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THE DEVELOPMENT OF TEACHING MATERIALS USING LEARNING CYCLE 5E TO INCREASE CRITICAL THINKING SKILLS AND STUDENT'S LEARNING OUTCOME OF HIGH SCHOOL STUDENTS ON THE SUBJECT OF REACTION RATE

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Abstract. The aim of research is to obtain the teaching materials based on Learning Cycle 5E Model that are feasible to increase the student's critical thinking skill and learning outcome. The type of research is a developmental research because this research was to develop the teaching material consisting of lesson plan, student's worksheet, and knowledge assessment instrument. The development of teaching materials was using four D model. The feasibility of teaching materials includes the validity, practicality, and the effectiveness. The data collecting used observation, test, and questionnaire method. The data analysis technique that is utilized is descriptive qualitative analysis and descriptive quantitative analysis. According to the observational data showed some finding as follows: (1) the validity of teaching materials were valid category; (2) the practicality of teaching material was shown by implementation of the lesson plan categorized as good, student's based activity was dominant, and the obstacle in learning process could be solved; and (3) the effectiveness of the teaching materials shown by positive student's response to implementation of learning process, developed critical thinking skill increased as high category, and the student's learning outcomes on Gnostic aspect increased, the average student's attitude aspect is B+ and the average of the student's skill aspect was A-. Based on these result, it can be concluded that developed teaching materials using learning cycle 5E model are feasible to be used to increase critical thinking skills and students learning outcomes.

Keywords: Teaching material, learning model, critical thinking skill, reaction rate.

INTRODUCTION

Education has a key role in a nation. Education should be developed continuously in accordance with the times. Through education, the nation expected Indonesia could increase the quality of education. The face of various changes in the current era of globalization, required human resources that have the quality of empowerment is more effective in order to be able to overcome the various challenges that arise. The 21st century this knowledge will become a major cornerstone of all aspects of life. Increased knowledge will not be detached from the world of education because education is the main line towards people who are knowledgeable.

Factors that affect success in a quality education to reach knowledgeable community: teachers, students, facilities and infrastructure, environmental education and the curriculum. All five of these factors play a role and authority respectively, which support each other (Sudjana, 2002). The government is constantly trying to improve the quality of education with optimally, given the importance of the role of education in all aspects of life. The Government has undertaken efforts among other improvements and curriculum development, teacher quality enhancement in the form of upgrading, training, seminars, as well as the enhancement of facilities and infrastructure. The goal of all these efforts is to improve the learning results.

Based on Permendikbud's Number 54 Year 2013 standard of Competency graduates, high school graduates must have a behavior that reflects the attitude of the faithful, noble character, and responsible, knowledgeable, and has the ability of thought and creative and effective follow-up in the realm of abstract and concrete as the development of learned in school independently.

The learning model used a teacher to this day still tends to be teacher oriented, where teachers are only delivering an explanation to the students. Knowledge should have been formed by students actively, not just passively received from the teacher. This is in accordance with the theory of Constructivism States that one must build their own knowledge. The process of building the knowledge through interaction with objects, phenomena, experience, and the environment. The constructivist believed that knowledge could not be moved away from the brain of a person (teacher) to the heads of other people (students), students must identify himself what has been taught by adjusting against the experience and knowledge they are (Slavin, 2006). Students that have had prior knowledge will further facilitate the teachers explain the material. This is in accordance with the opinion of Ausubel stating that what is learned will be meaningless if students connect new phenomenon into the structure of their knowledge. Head student engagement both mentally as well as indispensable in order that the body of learning become more meaningful.

The process of teaching and learning in the classroom should not only convey the subject matter but to train students ' ability to think, using their cognitive structure in full and directional. The process of teaching and learning that simply convey information will make students lose motivation and concentration. The process of teaching and learning is to invite students to think, so the thinking ability will produce students who are intelligent and capable solving any problems encountered. Application of the teaching and learning the process in Indonesia was less encouraging on the achievement of critical thinking ability (Sanjaya, 2009).

The implementation of the curriculum is competency-based learning in 2013 may be conducted with various approaches. Such approaches include contextual learning approach (contextual teaching and learning), role playing, learning, participatory (participative teaching and learning), Mastery Learning (learning mastery), and Constructivism encompasses learning (constructivism teaching and learning) (Mulyasa, 2013). The process of learning in the curriculum required to use the scientific approach to 2013 i.e. covering activities to observe, ask you, collect information, associate, and communicate.

Learning the subject of reaction rates is generally done by the method of lecture (conventional) so that students tend to memorize, as a result of the lessons become interesting and not boring. A teacher should be able to apply various models varied learning, that can change the way students learn from passive into active so it will make students interested and familiar with what is being taught by the teacher. The low activity students can still be seen from the lack of courage of the students asking questions, answering questions from teachers, expressed his opinion and worked on the matter of exercise in front of the class. Learning involves students actively can help develop critical thinking ability so that the results of the study. One of the approaches that involve students actively in the teaching and learning process is constructivist.

Learning Cycle 5E model is a learning model based on students is a series of stages of the activities organized in such a way so that learners can master the competencies-competencies to be achieved in learning with play an active role. The process of learning directly like this can store information in long-term memory (Slavin, 2009). *Learning Cycle 5E* model is feasible if applied to the scientific approach. The relationship between scientific approach and *Learning Cycle 5E* model: (1) Observing (observe) can be done on the Engagement phase (2) Ask (questions) can be done on phases of Exploration (3) collect information (experiments/explores) can be done on phase Explanation (4) Associate (analyzes) can be done on the Elaboration phase (5) to communicate (communicates) can be done on the phases of the Evaluation.

According to research Rahayuningsih, Masykuri, Caroline (2012), about the application of the *learning cycle 5E* model with an accompanying map concept can improve the quality of the learning process of students (student activity increases) and the quality of student learning outcome (ketuntasan students increased). Based on the research of Sartika, mentioning that student response is very good at learning using learning cycle model 5E (5E learning cycle) multimedia-assisted on the colloidal matter. Likewise, Sofuroh, Masrukan, Kartono (2014) in his work "Model 5E Learning Cycle with the scientific approach to improving critical thinking and mathematical desposisi" was declared effective. This is shown with critical thinking abilities achieve individually or classical ketuntasan with ketuntuan have been determined also the existence of the positive influence towards critical thinking ability of students. Thus the application of the learning model 5E Learning Cycle can be used as an alternative learning to improve critical thinking skills and student learning outcomes.

Quality teaching materials can support the learning process and can improve the quality of education. The device learning provides convenience and can assist teachers in preparing and implementing teaching and learning activities in the classroom. It is therefore very important that this be done now is to develop a teaching materials, and melatihkan to the teacher on a model-based learning activities of students.

METHOD

The type of research is a developmental research, because it is aimed at developing a teaching materials using a *learning cycle 5E* model (5E Learning Cycle) to increase critical thinking skills and students learning outcomes. Teaching materials that will be developed consisting of *Lesson Plan* (RPP), the *Students Workheet* (LKS), *Critical Thinking Skills Test* (TKBK), and *Test for the Achievement of Study* (THB) is applied to the 25 students of class XI SMA Muhammadiyah 5 Gresik academic year 2015/2016.

Data collection techniques used can be classified into: (1) validation of experts, (2) observation, (3) tests, and (4) the method of question form. Data that has been collected is then performed quantitative analysis. Data validity of teaching materials is calculated via average, while data on the implementation of RPP and the activity of the students is calculated through percentage. Data of student learning outcomes are analyzed according Permendikbud's No. 104 on the learning outcomes assessment guidelines.

RESULT AND DISCUSSION

The Validity of Learning Devics

The results of the average validation of the three validators against teaching materials that includes RPP, LKS, TKBK and THB can be seen in table 1.

Table 1. Results of Validation Teaching materials

No	Teaching Material	Validation Score	Category
1	Lesson plan (RPP)	3.67	Very valid
2	Student's worksheets (LKS)	3.52	Very valid
3	TKBK	3.57	Very valid
4	THB	3.46	Valid

Based on validation has been done by the validator, then teaching materials can be used to do a revision in accordance with advice and input from the validator, so this teaching materials can be used by teachers as a guide in the process of learning.

The Realization of *Lesson Plan* (RPP)

Lesson Plan realization measured with instrument *keterlaksanaan pembelajaran* (*learning implementation instruments*). The observation is done by two observers who is SMA Muhammadiyah 5 Gresik's science teachers by observing the implementation towards three aspects of learning activities (early activity, core activities, and activities of the end) in the syntax of Learning Cycle 5E model. This data is taken from the three meetings of the study which was carried out. Observation data of the realization of *lesson plan* presented in table 2.

Table 2. Realization of *Lesson Plan* (RPP)

No	Aspects of Assessment	Average Score	Criteria
1	**Early Activity** *Engagement*	3,50	Good

No	Aspects of Assessment	Average Score	Criteria
2	**Core Activities** *Exploration*	3,90	Very Good
	Explanation	3,60	Very Good
	Elaboration	3	Good
	Evaluation	3,50	Good
3	Closing	3,40	Good
4	Management of Classroom and Time	3,40	Good
Average		3,50	Good

The above results indicate that of the three meetings showed that the learning syntax of developed *lesson plan* was fully implemented.

Student Activity

Student activity data collected through observations made by two observers using the instrument observation sheet activity of students. The observation is done every 3 minutes period by assessing the dominant activity in a period of 3 minutes.

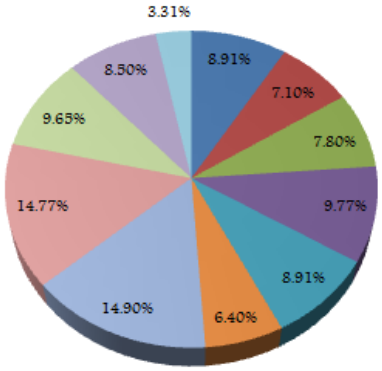

Figure 1. Student Activity Data

Remarks:
8.91% : Ask questions, ideas, or opinions
7.10% : Make a hypothesis
7.80% : Read (searching information etc.)
9.77% : Experiment
8.91% : Noting the observations and ideas
6.40% : Make inferences
14.90%: Deliver an opinion/communicate information in class discussion
14.77%: Answer questions/able to give reasons in class discussion
9.65%: Apply concepts or principles that are accepted
8.50%: Work on the evaluation of independently
3.31%: Behave not relevant

The results of the observation activity are the most dominant students deliver opinions or communicate the information to the class and the teacher in class discussion (14.90), answering questions or giving a reason in the class discussions (14.77), and conduct experiments to test the hypothesis in a group (9.77). These data indicate that chemical learning using learning cycle 5E model designed by teachers based on students. During the learning process of students given the opportunity to find their own knowledge independently so that meaningful knowledge formation. Not only do students learn from teachers but through the delivery of an activity that allows students to build their own knowledge. According to (Mulyasa, 2013) one of the keys that determine the success of the implementation of the curriculum of 2013 is a conducive environment for academic, either physical or non-physical, one is the activities that centered on students (*student centered activities*).

Students Response

Student response against components of the learning activities of the *Learning Cycle 5E* is collected via the question form student response. The percentage of student response embodied in Figure 2 is a recapitulation of the average student response obtained in three times learning activities using teaching materials with *Learning Cycle 5E* model.

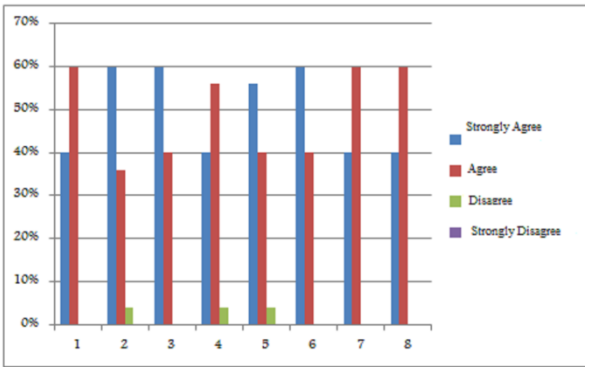

Figure 2. Student Response Data

Remarks:
1 = with the learning model based on *learning cycle 5E* through the experimental method, I prefer to learn by directly applying lessons or materials that I learned.
2 = with the learning model based on *learning cycle 5E* I would dare to express opinions that exist in my mind, resulting in a faster understanding of the material that I learned.
3 = with the learning model based on *learning cycle 5E* makes me more active in the learning activities.
4 = with the learning model based on *learning cycle 5E* can increase my motivation to learn.
5 = with the learning model based on *learning cycle 5E* its easier for me to work on the test.
6 = with the learning model based on experimental methods *learning cycle 5E* interesting and not boring.
7 = with the learning model based on experimental methods *learning cycle 5E* can train my critical thinking skills.

8= with the learning model based on experimental methods *learning cycle 5E* can increase my learning outcomes.

The positive response showed that students experience the ease of receiving well all components contained in the learning process so that the existence of such a good response in the hope of achieving success in teaching to become higher.

Critical Thinking Skills

Critical thinking skills of students are the student's skills in resolving a problem that is reflected through the ability (1) to answer the question why; (2) the ability to provide a reason; (3) make generalizations, hypotheses, and conclusions; (4) applying the accepted principle; and (5) to formulate viable alternative to solve the problem. Scores increase students' critical thinking skills, are presented in Table 3.

Table 3. Student's Critical thinking Skills

No	Name	*Pretest* Score (%)	*Postest* Score (%)	Gain Score (*n*-gain)	Category
1.	SW1	25	85	0.80	High
2.	SW2	30	85	0.79	High
3.	SW3	10	80	0.78	High
4.	SW4	45	75	0.55	Middle
5.	SW5	30	85	0.79	High
6.	SW6	35	70	0.54	Middle
7.	SW7	15	75	0.71	High
8.	SW8	10	65	0.61	Middle
9.	SW9	50	95	0.90	High
10.	SW10	35	80	0.69	Middle
11.	SW11	20	70	0.63	Middle
12.	SW12	15	70	0.65	Middle
13.	SW13	20	80	0.75	High
14.	SW14	45	90	0.82	High
15.	SW15	10	75	0.72	High
16.	SW16	15	80	0.76	High
17.	SW17	15	85	0.82	High
18.	SW18	30	80	0.71	High
19.	SW19	25	75	0.67	Middle
20.	SW20	35	85	0.77	High
21.	SW21	30	85	0.79	High
22.	SW22	25	75	0.67	Middle
23.	SW23	35	80	0.69	Middle
24.	SW24	10	75	0.72	High
25.	SW25	45	75	0.55	Middle
Average		26.4	79	**0.72**	**High**

Based on the analysis of data from this research is that every student increase critical thinking skills to increase the average value (*gain*) are 0.72. According to Hake (1999), the increased value (*gain*)> 0.7 are classified as major increases.

The high value of this increase shows that the learning based on *learning cycle 5E* model accompanied the use of this developed teaching materials can increase critical thinking skills.

The Learning Results Of The Knowledge Aspect

The individual completeness is measured based on the results of student learning through a *Pretest* and *Posttest.*

Table 4. The Students value of the *Pretest* and *Postest*

Name	*Pretest*				*Posttest*			
	Score	Conversion Score	Predicate	Remark	Score	Conversion Score	Predicate	Remark
SW1	40	1.00	D	TT	80	3.17	B	T
SW2	30	1.00	D	TT	80	3.17	B	T
SW3	25	1.00	D	TT	90	3.84	A-	T
SW4	35	1.00	D	TT	80	3.17	B	T
SW5	30	1.00	D	TT	85	3.50	B+	T
SW6	35	1.00	D	TT	70	2.50	C+	TT
SW7	20	1.00	D	TT	90	3.84	A-	T
SW8	40	1.00	D	TT	80	3.17	B	T
SW9	75	2.67	B-	T	95	3.85	A	T
SW10	25	1.00	D	TT	85	3.50	B+	T
SW11	35	1.00	D	TT	85	3.50	B+	T
SW12	30	1.00	D	TT	90	3.84	A-	T
SW13	40	1.00	D	TT	80	3.17	B	T
SW14	75	2.67	B-	T	80	3.17	B	T
SW15	25	1.00	D	TT	75	2.67	B-	T
SW16	40	1.00	D	TT	85	3.50	B+	T
SW17	30	1.00	D	TT	85	3.50	B+	T
SW18	30	1.00	D	TT	90	3.84	A-	T
SW19	35	1.00	D	TT	80	3.17	B	T
SW20	30	1.00	D	TT	90	3.84	A-	T
SW21	25	1.00	D	TT	75	2.67	B-	T
SW22	30	1.00	D	TT	85	3.50	B+	T
SW23	25	1.00	D	TT	90	3.84	A-	T
SW24	25	1.00	D	TT	80	3.17	B	T
SW25	35	1.00	D	TT	75	2.67	B-	T
Average	**34.6**	**1.13**			**83.2**	**3.35**		

Data for *Pretest* and *Posttest's* score are obtained significantly suit with Vygotsky theory , that the completeness of the students results is inseparable from the teacher's role in the motivating student so as to create an effective learning environment. More Piaget said that an attitude of curiosity, motivate students to build student understanding of the environment that students of the biological (Ibrahim, 2005).

CONCLUSION

Based on the analysis, results, and discussion of research findings it can be concluded up that the teaching materials of chemistry by using learning model based on *learning cycle 5E* qualify the validity, effectiveness, and practicality, making it feasible of use in the learning process.

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