The effect of problem based learning oriented by lesson study with adobe flash on critical thinking skill

Desi Natalia Purba¹; Retno Dwi Suyanti²; Tita Juwitaningsih³
¹,²,³Universitas Negeri Medan, Medan, Indonesia

E-mail: desinataliapurba07@gmail.com

Abstract. This study is aimed to determine the improvement of critical thinking skill using problem based learning oriented by lesson study with adobe flash compared to using direct instruction. A quasi-experimental design was employed for the study. The sample was selected purposive sampling technique. 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 skill test consist of 20 multiple choices and statistically analyzed using SPSS software. The results showed that the improvement of critical thinking skill using problem based learning oriented by lesson study with adobe flash is better than using direct instruction.

1. Introduction

Improving the quality of human resources through education is focused on higher order thinking skills (HOTS). HOTS is one of the abilities needed to prepare graduates who are able to compete and adapt to changing times. Critical thinking skills are one manifestation of HOTS. Higher-order thinking activities focus on critical thinking, which is thinking about deciding what to do or believe [1]. Critical thinking is related to the use of students’ cognitive skills and strategies that increase the likelihood of having the desired impact. The critical thinking process is needed in solving problems and making decisions [2]. The development of critical thinking skills is very important for students to obtain optimal results.

Solubility product constants 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 powerpoint 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 powerpoint also did not meet the criteria in developing students’ critical thinking skills and did not maximize the function of LCD in the classroom [3]. Teachers can take advantage of information and communication technology (ICT) for learning purposes [4].

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 [5]. 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 [6]. Adobe Flash-based learning media is suitable for use in learning chemical equilibrium at SMK and has received a positive response from students [7]. There is a significant impact of multimedia-based offline learning using Adobe Flash on student motivation and learning outcomes [8].

The use of instructional media in improving students' critical thinking skills can be optimized if its function is combined with the right learning model [9]. 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 skills. 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 [10]. PBL can also improve critical thinking skills, learning motivation, and student achievement [11].

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 [12-13]. PBL based lesson study can improve problem-solving skills 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 skills [14].

2. Methods
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. 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.

Data were collected using a critical thinking skill test consist of 20 multiple choices. Data were analyzed descriptively based on the average value, then the increase in pretest and posttest was calculated, namely the N-gain critical thinking skill. Furthermore, inferential statistical tests (hypothesis testing) were carried out with the t-test.

3. Results and discussion
The data obtained in this study is the improvement of critical thinking skill 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 skill as in Table 1. Improvement critical thinking skill (N-gain) can be seen from the difference in the average value of pretest and posttest. Results of the average value improved critical thinking skill in Table 2.
Table 1. Pretest and Posttest 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 Table 2 it can be concluded that the increase in critical thinking skill in the experiment group is better than the increase in critical thinking skill in the control group. Improvement of critical thinking skill can be visualized as Figure 1.

Figure 1. Graph of Average Improvement of Critical Thinking Skill

Based on Figure 1 it can be concluded that the improvement of critical thinking skill using problem based learning oriented by lesson study with adobe flash is higher than using direct instruction.

From the distribution table of the increase in critical thinking skill (N-gain) the two samples are normally distributed and homogeneous data, then hypothesis testing is performed. This test is proposed to support the success of the model in learning chemistry to improve the students’ critical thinking skills using independent sample T-tests. Presented presented in Table 3.
Table 3. Hypothesis Testing

| N-Gain | Levene's Test for Equality of Variances | t-test for Equality of Means | 95% Confidence Interval of the Difference |
|--------|----------------------------------------|-----------------------------|----------------------------------------|
|        | F          | Sig. | t     | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| Equal variances assumed | 1.037 | .314 | 4.758 | 48 | .000 | .14360 | .03018 | .08292 | .20428 |
| Equal variances not assumed | 4.758 | 47.890 | .000 | .14360 | .03018 | .08292 | .20428 |

Based on the results of testing the hypotheses presented in Table 3 the value of sig (0.000) < α (0.05) is obtained, then H₀ is rejected and Hₐ is accepted. Related to increasing critical thinking skills 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 [15], Cowden [16], and Oktaviani [17] 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 skills. Research by Mustofa [14] also states that PBL through a lesson study-based contextual approach can improve students' problem-solving skills and learning outcomes. Furthermore, Nirbita [18] shows that computer-based media can help problem-based learning in increasing students' critical thinking skills in terms of the ability to ask questions, provide arguments, collect and organize information, analyze problems, and make decisions or conclusions. Saselah[19] 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.

4. Conclusion
Based on the results of data analysis, it can be concluded there was the improvement of critical thinking skill using problem based learning oriented by lesson study with adobe flash is better than using direct instruction.

References
[1] Sani R A 2019 Cara Membuat Soal HOTS (Tangerang: Tira Smart)
[2] Halpern D F (2014) Thought and Knowledge: An Introduction to Critical Thinking (New York: Taylor & Francis)
[3] Sari DS and SugiyartoKH 2015 Pengembangan multimedia berbasis masalah untuk meningkatkan motivasi belajar dan kemampuan berpikir kritis siswa Jurnal Inovasi Pendidikan IPA1(2)pp153-166
[4] Permendiknas No 81A tahun 2013 tentang implementasi kurikulum
[5] Leow, F.T and Neo M2014 Interactive multimedia learning: Innovating classroom education in a Malaysian university Turkish Online Journal of Educational Technology-TOJET13(2)pp99-110
[6] Merdekawati ADC2014 Pengembangan one stop learning multimedia menggunakan software adobe flash pada materi bentuk molekul dan gaya antar molekul kelas XI SMA Jurnal Pendidikan Kimia3(1) pp 95-103

[7] Saselah Y Rand Qadar R. 2017. Interactive Multimedia Development Based on Adobe Flash CS6 Profesional on Learning of Chemical Equilibrium JKP (Jurnal Kimia dan Pendidikan Kimia)2(2) pp80-89

[8] Silalahi A Hutabarat W Tarigan S and Chandra Y. 2018. Impact of Multimedia-Based Off-Line Learning on Student Motivation and Outcomes Asian Journal of Social Science Studies3(4) p1

[9] Giavrimis P Papanis E and Papanis E M. 2011. Information and Communication Technologies and Development of Learners’ Critical Thinking: Primary School Teachers’ Attitudes International Education Studies 4(3)pp150-160

[10] Hikmah N Abram P H and Suherman S The Influence of Problem Based Learning Model (PBL) Using Lesson Study (LS) Pattern on Quality of Chemistry Learning in SMAN 1 Banawa Jurnal Akademika Kimia8(1)pp43-49

[11] Hussain H and Anwar N. 2017. Effects of problem based learning on students' critical thinking skills, attitudes towards learning and achievement Journal of Educational Research20(2) pp28-41

[12] Susilo H. 2013. Lesson Study sebagai sarana meningkatkan kompetensi Pendidikan Makalah) disajikan dalam Seminar dan Lokakarya PLEASEpp28-34

[13] Kartika Y, Wahyuni R, Sinaga B, Rajagukguk J. Improving Math Creative Thinking Ability by using Math Adventure Educational Game as an Interactive Media. InJournal of Physics: Conference Series 2019 Jul (Vol. 1179, No. 1, p. 012078). IOP Publishing.

[14] Jonny HP, Rajagukguk D, Rajagukguk J. Computational Modelling Based on Modellus to Improve Students’ Critical Thinking on Mechanical Energy. InJournal of Physics: Conference Series 2020 Jan (Vol. 1428, No. 1, p. 012042). IOP Publishing.

[15] Liu L, Du X, Zhang Z and Zhou J. 2019. Effect of problem-based learning in pharmacology education: A meta-analysis Studies in Educational Evaluation 60 pp43-58

[16] Cowden CD and Santiago M.F. 2016. Interdisciplinary explorations: promoting critical thinking via problem-based learning in an advanced biochemistry class Journal of Chemical Education 93(3)pp464-469

[17] Oktaviani P and Marwoto P. 2019. Sets vision of interactive multimedia on the problem based learning in science learning In Journal of Physics: Conference Series (Vol. 1170, No. 1, p. 012040)IOP Publishing

[18] Nirbita, B.N Joyoatmojo S and Sudiyanto S. 2018. ICT Media Assisted Problem Based Learning for Critical Thinking Ability. International Journal of Multicultural and Multireligious Understanding, 5(4) pp341-348

[19] SaselahY.R and Qadar R. 2017. Interactive Multimedia Development Based on Adobe Flash CS6 Profesional on Learning of Chemical Equilibrium JKP (Jurnal Kimia dan Pendidikan Kimia) 2(2) pp80-89