Exploring the effect of reflection to inquiry teaching through lesson study for learning community

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Abstract. The purpose of this study is to explore the learning science of Junior High School teachers from inquiry-based learning strategy through reflection session during activity of lesson study for learning community program. Reflection is important part of the professional development of teachers through lesson study for learning community that teachers learn science content, didactic, and pedagogy. In lesson study for learning community program, teachers learn science content, learn how to develop lesson design, learn how to deliver the science lesson at real class and teacher learn also how student learn through reflection sessions. Data was collected through video recordings and field note from two classes. Then video recordings was transcribed and analyzed. We found the most discussed reflection theme is 48% about student learning activity. In addition the second most discussed theme of reflection is about the learning phase of 43% and 9% of teachers to reflect on learning content. And then we found that teachers play an important role to facilitate (a) students to engage in scientific investigation, both cognitively and attitude; (b) students to understand and build the concept through collaborative learning. Reflection session helps teachers to learn new teaching strategies from practice and improve student learning outcome.

1. Introduction
The quality of education in Indonesia is determined by quality of a teacher in implementing learning. Therefore, the Indonesian government emphasizes the development of teacher professionalism. This is stipulated in Undang–Undang Republik Indonesia No. 20 tahun 2003 tentang Sistem Pendidikan Nasional dan Undang–Undang Republik Indonesia No. 14 tahun 2005 tentang Guru dan Dosen, states that a teacher must meet the competency standards of educators are: pedagogic competence, personality competence, professional competence and social competence. Therefore, it is necessary to develop teacher professionalism.

One of the efforts to develop teacher professionalism carried the program of lesson study for learning community (LSLC). LSLC able to improve teacher competence in Indonesia, because there are processes which lead to improvement of teacher competence in pedagogic, personality, professional and social. This activity aims to build a community of learning among teachers so collaboration occurs on developing learning quality. At the end, it will be created the condition of teachers and students who mutually collaborate in science transfer activities in schools. Lesson study is professional development practice, which originated in Japan, engages teachers in a process of systematically examining their teaching, with the goal of becoming more effective [1]. In addition, the aim of this activity is to
encourage the creativity and activeness of teachers to improve student learning outcomes and create students who are professional, active, and creative in learning.

Under these circumstances and in combination with the call for professional development that is more school-based and grounded in daily realities, scholars introduced lesson study as a Japanese professional development method [2]. During the LSLC program the teachers gain new learning experiences and reflect on those experiences with peers and content experts. Lesson study has three stages, there are plan, do and see. Plan is an activity to develop learning plan. Do is an activity to implementation the plan that has been made during the stage of the plan or the teaching practice session. The last stage is see, it is an activity to reflect on the learning process that has taken place.

This study examines the reflection of secondary school science teachers on teaching practice sessions during the LSLC science program. During the program, teachers practiced teaching with high school students, immediately followed by reflections from their teaching colleagues and group facilitators. It has the characteristics of effective professional development: teachers are actively involved in both the process as the products, the focus on content and specifically on students learning, it takes place over a longer time span, and there is coherence between the activities [3]. In this study, we set out to investigate how reflections during LSLC can improve knowledge and practice of teaching. To investigate this issue, we focus our data collection on two detailed questions:
1. What is the instructional theme that emerged during this reflection session?
2. What is the effect of reflection to inquiry teaching through lesson study for learning community?

Our investigation of teacher reflection on practical teaching experience during the LSLC program adds new knowledge about how teachers learn instructional strategies of inquiry through collaborative group teaching. In the case of Lesson Study, the reflection is undertaken collaboratively, where the potential exists to build on others’ concerns, insights, and ideas for future action [4]. Reflection becomes the most important part to analyze whether the plan has been made in the stage of the plan has been done or not. Therefore the quality of reflection is crucial in tracing the quality of learning.

Nevertheless, although reflection is seen as the most decisive stage of learning quality, the fact in the field of reflection activities has not led to improved learning quality and still found negative responses for model teachers. The ability to persistently and carefully consider what and how we are teaching, and to reflect on our actions as teachers to determine what works best for our students, is central to successful teaching [5]. Reflection is done after learning, as only to meet the stages in lesson study activities only. The results of the reflections have not been well documented cause there is no document improvement learning that can be applied by teachers in each school. The contents of reflection are dominated by problems of student learning difficulties, but it is not mentioned which part is difficult for students and has not revealed the exact solution of the problems found.

Schools, in collaboration with the University teacher training institutions, are encouraged to create a professional development program in schools to support teachers in the development of teacher professionalism. Research shows that the programs support a well-organized, including high-quality school mentor, gave a positive influence on the professionalism of teachers.

2. Method
This study used a qualitative descriptive [6] to understand teacher’s learning while reflecting on their implementation of new teaching strategies from practice and to improve student learning outcome. The primary data source was transcripts of teacher’s discussions during the reflection sessions that followed the 70-min team teaching sessions with middle level students. During the teaching practice sessions, a facilitator observed and took field notes of events occurred during the teaching practice sessions with the students. These sessions were also video-taped. The facilitator led the teaching group through their reflection on day’s instruction and also took field notes and video-taped these sessions.

The study presented in this paper focuses on the reflection sessions of fifty teachers. During the lesson study for learning community program, experienced middle school teacher is selected as model teacher to taught lessons in two classrooms from the curriculum to the middle school students enrolled in the enrichment program while the participating teachers observed. Teaching materials that are taught are biology about plant cells. As the authors, it was also necessary for us to participate in this study as facilitators.
Our roles as facilitators allowed us to observe during the practice teaching and reflection sessions, which, in turn, enabled us to provide rich qualitative descriptions and to have a thorough understanding of content taught in the practice teaching sessions. The study was conducted at Junior High School in Sumedang District. The location of this research is selected because this school is included in teacher professional development program through lesson study for learning community. And then they have openness from school and teacher to do research.

3. Result and Discussion

The majority of reflection themes (48%) of students learning activities from use of microscopes, learning materials, prior knowledge, students learning abilities and needs. Whereas 43% of the students reflect back and back on the practical aspects of learning. And the remaining (9%) of teachers reflect on how student interaction helps them understand learning content. The percentage of reflection themes are shown in Figure 1.

The practice teaching sessions with the students provided a rich learning environment for the teachers to reflect on. The general themes expressed were varied and multiple and are summarized in figure 1. The frequently occurring themes are discussed in detail below to illustrate how the teacher’s discussion with ideas during the reflection sessions and how this process of reflection led to improved teacher learning. Portions of the transcripts from the reflection sessions are provided to support the authors’ analyses of the identified themes and show the collaborative interactions between teachers.

3.1. Student Learning

Teachers most often discuss student learning issues. This discussion focuses on student content ideas, prior knowledge, students' learning abilities and needs. Inquiry learning is used in both classes which will provide opportunities for students to work in groups so as to complete the scientific inquiry (look for plant cell images) and to discuss the idea of their content with other students and teachers. Inquiry in science teaching plays at least two different roles. First, inquiry as a practice engaged in by scientists should be taught as part of the science curriculum. Second, and perhaps more importantly, inquiry should be used as a pedagogical tool through which students can learn science content and practice through experiencing the process of inquiry itself [7]. Teaching science through inquiry is an effective teaching strategy for teaching and developing the ability to expand argumentation skills [8]. During the lesson, the teacher identifies the student's activities, that the practicum learning activities generate student interest. Observer 6, an expert lecturer, made a distinctive commentary on the discussion of student learning:

... I will comment on groups 13, 12 and that draws a group of 14 (3 people). I am interested in their really struggle. On and on again and again not found also the cell image, continue to be slashed again (Daunnya), keep trying until come the teacher and say "Well good" (given appreciation).
In addition Observer 5 also argues that: *I am very impressed with the patience of students, I think his students are very good, very enthusiastic even if there is no problem quickly asked his teacher. So we see the student is so patient, but we have to be careful whether he is thinking or confused.*

In this case it illustrates students have a great interest in learning to build an understanding of concepts independently, in contrast to more traditional instructions where they may focus on students memorizing the content. Thus, newly acquired interest applies when objects, ideas or activities originally viewed as of no personal consequence become interesting through force of conscious and voluntary integration with existing acquired interests [9]. However, in the process most students have difficulty using microscopes and lack of interaction within the group. Difficulties students in using this microscope are caused students forget how to use it. Therefore, this reflection activity resulted in a change in the early part of the learning by demonstration of the use of microscopes by teacher. Demonstrations are among the fundamental tools in teaching motor skills. Demonstrations provide an effective means of communicating the "right" way to perform a new motoric skill [10]. The lack of interaction and function of the formation of this group is commented on by one observer, observer 1 states that: *The arrangement of a one-person one-microscope group is a good one, according to the group's based on Mr. Toyomane, which is ideal if it is possible for a male female to cross a female when possible. Therefore the resulting reflection gave a change of group arrangement, initially 14 groups of one to seven four-membered groups.*

Based on the interaction between teachers and students during learning and discussion reflection sessions, teachers collaboratively plan ways to improve student learning. Groups of size 4 indicated that the suggested model was successful in optimally solving the problem [11]. So in this reflection all observer agree to change from one group contain two students to be one group contain four students.

### 3.2. Science content

Teaching sessions and practice reflections provide opportunities for teachers to learn about science content. Teachers learn content during reflection sessions and when watching their colleagues interact with students during practice teaching. In studying or discovering these cell images the students are hampered by the misunderstanding of the use and function of the microscope. Observer 2 argues:

*... enlargement on the microscope is 10 times (objective lens), 5 times (ocular lens) and I am afraid to be understood by students that it is 10 times and 5 times magnification. Whereas in the physics concept that the microscope's enlargement is multiplied ...*

In addition students do not understand about microscopes such as use of ocular or objective lenses, the use of clamps and reflectors, as well as the meaning of microscope enlargement.

Other findings from this reflection on the content section of science according to observer 4 are:

*... his learning activities jump far in photosynthesis material. Well it should be explaining to the cell that there are sections such as cell walls, endoplasmic reticulum, lysosomes, this is shown only in learning more simply than discussing something far unrelated to learning.*

So this part of reflection produces an emphasis on the material core that students must understand about the concept of plant cells with the use of microscopes as a tool properly. During the reflection session, teachers explain how student interactions help them understand learning content. The teacher also discusses how they can be limiting from telling and letting the students do more thinking this is what is called inquiry learning. Then in this section the teacher discusses how they set the right goals to improve learning outcomes.

### 3.3. Learning stage

During the program, teachers learn to balance the needs of students with teacher guidance as they provide students with opportunities to learn more through student-centered interaction. In finding the student plant cell image is constrained by using a microscope, so the observer 2 suggests that:

*So what if it is explained again (the use of a microscope), the first rotation is macro rotation and then micro, if dark change the position of the mirror.*

To overcome these difficulties required demonstration of the use of microscopes by teachers. From preparing preparations to microscopy and explaining the function of each part of the microscope. Furthermore, at the core stage of student learning to do a lab work in groups consisting of four people,
who have provided understanding of the use of microscopes. So that the hopes occur scientific interaction and cell images produced in accordance with the concept. At the end of the lesson. Observer 6 argues that

... at the end of the study selected three groups but have different results ....

In this case the teacher facilitates the presentation of three groups of students who have different work results (well, less, wrong). In addition, the teacher confirms the cell shape, the picture shown is the best student work. Observer 2 argues that:

The laptop is used for confirmation is incredible ...

The final activity of the teacher's learning explains that one cell part is still composed of the smallest part of the cell organelle, the explanation of the function and part of the cell organel described in the next meeting. The differences aspect before and after reflection activities are shown in Table 1 shows the change after the reflection activity.

| Aspects of change | Before Reflection | After reflection |
|-------------------|-------------------|-----------------|
| Learning objectives | Through the observation of plant cells by using a microscope students can describe the cells, cell parts, cell organelles and cell organelle functions | Through observation of plant incisions using a microscope the student can describe what is seen |
| Stages of learning | Early part of learning: beginning with the use of a loop to see small objects so that when the object can’t be seen again then students observe with the help of a microscope | Early part of the lesson: Beginning with a demonstration of teachers using a microscope, beginning preparation of microscope preparations and explanations of functional parts of the microscope. |
| | The core part of learning: Students are divided into 14 groups (1 group consists of two students). Students are shown the use of a loop to view plant cells, from preparing preparations to observations using a microscope | The core part of learning: Students are divided into 7 groups (1 group consists of four students). Students conducted observations using a microscope to search for plant cell images in groups. |
| | Final section: The teacher shows the work of all groups, confirms the cell shape where the material is not the work of the students, the teacher explains photosynthesis as a cover of learning | Final section: Teachers facilitate the presentation of three groups of students who have different work results (well, less, wrong). The teacher confirms the cell shape where the material is the best student work. The teacher explains that one part of the cell is still composed of the smallest part of the cell organelle, an explanation of the function and part of the cell organelle described at the next meeting. |
| Evaluation | Students draw cells, cell parts, cell organelles and cell organelle functions. | Students can describe what is seen on a microscope. |
| Learning outcomes | All the groups did not manage to get a picture of plant cells | Two groups managed to find the cell image. |

4. Conclusion

This study found a significant relationship between the effects of reflection on inquiry teaching through lesson study for the learning community. The most discussed reflection theme is about 48% student learning activity. Among the use of microscopes, learning materials, early knowledge of students, students' learning abilities and needs. In addition the second most discussed theme of reflection is about the learning phase of 43% and 9% of teachers to reflect on learning content. The study does not assess the teacher's teaching style, but the teacher comments on learning content, sets goals, and grows in
teaching skills that demonstrate the potential to use this structure in teacher professionalism programs aimed at helping teachers integrate complex pedagogical strategies.

In addition, we found the impact of reflection on inquiry learning through this lesson study has an important role to facilitate (a) students to engage in scientific investigation, both cognitively and attitudes; (b) students to understand and build concepts through collaborative learning. Essentially a reflection session helps teachers to learn new teaching strategies from exercise and improve student learning outcomes.

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References
[1] Myers J 2013 Creating reflective practitioners with preservice lesson study. *International Journal of Pedagogies and Learning*, 8 pp 1-9.
[2] Saito E 2012 Key issues of lesson study in Japan and the United States: A literature review. *Professional development in education*, 38 pp 777-789
[3] Garet M S, Porter A C, Desimone L, Birman B F and Yoon K S 2001 What makes professional development effective? Results from a national sample of teachers. *American educational research journal*, 38 pp 915-945.
[4] Chikamori K, Ono Y, and Rogan J 2013 A lesson study approach to improving a biology lesson. *African Journal of Research in Mathematics, Science and Technology Education*, 17 pp 14-25.
[5] Myers J 2012 Lesson study as a means for facilitating preservice teacher reflectivity. *International Journal for the Scholarship of Teaching and Learning*, 6 p 15
[6] Fraenkel J R, Wallen N E, and Hyun H H 2012 *How to design and evaluate research in education* Vol. 7 (New York: McGraw-Hill) p 429
[7] Jiang F and McComas W F 2015 The effects of inquiry teaching on student science achievement and attitudes: Evidence from propensity score analysis of PISA data. *International Journal of Science Education*, 37 pp 554-576.
[8] Richard A, Duschl and Jonathan O 2002 Supporting and Promoting Argumentation Discourse in Science Education. *Studies in Science Education*, 38 pp 39-72
[9] Jack B M and Lin H S 2017 Making learning interesting and its application to the science classroom. *Studies in Science Education*, 53 pp 137-164.
[10] Gibson F D 1997 Demonstrating Motor Skills—Rethinking that Expert Demonstration. *Journal of Physical Education*, 68 pp 31-35
[11] Sadeghi H and Kardan A A 2016 Toward effective group formation in computer-supported collaborative learning. *Interactive learning environments*, 24 pp 382-395.