Analysis of problem based learning colaborative on critical thinking ability

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Abstract *Determine the significant of of critical thinking ability improvement using problem based learning oriented collaborative learning is the purpose of this study. A quasi-experimental design was employed for the study. The experimental group was taught using problem based learning oriented by lesson study with adobe flash whiles the control group was taught using direct instruction. The data was collected using a critical thinking ability test consist of 20 multiple choices. The data Normalized gain and homogenety data are measured as prerequisite of Hypothesis statistically analyzed using SPSS software. The results showed that there was the improvement of critical thinking Ability through problem based Collaborative learning is very significance (p=0.000).* [ANALYSIS OF PROBLEM BASED LEARNING COLABORATIVE ON CRITICAL THINKING ABILITY] ***(J. Math. Nat. Sci., 1(1): 21 - 24, 2021)***

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Introduction

Improving the quality of human resources through education is focused on higher order thinking Ability (HOTS). HOTS is one of the abilities needed to prepare graduates who are able to compete and adapt to changing times. Critical thinking Ability are one manifestation of HOTS. Higher-order thinking activities focus on critical thinking, which is thinking about deciding what to do or believe (Sani, 2019). Critical thinking is related to the use of students' cognitive Ability and strategies that increase the likelihood of having the desired impact. The critical thinking process is needed in solving problems and making decisions (Halpern, 2014). The development of critical thinking Ability is very important for students to obtain optimal results.

Solubility product Constanta is the chemical material for grade XI Senior High School. The characteristics of this material are abstract, conceptual understanding, applicative, and mathematical operations. So that not a few students have difficulty learning this material. Based on the results of observations of researchers at SMA Negeri 1 Binjai by conducting interviews with chemistry teachers, it was found that the presentation of chemistry learning materials still used conventional methods and occasionally used power point media. This learning is teacher-centered so that it does not provide opportunities for students to think critically in solving problems related to the material being studied. The learning process, which is limited to the delivery of material by the teacher and the provision of question exercises, results in low student motivation. The learning media used only power point also did not meet the criteria in developing students' critical thinking Ability and did not maximize the function of LCD in the classroom (Sari and Sugiyarto, 2015). Teachers can take advantage of information and communication technology (ICT) for learning purposes (Permendiknas No 81A tahun 2013).

Advances in technology have encouraged more attractive and effective learning approaches. The results of educational innovation have encouraged more creative developments for interactive technology in various forms, for example computer-based learning media (Leow and Neo, 2014). Technology science products that can be used as learning media are Adobe Flash software. Adobe Flash can be used to create interactive learning media effectively and efficiently and easily accessible to students. The program's ability to create multimedia presentations supports live animation with sound

and image insertion. In addition, the use of interactive buttons also makes teaching and learning activities as desired (Merdekawati, 2014). Adobe Flash-based learning media is suitable for use in learning chemical equilibrium at SMK and has received a positive response from students (Saselah and Qadar, 2017). There is a significant impact of multimedia-based offline learning using Adobe Flash on student motivation and learning outcomes (Silalahi et al., 2018).

The use of instructional media in improving students' critical thinking Ability can be optimized if its function is combined with the right learning model (Giavrimis et al., 2011). Among the many existing learning models, Problem Based Learning (PBL) which has a basic philosophy of constructivism, is able to encourage students to build their own knowledge and practice critical, creative and innovative thinking Ability. The effectiveness of PBL is that students are more active in thinking and understanding the material in groups by conducting investigations and inquiries on real problems around them so that they get a deep and more meaningful impression (Hikmah et al., 2019). PBL can also improve critical thinking Ability, learning motivation, and student achievement (Hussain and Anwar, 2017).

With a background on existing problems, the researcher views it is necessary to overcome student learning problems in class and overcome the weaknesses of conventional learning which puts less stress on post training. Students need to be actively trained where students are free to express opinions, suggestions and questions to both teachers and fellow students. Therefore, lesson study is one of the models of teaching professional development through collaborative and sustainable learning based on the principles of collaboration by a group of teachers to build a learning community that is seen as effective in improving the quality of learning in the classroom (Susilo, 2013). PBL based lesson study can improve problem-solving Ability and student learning outcomes. Learning using PBL through a contextual approach based on lesson study can be used as input for teachers to create creative learning to develop students' thinking Ability (Mustofa et al., 2016).

Materials and Methods

Location and time of research. A quasi-experimental design was employed for the study. This study was conducted at SMAN 1 Binjai. The population in this study were all students of class XI in SMAN 1 Binjai academic year 2019/2020.

Experimental design. Samples were selected using a purposive sampling technique, that is, of all students taken 25 students for experiment group taught using problem based learning oriented by lesson study with adobe flash and 25 students for control group taught using direct instruction.

Procedure. Data were collected using a critical thinking Ability test consist of 20 multiple choices.

Data analysis. Data were analyzed descriptively based on the average value, then the increase in pretest and posttest was calculated, namely the N-gain critical thinking Ability. Furthermore, inferential statistical tests (hypothesis testing) were carried out with the t-test.

Results

The data obtained in this study is the improvement of critical thinking Ability using problem based learning oriented by lesson study with adobe flash (experiment) compared to using direct instruction (control). From the results of the implementation of the experiment group and control group has an average value increase in critical thinking Ability as in Table 1. Improvement critical thinking Ability (N-gain) can be seen from the difference in the average value of pretest and posttest. Results of the average value improved critical thinking Ability in Table 2.

Based on Table 2 it can be concluded that the increase in critical thinking Ability in the experiment group is better than the increase in critical thinking Ability in the control group. Improvement of critical thinking Ability can be visualized as Figure 1.

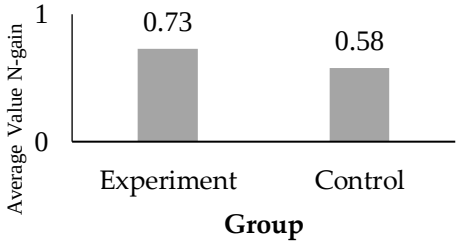

Figure 1. Graph of average improvement of critical thinking ability.

Table 1. Pre-test and Post-test Data.

Group	Average Value		Standard Deviation	
	Pre-test	Post-test	Pre-test	Post-test
Experiment	33.80	81.20	11.572	8.573
Control	33.20	71.20	11.075	11.391

Table 2. Difference N-Gain.

Group	Average Value	Standard Deviation
Experiment	0.73	0.10411
Control	0.58	0.10923

Based on Figure 1 it can be concluded that the improvement of critical thinking Ability using problem based learning oriented by lesson study with adobe flash is higher than using direct instruction. The increase in critical thinking Ability (N-gain) the both samples are normally distributed and homogeneous. This test is proposed to support the success of the model in learning chemistry to improve the students' critical thinking Ability using independent sample T-tests. Presented present in Table 3.

Discussion

Based on the results of testing the hypotheses presented in Table 3 the value of sig (0.000) < α (0.05) is obtained, then H_0 is rejected and H_a is accepted. Related to increasing critical thinking Ability that support problem based learning oriented by lesson study with adobe flash better than students who support direct instruction on material the solubility product constants.

This is supported by the results of research conducted by Liu et al. (2019), Cowden and Santiago (2016), and Oktaviani and Marwoto (2019) concluded that PBL is more effective than conventional teaching methods in improving student learning outcomes, interest in learning, team spirit, problem solving, and students' critical thinking Ability. Research by Mustofa et al. (2016) also states that PBL through a lesson study-based contextual approach can improve students' problem-solving Ability and learning outcomes. Furthermore, Nirbita et al. (2018) shows that computer-based media can help problem-based learning in increasing students' critical thinking Ability in terms of the ability to ask questions, provide arguments, collect and organize information, analyze problems, and make decisions or conclusions. Saselah and Qadar (2017) states that interactive multimedia based on Adobe Flash CS6 which is operated on computers and Android gets a positive response from students as much as 97.8% in the material of chemical equilibrium.

Table 3. Hypothesis testing.

Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
N-Gain	Equal variances assumed	1.037	.314	4.758	48	.000	.14360	.03018
	Equal variances not assumed			4.758	47.890	.000	.14360	.03018

Conclusion

Based on the results of data analysis, it can be concluded there was the improvement of critical thinking Ability through problem based Collaborative learning is very significance (p=0.000).

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