Student discussion skill activities on microbiology courses through lesson study

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Abstract. Lesson study is an educator professional development program through collaborative and continuous learning based on the principles of collegiality and mutual learning. This lesson study activity aims to increase student discussion activities in the Microbiology course at the Teacher Training and Education Faculty Biology Study Program at Muhammadiyah University of Bengkulu. This research was a classroom action research using 4 cycles. It used a qualitative design with a problem-based approach. The lesson study implementation phase was planning (Plan), implementing learning (Do) and Reflection (See). The topics chosen in the lesson study activities were (1) Bacteria (2) Fungi, (3) Protozoa, and (4) Viruses. The data collection used observation sheet observation of student discussion activities through lesson study activities. The data collected were then analyzed by descriptive qualitative. The results of lesson study activities showed the increasing in skills activity to student discussions in microbiology courses at the Teacher Training and Education Faculty of Muhammadiyah University of Bengkulu. Continuous implementation of lesson study in the lecture process improved the professionalism of lecturers. Along with the increase in lecturer professionalism, it had an impact on the effectiveness of learning activities and improving the quality of education as a whole.

1. Introduction

Lesson study is an adaptation of learning quality improvement programs conducted in Japan. Lesson study is one of the modifications and part of the initiator of improving more broadly learning process [1]. Lesson study can improve the quality of learning both in universities and schools [2]. Lesson study is conducted as a way to help educators and can also improve skills in conducting learning activities. Lesson study becomes an analytical framework in exploring learning that is good enough to foster educators’ professional understanding [3,4]. Lesson Study becomes a vehicle for educators to develop their professionalism [3]. Lesson study activities include the study of collaborative and continuous learning based on the principles of collegiality and mutual learning and can build learning communities [5-7]. Lesson Study challenges educators to reflect learning activities using detailed planning and observation that relates to students’ learning. Lesson Study is used as a context for building dialogue in students’ science learning communities [6]. The main principle of Lesson Study is the gradual improvement in the quality of learning with the way of learning from one's own experience and those
of others in conducting learning activities [8]. Lesson studies show the important role of an educator as a facilitator and others who are knowledgeable as observers. Lesson studies are interactive and their effects reach all levels of the existing learning system [1].

Assessment of the development of student learning outcomes is not enough to be seen only from the test results sheet and lesson plans, but also needs to be seen from the learning process directly. Doing direct observations in class during the learning process takes place, will be more accurate and complete, even to the details things can be known. Lesson study has a positive effect on students ‘learning outcomes when it is integrated into the learning process [1]. The use of video in the learning process can be done as a complement and not as a substitution [9]. Direct observations of learning in lesson study are very beneficial for lecturers and educators. In the Lesson study, the observer shares his knowledge while the teacher obtains additional knowledge from the observer who is involved in the learning activities to be carried out. The collaboration between the teacher and the observer gained valuable knowledge and experience for each other. Collaboration in lesson study becomes a powerful and effective instrument for improving teaching practices of educators [4,10].

In the learning process, lecturers need to make improvements to the learning method so that students do not find difficulties in the learning process. One of them is in Microbiology subject. Microbiology is a compulsory subject for all Biology Education students at the Muhammadiyah University of Bengkulu. Based on the experience of microbiology lectures from the previous year, lecturers used lecturing methods in collaboration with the use of power point media. It causes difficulties for students to understand the material. The characteristics of the objects studied in microbiology subject are very small and the majority cannot be directly observed. Broadly speaking, the objects being studied are about bacteria, algae, fungi, protozoa and bacteria. The study of microorganisms not only covers the size of microscopic objects, but also relates to aseptic techniques applied to the media to grow them. Therefore, it requires different learning media from other subjects.

Students’ learning performance becomes the most important part of the learning process. The interactions of student-student, student-lecturer, student-instructional materials and student-environment are matters of concern. It is done to overcome the weaknesses of the low quality of learning in higher education, especially in the Biology Education Study Program at the Muhammadiyah University of Bengkulu which needs to be pursued an alternative solution. A way that can be taken is by conducting an experience sharing forum among lecturers to establish a programmed learning community through a professional coaching model for the lecturers that is known as lesson study. Basically the lesson study follows the Plan-Do-See pattern. In the Plan phase the lecturer prepares a learning plan, the preparation of the learning plan is usually carried out with other lecturers (discussion plan). In the Do phase, the lecturer appointed as the model lecturer implements learning (openlesson) with observation of observers. After openlesson implemented, see phase is a reflection of the implementation of learning in openlesson [7,10].

The problems found in the learning process need to be solved immediately in order to achieve optimal results. Therefore, it is necessary to make improvements. One of the ways taken is to carry out lesson studies in order to improve the quality of learning.

2. Methods
This study uses a qualitative design with a problem-based approach and case studies with the media assistance. The research location is in the Biology Education Study Program, Muhammadiyah University of Bengkulu. Problem Based Approach and case studies in this study require researchers to be present during the research. The sample of this study is biology education students who took Microbiology subject. This study was conducted in 4 cycles with the topic; 1) Bacteria, 2) Fungi, 3) Protozoa, and 4) Viruses. Data collection techniques used are observation and direct observation techniques by using observation sheets of students’ discussion skills done by observer. The data that had been collected are then analyzed in descriptive qualitative.
3. Results and discussion

Before carrying out the lesson study cycle, researchers did observations first. The results of observations are (1) there are identified problems found in the subject; (2) formulating problems in order to find solutions and supporting data; (3) finding and determining alternatives in the effort to improve the learning quality in microbiology subject; (4) designing an action plan; and (5) developing instruments to observe the learning process.

In the process of lesson study activities, it started with the planning phase (Plan). The model lecturer delivered the learning program on topics that would be studied in the form of chapter design, lesson design, Student Worksheets, learning materials, media, and evaluation instruments. The model lecturer conveyed that learning would take place in the form of 5-7 people group discussions, each group was asked to work on a Student Worksheet. After the model lecturer conveys the learning program, the observer team gave a response. At the implementation phase (Do), the model lecturer started the learning process by conveying the learning objectives to be achieved and how the learning procedures are. Model lecturer motivates students by showing pictures or videos about the material to be studied as apperception activities. Furthermore, the model lecturer conveys important concepts of learning material to be studied and students are given time to ask questions, and respond to the material presented. Lecturers provide Student Worksheets that will help students in learning. Students are asked to work in groups that have been set. During the discussion and practice process, the model lecturer observed the discussion process of each group, and provided guidance if there were groups that found difficulties. After students completed the Student Worksheet, the model lecturer asked one or several groups to present the results of their discussion. Then the model lecturer and students discussed the results of the discussion. The model lecturer gave an opportunity to students to ask questions, responded to the discussion material. The lecturer and students conclude the learning material. In the final stage of learning the lecturer conducted an evaluation in accordance with the learning material that had been learned. The next phase is a reflection (See) between the model lecturer and the observer to evaluate the learning that had been done, in order to improve further learning.

The implementation of lesson study in microbiology subject is done in 4 cycles, each cycle passed the phases of Planning (Plan), Implementation (Do), and Reflection (See). The initial cycle is choosing the topic to be implemented in the open lesson. Determination of the topic at the beginning of the lecture aims to provide basic provisions in learning the next topic. The reason for choosing topics in implementing lesson study is to overcome the weaknesses of students in learning topics that are difficult for lecturers to teach, current subject, such as the novelty of the content, technology, learning approaches, and focus on the most important fundamental things that affect other learning [11].

3.1. Open lesson I

3.1.1. Planning phase (Plan). At the planning phase (Plan) the model lecturer presented a learning program about 'Bacteria' and the observer team responds. The responses from the observer team were as follows:

"The improvement must be clear from previous lesson study activities that have been carried out".
"The issue of learning problems must be clear and contextual"
"The strategy used must be clear, namely the Problem Based Learning (PBL) strategy".
"The learning model must be clear, i.e. PBL".
"It should not add objects to be investigated".

3.1.2. Implementation phase (Do). In the lesson study implementation phase, it was obtained the results of observations made by five observers on five groups of students. The results of responses in the observation sheet done the observer in the process of implementing learning are presented in Table 1.
Table 1. Results of Open Lesson 1 Implementation.

| No | The Observed Aspects              | Categories |
|----|-----------------------------------|------------|
|    |                                   | Good | Sufficient | Less |
| 1  | Giving ideas and suggestions     | 8    | 14    | 1   |
| 2  | Listening and paying attention   | 18   | 7     | 0   |
| 3  | Cooperation                      | 21   | 4     | 0   |
| 4  | Reading and Writing              | 13   | 9     | 3   |
| 5  | Ethics of group Discussion       | 21   | 3     | 1   |
| 6  | Enthusiasm                       | 20   | 5     | 0   |

Based on the results in table 1, students are quite active and good in group discussion, but there is one person who still lack in the process of providing ideas and suggestions, three people still lack in reading, and one person lack in discussion ethics.

3.1.3. Reflection phase (see). The results of the observer team reflection in the open lesson phase I were as follows.
- "There are still many students who are less active in discussions".  
- "Group discussions are less enthusiastic".  
- "The problems discussed must have many alternative answers (open-ended)".  
- "Students are appointed to answer questions".  
- "Seats must be arranged, so that the students are more freely."  
- "Problems must be resolved only".

From Table 1 above, it can be described as follows. In the open lesson I activities, observers have not been very good at observing students who are learning, it is seen from the small amount of data obtained, the less category is only 5 students able to be observed by observers. This happens because the observers have not very well understood the purpose of the observation sheet and how to observe it. Therefore, in the reflection discussion activity (See), it was explained again how to observe them. From Table 1, it can be seen that the learning activities of students are still lack in the aspect of providing responses, ideas, and suggestions in discussions, then in the aspects of writing, reading, making tables or pictures also seem less. This shows that the most important thing in lesson study is that lecturers have experience in real situations and an observer should have knowledge about pedagogy. When the two cooperate, they can share knowledge and experiences each other [10].

3.2. Open lesson II

3.2.1. Plan phase. Before engaging to the next phase, the model lecturer delivered a learning program on the topic of 'fungi'. After the model lecturer submitting the lesson plan, the observer lecturer given responses. The responses from the observer lecturer were as follows:
- "It should be clear on what students will observe, whether it was spores, hypha, or mycelium".  
- "There was no need to compare with macroscopic fungi".  
- "Time allocation must be a concern".  
- "Must be tested first before lectures began".  
- "Student worksheets must be accompanied by drawings, for instance a fungus hypha.

3.2.2. Do phase. From the implementation of the lesson study, the observation results have been obtained by four observers. The results of the observation sheet responses from the observer from the process of implementing learning can be seen in table 2 bellow.
Table 2. Results of open lesson 2.

| No | The Observed Aspects          | Categories |
|----|------------------------------|------------|
|    |                              | Good | Sufficient | Less |
| 1  | Giving ideas and suggestions | 3    | 12          | 10   |
| 2  | Listening and paying attention| 7    | 17          | 1    |
| 3  | Cooperation                  | 17   | 5           | 3    |
| 4  | Reading and writing          | 14   | 8           | 3    |
| 5  | Ethics of group discussion   | 2    | 20          | 3    |
| 6  | Enthusiasm                   | 7    | 8           | 10   |

The above table shows that students were quite good at discussing activities with their groups. However, there were still ten people who lacked ideas and suggestions, one person lacked in listening and paying attention, three people lacked cooperation in groups, three people lacked in reading and writing, three people were still lacking in discussion ethics, and ten other people were less enthusiastic in the discussion.

3.2.3. See phase. The results of the observer team's reflection on the open lesson phase II were as follows:

"Most students were quite capable of using a microscope".
"At the moment of practice, students were long enough to find objects".
"Spores on bread fungi were hard to find".
"There were some students who were not yet proficient in using microscopes."
"There was a tense atmosphere occurred during classroom discussions".
"Students compared what they observe with references".
"Student groups that required a long time to observe the object, finally only seen pictures in textbooks".
"There were still many students still did not understand materials on fungi".
"Students were very enthusiastic in learning, curiosity was very high. Some were able to see the object and some were only looking at pictures from the book".
"Group II was unable to see the fungi object. It was curtained which group whose object was correct, if it was correct then the other groups were told to see. It was necessary to carry out a training for biology students on how to observe biological objects microorganisms through a microscope".

In the open lesson II activities, the observer has been so kind in observing students who were learning. This can be seen from the amount of data obtained during the learning process. In Table 2 it appears that, in the aspect of providing responses, ideas, and suggestions in the discussion there were still many in the category of less (10 people), the aspect of enthusiasm in conducting discussions was also very much of lacking (10 people). Elsewhere, aspects of reading, writing, making pictures, etc. were still many that were in less category (3 people). In addition, the ability to cooperate and be enthusiastic in discussions was also lacking.

3.3. Open lesson III

3.3.1. Plan phase. At this cycle the model lecturer submitted a learning plan on 'Protozoa', then the observer responded. The responses from the observer were as follows:

"The observed protozoa came from rice field water, sewerage water, pond water, and river water".
"The material to be discussed was about the structure, way of life and reproduction, identification of colony nature, and the role of Protozoa in life".
"One sample will be given to each group".
"Implementation of practicum must be clear on what will be observed by students".
"Student papers must be accompanied by pictures of Protozoa."
"Each sample must be placed in 2 containers, pond water must have 2 containers".

3.3.2. Do phase. At the time the application of lesson study, it was observed by four observers, and they obtained some observations results. The results of the observation sheet responses from the observer can be seen in 3.

| No | The Observed Aspects          | Good | Sufficient | Less |
|----|-------------------------------|------|------------|------|
| 1  | Giving ideas and suggestions | 6    | 13         | 13   |
| 2  | Listening and paying attention| 10   | 15         | 0    |
| 3  | Cooperation                   | 14   | 9          | 2    |
| 4  | Reading and writing           | 13   | 11         | 1    |
| 5  | Ethics of group discussion    | 8    | 15         | 2    |
| 6  | Enthusiasm                    | 11   | 6          | 2    |

In table 3, it can be seen that students were quite good in discussing activities with their groups, but there were still thirteen students were still lacking in giving ideas and suggestions, two people had a lack ability in cooperation, one person also had a lack ability in reading and writing, two were lacking in ethical discussion, and two people were less enthusiastic in learning discussions.

3.3.3. See phase. The results of the observer team's reflection on the open lesson stage III were as follows:

- "Group III could not find the Protozoa object, so only saw the object through the pictures in the book"
- "Group I students were very active, could find Protozoa objects, they took turns seeing objects through microscope".
- "Group IV was divided into two small groups, one group observed an object through microscope while the other group completed student worksheets".

It can be understood from Table 3 that student learning activities still seemed to be insufficient in the aspects of giving responses, ideas, and suggestions in discussions, as well as in the aspect of enthusiastic in discussion. Then, other aspects such as collaboration, reading and writing, and ethics are still lacking, but when compared to the 2nd open lesson it has been much decreased (only an average of 1 person).

3.4. Open lesson IV

3.4.1. Plan phase. At the meeting of the plan phase, the model lecturer delivered a learning program on the topic 'Viruses'. After the model lecturer presented the lesson plan, the observer responded. The responses from the observer were as follows:

- "Lecture material about Viruses, must discuss the structure of viruses, how viruses live, and role of viruses in human life."
- "Students must be given references Viruses, can be either in form of pictures or in form of articles."
- "The issue raised must be about the impact of giving the virus vaccine to humans as well as the breeding of the virus itself."

3.4.2. Do phase. At the implementation stage of the lesson study, the results of observations were made by four observers. The results of the observation sheet responses from the observer team in the learning implementation process can be seen in table 4.
Table 4. Results of observation in open lesson 4.

| No | Aspects Observed           | Categories |
|----|----------------------------|------------|
|    |                            | Good | Sufficient | Less |
| 1  | Giving ideas and suggestions | 17   | 10          | 1    |
| 2  | Listening and paying attention | 19   | 8           | 1    |
| 3  | Cooperation                 | 20   | 9           | 1    |
| 4  | Reading and writing         | 21   | 8           | 1    |
| 5  | Ethics of group discussion  | 18   | 11          | 1    |
| 6  | Enthusiasm                  | 16   | 13          | 0    |

As can be noted from the table above, in general students were good at discussing with the group. The results of lesson study activities had a positive effect on student learning outcomes when implemented as a whole.

3.4.3. See phase. The results of the observer team's reflection on the open lesson phase IV are as follows:

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There was one student in group III who was less active. He has difficulty in answering questions in the LKM (students worksheet).”

“Students were still unable to answer questions whose answers must be in form of reasoning”.

“Group I students were already good in discussion both in group and in class”.

Based on table 4, the following conclusions can be drawn; In the fourth open lesson activity, it was seen that the less category were decreased in every aspect of discussion skills. Based on observations that has been done, overall students were good in discussion in their groups. This is in line with the statement that every word spoken by students and model lecturers has the potential to create a dialogue space that contributes to students’ thinking process.

4. Conclusion

In the application of Lesson Study in Microbiology Subjects at Biology Education Study Program of FKIP of University of Muhammadiyah Bengkulu carried out by the Lecturer Team (model lecturers and Observers) has given ability and understanding to the team of lecturers on how to design lectures based on Lesson Study. This process also triggered an increase on student learning activities, especially in skills to conduct discussions in learning. It is necessary to carry out a follow-up for the next semester in another course in the Biology Education Study Program University of Muhammadiyah University of Bengkulu. Before open lesson activities are carried out, discussions between the lecturer team (model lecturers and observers) must be held first, so that the activities carried out can be done optimally.

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References

[1] Hadfield M and Jopling M 2016 Problematizing Lesson Study and Its Impacts : Studying a Highly Contextualised Approach to Professional Learning Teaching and Teacher Education 60 203–214

[2] Wahyuni S 2013 Optimalisasi Pembelajaran Melalui Pelaksanaan Lesson Study Jurnal Pendidikan Almuslim 1 1 1–5

[3] Schipper T, Lin Goei S, Vries S D and Veen K V 2017 Professional Growth in Adaptive Teaching Competence as a Result of Lesson Study Teaching and Teacher Education 68 289–303

[4] Vermunt J D, Vrikkii M, Halem N V, Warwick P and Mercer N 2019 The Impact of Lesson Study Professional Development on the Quality of Teacher Learning Teaching and Teacher Education 81 61–73
[5] Hendayana S 2007 Lesson Study Suatu Strategi untuk Meningkatkan Keprofesionalan Pendidik (Bandung: UPI Press)

[6] Bjuland R and Helgevold N 2018 Dialogic Processes that Enable Student Teachers’ Learning about Pupil Learning in Mentoring Conversations in A Lesson Study Field Practice Teaching and Teacher Education 70 246–254

[7] Inprasitha M and Changsri N 2014 Teachers’ Beliefs about Teaching Practices in the Context of Lesson Study and Open Approach Procedia - Social and Behavioral Sciences 116 4637–4642

[8] Widodo A 2008 Lesson Study in Indonesia: Introspect and Prospect Proceeding of the International Conference on Lesson Study 1–6

[9] Rakhmawati A, Octavia B and Umniyatie S 2010 Implementasi Lesson Study dalam Mata Kuliah Mikrobiologi Juridik Biologi FMIPA UNY (Yogyakarta: UNY)

[10] Inprasitha N 2014 Perceptions on Professional Development of Supervisors in the Non-project and Project Schools Using Lesson Study Procedia - Social and Behavioral Sciences 116 2069–2073

[11] Santyasa I W 2009 Implementasi Lesson Study dalam Pembelajaran. Seminar Implementasi Lesson Study dalam Pembelajaran bagi Guru-Guru TK, Sekolah Dasar, dan Sekolah Menengah Pertama di Kecamatan Nusa Penida (Nusa Penida)