Improvement of mathematics learning activity through lesson study

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Abstract. The purpose of this lesson study was to improve learning activities of Mathematics instruction. Learning activities to be improved is the theory of probability. There are three phases on this lesson study, PLAN, DO and SEE. In PLAN cycle, the researcher organizes chapter design and lesson plan. In the Do cycle, the lesson plan was implemented in instruction using Think-Pair-Share model. Students are thinking individually before they were paired in groups. The teaching process is organized in two sequence classes. In the first lesson, the learning process was quite conducive, but it still needed some improvement. In cycle SEE, based on the observation of the first lesson, teachers are suggested to use more concrete-case examples to build students' understanding of concepts for the next lesson. The teachers should ask more questions and pay attention to students who are less active during the class. The last recommendation is that students should analyse assignment independently before posing criticisms and providing suggestions to others. The second lesson shows that students are more active compared to the first lessons. Students have more relaxed learning atmosphere. They are more assertive and involved in whole class activities. The students are more confident to ask questions, give objections, and make some corrections.

1. Introduction
The University of Papua, the only state university in West Papua Province, consists of 12 faculties, one of which is the Faculty of Teacher Training and Education (FKIP). The students of the faculty have various characteristics, especially characteristics when learning mathematics. The student's character is the result of what they experienced in learning in senior high school. According to Tanujaya, some of the characters can be developed in mathematics instruction. Several characters can be prepared in mathematics instruction, i.e., honesty, discipline, responsibility, and confidence [1].

However, character development in mathematics instruction is difficult to implement, especially in Manokwari, West Papua. This problem is because, in Manokwari's learning culture, the teacher is the primary learning source in addition to textbooks. When teaching mathematics, teachers start lessons by writing definitions, followed by presenting examples and counter-examples [2]. The learning system directed the difficulty for students to study mathematics at university. They tend to not be active in the learning of mathematics.

Some students of mathematics education from the University of Papua have a low reading interest, and they tend to be lazy to do the task, especially homework. They prefer cheating on the result of their friends, rather than doing the assignment independently. The students who belong to this group have a low learning interest. They have not motivation to study mathematics [3]. This causes these
students not to be able to participate in mathematics instruction properly. In the end, the students' learning outcomes tend to be unsatisfactory.

However, by the philosophy of education, every student has the right to study. The students should be able to understand the lesson well. They should have had the ability and courage to discuss, asking a question, posing a suggestion, and answering the teacher's problems well. They have to pass in every subject taken. Therefore, it is necessary to improve the quality of their learning activities.

On the other hand, in the education system, there are various methods and approaches of instruction used by teachers to create their teaching more effective [4]. In order to increase student activity on mathematics instruction, it can be done with various learning models, methods, and strategies. One learning model that can be used in mathematics instruction is the cooperative model.

One type of cooperative learning model that can improve students' thinking ability is Think Pair Share. Through the application of the learning model Think-Pair-Share, students can build their understanding, to enhance their knowledge. However, the quality of learning by using this model still needs to be improved for the sake of its effectiveness. One effort that can be done is by integrating the TPS learning model with Lesson study.

Lesson study is a learning model developed in Japan. The term lesson study comes from the Japanese words ‘jugyo kenkyu’ which are commonly translated as "lesson study" since jugyo means "lesson" and kenkyu means "study" or "research" [5]. Therefore, lesson study is a system of planning and delivering instruction that is designed to challenge teachers to innovate their teaching approaches and to recognize the possibilities of intellectual and responsible growth of learners while fostering self-confidence in all concerned [6]. The lesson study aim is to improve instruction and advance student learning [7 - 14].

Successful implementation of lesson studies has been confirmed in some subject and countries. Some countries that have publicized successful implementation of Lesson Study, among others: Japan [8], United States [9], Indonesia [10], Hong Kong [11], Sweden [12], Singapore [13], and China [14]. The experience of the success of Lesson Study in various countries can also be applied at the University of Papua, especially when learning about probability.

Probability is one of the required course in Mathematics Education Department University of Papua. The subject has a fairly low graduation rate. Every year no more than 30% of students who graduated at the Good (B) and excellent (A). Most only get enough grades (C), and the rest do not pass the lesson. This causes the students assume that the probability is very difficult subjects.

Some researchers report that Probability is a challenging subject, both for teachers and students. According to them, probability in an elementary statistics classic challenging to teach because there is not much time, the concepts and procedures are complicated, and the students do not see the importance of learning it [15, 16]. The situation is even worse for textbooks, and curriculum documents of probability prepared for elementary and high school teachers do not offer adequate support [17].

Can lesson study improve learning activities in mathematics lectures at University of Papua? Does the use of Think Pair Share approach could increase mathematics students’ learning activities? How to combine Lesson Study and Think Pair Share to improve learning activities of mathematics students? Student activities, according to Tanujaya and Mumu, are the activities of students in the classroom when asked questions, delivered the answer, did argument and provided a suggestion [18].

2. Method
The lesson study was conducted on 22 students who took mathematical statistics course (probability). Probability is a compulsory lesson that implemented in Mathematics Education Department the University of Papua in the academic year 2018/2019. There are two sequences classes to carry out the lesson study.

The application of lesson study in this instruction includes preparation (plan), implementation (do), and reflection (see). In preparation session, the model teacher with a lecturer team consisting of two
lecturers, doing a discussion in order to arrange chapter design and lesson design. The design chapter and lesson design are arranged based on the material to be taught, permutations and combinations. In lesson design, there are several steps of learning carried out by the lecturer model.

The next step is implementation of instruction using the think pair share approach. Think pair share is a type of cooperative learning model. When the cooperative model used in instruction, Tanujaya, et al. (2017) stated that students have opportunities to help each other. The activities of the cooperative model help students to improve their achievement and retention, increase self-esteem, intrinsic motivation and develop more positive attitudes toward learning skills. Cooperative interaction in the learning model enables students to achieve better in terms of knowledge and skill with a help from the teacher [3].

When implementation of cooperative learning model in the lesson, there are several procedures as follow; students were paired in groups of two before they were grouped in more prominent groups: groups of three then groups of four. Before grouped, students were asked to solve an assignment individually, whereas the bigger groups were formed after the smaller groups finish discussing and doing the assignments.

The observation was done during the instruction process. Observers deliver their criticism and suggestions on reflection activities; the discussion was about Counting Rule. The learning activities were conducted in two cycles. Data collection is conducted by using observation guidance and evaluation of learning outcomes. Observation guides are used by observers while evaluating student learning outcomes at several evaluation phases using assessment as learning methods.

Assessment as learning is a method of learning evaluation conducted by lecturers and students themselves. The assessment was conducted in order to evaluate what the students have already known and what they did not know before [19]. In this instruction, students conduct an evaluation by conveying the knowledge and skills acquired to their friends in groups. Then their peers corrected the evaluation by adding or reducing what was said before. This discussion was aimed to increase both then knowledge and skills. It was later continued on groups of three and four students.

3. Result and Discussion
Students are asked to draw up theorem of counting rules using some various examples, especially about permutation and combination. Both of these topics are the basis for studying probability theory. To apply this rule, students need to be able to count the number or elements of events. To improve their abilities, students are asked to understand concepts using some various examples. They have to think individually before discussing in pairs. Examples permutation and combination in probability theory of obtained using a variety of learning resources, especially mobile phones (Android).

3.1. The first lecture
In the first lecture, the students showed satisfactory learning activities. All students are evenly involved in the group of discussions. They seemed to be comfortable when they argued, delivered criticism and expressed suggestion during discussions. There was at least one student who asks questions to teacher from each group that consists of four students.

The results of the discussion showed that all concepts about permutation and combination were successfully constructed by students at the first discussion. Students were able to construct the concept of permutation and combination by analysing the questions task obtained from the internet. The students compared the questions task obtained, provided differences and similarities to find the principal of the task.

Furthermore, to improve the validity of the evaluation results of learning achievement, triangulation is carried out.

Daily assessments, besides evaluating group learning activities, can be done by checking student understanding. Students' knowledge can be known by asking students to convey their learning experiences and making connections between the substantial being learned [20]. This is because, the teachers should be able to predict students' learning difficulties, mistakes, and obstacles [16]. On the
other hand, the results of the daily assessment show that about 50 percent of students was able to solve the problem correctly.

Daily assessment, as well as other classroom assessments, can be used to enhance the teaching and learning process [21]. The results of daily assessment, especially regarding student achievement, shows that there are still shortcomings in the study. A low value indicates that the students cannot well receive the knowledge and skills delivered by teachers. Furthermore, Naga states that student scores are manifest variables used to measure latent variables, the knowledge students have in learning [22]. Therefore, it is necessary to reflect on the latest lesson. The results of reflection are used to improve the next learning process [23].

3.2. The reflection results
After the learning activity, the teacher and observer doing a reflection. Reflection is implemented to analyse the learning process, especially students’ difficulties in learning. At this phase, the student's problems are discussed to obtain various solutions. The solution will be applied to further lessons. In the reflection period, it was concluded that the results obtained in the assessments were due to four things.

First, the discussion is earned out directly in pairs without students independently analysing the questions obtained. Before discussing in pairs, students should analyse information obtained independently. The results of his/her thinking are then discussed with the partner.

Second, each group should present their findings for discussion with other groups. When presenting the results of the discussion, each other group is required to submit criticism and suggestions.

Third, the task questions obtained by students should be selected before students do the analysis. The task questions used should be a more real and contextual case.

Fourth. Teachers are also advised to ask more questions and pay attention to students who are less active.

The results of this reflection are based on the fact that learning mathematics is learning to develop knowledge through the ability to think. The student who studied mathematics must think and learn mathematics by/for themselves. They have to think mathematically [21, 24, 25, 26].

3.3. The second lecture
In the second lecture, learning procedures as follows:

- First of all, each student was asked to collect problems of permutation and combination from various sources, especially the internet by using their smartphones.
- Then, they were asked to reconstruct their understanding of the theorem of permutations and combinations.
- The students in pairs were asked to analyse these question tasks as they did in the previous lecture.
- Finally, the teacher does construction and reconstruction.

Reconstruction is a strategy of the teacher to make corrections to students' misconceptions about the concepts they have learned. Like concept construction, concept reconstruction also uses analogies. The difference between the two lies in the type of analogy used. In reconstruction, the analogy used is based on students' misconceptions of the concept. Misconceptions can occur in both capable and weak students [27].

Learning in the second lecture shows that learning activities are more attractive than previous learning. Most of students were able to argue what was said by his friends in the group. The students are more capable of asking questions, provide objections, and make corrections. Even some students can refute the opinions of friends outside the group, who accidentally hear the results of their discussion by the student.

The result of the daily assessment of the second lecture shows that there is an improvement in the quality of learning. Improving the quality of learning can be seen in the learning activities and students' score. More students are involved in class discussions. The students are more active compared to the first lessons. As a result, students were in a more relaxed learning atmosphere; they
are more assertive and involved in whole class activities. Students became more confident to ask questions, give objections, and make some corrections.

Besides, there are 85 percent of students who pass the final assignment. This shows that there is a positive relationship between learning activities and student achievement. Students who were active tend to understand the lessons well, so as to complete the exam.

4. Conclusion
Lesson study using a think pair share can improve the quality of mathematics learning activities. Using Lesson study, scarcities in learning that is not gathered by the teacher can be grasped by the observer. Therefore, the problems can be addressed properly through a solution based on the discussion between the teacher and the observer. The students were active during the class discussion in the group. The thinking process of students occurs well. The learning atmosphere was more relaxed, where students were more assertive and involved in classroom discussions. Students are more capable of asking questions, providing objections, and making corrections.

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