

# Using Lesson Study for Capability Development of Undergraduate Biology Education Students

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**Keywords:** Capability Development, Capability of Biology Students, Lesson Study, The 21st Century Life Skills, Undergraduate Student.

**Abstract:** An action research has been conducted to develop the capability of undergraduate biology education students in the 2017-2018 odd semester. The capabilities that were developed relate to the ability to design, implement, and assess biological learning materials and the development of the 21st century life skills. The subjects were 32 students consisting of 5 male students and 27 female students. The class was divided into 6 groups consist of 5-6 students. Each group functions as a team of lesson study. Each team is tasked with teaching learning materials for 2 meetings using the learning strategy that best suits the topic of the learned material. Each lesson study team was also expected to develop two of 21st century life skills suited to their interests. The result of this study is that there are variations in 21st century life skills that were developed and there were variation in learning models used to develop these skills.

## 1 INTRODUCTION

Globalization brings various impacts in human social life (Lee and Vivarelli, 2006; Irani and Noruzi, 2011). Globalization makes the competition happen globally because the state borders are no longer working (Ocampo, 2010). In the 21st century people need some abilities to compete globally, Greenstein (2012) explained in the 21st century there are 3 main capabilities that must be possessed which are the ability to live in society; the ability to learn and innovate (including critical thinking skills, communicating, creating, and collaborating); and information and technology capabilities. Dede (2010), explains the capabilities that humans need to work and socialize very differently in the 20th and 21st centuries. The existence of industrial revolution 4.0 also requires students to develop their capabilities in order to compete with other countries. According to Thai & Anh (2017) the industrial revolution includes 3 aspects that are digital, biotechnology, and physics. Those aspects are very influential in the world of Biology, especially Biology education in the future.

Education in the 21st century is characterized by interconnectedness in the world of science comprehensively (Sudarisman, 2015). Education in

the 21st century is greatly influenced by globalization and internationalization (Leon-abao *et al.*, 2015). Students in the 21st century have grown in a very fast digital world (Boholano, 2017; Chiappe and Rodríguez, 2017). This makes it very easy for students to receive various information from the internet. Classroom-based learning will be easily abandoned by students (Boholano, 2017). Another fact is that teachers implement "No Name Learning" or "Anonymous Learning" (Corebima, 2016). No name learning has low accountability and is shown to have a very low potential in empowering the various skills needed in the 21st century (Corebima, 2016). According to Indahri (2017), there are four competencies students must have in order to compete in the 21st century, namely critical thinking and problem solving, creativity, communication skills, and ability to work collaboratively (the ability to work together).

According to the Curriculum based on Indonesian National Qualification Framework (KKNI), undergraduate graduates should be able to apply, study, design, utilize science and technology (Science, Technology and Arts), and solve problems (Direktorat Pembelajaran dan Kemahasiswaan, 2014). Achievement of Competence of S1 Biology Education graduates are able to design biology learning to develop life skills of 21st century learners

by utilizing advancement of science and technology in accordance with school context, learner development, and current educational issues. While the achievement of Biology Education course in 21st Century are students able to develop and measure 21st Century Life Skills consisting of (1) high-level thinking skills (critical thinking skills, creative thinking skills, problem-solving skills, and metacognition), (2) skills of action (utilizing ICT, communicating and collaborating), and (3) skills to live together (multicultural education, continuing studies, work, leadership)(Susilo, 2017).

State University of Malang as a State University has a center of excellence in learning innovation, through the IDB Project, State University of Malang trusted to develop learning innovations that will become national references (Setiawan, 2018). Efforts made by State University of Malang as the center of excellence in learning innovation and to overcome the problems of education in the 21st century is to develop a Life Based Learning with one of the characteristics generally emphasize the development of students' capabilities and talents (TIM BBK UM, 2016). Capabilities have multiple definitions according to Baker & Sinkula (2005), capability is a more specific set of skills, procedures, and processes that can leverage resources into competitive advantage. Robeyns (2003) explains that capability can be used as an evaluation tool of existing weaknesses. One way to improve student capability is through Lesson Study. Lesson Study has a positive impact in learning (Yoshida, 2012; Cajkler *et al.*, 2015; Yakar and Turgut, 2017). Lesson Study with 3 philosophies of Excellence, Openness, and Democracy, with the philosophy that educators will continue to improve learning (Sudrajat, 2017) so that the capability in learning will increase and the learning rights of students will be fulfilled. Based on the results of previous studies Lesson study has the potential to develop pedagogical skills of prospective educators (Chokshi and Fernandez, 2010). Lesson study also can make a professional educator community (Doig and Groves, 2011). According to (Isoda *et al.*, 2007), Lesson Study has become a common form of school practice in solving teaching and learning problems while enhancing educator skills. Based on the above explanation, the researcher explained the use of lesson study to develop the capability of undergraduate students of Biology Education in the biology learning in 21st century course. The novelty of this research is the development of capabilities carried out by fellow students through lesson study. Students will teach

each other their friends so they can train their capabilities, both in terms of students and as teachers.

## 2 METHOD

This research is included in descriptive research. The type of data in this study is qualitative data. Data were analyzed descriptively. The study was conducted in the Biology Learning in the 21st Century class. The subjects were 32 students of Undergraduate Biology Education which consist of 5 male students and 27 female students. Class are divided into 6 groups that consist of 5-6 students. Each group functions as a team of lesson study. That is, in teaching fellow students, one of the team members will serve as a model lecturer and other members serve as observers. Each team is tasked to teach the learning materials as much as 2 times meetings by using the learning strategy that best suits the topic of learning material and with fellow students who are taught. Each lesson is a 3-stage Lesson Study, i.e. Plan, Do, and See. The study was conducted in 2017/2018 semester together with 3 field practice study/kajian praktek lapangan (KPL) students as research partners. Stages of research conducted are.

### 2.1 Forming Groups

In this research, 6 groups consisted of 5-6 students each. Group formation was done randomly. Group formation at random allows for a balanced group to form (Rao and Fuller, 2017). Each group served as a Lesson study team. Each group then taught the learning materials that had been designed in the Semester Learning Plan and practiced teaching interchangeably.

### 2.2 Implementation of Plan phase

The Plan phase was done before the teaching practice was implemented. The plan stage was carried out 2 times by all members of the lesson study group. The first plan discusses the capabilities to be developed in learning. The second plan discusses the appropriate learning model for developing selected capabilities and the creation of chapter design and lesson design. The Plan Stage contains the lesson planning that will be conducted, including the making of the Learning Implementation Plan, Student Worksheet, and the 21st Century Life Skills Observation Sheet that were developed. Plan Stage was done in detail, detailed learning planning is important in the learning process (Groves *et al.*, 2013).

### 2.3 Implementation of Do Stage

The Do phase held in the Biology Learning in the 21st Century class. At this stage model lecturers carried out the teaching learning process, while other members acted as observers who observed the learning process by using the developed assessment instrument (Diputra and Trisiantari, 2016). Do phase was done by forming some groups at random. Each group was assigned a specific task in accordance with the capabilities that the Lesson Study team was working on.

### 2.4 Implementation of See Stage

The see phase implemented after the learning process was completed. See phase was done to evaluate the learning that had been done. The see stage was led by a moderator and a notulist from the Lesson Study team on duty. Reflection and evaluation was started from the model lecturer then the observers and the last one were the students who learned. The see phase aimed to provide input on the lessons learned.

## 3 RESULT AND DISCUSSION

The implementation of the lesson study has been done well. The plan phase was implemented by each group 2 times. The implementation of the two-phase plan is aimed at optimizing the lesson plan. The more plan phase that was done made the lesson be planned better. At the implementation of Do phase students looked enthusiastic in following the learning process. At the Do phase one observer oversees one group, it was intended that every student who learned could be observed thoroughly. Learning at the Do phase was carried out using innovative learning models that were previously developed. The results of the See phase in this study indicated an improvement in the quality of learning at each meeting. At this stage there were many inputs that could be used to improve the learning process.

The capabilities developed in this course include designing, implementing, and assessing biological learning materials and life skills of the 21st century. Capabilities related to designing, implementing and assessing biological learning were learned through project tasks assigned to each student at the end of the course. The tasks of the project was to create a learning design (for 1 meeting) that is appropriate to the learning and characteristics of the 21st century

and contains the capabilities to be developed. The distribution of project tasks was based on grade levels in high school, grade 1 by groups 1 and 5, grade 2 by groups 4 and 6, and grade 3 by groups 2 and 3.

Capabilities in the form of life skills of the 21st century were developed through the implementation of lesson study in the classroom by the lesson study team on duty. Life skills of the 21st century in this course were developed in the form of the 21st century biological learning materials not through biological material. The distribution of learning materials, learning models used, and capabilities developed can be seen in Table 1.

Based on Table 1 it can be seen that each group developed a variety of life skills. Life skills of the 21st century developed by each group in the first and second lesson studies are sometimes different, causing the development of its capabilities to be less focused. Recommendations for next course are to determine the capabilities that each group wants to develop so that the capabilities developed are maximized. Each group was free to determine the learning model. Selection of free learning model was expected to improve student creativity. Below it would be shown and discussed the learning models used to develop each of the 21st century life skills.

Table 1: Learning materials, learning models used, and capabilities developed by each group.

No	Learning Materials	Group	Model	Capabilities Developed
1	Understanding the 21st Century as a century of knowledge	6	Team Game Tournament (TGT)	Critical Thinking
2	Analysing the Characteristics of 21st Century Skills	5	Humber Head Together (NHT)	Communication and Collaborative Skills
3	Analyze Attitudes, and Character Teachers Must Have in 21st Century Learning (Creative, Innovative, and Professional Teachers Who Can Facilitate Students Learn) and Measuring Student Learning Outcomes	4	Talking Stick (TS)	Critical Thinking and Collaborative Skills
4	Development of a 21st Century-Based Curriculum Development and Development of Assessment Strategies for the 21st Century	1	Problem Based Learning (PBL)	Creative Thinking and Collaborative Skills
5	Develop and Measure Critical and Creative Thinking Skills, on 21st Century Learning	2	Problem Solving (PS)	Critical and Creative Thinking and Collaborative Skills
6	Develop and measure problem solving and metacognition in 21st century learning	3	Problem Based Learning (PBL)	Communication Skills and Metacognition
7	Develop and measure the skills of acting (communicating and collaborating) on 21st century learning	1	Problem Based Learning (PBL)	Communication and Collaborative Skills
8	Develop and measure the skills of action (utilizing ICT: digital literacy, visual literacy, and technological literacy) in 21st century learning	6	BLENDED LEARNING	Literacy skills
9	Develop and measure skills of community life (citizen skills, multicultural education/global understanding, leadership and responsibility, continuing studies/ work) on 21st century learning	4	Problem Based Learning (PBL)	Communication skills
10	Model/Strategy, and Learning Methods that Match the Characteristics of Learning 21st Century (Inquiry, Problem Based Learning, and Project Based Learning)	5	Problem Based Learning (PBL)	Communication and Collaborative Skills
11	Model/Strategy, and Learning Methods that Match the Characteristics of Learning 21st Century (Cooperative and Collaborative)	3	Student Team Achievement Division (STAD)	Communication and Collaborative Skills
12	Utilization of Technology in supporting learning/development of 21st Century Learning Media (Blended learning/internet based learning)	2	Problem Based Learning (PBL)	Critical Thinking and Collaborative Skills

### 3.1 Collaborative Skills

Collaborative skills that were developed by the lesson study team can be seen in Table 2. The ability of collaboration in the 21st century has a very important role. The ability of collaboration owned by the teacher has a relationship to student achievement (Goddard, Goddard and Tschannen-moran, 2007). The ability of prospective teacher collaboration can be trained through Lesson study.

Table 2: Learning models used to develop collaborative skills and group of developers.

Life Skills of the 21st Century Developed	Developer Group	Learning Model Used	
		First Meeting	Second Meeting
Collaborative Skills	1	PBL	PBL
	2	PS	PBL
	3	-	STAD
	4	TS	-
	5	NHT	PBL

Lesson study makes teachers meet, work together, and collaborate (Gero, 2015; Mon, Dali and Sam, 2016). The ability of collaboration in addition to being developed with the formation of the lesson study group was also conducted with the formation of groups by the model lecturers at each meeting. Group formation was done randomly and alternately at each meeting.

Several studies supported that collaboration capabilities can be developed with several learning models such as chosen by the lesson study team. Problem Based Learning (PBL) can enhance learning and collaborative abilities (Goldstein, 2016). More than 20 respondents stated that PBL has an effect on enhancing collaboration skills (Surif, Ibrahim and Mokhtar, 2013). Problem Solving (PS) can also increase collaboration between educators (Canter, 2004). Using Student Teams Achievement Divisions (STAD) learning model can increase collaboration ability as much as 7.11% in class X of senior high vocational school (Darmawan and Dewanto, 2018). The application of Numbered Heads Together (NHT) Method Assisted Puzzle can improve collaboration skills of 4th grade students (Devi, Wahyudi and Indarini, 2016). Talking Stick (TS) can improve collaboration skills (Ica, Mardian and Oktavia, 2017).

### 3.2 Creative Thinking Skills

Creative Thinking Skills developed by the lesson study team can be seen in Table 3.

Table 3: Learning models used to develop creative thinking skills and group of developers.

Life Skills of the 21st Century Developed	Developer Group	Learning Model Used	
		First Meeting	Second Meeting
Creative Thinking Skills	1	PBL	-
	2	PS	-

The ability to think creatively is essential for teachers in the 21st century. Creative thinking skills make teachers continue to innovate on the learning that is done. Pishghadam, Nejad, & Shayesteh (2012), argued that successful teachers are creative teachers. Creative thinking skills in learning are developed by model lecturers by asking students to create a mind map and creative learning design and in accordance with the given problems and conditions of students in the 21st century.

Several study results support the development of ability to think creatively using Problem Based Learning (PBL) and Problem Solving (PS) models. The results of the research on the application of PBL models can improve students' creative thinking skills and student achievement even though the increase is not significant (Hidayat, Danawan and Hidayat, 2013). Other studies showed an increase in the ability to think creatively in students of class X-10 senior high school using PBL (Purnamaningrum *et al.*, 2012) and creative thinking skills of students of Grade XI senior high school using Problem Solving (PS) learning (Elma, 2018) and using Creative Problem Solving learning model (Syamsu, Yunus and Masri, 2016).

### 3.3 Communication Skills

Communication skills developed by team lesson study can be seen in Table 4.

Table 4: Learning models used to develop communication skills and group of developers

Life Skills of the 21st Century Developed	Developer Group	Learning Model Used	
		First Meeting	Second Meeting
Communication Skills	1	-	PBL
	3	PBL	STAD
	4	NHT	PBL
	5	-	PBL

Communication skills are very important possessed by teachers in the 21st century, the

teacher's communication skills affect student learning outcomes (Khan *et al.*, 2017). Students will be easy to receive information if teachers have good communication skills. Communication skills in this learning were developed using debate learning method by one of the model lecturers. Model lecturers made 3 topics of debate, then class was divided into 6 groups (3 groups as pro parties and 3 groups as contra parties). Moderator in the debate was selected from members of other groups who were not on duty.

Several results of studies support the choice of the Lesson study team. Problem Based Learning (PBL) model can improve student communication skills (Ahyan and Endriana, 2014). Application of STAD learning model can improve communication skills of State Vocational School students of Tasikmalaya District (Muharom, 2014). The application of the NHT model can improve the communication skills of junior high school students (Maman and Rajab, 2016).

### 3.4 Critical Thinking Skills

Critical Thinking Skills developed by the lesson study team can be seen in Table 5.

Table 5: Learning models used to develop critical thinking skills and group of developers.

Life Skills of the 21st Century Developed	Developer Group	Learning Model Used	
		First Meeting	Second Meeting
Critical Thinking Skills	2	PS	PBL
	4	TS	-
	6	TGT	-

It is important for prospective teachers to develop their critical thinking skills so that they can match the expectations and needs of their profession (Seker and Komur, 2008). Critical thinking skills in the learning was developed using the problem analysis method of education. Each group was given a problem and then asked to find the main cause in the problem and provide solutions to the problems given.

Several study results support the models chosen by the Lesson Study Team. Problem Solving (PS) models can improve students' critical thinking skills in Class XI senior high school students on solubility material (Sulistyaningkartti, Utami and Haryono, 2016). Talking Stick (TS) can improve critical thinking skills of fifth grade students (Minariskawati and Suryani, 2016). The use of Team Games Tournament (TGT) learning model can improve students' critical thinking skills at senior vocational

high school (Putri, Suwanto and Sobandi, 2018). PBL learning models can significantly improve critical thinking skills in class X senior high school students (Al-fikry, Yusrizal and Syukri, 2018), in class XI senior high school students (Ullynuha, Prayitno and Ariyanto, 2015; Rahayu, Ismail and Hasan, 2016).

### 3.5 Literacy Skills

Literacy Skills developed by the lesson study team can be seen in Table 6.

Table 6: Learning models used to develop literacy skills and group of developers.

Life Skills of the 21st Century Developed	Developer Group	Learning Model Used	
		First Meeting	Second Meeting
Literacy Skills	6	Blended Learning	-

Literacy skill was developed by model lecturer by using blended learning model. Literacy ability assessment was divided into 3 aspects: digital literacy, visual literacy, and technology literacy. Students were given the task to make learning media using power point as interesting as possible then students were requested to collect their works into Edmodo which had been provided and presented it in front of the class. Literacy skills, especially technology literacy owned by teachers have a positive effect on the effectiveness of learning (Xu and Chen, 2016). Therefore, it is very important for teachers to develop literacy skills.

The choice of the lesson study team using blended learning to develop literacy skills is supported by a study result. The use of Blended Learning combined with Guided inquiry can improve the literacy skills of undergraduate students of Biology State University of Malang (Adi, Suwono and Suarsini, 2017).

### 3.6 Metacognition

Metacognition developed by the lesson study team can be seen in Table 7.

Table 7: Learning models used to develop metacognition and group of developers.

Life Skills of the 21st Century Developed	Developer Group	Learning Model Used	
		First Meeting	Second Meeting
Metacognition	3	PBL	-

Metacognition is very important to be developed to improve the quality of learning. A teacher who has good metacognition will motivate or influence a person to organize his own learning or other people's learning to become better (Prytula, 2012). Teachers who have good metacognition understanding reported that to teach students to have high metacognition requires a complex understanding of both the concepts and strategies of teaching metacognition (Wilson and Bai, 2010).

Several results of studies using PBL for developing metacognitive skills support the choice of Lesson Study team. PBL can improve the metacognitive of senior high school students in Ambulu-Jember (Fitriyani, Corebima and Ibrohim, 2015), and in Malang City (Rizkita, Suwono and Susilo, 2016). PBL models combined with NHT can improve the metacognition of social science students of senior high school students in Malang (Sari, Budijanto and Amiruddin, 2017).

The number of life skills developed by each team of lesson study at each meeting was different, there was one lesson study team that developed 3 life skills, 8 lesson study teams that develop 2 life skills, and 3 lesson study teams that develop 1 life skills. The recommendation for next course is that each team of lesson study develops two life skills so that the burden and experience of each team of lesson study is the same and the lesson study team is more focused on developing life skills of the 21st century that it chooses. In addition, life skills developed at meetings 1 and 2 different, this is tailored to the material that each lesson study team will learn. The result of capability development data conducted by the lesson study team is not shown because in conducting a 21st century Life Skills assessment developed by each team of lesson study using different rubrics. Recommendations for subsequent learning are all lesson study teams using the same rubric to measure life skills of the particular 21st century, the selection of rubrics is done in consultation with the lecturer. Based on the presentation of Tables 2, 3, 4, 5, 6, and 7 life skills of the 21st century were developed with a variety of learning models. The selection of learning model was adapted to the learning materials and the evaluation result of the see phase by each group.

## 4 CONCLUSIONS

Lesson Study can be used to develop capability of undergraduate biology education students. Capability that could be developed were the ability to plan, implement, and assess 21st century biological

learning and life skills of the 21st century in the form of collaborative skills, creative thinking skills, communication skills, critical thinking skills, literacy, and metacognition. Lesson study can be used to design the learning as best as possible so that capability development can be done maximally. A further research suggestion should be that life skills of the 21st century developed are measured using the same rubric and each student's work results when the lesson is assessed by the lesson study team on duty.

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