

Application of Learning Based on Problem through Lesson Study in Learning Biology in 21st Century Course for Developing Biology Students Critical Thinking Skills and Collaboration Ability

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Keywords: Critical Thinking Skills, Collaboration Ability, Learning Based on Problem, Lesson Study.

Abstract: Learning based on problem has been done through Lesson Study in the learning biology in 21st century course. This type of research is an action research. The study was conducted 2 times. The subjects of this study were 26 students. Class are divided into 4 small groups of 6-7 students. The division of groups is done randomly. The results of the first meeting indicate students' critical thinking skills with very good criteria of 52%, good criteria at 30%, and pretty good at 18%. Student collaboration ability with very good criteria is 61% and good criteria is 39%. The results of the second meeting indicate students' critical thinking skills with very good criteria of 72% and good 28%. Student collaboration ability with very good criteria is 72% and good 28%. The conclusion in this research is there are improvement of students' critical thinking skills and students' collaboration ability by using Learning based on problem models (Problem Solving and Problem Based Learning models).

1 INTRODUCTION

Education has an important role in improving the ability and skills of students in facing the 21st century. In the 21st century, students are required not only to have high ability, but also to have skills in various fields. According to Euro Pass Teacher Academy (europass: teacher academy, no date), there are several capabilities that must be acquired in order to compete in the 21st century including communication, collaboration, critical thinking, and creativity. The ability to think critically will make teachers more critical in improving their learning. In addition, the critical thinking skills that teachers have will affect the students' critical thinking improvement (Rumpagaporn and Darmawan, 2007). Similarly, the collaborative skills (Dickinson, 2009; Killion, 2015), with good collaboration of teachers will be able to make good learning.

Critical thinking skills and collaboration ability are needed by students in addressing problems in life, with critical thinking the students are expected to be able to organize, adjust, change, or improve their thinking patterns so that they can make decisions to take good action. Developing students' critical thinking skills requires some support elements in the

form of experience, deep understanding of a topic, basic processes of thought, and attitudes (Mahanal *et al.*, 2016). The ability of collaboration is the ability to work together. Important collaborative skills developed in the 21st century for students to learn from each other to develop themselves (Ananyarta and Sari, 2017). Critical thinking skills and collaborative skills can be developed with some learning models. Based on the results of research, learning based on problem model is known to improve critical thinking skills and collaboration ability (Redhana, 2012; Jones *et al.*, 2013; Chen, Hernandez and Dong, 2015; Herman, 2017; Zakiyah, Suryandari and Wahyudi., 2017).

Critical thinking skills and student collaboration ability can be developed maximally if the lecturer can do the learning well, one way to create a good quality of learning is to use lesson study. Lesson study can be used to improve the learning process because it has a continuous stage so that the longer the learning is done the better. Lesson Study has been widely used in Asian or world countries to improve learning (Rock and Wilson, 2005; Roback *et al.*, 2006; Dotger, Moquin and Hammond, 2009; Lenski, Caskey and Jr, 2009; Myers, 2012; Bjuland and Mosvold, 2015; Gutierrez, 2015b, 2015a; Djumingin, 2017).

2 METHOD

This type of research is qualitative descriptive research. The research was conducted in October and November 2017 with the subject of the study are 26 undergraduate students of Biology Education who took the learning biology in 21st century course. The study was conducted twice in meetings when the researcher acted as a teacher in a team of lesson study on learning biology in 21st century course. This research was conducted by a team of researchers who consist of 6 S1 students with 3 S2 students from Postgraduate Biology Education Program State University of Malang and two lecturers of learning biology in 21st century course. Learning based on problem model used in this research are Problem Solving and Problem Based Learning models. Critical thinking skills and collaboration ability are measured using critical thinking skills rubric and collaboration ability rubric. The scores obtained are converted into 5 categories which are very good, good, pretty good, not good, and very bad. The improvement of critical thinking skills and collaboration ability are measured by comparing the percentage of students' critical thinking skills and collaboration ability at the first meeting and the second meeting.

3 RESULT AND DISCUSSION

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3.1 Lesson Study Exercise 1st Meeting

3.1.1 Plan Phase

Plan phase was attended by a research team consisting of 6 S1 students and 3 KPL students as research partners. Implementation of the Plan phase is done 2 times. In the first plan held on 14 October 2017 discussed about the learning model that will be selected to teach the material "Development and measurement of critical and creative thinking skills in 21st century biological learning" and 21st century life skills that will be developed in students. In the first plan it was decided to use Problem Solving learning model through discussion methods and the life skills of the 21st century to be developed are critical

thinking skills, and collaboration ability. The second plan was held on October 17, 2017 to develop chapter design and lesson design. In the preparation of lesson design it was agreed to use a teacher-centred learning videos for apperception with the web address (<https://www.youtube.com/watch?v=ZwAZGWdD7jg>). In the second plan the team also prepared rubrics for measuring the 21st century life skills developed and the division of the group at the time of learning. Results of Chapter Design and Lesson Design in the second Plan stage can be seen in Figure 1 and Figure 2.

3.1.2 Do Phase

The Do phase was held on October 19, 2017 for 2 x 50 minutes by dividing the class into 4 groups randomly consist of 6-7 students. Each group is given a problem in the form of a school whose students are less interested in biology learning, then the students are asked to discuss with members of the group on the cause of the problem, the plan to solve the problem, and make a simple learning design to solve the problem. The last stage is the group presentation in turn in front of the class on learning designs they made.

3.1.3 See Phase

See phase is implemented by all class members with one student as minutes and one student as moderator. At the see phase KPL students act as clinical supervisors. The results of See phase are: (1) model lecturers still feel nervous in learning, especially when the lecturer forgot to bring stationery while teaching, in addition there are some students who are difficult to be given instruction in the class; (2) according to observer 1, Group 3 has followed the learning well, but there are one/two students who play alone with the stationery during the presentation of the learning design; (3) according to observer 2, critical thinking skills and collaboration ability in the observed group had been seen, but there was one student who ass less focused and daydreaming at the time of apperception; (4) according to observer 3, all of students discuss the problems well, the division of group tasks is good, and the group members do their respective tasks; (5) according to observer 4, most of the students have studied well, but there was one member of the group during the class discussion still

discussing with his group and paying less attention to the presentation of the other group.

3.2 Lesson Study Exercise 2nd Meeting

3.2.1 Plan Phase

The plan phase of second time lesson study was conducted twice, attended by a research team consisting of 6 S1 students and 3 KPL students as research partners. The first plan on 27 November 2017 discussed about the learning model that will be used to teach the material "Utilization of Technology in Supporting Learn/Development of Learning Media in 21st Century" and life skills 21 which will be developed in students. Based on the results at the first meeting it was decided that the model used is Problem Based Learning based IT. The method used is discussion and critical analysis of the article. Life skills of the 21st century developed are critical thinking skills and collaboration ability. The second plan of 29 November 2017 discussed apperception, division of groups, and preparation of student worksheets used and articles used by each group. In this second plan, group members were rotated based on the evaluation result of the first phase of the meeting. In addition, it was also agreed that a video about the technological progress of Education in the 21st century would be used for the apperception with the source (https://www.facebook.com/graciaschool.malang/vid eos/?ref=page_internal&mt_nav=1). Results of Chapter Design and Lesson Design in the second Plan stage can be seen in Figure 3 and Figure 4.

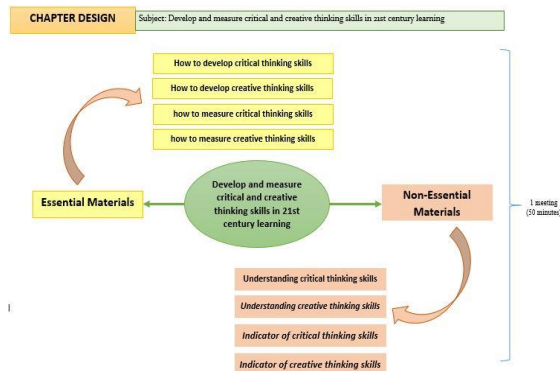


Figure 1: Result of chapter design at the first meeting.

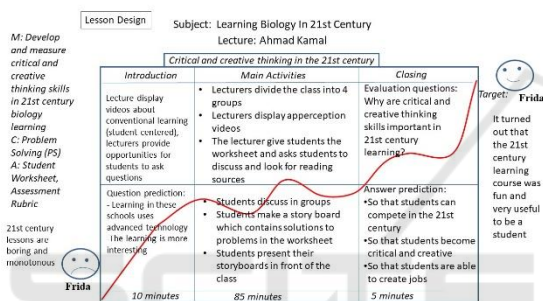


Figure 2: Result of lesson design at the first meeting.

The comments from the clinical supervisors in this meeting are (1) the learning was well done, the use of gadgets outside the task has been reduced, all the students are enthusiastic, and in the discussion there have been collaboration and critical thinking, (2) learning has been implemented in accordance with the Lesson Plan, critical thinking skills, and collaboration ability have been developed well, (3) the firmness of the teacher should be improved in conditioning the class, (4) the model lecturer did not explain the procedure of the discussion and did not explain the existing design, so the students were at first confused on what they will do. The lessons learned from the first lesson study are (1) it is important to condition the class when the discussion takes place, especially when focusing on all students, (2) instructions given to students should be clear and easily understood, (3) there are groups that are slightly more effective at work, (4) group rotation is necessary because there are members who strongly dominate one group and there are passive members.

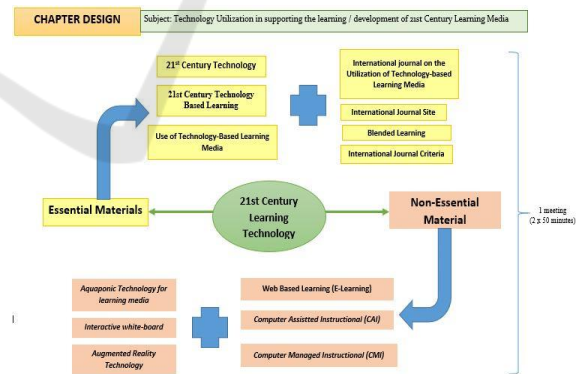


Figure 3: Result of chapter design at the second meeting.

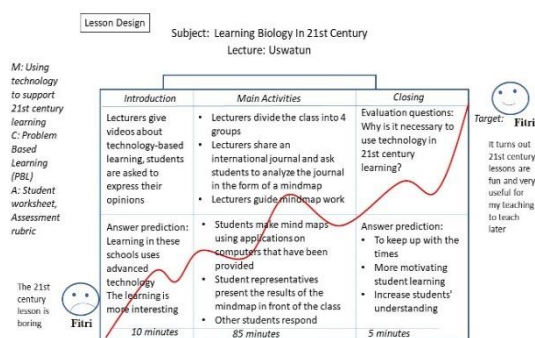


Figure 4: Result of lesson design at the second meeting.

3.2.2 Do Phase

Implementation of the second stage is held on 30 November 2017 for 2 x 50 minutes. Classes are divided into 4 groups. Each group is asked to download the specified article through whats-app application. Furthermore, the students are asked to analyse the article which are about (1) Journal identity (title and author's name), (2) Background, (3) Method, (4) Result, (5) Discussion, and (6) Unique things found. Furthermore, the students are asked to make mind maps about the design plan/learning pattern that will be applied to the unique thing when become an educator. The next stage each group presents their mind map that was made and other groups respond to the presentation.

lecturer's response was good by going around each group and speaking to the students who were still working; (5) according to observer 5, all students learn well, active, and always check progress work.

The comments from the clinical supervisors in this meeting are the model lecturers have been well educated students, the control of the class was good, the model lecturer had also provided motivation and strengthening to each group well. At this meeting the class atmosphere is less fun so it is better to apply the learning method that is fun. The valuable lessons learned from this second meeting are students interested in IT-based learning. Lesson Study Stages performed can be seen in Figures 5, 6, and 7.

3.2.3 See Phase

Phase see was implemented after the lesson study process with members of all members of the class and one moderator and one minutes. The results of the second phase of the meeting are: (1) the model lecturer was nervous because the preparation was too abrupt because the previously designated lecturer model was unable to attend due to a disaster and forgot to name the journal and the site providing the journal; (2) according to observer 1, all students learn well and can follow the learning. Model lecturers have come to each group to admonish a rowdy student when another group presents. There are some students who have not used the mind map and still use concept maps; (3) according to observer 2, model lecturers have been good at teaching, the observed group already understood because the model lecturer came to the group; (4) according to observer 3, most students learn well, divide the task, and at the end inform each other about their work. However, when one observed group was still doing their group work during the time of group presentation, the model



Figure 5: Plan phase.



Figure 6: Do phase.



Figure 7: See phase.

3.3 Results of Critical Thinking Skills Development

Critical thinking is a directional process used in mental activities to solve problems (Johnson, 2007). According to (Sutawijaja and Jarnawi, 2011), critical thinking is a systematic process that allows students to formulate and evaluate their own beliefs and opinions. Developing critical thinking skills is an important element in modern education (Karakoç, 2016). Critical thinking increases creativity and uses time effectively (Hader, 2005). Critical thinking is one of the essential skills that must be possessed in the 21st century (Vogler *et al.*, 2011; Bermingham, 2015; Kivunja, 2015; Zare and Othman, 2015; Cahyono, 2017). A person who has good high critical thinking skills will easily adapt to changing conditions and be valued in both academic and workplace contexts (Rudd, Baker and Hoover, 2000; Kosciulek and Wheaton, 2003; Mason, 2008). In the opinion of (Arend, 2009) the ability to think critically can be possessed by students if the student is consistently trained through good learning. Therefore, every learning implementation must empower the students to think.

The indicators of critical thinking skills used to measure students' critical thinking skills are (1) applying (students searching information and data, using information and data, and linking previous experiences); (2) evaluating (great to evaluating evidence, comparing multiple criteria and perspectives), (3) analyse (students identify the main problem, set priority problems, and be able to explain a problem), and (4) synthesize (identify arguments, combine several arguments, and make new conclusions that are cohesive). The percentage of the result of developing critical thinking skills can be seen in Figure 8.

Critical Thinking Skills

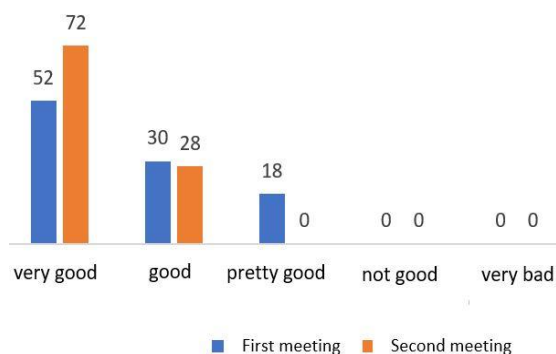


Figure 8: Percentage of developing results of critical thinking skills.

In addition to good learning, improving the ability to think critically is also caused by the use of appropriate models and learning methods. In the second meeting the learning model used is problem based learning, the problem-based learning model is known to be effective/influential on the improvement of critical thinking skills (Burris and Garton, 2007; Masek and Yamin, 2011; Saiz and Rivas, 2011; Birgili, 2015; Rahman *et al.*, 2016; Radulović and Stančić, 2017). In addition, critical thinking skills in this second meeting were developed through the method of learning in the form of finding solutions of problem at the first meeting and critical analysis of scientific articles at the second meeting. Finding a solution to solving a problem is one of the critical thinking development process (Husen, Indriwati and Lestari, 2017). After finding solutions, students are asked to make a mind map on the solutions offered. Make mind map train students to think critically (Santiago, 2011). Article analysis is also one way in developing critical thinking skills (Martínez and Niño, 2013).

3.4 Results of Collaboration Ability Development

Collaboration is a group work activity on a joint project (Gokhale, 1995; Styron, 2014). The collaboration ability is one of the capabilities that needs to be developed in the 21st century (Huang *et al.*, 2010; Lamb, Maire and Doecke, 2017). Collaboration ability are important developed for prospective teachers (Gentry, 2012). Collaboration ability can be developed by providing issues with less obvious topics (Almajed *et al.*, 2016). Sharing activities in groups can enhance students'

collaboration and thinking skills (Muhlisin *et al.*, 2016).

Indicators of collaboration ability that used to measure students' collaborative skills are (1) work productively (students focus on discussions, issue opinions during discussions, and do discussion tasks), (2) respect (students pay attention to opinions of other members, respect other members' opinions, and discuss such opinions), (3) compromise (work flexibly, work as closely as possible, and work on its part). Percentage of results of collaborative ability development can be seen in Figure 9.

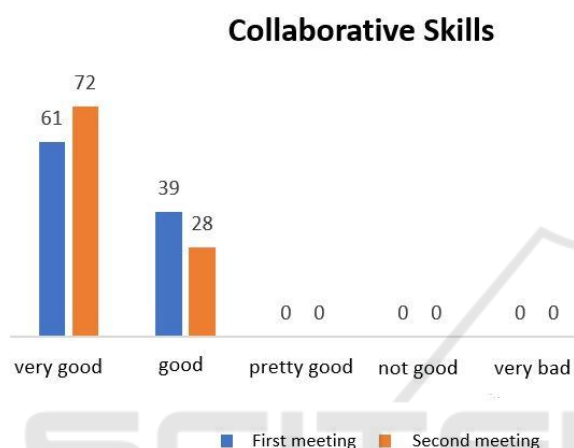


Figure 9: Percentage of developing results of collaboration ability.

Based on Figure 9 the percentage of student collaboration skills has increased from meetings 1 to 2. Improved collaboration ability in this learning are developed through random group formation. Random group formation give advantage of maximizing heterogeneity (Burke, 2011), so that low-ability students will be motivated by highly ability students. In addition, the application of problem-based learning model influences/effectively improves students' collaboration skills (Blumhof, Hall and Honeybone, 2001; Remedios, Clarke and Hawthorne, 2008; Miftari, 2014; Babayi and Arshad, 2015; Rakhudu, Davhana-Maselesele and Useh, 2016).

4 CONCLUSION

The conclusion of this research is the application of learning based on problem model through lesson study can improve critical thinking skill and collaboration ability seen from percentage of students who have critical thinking skill and excellent collaboration ability. Lesson Study is very well used

in learning planning so that learning can be done as well as possible and development of critical thinking skill and collaboration ability can be done maximally. The recommendation of this research is that critical analysis of article and mind map of learning design made by students during the learning process are also assessed, so that the measurement of critical thinking skill and collaboration ability were not only measured by the observation sheet but also from the assignment given to the students.

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