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MACROMEDIA FLASH BASED ON GUIDED INQUIRY IN CRITICAL THINKING SKILLS AS LEARNING INNOVATIONS

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Abstract
The aim of this research was to examine the effect of students' critical thinking skills using a guided inquiry model with macromedia flash and direct instruction in chemistry learning. The researchers used a quasi-experiment, with post-test only control group design. This research was conducted at SMAN 3 Kota Ternate. The research subjects were 50 experimental group students and 46 control group students. The data were collected through critical thinking test with seven description questions to see the student's critical thinking skills that have been implemented. Then, the data were analyzed using ANOVA test statistics. The results of media validation were categorized into good and feasible, obtained from the validation test by media experts and material experts. The analysis of critical thinking skills test revealed that there is an increase in students' critical thinking skills using a guided inquiry model with macromedia flash.

Keywords: Chemical learning, critical thinking, guided inquiry,macromedia flash.

INTRODUCTION

Students consider chemistry learning as a challenging material, because it seems difficult to construct abstract concepts (Ayas & Demirbas, 1997; Nakleh, 1992). One of the chemistry materials which is hard to learn for eleventh grade of high school students is chemical equilibrium (Indriani, 2017). Most schools emphasize low-level thinking skills in learning (Bassham, Irwin, Nardone, & Wallace, 2008), whereas the students need a high-level of ability to understand chemistry that can help students solve the problems existed in daily life. As stated in Basic Competence of the 2013 Curriculum, the students are expected to demonstrate the attitude of logical, critical, analytical, consistent and thorough, responsible, responsive, and not easily giving up in solving problems. Therefore, the critical thinking skills in chemistry learning is one of the competencies that the students must possess.

Several previous studies regarding critical thinking skills were examined by Svecova, et al. (2013) and Chukwuyenum (2013) which emphasized the learning process to implement and sharpen the critical thinking skills. Duron's study (2006) also suggested that the learning process need to emphasize students' critical thinking skills which aim to produce valuable and more enjoyable learning experiences. The importance of critical thinking skills based on the above data from the previous studies is no longer be denied, because based on the results of the survey conducted by PISA (Programme for International Students Assessment), Indonesia is still far below the international average. Indonesia ranks the third from the bottom in the science performance if viewed from the average score obtained in the division of men and women (OECD, 2016). The low level of the students' critical thinking skills is influenced by two factors. First, the curriculum is mostly designed with broad material targets so that the teacher is more focused on the material completion. In other words, the students are only able to complete the calculation but are not able to connect the concept to the actual situation so that it impacts on students' learning outcomes. Second, the teachers still carry out the conventional learning as the learning activities in the classroom in which the teaching is

based on changes in practice and the result of the teacher's instructional concepts is not maximal. As a result, the students passively listen and copy in which the teacher asks and the students answer occasionally (Barak, 2007; Priyadi, 2018). A solution to overcome the low-level of critical thinking skills is by implementing a guided inquiry learning model (Bamiro, 2015). Through the use of guided inquiry learning model, the teachers can provide the opportunities for students to learn, think critically, and discuss with peers (Ibe, 2013).

In addition to the learning model, another aspect related to overcoming the students' low critical thinking skills is facilities and media used by the teacher in the learning process. Information and communication became the most important components of modern education. Information and communication education are cared all over the world and almost all educational organizations had information and communication departments (Cereci, 2019). As the information and technology field has rapid development, the information and technology use in the education field can support the learning process, and one of which is the use of macromedia flash. The presentation of the macromedia flash is easy to understand because it is able to visualize simulations and animations that make the images look real objects. Thus, using animation can affect students' thinking process (Tasker & Dalton, 2006).

Relevant previous study was conducted by Purwati and Dwisuyanti (2009) regarding the effect of guided inquiry learning methods and the learning media used in their study was macromedia flash which is categorized into audio-visual media. It was implemented in learning solubility and solubility product constant (Ksp) material to improve the student's learning outcomes. To be summarized, the students' learning outcomes taught with guided inquiry learning method using macromedia flash media are higher than conventional methods. Besides, the cognitive aspects developed with the implementation of guided inquiry learning method using macromedia flash media are C2, C3 and C4. The levels of cognitive aspects are C2 (Understanding), C3 (Application) and C4 (Analysis). The average normalized gain are C2, C3 and C4.

Based on the explanation, the recent research aims to examine the effect of the guided inquiry learning model using macromedia flash and direct instruction models on the students' critical thinking skills (C4, C5, and C6) in the material concept of chemical equilibrium at Ternate State High School 3 (SMAN 3 Kota Ternate).

METHODS

This research examines the effect of independent variables (guided inquiry using macromedia flash) and dependent variables (critical thinking).

Research Design

The design of this research is a quasi-experimental design, namely post-test only control group design. The research design is shown in Table 1.

Table 1: Post-test only control group design

No	Class	Treatment	Post-test
1	Experiment	X_1	**O_1**
2	Control	X_2	**O_2**

Note: X_1 is the learning with a guided inquiry model using macromedia flash, X_2 is the learning with direct instruction model, O_1 is the posttest experiment, and O_2 the is posttest control.

Subject

The students of XI IPA class (eleventh grade of science) at SMAN 3 Kota Ternate were the subjects of this research for a month, with 50 students in the experimental class and 46 students in the control class. The sampling technique used was cluster random sampling.

Instrument

The instrument of this research was a test. The test is conducted to see students' critical thinking skills. Before the instrument is used, the validity tests (material and media) and reliability were conducted.

Data Analysis

The data were analyzed through ANOVA test using SPSS version 19 (a software package used for statistical analysis).

FINDINGS

This study examines the effect of independent variables (guided inquiry based macromedia flash) and dependent variables (critical thinking). A guided inquiry-based macromedia flash and materials packaged in the form of interactive multimedia-based computer software. In this macromedia flash, there are three chemical equilibrium factors, namely the effects of concentration, pressure and volume on the shift in equilibrium direction and temperature. In the maromedia flash, there is a syntax of guided inquiry learning models. The syntax of the guided inquiry learning applied in the media models were adapted from the synthesis steps according to Orlich *et al* (2010); National Research Council (2000); Martin (2002); Wang and Posey (2011). The result of the synthesis of the guided inquiry phase in the media is that students write on student worksheets to formulate problems, write hypotheses from questions that have been made, collect data, test hypotheses, make temporary conclusions, replicate and give conclusions. Guided inquiry based macromedia flash can be seen in Appendix.

In general, the media validation category according to the ideal assessment criteria (Azwar, 2015) described in the Table 2.

Table 2: Quality of Validation Media

No	Score Range (i)	Quality
1	$\bar{X} > M_i + 1.5\ SBi$	Excellent
2	$M_i + 0.5\ SB_i < \bar{X} \leq M_i + 1.5\ SBi$	Good
3	$M_i - 0.5\ SB_i < \bar{X} \leq M_i + 0.5\ SBi$	Fair
4	$M_i - 0.5\ SB_i < \bar{X} \leq M_i - 0.5\ SBi$	Poor
5	$\leq M_i - 1\ \bar{X}\ .5\ Sbi$	Very Poor

Note: = average score; Mi =½ (ideal max score + ideal min score); SBi = x (ideal max score + ideal min score).

Based on the responses of validity test by material experts and media experts on the learning using macromedia flash with guided inquiry learning model can be seen in Table 3.

Table 3: Media Validation by Experts

No	Aspects	Average	Category
1	Learning	3.8	Good
2	Material	3.6	Good
3	Audio visual	3.4	Good
4	Software engineering	4.5	Very Good
5	**Average of all aspects**	3.84	Good

The validity assessed by the experts consists of material experts and media experts. The material experts assessed the learning aspects and material aspects, while media experts assessed audio visual and software engineering aspects. The average quality of the media in all aspects is 3.84, indicating that the media is categorized to good and it is feasible to use.

This design of flash media was adapted to a guided inquiry learning. In this research, the media was created and developed as the supporting media that can assist the teachers and students in the learning process. The design of flash media consists of cover pages, main menus, standard competencies, basic competencies, materials, and experimental simulations.

Validity and reliability

The students conducted validity and reliability tests to ensure that the critical thinking questions are valid and can be used. There are seven questions in the test. Based on the theory, if $r_{pbls} \geq t_{table}$ the question is valid, and if $\alpha \geq 0.70$ the critical thinking test can be used. Based on the results of the analysis, since $r_{11} = 0.789$, all the questions were valid and were able to use to measure the students' critical thinking skills in the SMAN 3 Kota Ternate.

Normality

The normality test was used to test the distribution of each variable data. The normality test was carried out through the Kolmogorov-Smirnov test in Table 4.

Table 4: Summary of Normality Test Results

No	Variabel	Model	Level of significance count	α = 5%	Information
1		Eksperiment	0.062	Sig> 0.05	Normal
2	Critical thinking	Control	0.060	Sig> 0.05	Normal

Based on the table above, it can be seen that the significance is more than 0.05. Therefore, the sample comes from a normally distributed population.

Homogeneity

The homogeneity test was used to test whether the sample comes from a population that has the same variance. Homogeneity test was carried out through the Levene test in Table 5.

Table 5: Summary of Homogeneity Test Results

Variabel	Level of significance count	α = 5%	Information
Critical thinking	0.884	Sig> 0.05	Homogeneous

Table 5 showed that the significance is more than 0.05. It can be concluded that the samples from both populations have the same variance.

ANOVA Test

ANOVA test was used to determine the significance of the mean difference (μ) between groups of one sample to another. These results can be seen in Table 6.

Table 6: Summary of ANOVA Test Result

Variabel	Result	Sig <0.05	Decision	Information
Critical thinking	Between groups	0.027	H_0 is rejected	There is a significant difference

Students' critical thinking scores were calculated through ANOVA test using SPSS 19 with a significance level of 5%. Based on the results of the analysis of the scores of the two classes, the significance of the two classes is 0.027, which means that the guided inquiry model using macromedia flash effectively influences the students' critical thinking skills, and it can be seen from the significant differences between the experimental group and the control group.

DISCUSSION AND CONCLUSION

The purpose of this study was to examine the effect of guided inquiry learning using macromedia flash on students' critical thinking skills. The descriptive findings from this research revealed that students' critical thinking skills in the experimental group and the control group had significant differences. In other words, there was the improvement of the students' critical thinking skills in the experimental group in that the students experienced the guided inquiry learning using macromedia flash. The results of this research also showed that there were differences in posttest mean scores of students' critical thinking skills in the control group. However, the teaching in the control group may not affect the students' critical thinking skills.

The results of this research revealed that there were significant differences between the experimental and control groups on the students' critical thinking skills at the end of the implementation of a guided inquiry learning using macromedia flash. The macromedia flash-based guided inquiry learning more effectively influences the students' critical thinking skills in the experimental group than in the control group where the teaching did not implement a guided inquiry. The results of this research are consistent with the previous research by Leo and Neo (2014), Nasution (2015), Kristanto and Susilo (2015) demonstrating that there is an effect of critical thinking skills in guided inquiry learning using macromedia flash. More importantly, the role of media, especially macromedia flash, is an important component in the learning because it provides the students with other alternative tools in order to have more choices when learning. For instance, the research conducted by Desharnais and Limson (2007) declared that media-based inquiry learning provides an interesting and open learning experience that strengthen the critical thinking skills.

The results of this study also indicated that the students' critical thinking skills has an influence after implementing the guided inquiry learning using macromedia flash in which the stages in the learning can help the students develop their scientific concepts so that they can improve their critical thinking skills. In general, the critical thinking includes cognitive skills and is based on the process of making decisions, building new knowledge and understanding (Cotrell, 2005; Palasan, 2018; Spronken-Smith & Walker, 2010). Besides, critical thinking is complex and multidimensional which includes cognitive and metacognitive skills, assessment aimed at self-regulation that results in the interpretation, analysis, evaluation, and inference (Fisher, 2009; Johnson, 2010). When experiencing the guided inquiry learning using macromedia flash, the students in the experimental group explored discovering the concepts or information such as suggesting the hypotheses, and gathering, analyzing, and interpreting the data that the students can draw some scientific conclusions. These activities are the reasons for the increase of the students' critical thinking skills in the experiment.

Based on the purpose of this research and the analysis of the research data, it can be concluded that there are differences between the students' critical thinking skills using macromedia flash-based guided inquiry learning models and direct instruction model. Therefore, the students can find the concepts and the self-regulation that are able to influence their critical thinking skills.

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Srireski Jainal is a student of Chemistry Departement, Graduate School, Yogyakarta State University, Indonesia. Her interest of researcher are the application of media-based learning models as educational innovations in teaching-learning of various chemistry teaching method.

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APPENDIX

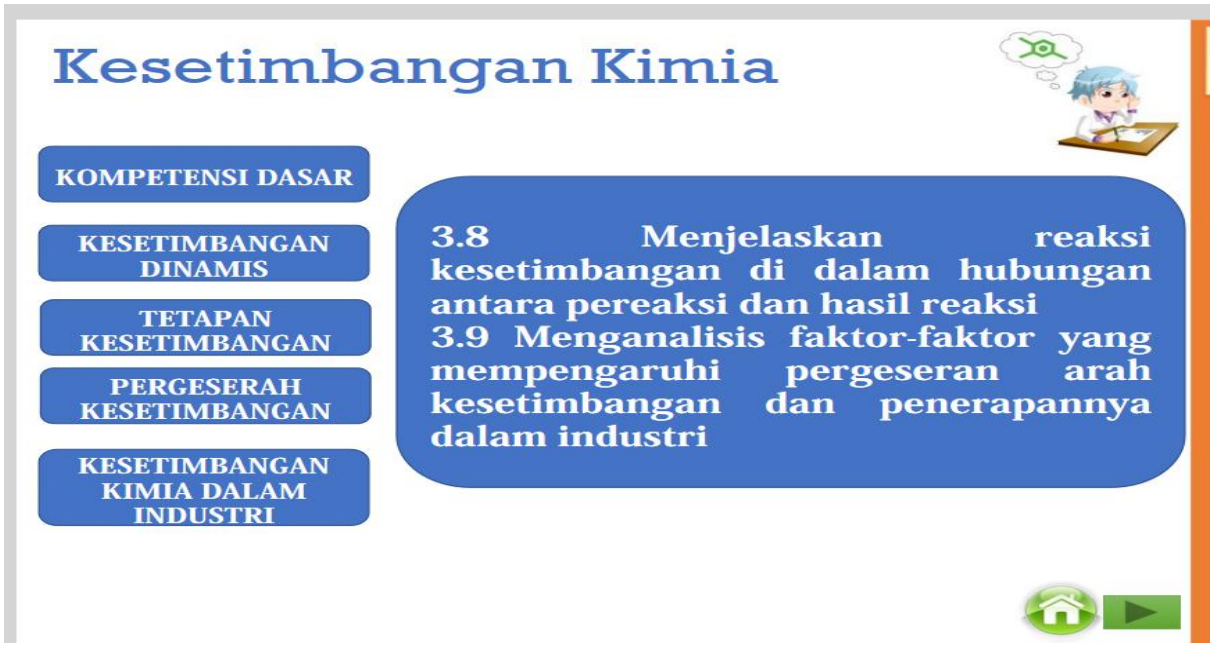

Figure 1: Menu for basic competencies

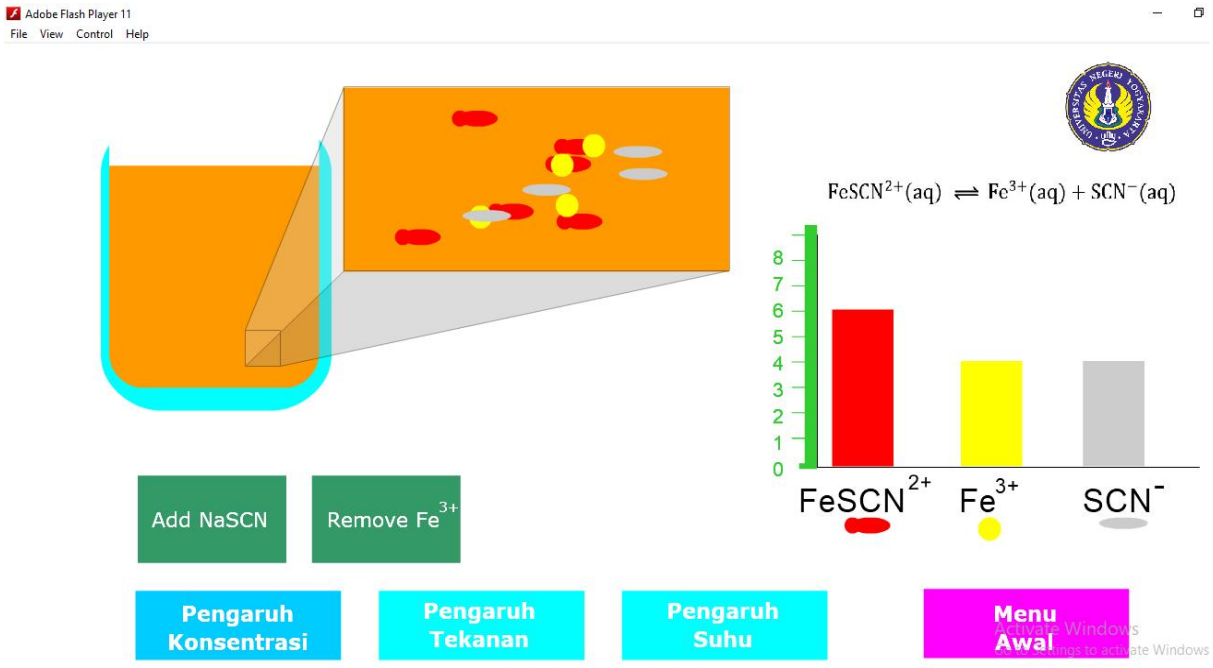

Figure 2: The effects of concentration

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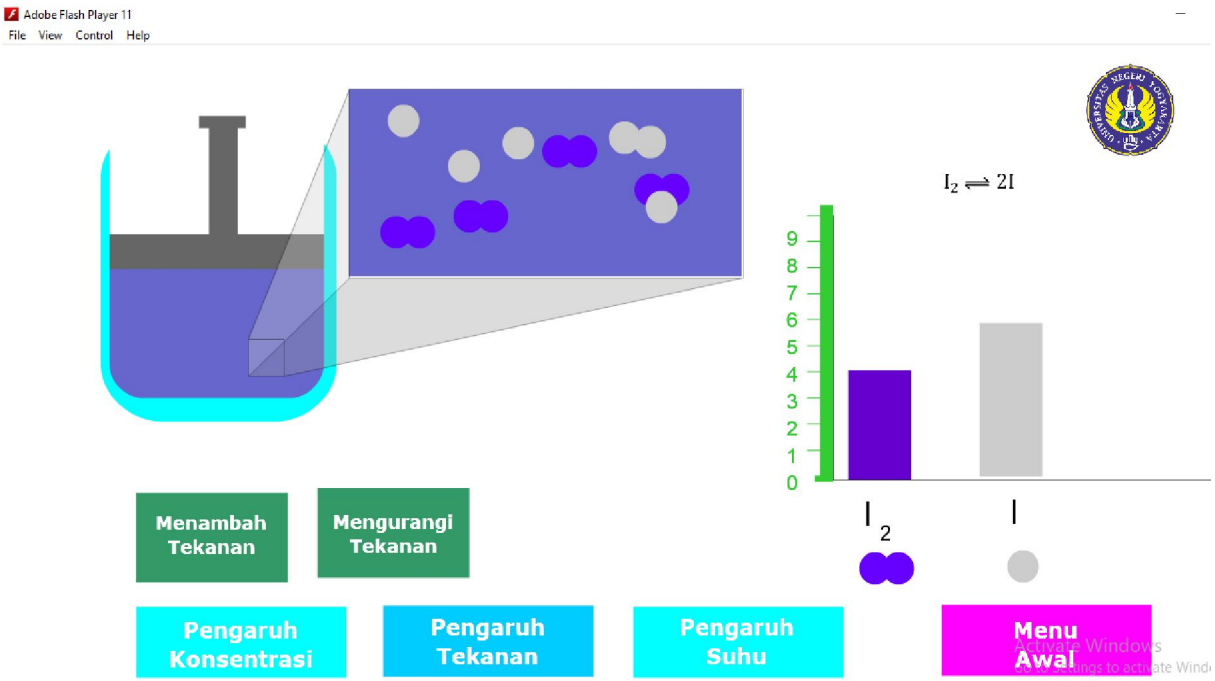

Figure 3: The influence of pressure and volume

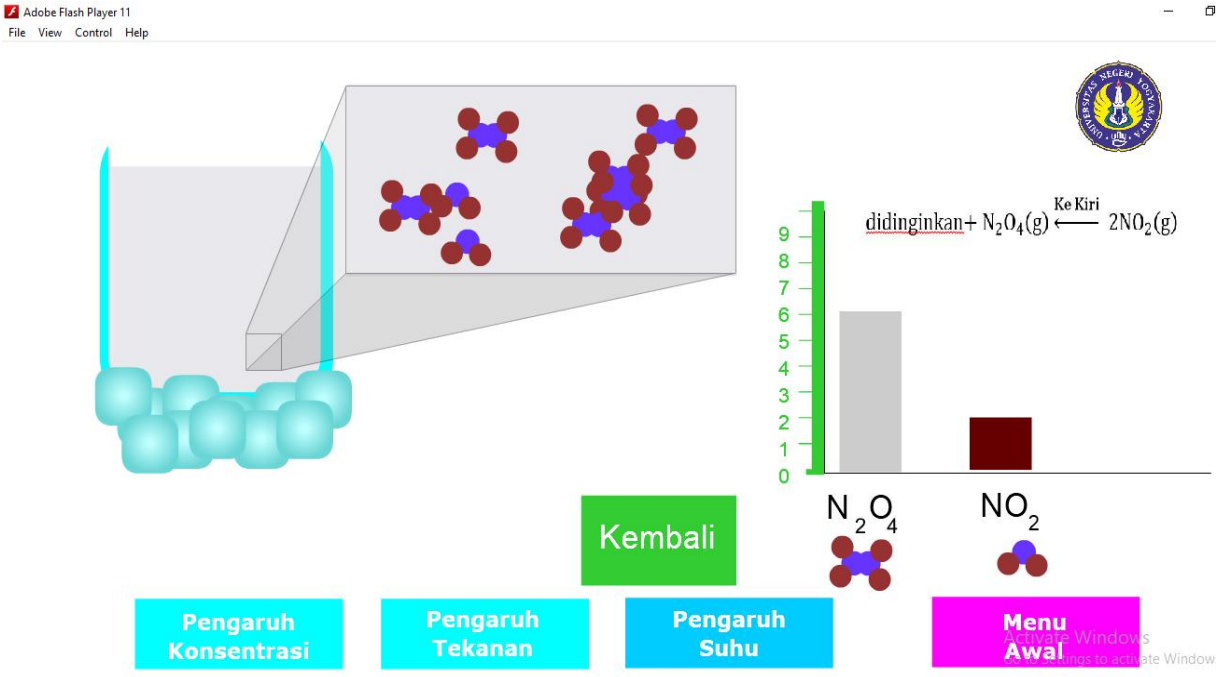

Figure 4: The influence of temperature