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Implementation of Material-Based Inquiry to Improve the Critical Thinking Ability of Senior High School Students

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A B S T R A C T

The development of technology today has a huge impact on education, especially in the learning process. Therefore, an educator must be able to adapt the learning process to technological developments. One way to apply technology development in learning systems is to use e-modules in the learning process. The purpose of this study is to use guided inquiry-based e-modules to see the magnitude of the increase in students' critical thinking skills in the material reaction rate after using guided inquiry-based e-modules. The research method used a quasy experiment with a pretest-postest design using two classes as the experimental class and the control class. The sample in this study were students of State Senior High School (SMAN) 1 Sebrida Indragiri Hulu class XI. The results obtained were an increase in students' critical thinking abilities from before the use of guided inquiry-based e-modules. After the use of e-module based guided inquiry. This increase is seen from the comparison between the experimental class and the control cash class. The experimental class using e-module has a higher critical thinking ability of students than the control class that does not use e-module in the learning process.

1. Introduction

Along with the increasing intellectuality and quality of human life, development in the field of education is also increasing rapidly. This encourages education actors to make educational designs that are appropriate and in accordance with these conditions. One form of development in the field of education is the implementation of the 2013 curriculum. In the 2013 curriculum in the learning process students are guided to master three competencies, namely the competence of attitudes, knowledge and skills. The achievement of learning outcomes from the competence of attitudes, knowledge and skills illustrates a balanced quality between the achievement of hard skills and soft skills.

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The 2013 curriculum system is a scientific learning approach system with four learning models, namely discovery, inquiry, problem based learning (PBL) and project based learning (PJBL) (Sariono, 2011). The learning approaches and models in the 2013 curriculum want students to be able to learn independently and the learning process is no longer a teacher center but a student center. Therefore, students are expected to play an active role during the learning process. This is in accordance with the demands of the future world, students must have thinking skills in learning. These skills include problem solving skills, critical thinking, collaboration and communication skills. All of these skills can be owned by students if educators are able to develop learning that leads students to activities that can improve critical thinking skills in solving problems. Teaching materials are basically all materials (both information, tools, and text) that are arranged systematically, which displays a complete figure of the competencies that will be mastered by students and used in the learning process with the aim of planning and studying the implementation of learning (Andi, 2012) .

Referring to K13, the aim of the 2013 curriculum is to prepare Indonesian people to have the ability to live as individuals and citizens who are faithful, productive, creative, innovative, and affective by strengthening attitudes, skills and knowledge that are integrated and able to contribute to the life of society, nation and state. and world civilization (Permendikbud, 2013), a teacher, especially a chemistry teacher, must have a strategy so that the learning process is carried out according to K13. Therefore chemistry teachers need to have innovative teaching materials to improve the quality of teaching and learning chemistry. The 2013 curriculum hopes that scientific learning that can be carried out can help students to be skilled in using the information and communication technology (ICT) media needed in the 21st century (Asmiyunda, et.al., 2018) One of the uses for ICT development to increase student interest in learning is by using e-module.

E-Module is a technology-based teaching material, seeing the current developments, there are no students who do not have Gadgets. E-modules can be applied to gadgets so that e-modules are innovative teaching materials that teachers can use in the learning process and can be used by students outside of learning as independent reading materials. The advantages of the e-module compared to the print module are its interactive nature which makes it easy to navigate, allows displaying / loading images, audio, video and animation and is equipped with formative tests / quizzes that allow immediate automatic feedback (I M. Suarsana e.at. 2013), besides that the e-module is in accordance with the demands of the times and is environmentally friendly.

The kvisoft flipbook maker application is an application that can be used in making e-modules. This application has the advantage that the e-module produced can not only be used using a laptop or PC, it can also be applied to android. In addition, the Kvisoft flipbook maker is suitable for making innovative teaching materials, and can also be designed interactively which allows students to learn independently. Based on this, the researcher is interested in developing the e-module, using the Kvisoft flipbook maker application.

Chemistry is a branch of natural science that students find difficult. One of the materials considered difficult by students is the material reaction rate. According to Marsita. (2010), one of the factors that causes students to have difficulty learning the reaction rate material is the planting of the concept of reaction rate material which is less profound and this can be overcome by linking the concepts of reaction rate with everyday life. In addition, it is necessary to have a learning strategy that creates a learning atmosphere in such a way that students can work together to solve a problem by finding new things. This is expected to make the learning process of students more meaningful so that learning outcomes are not only temporary, but are permanent because students get learning experiences.

Reaction rate material is a chemical material that is closely related to everyday life, so that in understanding the material reaction rate, students not only memorize the theory but need to relate the reaction rate material with examples in life. Suharyadi (2013), states that the learning process that connects a concept with an example in life lasts longer in one's memory. In addition, the existence of examples of reaction rates in life can make it easier for students to find the concept of the reaction rate material independently. Concept discovery through self-discovery will make student learning more meaningful (meaningful learning), this meaning will have an impact on improving student learning outcomes (Budiada, et.al., 2011). Therefore, the learning process by involving students actively in finding their own concept of a material is very suitable to be used to overcome the difficulties of students in understanding the material reaction rate.

One learning model that involves students to discover a material concept for themselves is the guided inquiry learning model. According to Wijayanto (2008) guided inquiry learning is a series of learning activities that emphasize critical and analytical thinking processes to seek and find their own answers to a questionable problem that leads students to find answers to problems. In general, the inquiry learning process includes five steps, namely formulating problems, proposing hypotheses, collecting data, testing hypotheses, and drawing conclusions (Bulunuz, et.al., 2009). This is in accordance with the stages in scientific activities that are usually carried out in studying natural science, one of which is in chemistry. Based on this, the researcher is interested in implementing the e-module that has been developed on the rate of reaction material to improve students' critical thinking skills.

2. Methodology

Research Desain

This study uses a quantitative approach with a quasy experimental design. This design uses two classes, namely the experimental class and the control class. The research design can be seen in table 1:

Table 1: Study design

Class	Pretest	Treatment	Postest
Experiment	O1	X	O2
Control	O1		O2

(Sugiono., 2011)

This research was conducted in October 2019/2020 in SMAN 1 Seberida, Indragiri Hulu. The subjects of this study were students of class XI SMAN 1 Sebrida Indragiri Hulu in the 2019/2020 school year. The research sample was class XI, while the object in this study was the critical thinking ability of students in chemistry subjects, the subject of reaction rates.

Data collection technique

The sample was taken by using purposive sample technique. Data collection was taken by the method of documentation, interviews, and critical thinking ability test questions.

Data analysis technique

The data analysis technique was carried out by analyzing the data from the pretest-posttest results in the experimental class and the control class. Prior to further analysis of the pretest-posttest data, the normlits test was performed first for the experimental and control classes.

Analysis of normality from the results of the pretest-posttest with the Kolmogorov Smirnov test using SPSS 16. Furthermore, the t test hypothesis analysis was carried out using SPSS 23.0 (Independent sample t-test). With the hypothesis in this study are

Ha: Is there a significant difference in the test results of students' critical thinking skills in the experimental and control groups.
H0: There is no significant difference in the test results of students' critical thinking skills in the experimental and control groups.
T test decision making is by right side test, that is, if t count is bigger than t table then hypothesis H0 is rejected and Ha is accepted.

3. Results and Discussion

The e-module used by researchers is an e-module that has been valid both materially and media. So that researchers can use or apply this e-module to be applied in the learning process which is expected to provide an increase in the critical thinking skills of students. The advantage of this e-module is that in the e-module development design, e-module is designed based on inquiry that is in accordance with the indicators of critical thinking, so that this e-module can help students develop critical thinking skills. E-moudule that has been developed using

the kvisoft fipbok maker application as well as the e-module development that has been carried out by Roza Linda (2018), who uses the kvisoft flupbook maker application to develop e-modules shows the advantages and advantages of the e-module. One of them is the ease of using the e-module so that it is effectively used in the learning process.

At the time of e-module development, in each e-module activity, the reaction rate material is adjusted to guided instruction stages and also adjusted to indicators of critical thinking. The e-module validation was carried out by validating the media and validating the material. The initial view / cover e-module based on guided inquiry on the reaction rate material that has been developed and is valid can be seen in Figure 1.

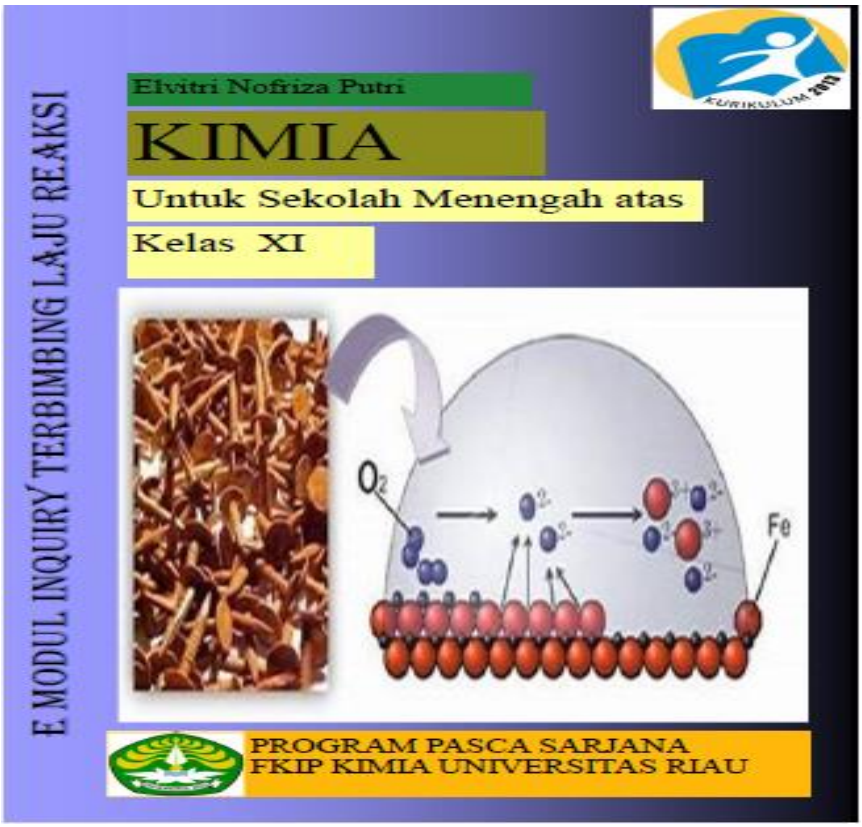

Figure 1: Guided Inquiry Based e-module Initial View on the Material Reaction Rate

The validity of the guided inquiry-based e-module that has been developed using the kvisoft flipbook maker application to improve students' critical thinking skills on the material reaction rate based on the validation of material experts and media experts is declared very valid or very suitable for use. The practicality of the guided inquiry-based e-module developed using the Kvisoft Flipbook Maker application on reaction rate material based on teacher and student response assessments is stated to be very practical. So that the e-module can be applied in the learning process which is expected to increase students' critical thinking after learning using e-module based on guided inquiry on the reaction rate material.

This refers to research conducted by Miftahul (2019), Hayati (2020), Okta (2020), regarding the development of ICT-based media obtained by valid media so that they can be effective and fit for use in the learning process.

Before implementing the e-module in the learning process, the researcher determined the control class and the experimental class first by using a homogeneity test of the population in SMAN 1 Seberida, which consisted of 3 populations, including class XI MIPA A, XI MIPA B, XI MIPA C. used is the result of daily test data on the previous learning material, namely Thermochemistry. Then the samples selected were class A and C. To determine the homogeneity of the samples, the homogeneity test was carried out using pretest data. The homogeneity test data analysis is presented in Table 2 below:

Table 2. Results of the Homogeneity Test Analysis

Class	Levene Statistic	df1	df2	Sig.
XI MIPA A XI MIPA C	0,767	1	56	0,385

Information

If Sig Based on Mean> 0.05, the data obtained is homogeneous. The table shows the sig value of 0.769> 0.05, then the population of classes A and C is homogeneous. Based on the results of the analysis in Table 2 it shows that the data originating from the population varies homogeneously if the value (sig)> α = 0.05. From Table 2, it can be seen that the data originating from population XI MIPA A, and XI MIPA C are homogeneous.

Furthermore, the selection of experimental and control classes was carried out randomly, namely class XI MIPA C (experimental class) and XI MIPA A (control class). Before the treatment was given, first the two classes (experimental and control) were given a pretest to determine the students' initial ability on the subject of reaction rates, where before the pretest was given the researcher had asked students to read the reaction rate material at home, and at the end of the meeting the two classes were given a posttest. (final test).

In order to find out whether the difference in the average posttest score of the experimental class and the control class is significant (significant) or not, it can be done through the independent sample t-test. One of the requirements for the independent sample t-test is that the data must be normally distributed. The normality test is carried out through the Shapiro Wilk test at a significance level of alpha 0.05 with the help of software version 18. The results of the posttest data normality test for the experimental class and control class are presented in Table 3 follows:

Table 3.The results of the posttest data normality test for the experimental and control classes

Class XI MIPA C

		Unstandardized Residual
N		35
Normal Parameters[a,,b]	Mean	.000000
	Std. Deviation	6.65451616
Most Extreme Differences	Absolute	.142
	Positive	.142
	Negative	-142
Kolmogorov-Smirnov Z		.841
Asymp. Sig. (2-tailed)		.479

Class XI MIPA A

		Unstandardized Residual
N		36
Normal Parameters[a,,b]	Mean	.000000
	Std. Deviation	2.70204413
Most Extreme Differences	Absolute	.148
	Positive	.148
	Negative	-142
Kolmogorov-Smirnov Z		.891
Asymp. Sig. (2-tailed)		.405

Based on Table 3, it can be seen that the posttest value data for the experimental class and control class have a sig value of 0.479 and 0.405 respectively, meaning that the two data have sig> alpha so it can be concluded that the data is normally distributed.

After the data was declared to be normally distributed, to see whether there is a significant difference in the average posttest scores of the experimental class and the control class, it is carried out through the independent sample t-test which can be seen in Table 4 below:

Table 4. The results of the analysis of the independent sample t-test

		t-test for Equality-sample t-test						
		T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Value	Equal Variances assumed	3,602	69	0,001	15,883	4,410	7,085	24,660

Based on Table 4, it is known that the difference in the average posttest score of students' critical thinking skills in the experimental class and the control class is 15.883 with a significance value of 0.001 <0.05, meaning that Ha is accepted. So it can be concluded that, there is a significant difference in the critical thinking skills of students in the experimental class with students in the control class.

Factors that affect the differences in critical thinking skills between students in the experimental and control class are in the experimental class learning using e-module based on guided inquiry, reaction rate material as teaching material, while in the control class learning uses school textbooks as teaching materials. This is in line with the research results of Pynka Marsha Nikita, Albertus Djoko Laksmono and Alex Harijanto (2018), that there are differences in students' critical thinking abilities.

The increase in critical thinking skills of students in the experimental class is due to the use of scientific literacy-oriented e-modules which have several advantages, namely: the use of e-modules makes learning more enjoyable, because the e-module is equipped with multimedia facilities such as images, animation, audio and video. This can be seen during the learning process, students are very active in asking questions and enthusiastic in learning the material in the e-module. The results of this observation are in accordance with the findings of Fengky Adie Perdana (2017), who found that e-module based on process skills was effective in increasing the motivation of students in the experimental class compared to the control class.

The research results of S. Hartini (2017) also found that the use of instructional media integrated with text, images, animation, audio and video effectively increases motivation, making it easier for students to understand the concept of the material. The E-module helps students understand the material reaction rate. through video and animation, so that the material is not only received by reading and memorizing, but also improves concept understanding and trains students' critical thinking skills through independent concept discovery activities in the e-module. This is in accordance with the findings of I.M.Suarsana and Mahayukti (2013), who found that e-modules can improve students' critical thinking skills and get a positive response from students.

4. Conclusion

Based on the results of the study, it can be concluded that the implementation of e-module based on guided inquiry on the material of reaction rate for class XI State Senior High School 1 Sebrida Indragiri Hulu in the academic year 2019/2020 was carried out according to the research objectives. This can be seen from the achievement of learning targets, namely the good implementation of the e-module based on guided inquiry in the Reaction Rate material. Based on the data on critical thinking skills of students in the experimental class, it shows that guided inquiry-based e-module is effective in improving students' critical thinking skills. While the critical thinking skills of control class students by using school textbooks were less effective for students' critical thinking skills. This can be seen from the achievement of learning targets, namely; 90% of students have high critical thinking skills after learning to use e-module based on guided inquiry.

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