in the control class and experimental class can be seen in Figure 4 below.

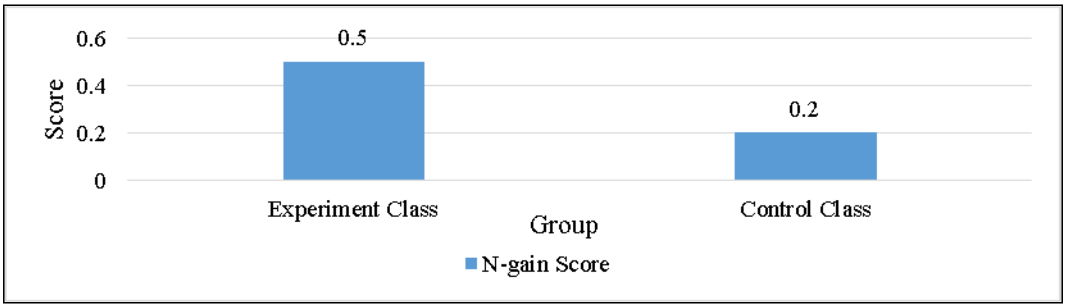

Figure 4: N-gain scores Learning Outcomes Test in the Control and Experimental Classes

Based on the average learning outcomes obtained the results of the N-gain value for the control class obtained a score of 0.2 categorized low, while the experimental class obtained a score of 0.5 categorized medium. The results of the N-gain test show contextual based teaching materials have an influence on student learning outcomes. The test of the effectiveness of student learning outcomes tests in the field test shows classical completeness which means contextual-based teaching materials have been effective against critical thinking skills. Completion of students in classical learning outcomes tests because the evaluation questions given are problems that have been solved while conducting learning activities.

3.3 Analysis of the Effectiveness of Contextual Based Learning Materials

Effectiveness analysis aims to determine the effect of contextual-based teaching materials on the development of critical thinking skills and student learning outcomes in the experimental class and the control class. The data used for analysis are the results of critical thinking skills and student learning outcomes. The analysis used is a univariate test with ANOVA. Before conducting the ANOVA test, a prerequisite test must be carried out, namely the normality, homogeneity and correlation test.

1) Normality Test

The normality test was carried out on the value of critical thinking skills and learning outcomes in the experimental class and the control class. The normality test was carried out using the Kolmogorov-Smirnov test, with a significance level of 5%. Kolmogorov-Smirnov Test. The decision criteria used are H_0 rejected if the significance value is greater than 0.05. Summary: the results of testing the normality of critical thinking skills and learning outcomes can be seen in Table 1.

Table 1: Normality Test Results

Group	**Dependent variable**	**Kolmogorov-Smirnov**		
		Statistic	**df**	**Sig.**
Experiment	Critical Thinking Skills	0,176	32	0,09
	Learning Outcomes	0,130	32	0,072
Control	Critical Thinking Skills	0,208	32	0,007
	Learning Outcomes	0,221	32	0,77

The results of the normality test in Table 4.23 show the significance value of critical thinking skills and learning outcomes in the experimental class and control class >0.05, so that H_0 is rejected. Thus, it can be stated that data on critical thinking skills and learning outcomes are normally distributed.

2) Homogeneity Test

The homogeneity test aims to find out whether the data in the experimental and control groups have the same variance or not. The variance homogeneity test was conducted on the data of critical thinking skills and learning outcomes carried out using the Lavene test with a significance level of 5%. The Lavene test was carried out with the help of SPSS 16. The decision criteria used were H0 rejected if the significance value was more than 0.05. The test results of homogeneity of critical thinking skills and learning outcomes in the control class and experimental class can be seen in Table 2.

Table 2: Homogeneity Test Results

Dependent variable	**Levene statistic**	**df1**	**df2**	**Sig.**
Crtitical Thinking Skills	2,493	1	8	0,153
Learning Outcomes	1,426	1	62	0,237

The homogeneity test results in Table 2 show the significance value of critical thinking skills and learning outcomes in the experimental class and control class >0.05, so that H0 is rejected. Thus, it can be stated that the data of critical thinking skills and learning outcomes have the same variance.

3) Correlation Test

Correlation test aims to determine whether there is a relationship between critical thinking skills in the class that uses contextual-based teaching materials and classes that use teaching materials that are available at school. Correlation tests were carried out on data on critical thinking skills and learning outcomes carried out using Pearson Product Moment with a significance level of 5%. The decision criteria used are H_0 rejected if the significance value is more than 0.05. The results of the correlation test of critical thinking skills and learning outcomes in the control class and experimental class can be seen in Table 3.

Table 3: Correlation Test Results

Variable		**(X) Critical Thinking**	**(Y) Learning Outcomes**
X (Critical Thinking)	Pearson Correlation	1	.770*
	Sig. (2-Tailed)		.000
	N	32	32
(Y) Learning Outcomes	Pearson Correlation	.770	1
	Sig. (2-Tailed)	.000	
	N	32	32

Table 3 shows that the results of the Pearson Product Moment test obtained a significance value of <0.005, so that H_0 was rejected. Thus, it can be stated that there is a significant relationship between critical thinking skills and learning outcomes.

4) ANOVA Test

Univariate ANOVA test was conducted to determine the effect of treatment on each dependent variable. Univariate tests using the ANOVA test with a significance level of 5%. The decision criteria used are H_0 rejected if the significance value is more than 0.05. The results of the ANOVA test can be seen in Table 4 below.

Table 4: ANOVA Test Results

Dependent Variable	**df**	**Mean Square**	**F**	**Sig.**
Experimental Class Critical Thinking Skills	18	131,204	9,784	0,000
Control Class Critical Thinking Skills	1	272,250	7,353	0,09

Based on the results of ANOVA analysis, critical thinking skills in the experimental class have a significance of <0.05, so that H_0 is rejected while in the control class the significance value is >0.05 so that H0 is accepted. Thus, it can be stated that students who use contextual-based teaching materials have a considerable influence on critical thinking skills.

4. Conclusion

Contextual-based teaching materials that have been developed are very practical because they are easy to implement and implement by the teacher and receive a positive response from students. Teaching materials are also effectively impacted because student learning outcomes are achieved very well and meet the minimum learning criteria so that they are considered to have an effect on improving students' critical thinking skills.

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