Implementation of *E-Module* Buffer Solution To Improve Students' Critical Thinking Skills

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Abstract

This study aims to describe student activities, analyze improvement in students 'critical thinking skills, and analyze students' responses to learning using the buffer e-module solution. The method used was a one group pretest posttest with research subjects in class XI IPA 3 SMA Jaya Suti Abadi. The percentage of student activities in implementing this e-module is 93% with a very good category. Students' critical thinking skills have improved with an average value of n-gain of 0.59 in the medium category. The response of students who answered agreed to achieve 54% results, which means students like to learn with e-modules and e-modules get positive responses. The results of this study indicate that learning by applying a buffer solution e-module can be used as an alternative to improving students' critical thinking skills.

Keywords: *Chemistry;Pendidikan;Education*

INTRODUCTION

Learning in this era is developed through the use of technology that is student *centered* so that it can involve student activity (Indrayani, 2013:208). Efforts are needed to develop teaching materials from printed teaching materials to electronic teaching materials or*e-module*. *E-module is* a good development option that can be presented in the form of a combination of text with multimedia such as video, animation, simulation, and questions with interactive feedback so that the presentation is more informative compared to printed modules (Syamsurizal, et al., 2015: 656; Irwansyah,*et al.*, 2017:2).

Based on the results of the literature study, it was found that learning using e-modules can affect students' potential to actively study concepts. As many as 70% of students said that using e-modules in their learning process can foster activeness in observing a representative phenomenon presented in the form of images and animated videos (Syamsurizal, et al., 2015: 657). Learning chemistry is not just observing once finished. However, learning chemistry also needs to analyze each concept in it, namely critical thinking skills are needed. Critical thinking plays an important role conceptually in the material being studied, so that learning becomes meaningful (Iakovos, 2011: 84; Purnamasari, et al., 2015: 133).

Critical thinking not only describes the ability to think according to logical rules, but also the ability to apply them to reality and provide deeper understanding. It can provide an opportunity to be objective, less emotional, and more open-minded when appreciating the views and opinions of others. Based on that, the ability to think can increase self-confidence to present new perspectives and new insights (Karakoç, 2016:81).

Usage *e-module in* chemistry learning to improve students' critical thinking skills, it is expected to reduce students' difficulties in understanding buffer solution material, because they can visualize abstract material into concrete (Aprilia, et al., 2015:1608). Implementation-module considered effective in improving students' critical thinking skills and learning motivation compared to using existing teaching materials (Perdana, 2016:157). Bukhori (2014:68) has also conducted research on improving students' critical thinking when learning on hydrolyzed salt material is used with interactive media.

Previously, a printed module was developed on buffer solutions and testing the effectiveness of the module with a critical thinking approach by Nuswowati and Purwanti (2018:1), but there were limitations in the presentation of the material and it was not flexible enough, because the concept of buffer solutions requires proper visualization, so it is necessary- *module* which can be visualized and

easily accessed by students. Then Puja Rahmaniah (2018), created a representative interactive media (*e-module)* on the material of buffer solutions oriented to critical thinking skills. Therefore, the researcher intends to apply the buffer solution e-module media created by Puja Rahmaniah (2018) as a learning medium for the buffer solution material applied in this study. Aims to improve critical thinking skills and increase interest in learning with the results in the form of student responses. This study is expected to be a reference for further researchers.

METHOD

The method used is pre-experiment with research design one *group pretest-posttest design*, namely research conducted on one group only without a comparison group (Suharsimi & Arikunto, 2001).

This study produces qualitative and quantitative data types. Data sources are obtained from predetermined subjects. The subjects in this study were XI MIPA 3 SMA Jaya Suti Abadi in the even semester of the 2018-2019 academic year. The number of students who were the subjects of the study was 31 students. Then the students were grouped into three groups, namely high, medium and low groups. This group is seen from the results of the previous material test scores

RESULTS AND DISCUSSION

Recapitulation of learning outcomes using-module buffer solution gets an average percentage of93%with a very good implementation category.

Table 4.1 Recapitulation of Percentage of Student Activity Implementation in Learning Using Buffer Solution E-Module

Group	Percentage of Implementation of Each Learning Stage				Rate-Rata
	I	II	III	IV	
A	83	100	100	75	89
B	100	100	100	75	94
C	83	100	100	75	89
D	83	100	100	75	89
AND	100	100	100	75	94
F	100	100	100	100	100
Rate-Rata	92	100	100	79	93
Interpretation	Very good	Very good	Very good	Good	Very good

*Information:

I : Problem Orientation
II : Organizing Problems
III : Problem Investigation
IV : Evaluation

The observation results showed that three groups of good categories obtained an average score of 89. Based on the learning process, students were only able to carry out calculation formulas without understanding the relationship between concepts. In solving mathematical problems, everyone has the same way and style of thinking (Ngilawajan, 2013: 73). In line with Ardana's opinion (2007) which states that everyone has special ways of acting, which are expressed through consistent perceptual and intellectual activities. In studying the concept of buffer solutions, prerequisite concepts are needed that can be supported conceptually. The prerequisite concepts are chemical equilibrium, acids and bases, and calculation concepts, both basic calculations and logarithms must be well understood (Marsita, Priatmoko, & Kusuma, 2010: 8). If students are only able to carry out calculations without conceptual understanding, students are not used to dealing with concepts with complex problems (Mentari, Suardana, &

Subagia, 2014: 10). In addition, cooperation between groups can help students to understand a concept (Ransom & Manning, 2013: 189). This activity can encourage students to think and improve the ability of students with average and low achievements to participate in the learning process (Djamarah and Zain, 2006: 30)

The category of improvement in each student's critical thinking skills can be determined using the formula-gain. In addition, whether or not the hypothesis is accepted can be seen from the results of the t-test. *paired sample*. Distribution calculation results-gain students' critical thinking skills are shown in Appendix B.5. Interpretation of improvement is determined based on references in Table 3.6, the values are *n-gain* in each group, overall student achievement is presented in Table 4.5.

Table 2. *N-Gain*in Each Achievement Group

Group	**Rate-Rata**		***N-gain***	**Interpretation**
	Pre	**Post**		
High	23	63	0,52	Currently
Currently	20	63	0,53	Currently
Low	20	60	0,50	Currently
Amount	21	62	0,59	Currently

Based on the data in Table 4.5, the overall average value-gain for increasing critical thinking skills is 0.59 with moderate criteria. The highest value is the moderate group with an average value-gain 0.53 and the lowest value is the low group, which is 0.50. While the high group has an average-gain of 0.52. As for the increase or value-gain on each indicator of critical thinking skills before and after learning can be seen in Table 4.6.

Table 3.*N-Gain*on Each Critical Thinking Ability Indicator

Achievement Group	***N-Gain* Each KBK Indicator**			
	1	**2**	**3**	**4**
High Group	0,25	0,40	0,64	0,56
Medium Group	0,34	0,37	0,78	0,49
Low Group	0,31	0,63	0,75	0,55
Rate-Rata *N-Gain*	0,30	0,47	0,72	0,54
Interpretation	Currently	Currently	High	Currently

*Information:
1: Ask and answer clarifying questions and challenging questions
2: Observe and consider the results of observations
3: Induce and consider the results of induction.
4: Make and review the value of the result of consideration

Based on the data in Table 4.6, all indicators of critical thinking skills on the material on buffer solutions with the application using-module experienced various increases (Rahmaniah, 2018). Among the four indicators, only the third indicator, namely inducing and considering induction results, reached a high increase category with-gain of 0.72. While the other three indicators achieved the same increase, namely in the moderate category. The three indicators along with-gainThe results obtained were asking 0.30, inducing 0.47 and reviewing 0.54.

Based on the results *n-gain pretest* and *posttest*, overall students experienced an increase in critical thinking in the moderate category. All achievement groups, whether high, medium or low, received-gain with a moderate category due to insufficient use of material information during learning using *e-module*. The available facilities should be utilized to increase learning independence and initiative to initiate change (Aunurrahman, 2012: 14).However, students based on achievement groups are still able to achieve the category of increasing critical thinking due to heterogeneous learning groups during the learning process and the existence of...*e-module which* is very useful. This shows that heterogeneous learning groups can improve students' thinking skills (Djamarah and Zain, 2006: 65). Likewise, Slavin (in Bahri et al., 2016: 55) stated that groups greatly help each member in mastering the subject matter with various cooperative procedures and providing academic support.

The average result of student responses that agree with learning using the buffer solution e-module is 54% and those who strongly agree are 37%. This shows that students like it during the learning process because-module contains material packaged in the form of videos or images, which means that-module get a positive impression from students. This is because *E-module* chosen because of its complete development characteristics, including being able to display videos, animations, and questions with feedback which is direct so that it is liked by everyone who uses it. The use of this visualization aims to make users understand the content presented in-module (Irwansyah,*et al.*, 2017:5)

CONCLUSION

Student activities during the learning process using-module buffer solution gets an average percentage of93%with a very good implementation category. Students' critical thinking skills after learning using-module buffer solution increases withN-gain of 0.59 with a moderate category. The increase in students' critical thinking skills is in accordance with the results of the hypothesis test conducted using the t-test.*pair sample*. Obtained t value$_{count}$ of 30,253, and $t_{table}$of 1.699. The results of this t-test show that $t_{count} > t_{table}$, which means that Ho is rejected. Student responses get the largest percentage result of 54% with a positive response and get a message to continue using learning media in the following materials so that learning becomes fun.

SUGGESTION

The application of critical thinking learning should be further developed in educational institutions. Its application is better combined with the use of teaching materials in the form of *e-module,* Because *a-module able* to complement the shortcomings of textbooks so as to improve students' understanding in studying the chemical concepts being studied.

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