

Project-Based Activities through Lesson Study: Improvements of Creative Thinking Performance of Pre-Service Biology Teachers in Indonesia

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Abstract: Project-Based Activities through Lesson Study: Improvements of Creative Thinking Performance of Pre-Service Biology Teachers in Indonesia. **Objective :** This study aims to improve students' creative thinking skills by applying project-based learning through lesson study. **Method:** This research uses classroom action research through lesson study with three open classes with a total of 16 subjects of departement biology education, Universitas Hamzanwadi . The data were analyzed using descriptive statistics. **Findings:** Student activity scores during the learning process from the first, second and third open classes were 73.62%, 80.09% and 84.72% there was an average increase in activity of 5.56%. Data on students' creative thinking ability were obtained successively by 75%, 81.25% and 93.75%, there was an average increase of 9.38%. **Conclusion:** The application of project-based learning through lesson study can improve students' creative thinking skills.

Keywords: project-based learning, creative thinking, lesson study.

Abstrak: Aktivitas-Aktivitas Berbasis Proyek melalui Lesson Study: Peningkatan Kemampuan Berpikir Kreatif Calon Guru Biologi di Indonesia. **Tujuan :** Penelitian ini bertujuan meningkatkan kemampuan berpikir kreatif mahasiswa dengan menerapkan pembelajaran berbasis proyek melalui lesson study. **Metode :** Penelitian ini menggunakan penelitian tindakan kelas melalui lesson studi dengan tiga open class dengan subyek berjumlah 16 orang mahasiswa program studi pendidikan biologi Universitas Hamzanwadi>Data dianalisis menggunakan statistik deskriptif. **Temuan :** Skor aktivitas siswa selama proses pembelajaran dari open class pertama, kedua dan ketiga sebesar 73, 62%, 80,09% dan 84, 72%terdapat peningkatan rata rata aktivitas sebesar 5,56%. Data kemampuan berpikir kreatif mahasiswa diperoleh berturut turut sebesar 75%, 81,25% dan 93,75%, terjadi rata rata peningkatan sebesar 9, 38%. **Kesimpulan :** Penerapan pembelajaran project based learning melalui lesson study dapat meningkatkan kemampuan berpikir kreatif mahasiswa.

Kata kunci: pembelajaran berbasis proyek, berpikir kreatif, lesson study.

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■ INTRODUCTION

21st century learning is characterized by the presence of technology, which at the same time the implementation of learning must also adjust to the adaptation of new habits due to the Covid-19 pandemic. The Covid-19 pandemic has greatly affected the management of learning and student characteristics which is a challenge for teachers. This challenge can be overcome by developing students' creative thinking skills (Ulger, 2018). 21st century learning on the adaptation of new habits is now a necessity to integrate information and communication technologies, as well as learner-centered learning management. A person's creative thinking ability in learning will determine his learning outcomes. Yanti (2019), the results of the PISA study in 2015 and TIMSS are one of the proofs that Indonesian formal education emphasizes more on the aspects of low-level thinking and rarely familiarizes students to use high-level thinking in facing and solving real problems in everyday life. Mahmudi (2009) Stating that the thinking ability of learners in learning is still low, this is due to the process of learning activities carried out by teachers have not been able to facilitate learners to explore new ideas because they are still mechanistic, which only memorizes facts in biology instead of the emphasis on developing the mindset of learners. Creative thinking skills are one of the important competencies needed in the 21st century (Toheri, 2020). In addition, the learning carried out by teachers will affect the learning atmosphere carried out (Kilinc, 2018). Teachers need to design and manage learning by actively involving students in learning that encourages students to learn (Mbhiza, 2021; Öztürk, 2020; Tsakeni, 2021). Meanwhile, the results of the PISA study in 2015 stated that the creative thinking skills possessed by students in Indonesia are still relatively low (OECD, 2016). Creative thinking is indispensable to a person when they enter the workforce. The

ability to think creatively is the ability to create something new (Sulistiyono, 2017). Meanwhile, Risnanosanti & Syofiana (2020) stated that creative thinking skills can be trained according to learning materials. Teachers must be able to use innovative or varied learning models that are tailored to the learning materials that will be learned by students, so that students will not feel bored in following lessons and motivated to learn well and enthusiasm during learning (Furmanti & Hasan, 2019). Therefore, in IPA learning in particular, a teacher is required to carry out learning that not only memorizes facts but is also required to train and develop the creative thinking skills of learners that will be needed to face and solve problems in their lives. In creative thinking, learners are required to explore new ideas, insights and ideas to solve the problems faced, so that in the learning process in the class, teachers are required to be able to design learning that is able to train and develop students' creative thinking skills.

One of the learning models that can be developed and adopted to put students at the center of learning is the application of the Project Based Learning model. Project Based Learning is effective learning to develop the creative thinking skills of Project Based Learning (PjBL) students to provide opportunities for teachers to manage learning in the classroom by involving project work (Wena, 2014). PjBL is student-centered and gives students the opportunity to conduct in-depth investigations on essential topics (Grant, 2003). PjBL is an activity where students can access knowledge and teachers facilitate students in conducting investigations (Julie, 2003). The basic principle of PjBL is the external motivation of students to foster independence in carrying out and completing tasks in learning (Ramesh & Duncan, 2020; Timberlake, 2020). PjBL also encourages students to determine and choose the main principles on the subjects

students are learning (Guo, et al., 2020). PjBL requires students to design and develop systems that can be used to conduct real-world investigations and solving problems (Sababha, 2016). PjBL is a method by which students engage in intellectually challenging task assignments to gain the knowledge and abilities used in solving problems (Movahedzadeh, 2012). PjBL provides a structure for students to engage in each practice by taking steps to develop and implement projects (Baker, 2004). PjBL is a complex activity based on challenging problems that engages students in project design and problem solving as well as providing opportunities for students to work independently (Fitrina, 2016). PjBL is an effective learning to develop students' creative thinking skills (Tasiwan, 2015). Students who undertake PjBL activities will have more significant learning outcomes than those who use regular learning as usual (Çakici & Turkmen, 2013).

The use of PjBL learning must also be in accordance with the material to be delivered in order to encourage students as if carrying out an investigation project to the real world (Farihatun & Rusdarti, 2019). PjBL provides opportunities for teachers to motivate students to devise the right strategy, design projects and conduct research in solving real problems faced. Student-centered learning can make students more creative, investigative, communicative and interactive in conducting experiments (Farida, 2017). Project-based learning emphasizes the interrelationship between concepts and everyday children's experiences so that students can relate concepts they already have with the new knowledge they have acquired. The application of PjBL can improve learning outcomes, motivation and encourage students to creatively and independently produce products, provide student experience to build their own knowledge and improve students' ability to communicate

products (Adinugraha, 2018). Characteristics of Project Based Learning according to Kosasih (2013) among others, (1) the existence of activities that produce products or works, (2) the concept of learning materials related to daily life, (3) learning can be done in the classroom or outside the classroom, (4) students design the activities or products produced, (5) assessments are carried out since planning activities, processes to results. Tiantong (2013) in his research mentioned that project-based learning is effective to improve student learning outcomes. Through project-based learning students can gain more active knowledge, and students are more responsible in the learning process.

Lesson study is a process of increasing learning derived from basic education in Japan that implements professional development practices. Working in small groups, teachers collaborate with each other, meet to discuss learning goals, plan actual classroom lessons, observe how their ideas work in hands-on lessons with learners, and then report the results so that other teachers can take advantage of them (Takahashi & Thomas, 2014). Lesson study is defined as a cycle in which teachers collaboratively plan a research lesson, and implement, observe and revise this lesson (Hurd & Licciardo, 2005). Lesson study which is one of the models addressing teachers' improvements has many properties of high-quality professional development (Perry & Lewis, 2009). In lesson study can be selected and applied various learning methods or strategies that are in accordance with the situation, conditions, or learning problems faced by lecturers and students. In the lesson study, lecturers must change the classic learning process oriented towards Teacher Center Learning into student-centered learning or Student Center Learning (Wiharto, 2017).

Referring to the above exposure, each researchers are interested in applying Project

Based Learning to general biology courses to improve students' creative thinking skills through Lesson Study. The implementation of Project Based Learning is intended to describe the learning process carried out by lecturers with learning stages using project based learning steps through Lesson activities.

■ METHODS

Participants

The sampling technique used in this study is Cluster Random Sampling. The sample in this study was students in the 3rd semester students of department of Biology Education Universitas Hamzanwadi which amounted to 16 people consisting of 10 female students and 6 male students.

Research Design and Procedures

The type of research used in this study is Class Action Research by implementing a Lesson Study for 3 cycles with activity stages including (1) Plan, (2) Do and (3) See (Hicyilmaz, 2020). Activities in lesson study are continuous and continuous activities in a learning process. The lesson study stage is illustrated as in figure 1.



Figure 1. Lesson Study Stages

In the planning stage (Plan), lecturers prepare supporting devices that will be used in the Lesson Study including: a. Learning Implementation Plan, b) Student Activity Sheet,

c) Camera to document and record the implementation of learning. In the implementation stage (Do), there are two main activities carried out, namely: 1) model lecturers carry out learning design that has been developed together, 2) observation activities by 2-3 lecturers on the implementation of learning carried out by model lecturers. At this stage, the supporting documents prepared include: 1) observation sheet for learning implementation, 2) observation sheet of student activity during learning, and 3) instruments of students' creative thinking skills. Reflection Stage (See), the observer (observer) delivers a response based on the data of his observations, regarding student activities during the learning and the implementation of learning design carried out by model lecturers.

Instrument

The data collection instruments used in this study are in the form of observation sheets of student activity and tests of students' creative thinking skills. Indicators of student activity observation sheets between: 1) determination of topics, 2) making project designs, 3) making project schedules. While the test of creative thinking skills in the form of essay tests with indicators: 1) smoothly, is the ability to produce many ideas, 2). flexible, is the ability to produce ideas that vary, 3) original, is the ability to produce new ideas, and 4) elaboration, is the ability to develop or add ideas so that detailed ideas are produced.

Data analysis

The data collected in the form of data from student activity observations during learning and student creative thinking skills data is analyzed using descriptive statistics. The indicator of success in this study is 1) the percentage of student activity in participating in project-based learning is at least 80%, 2) classically there are at

least 85% of students obtaining a creative thinking skill score of at least 75.

■ RESULTS AND DISCUSSION

Planning Stage (Plan)

In the plan stage, researchers compile instruments including planning the implementation of learning using project-based learning,

compiling observation sheets about student activities in project-based learning and test instruments to measure students' creative thinking ability. Before the instrument is used, the FGD is carried out with 4 lecturers to get input and revise the instrument to be used in learning. Documentation of activities at the planning stage is shown as in figure 2.



Figure 2. Project based learning planning

The results of the FGD with partner lecturers were obtained, including: 1) determining the final ability that is expected to be achieved by a student, 2) the topic of discussion to be made lesson design, 3) needing lesson design that contains sharing tasks and jumping tasks. This is in accordance with the opinion Rock (2005) bahwa during the lesson study process, professional collaboration occurs as teachers of various levels of experience work together in groups to study their practice through the implementation of a research lesson.

Implementation Stage (Do)

At the do stage, researchers as model lecturers carry out learning based on the design of learning implementation that has been compiled

and involves 3 lecturers of the Biology education study program as observers. The implementation of learning is carried out for 3 open classes. The implementation of each open class is presented as follows.

The First Open Class

Was held on October 14, 2021 for 2 x 50 minutes. In this activity, model lecturers applied project-based learning to environmental problem analysis materials by involving 3 partner lecturers as observers. Azima (2020) in the supervision of this peer the teacher as the observer who has been selected to observe the lecturer model where the observation is based on a peer sharing group. The activities in the first open class are shown as in figure 3.



Figure 3. Learning activities in the first open class

At this stage, some of the findings obtained include: 1) Model lecturers have not followed the learning steps in lesson design in order, 2). Model lecturers are still dominant in learning so that learning is not yet student-centered, 3) Sharing tasks and jumping tasks activities have not been seen, 4) students need to be guided in creating a project design and creating a project schedule, 5) student cooperation in making projects is still low. Some of the findings in this open class are

what cause student activities while participating in learning are still low. Meanwhile, according to Abu Alghayth (2020) where learning must be student-centered. In the learning process, teachers need to create a learning environment that makes students the center of learning (Ankar, 2007)

The results of observer observations related to student activities are presented as in table 1.

Table 1. Observation results of student activity during the first open class learning

Observed aspects	Average observation results		
	Observer 1	Observer 2	Observer 3
Topic determination	38	34	32
Creating a Project Design	34	38	36
Create a project schedule	36	35	35
Number of scores	108	107	103
Score Maksimal		144	
Average score		106	
Percentage		73,61%	

Based on observations such as the data above, the average student activity during the learning process is 73.61 is still below 80%. Meanwhile, based on the results of the student's creative thinking skills test after participating in the first open class, it showed that out of 16 students there were 12 students who obtained a learning result score above 75 or 75% and 4 students who scored below 75 or 25%. Based on the established achievement indicators, student activity and student creative thinking skills in the first open class are still below the established indicators. The low activity of students during learning and students' creative thinking skills are caused by the implementation of lesson learn by model lecturers who have not been optimal. This is in accordance with research conducted by Kizkapan (2017) which states that the application of learning strategies carried out by teachers

affects the learning outcomes obtained by students.

Reflection (See)

At this stage, discussions were held between model lecturers and observers regarding the implementation of learning in the first open class. The model lecturer conveyed the impressions and obstacles made while applying lesson learning with project-based learning. Meanwhile, the observer conveyed his findings during the first open class. Observers provide input, suggestions and criticisms in order to overcome deficiencies during the implementation of learning. This is in accordance with the opinion of Amini & Gholami (2018) where there are three movements that can be applied in the process of reflection or delivery of reflection results, namely praise, criticism, and suggestions Based on the

results of observations about the implementation of learning in the first open class, revisions were made to the lesson learn that will be used in the second open class.

The Second Open Class.

The second open class was held on November 2, 2021 for 2 x 50 minutes. In this

activity, model lecturers implemented project-based learning that has been revised. To measure the implementation of learning, this activity involves 3 partner lecturers as observers. Learning activities in the second open class are shown as in figure 4.

Based on the observations of the observing lecturer, it was identified that the model lecturer



Figure 4. Second open class learning activity

had carried out learning in accordance with the agreed plan. However, during the course of learning, several weaknesses of the model lecturer were found that should be corrected at the next meeting, namely the lack of interaction during the material presentation process. Model lecturers still apply one way communication, namely explanations from lecturers to students This has an impact on the lack of enthusiasm of students

during the material presentation session. Several students were seen talking to other colleagues. These symptoms indicate a lack of motivation for students to listen to the presentation from the model lecturer and affect student learning outcomes (Singh, 2011)

The results of observer observations related to student activities are presented as in table 2.

Table 2. Observation of student activity during the second open class learning

Observed aspects	Average observation results		
	Observer 1	Observer 2	Observer 3
Topic determination	40	38	36
Creating a Project Design	38	40	36
Create a project schedule	38	40	40
Number of scores	116	118	112
Score Maksimal		144	
Average score		115,33	
Percentage		80,09%	

Based on table 3 data, the average student activity during the learning process is 80.09% above the established indicator of 80%. Meanwhile, the results of the student's creative thinking skills test after participating in learning in the second open class showed that of the 16 students who participated in the learning there were 13 students who scored at least 75 creative thinking skills as many as 13 people or 81.25%. Based on the achievement indicator set, the thinking ability of students in the second open class is still below the established indicator of 85%. Based on the score of students' creative thinking ability in the second open class, it shows that there is an indicator of creative thinking ability, namely an elaboration indicator that has not met the set achievement indicator. This affects the student's creative thinking ability score in a classical manner. This condition is in accordance with research conducted by Hsieh (2013) states that students' creative thinking ability scores are shown by the achievement of each established creative thinking indicator.

Reflection (See)

At this stage, the model lecturer and observer again discussed the problems found in

the second open class. Observer gives suggestions that in applying the lesson learns that are made together, it is carried out properly, following the stages of project-based learning and paying attention to the achievement of creative thinking indicators to be achieved, especially the elaboration indicators whose achievement is still below the established achievement indicators. Research conducted by Sookpatdhe (2016) shows that learning with project-based learning can develop students' creative thinking.

Third Open Class

Based on the results of the observer's record on the implementation of learning in the second open class, revisions were made to the learning implementation plan that will be used in the third open class. The third open class was held on November 18, 2021 for 2 x 50 minutes. The third open class activity involves 3 partner lecturers as observers. Learning activities in the third open class are shown as in figure 5.

In this activity, model lecturers implement project-based learning that has been revised based on observer input. Learning goes better, students discuss based on groups that have been determined to create a project design and create



Figure 5. Third open class learning activities

a project schedule, but students who have high abilities are still dominant in discussions. Therefore, model lecturers need to provide guidance to each group in solving problems so

that each group member actively participates both in creating a project design and creating a project schedule. Research conducted by Yoshida (2012) states that in learning teachers must be able to

coordinate the classroom atmosphere and time, as well as re-infer the material taught. Celik & Guzel (2020) in his research states that teachers need to support students to find and

discuss various solutions by giving enough time.

The results of observer observations related to student activities are presented as in table 3.

Table 3. Observation results of student activity during the third open class learning

Observed aspects	Average observation results		
	Observer 1	Observer 2	Observer 3
Topic determination	42	41	40
Creating a Project Design	42	40	39
Create a project schedule	40	42	40
Number of scores	124	123	119
Score Maksimal		144	
Average score		122	
Percentage		84.72%	

Based on table 3 data, the average student activity during the learning process is 84.72% above the established indicator of 80%. While the results of the student's creative thinking skills test after participating in learning in the third open class showed that of the 16 students who participated in the learning there were 15 students who got a creative thinking ability score of at least 75 or 93.75%. Based on the achievement indicators set, the thinking ability of students in the third open class is above the established indicator of 85%. The achievement of the indicators set by both student activity indicators while participating in project-based learning and indicators of creative thinking ability is greatly influenced by how model lecturers are able to apply lesson learning compiled with observers at the plan stage. In addition, the ability of model lecturers in managing classes and guiding students in developing projects and solving problems related to the material being taught. Research conducted by Özalın Çelik (2018) expressed that teachers supported for students to find and discuss different solution ways by giving enough time. Meanwhile, Kula Ünver and Bukova Güzel (2016) stated that teachers could enable students

to understand suggested thoughts, reasons of different thinking and another ideas by explaining students' ideas. Parallel to this, in our study, explaining and expanding a student's thinking was important in rethinking of students' own ideas by supporting their understanding and associating to different ideas

In this study, the analysis of environmental problems was selected as the main problem that must be solved by students. Projects designed by students are the solution to the problem at hand, namely environmental problems. Students are divided into four groups with each group given the freedom to determine the materials and methods used to conduct environmental analysis according to their creativity. After that they explain and test the project they have created. Based on the implementation of 3 open classes as outlined above shows that the application of Project Based Learning through lesson study can improve students' creative thinking skills in environmental problem analysis materials in environmental biology courses. At the project design stage at PjBL, students actively discuss in conducting experiments, then students present the results of their projects. The series of activities carried out

in IPA Learning with PjBL is believed to be able to create student curiosity and improve science literacy and students' creative thinking skills (Nuraini & Waluyo, 2021). The results of this study are in line with research conducted by Nita (2021) which stated that the application of PjBL through lesson study can improve students' creative thinking skills with a score of 95 and an average of 79.19%. Through PjBL, students not only identify problems and find solutions to problems at hand, but students can also use their various knowledge and creative thinking skills to solve problems (Yamin, 2020). PjBL has also facilitated students to develop themselves both academically and practically to find solutions in everyday life (Husamah, 2015). Meanwhile, Sasson & Malkinson (2018) In his research stated that PjBL is included in innovative learning that can develop students' creative thinking skills. By applying PjBL in learning, students will be facilitated in developing their creative thinking skills in dealing with contextual problems (Chen & Yang, 2019). By implementing PjBL, students are given the freedom to be more active and express their ideas through the projects they create (Ririn, 2021). By applying this PjBL, learning is not only delivered theoretically but also through hands-on practice in making works. Therefore, it can stimulate students to think creatively and to cooperate in completing their projects.

■ CONCLUSIONS

The results of this study concluded that the implementation of PjBL through lesson study can help students develop creative thinking skills. In PjBL, students improve their creative thinking skills through project design activities as their efforts to solve the problems they face. The increase in students' creative thinking ability is indicated by the high percentage of student activity during the implementation of learning and the percentage of achievement of students' creative

thinking skills. Given the high impact of PjBL, the application of this learning must be more massively applied in learning ranging from elementary school to college. The government as a policy maker is expected to organize various activities and conduct socialization related to the implementation of PjBL in learning. Various PjBL studies also need to be carried out continuously in order to provide more information about the benefits of implementing this learning.

The implications of the application of project-based learning through lesson study are believed to be able to improve teacher professionalism and teach the importance of how to cooperate with fellow lecturers to achieve certain learning goals, improve the ability of a lecturer to carry out their duties in order to achieve learning objectives. In addition, by implementing project-based learning through lesson studies, it is hoped that students' abilities can be improved in each of the courses taught by lecturers. However, the limitation in implementing this learning is that it requires a long time both when designing lesson design and implementation in the classroom. Learning is carried out up to 3 cycles also requires a long time. It is also difficult to determine the time agreement between model lecturers and observers in discussing lesson learns and reflection activities. In addition, various media are also needed that are used in developing projects carried out by students.

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