The students’ interaction in mathematics collaborative learning, caring community, and jumping task

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Abstract. Collaborative Learning (CL) is one of Student Centred Learning method. CbL is main aspect in Lesson Study for Learning Community (LSLC). In application, it is combined with Caring Community (CC), and Jumping Task (JT). CL, CC, and JT is very important to build students’ self confidence and their ability. Data is collected by questionnaire, interview, and observation. This study is done in Mathematics Learning in Junior High School. CL that integrate with JT is done by 4 steps: (1) lecturer build group with 3-4 members, (2) lecturer give task to students, that is write research topic, (3) one student present their idea in his/her group, and other students discuss and give some solutions, (4) lecturer and students discuss about the research topic, problems and solution. The result if this research is analyzed in 4 aspects, that is, description and quality of CL that integrate with JT, description and quality of CC, quality of students’ self confidence, and students’ ability. First, the quality of CL is high. Group is designed by 3-4 members, with JT, that what is give, what is problem, and their solution. Quality of students presentation is high, process of presentation their idea in his/her group is systematic and clear, and process of discussion is very good. Discussion between teacher and students about the research topic, problems and solution is high. Second, quality of CC is very high. The meaning of CC is communication between students, especially, from higher level student to lower level student.

1. Introduction

Lesson Study is a model of teaching profession development through learning activities conducted by a group of educators collaboratively and continuously to improve the quality of learning [1]. Lesson Study, abbreviated LS, was first known in Japan around the 1900s. In Japanese, Lesson Study is known as "jugyokenkyu" which consists of two words. First, "jugyo" which means lesson (learning), and second, "kenkyu" which means study / research (research / assessment). Thus, the word Lesson Study means the assessment of learning [2]. In its implementation, LS applies the principles of collegiality and mutual learning [1]. In other words, LS activity participants must not feel superior (feel the smartest) or inferior (feel inferior), but all LS participants must be intended to learn from each other. Participants who already understand or have more knowledge must be willing to share with participants who understand more, otherwise participants who do not understand must be willing to ask other participants who already understand. Therefore, it can be understood that LS is a learning assessment activity carried out continuously by a group of educators collaboratively with the principle of collegiality and mutual learning to improve the quality of learning and professionalism of...
Hobri [1] argues that the development of LS in Japan is divided into 2 paradigms, namely conventional and modern. Conventional LS starts from 1872 through the socialization of classical teaching methods with an emphasis on aspects of the assessment of teachers and mastery of material by students rather than student learning activities. While LS with the modern paradigm presents the concept of Learning Community (LC), so it is called Lesson Study for Learning Community (LSLC). LSLC follows the development of science using a pattern of documenting learning activities that is more oriented to the assessment of student activities as well as how students learn and collaborate rather than assessing how teachers teach. Saito et al [17] suggested that LSLC emphasized two important things, namely mutual collaborative learning in groups and the teacher's sensitivity to student learning needs through joint observation and reflection of learning. LSLC has supporting elements including (1) collaborative learning, (2) caring community, and (3) jumping task.

2. Theoretical Background

Research on collaborative learning has been encountered in recent times [3, 4] who observed various conditions of collaborative learning. Collaboration is a process of interrelation between learning contexts, student personalities, previous experiences and learning skills [4] and is also a situation and process of shared meaning that contribute to learning success [5]. This collaborative learning is one way to implement a learning community [6]. Collaborative learning based on Lesson Study of Learning Community (LSLC) can improve student learning outcomes [7, 8]. Collaborative learning can provide opportunities for students to actively participate and they can learn from each other to build their own knowledge through discussion and collaboration [9]. In collaborative learning, given questions or tasks that encourage exploration of students working in groups [10]. Collaborative learning is a method that gives students opportunities to learn from one another [10]. In learning there is a reciprocal relationship or a teaching relationship. Likewise, the results of Hobri's research [1] state that designing collaborative learning elements that emerge is learning that makes children as the main role, from teaching to learning and then to mutual learning, mutual learning with dialogue and collaboration. The role of Lesson Study in collaborative learning is not to prioritize solving problems and difficulties, but rather to share problems, interact and share also think to overcome together.

In caring community-based learning, students are directed first to think individually then collaborate with friends in groups in accordance with the caring community's vision that is in learning process student should not be left alone or "no student is neglected" so that the ability of children's social interaction can develop which is then followed by the development of children's academic abilities [11, 12]. The teacher must ensure that the patterns of interaction and communication that occur in groups are not actions that teach each other characterized by smart students always dominating and always teaching students who are less smart. In the caring community (CC) interaction process, students in one class are divided into small groups consisting of 3-4 students whose aim is to foster a sense of mutual care starting from mutual care with friends in the group, followed by growing mutual care with friends outside the group, so that there is a sense of mutual care in one class. Besides students, teachers also have a role in the CC to always provide guidance and direction to students to always establish mutual care for each other, and mutual care between students and teachers [13].

Caring community-based learning is based on Vygotsky-Bruner theory (meaning of knowledge), active, collaborative, and reflection. In practice, the CC does not discuss educational input-output, but rather shows a process called an illumination model, so there is no need to assess learning outcomes in each learning activity [1]. The vision of CC is that student learning must not be left alone or "no student will be ignored". The teacher must know, care for, and educate (care for) students with problems by facilitating them to be able to learn in a collaborative form. CC is training students as well as honing students' social sensitivity towards their friends in group activities. In essence, students are encouraged to care for one another, to learn and develop with mutual trust and comfort, a place to knit and can guarantee the learning rights to each student. From the description above, CC is part of
the discussion activity where in its implementation it will bring up and build a community concern in a class to learn and develop with mutual trust and comfort.

Jumping task (JT) is an element of LSLC. LSLC has four elements: (1) learning based on collaborative learning (CL), (2) CC, (3) application of learning based LC, (4) implementing learning based on JT [14]. JT are questions that are challenging or are at a level above the level of curriculum demands given to students [1, 15, 16]. There are four things that need to be considered in giving a jumping problem, namely (1) What is understood after working on the jumping question and how to apply it, (2) The jumping question is analyzed from various recent sources, (3) The jumping question is used to interpret a symptom/event/event these, (4) In solving jumping questions linking knowledge and concepts that have been learned [1]. Giving jumping questions to students aims to make students think critically, creatively and innovatively through group discussions [1],[14]. Besides the advantages of giving jumping questions that is creating an active learning atmosphere, effective and intertwined interaction between study groups [1, 14]. Through active group learning in solving challenging JT can stimulate students’ higher-order thinking skills [1, 15, 16].

JT are challenging tasks, which are known to have a level above curriculum demands [17, 18]. This kind of task has long been applied in several countries, such as Japan [10], and is now being applied in some developing countries such as Indonesia [17]. JT is a task that contains problems that aim to improve students’ abilities. The problem given in the JT is the development and application of material concepts. This type of assignment is given so that students can think more critically and be challenged so students want to experience a ‘leap’ of learning to encourage them to think harder and get something from what is learned. JT is a central part of teaching using high-level thinking skills (HOTs) in Japan. Low-performance students have difficulty completing jumping assignments. However, with collaborative learning, students can answer the task of JT. Some researchers suggest that the application of JT is better than sharing tasks in improving student achievement [11].

The purpose of giving a JT is to challenge the students to think critically so that they don’t get bored studying. Students need to use their ability to think critically, creatively and divergently to complete the JT because the jumping question is one of the high-level exercises. To solve a JT problem, the learning model is used to give students the opportunity to practice on completing the jumping assignment questions. The JT is one element of the LSLC.

3. Research Method
This type of research is qualitative research. Qualitative research is a research that produces descriptive data in the form of written or oral words from people and observed behavior. This type of research was chosen with the intention of understanding the phenomenon about what is experienced by the research subjects including behavior, perception, motivation, action, etc. holistically and by means of descriptions in the form of words and language, in a special natural context and by utilizing various natural methods. The subjects of this study were students of class XI SMA Muhammadiyah 3 Jember.

The phenomenon studied in the research subject are activities and interactions between students in collaborative learning. This research consists of four stages, namely the stage before going to the field, research field, data analysis, and writing report. First, the stage before going to the field that discusses all the preparations needed before the researcher plunges into the research activity. Second, a research effort is discussed to seriously understand the research setting. In addition, researchers needs to be serious with all the power, effort, and energy to prepare themselves to face the research field. Third, the concept of data analysis is proposed, which also discusses efforts to find work themes and hypotheses. And the fourth stage is writing the report.

Data collection techniques used in this study include observation and in-depth interviews. Observations were made to obtain a description of all student learning activities during collaborative learning and the interaction between students in their study groups. Learning activities and interactions between students are observed based on aspects of collaborative learning, caring community, and jumping tasks. While in-depth interviews are conducted to explore students’ motivation, perceptions,
and behavior in collaborative learning in groups. This in-depth interview aims to explore the research data obtained through observation. The data of this study were analyzed by triangulation techniques.

4. Results and discussion
4.1. Collaborative Element

1. Interaction occurs between students
Student interaction occurs at the beginning of learning when the teacher forms student learning groups. Communication between students sitting close to the front and back, consisting of 4 students to form a study group. Forming a group by taking seats adjacent to the front and back like this is done so as not to spend a lot of time to form groups because it does not change the floor plan sitting class. The subject of this research is a class consisting of 36 students of class X (Grade 10) so that in this class one group can be formed into 9 study groups. The teacher instructs students to form groups, then divide worksheets and do apperception. Observations are made when students do learning in groups.

2. Division of tasks
The division of tasks in groups according to the direction of the teacher is in one group existing. The teacher instructs to discuss freely with their respective groups about the problems encountered on the student worksheet. The teacher gives the opportunity to each group representative to present the results of the discussion.

3. Activity asking questions to peers
Before collaborative learning takes place, students tend to ask the teacher if they encounter difficulties or problems in the learning process. They do not want to ask fellow friends because of distrust of fellow friends that their friends are able to solve the problems they encounter. This has an impact on not increasing interpersonal relationships, because students who feel smart do not want to teach other friends who do not understand and need help and consider the work of other friends less true or even wrong. In addition, students who are smarter choose to do their own work and give results to their friends without any interaction process. After the collaborative learning process takes place, they have already asked each other to closest friends in one group or another group of friends if they encounter problems in learning, no longer rely on the teacher as the center of problem solving.
4. Answering activity
Before collaborative learning takes place, what happens is not an answering activity, explaining and providing assistance to friends who are having problems, but students who are able and feel smarter just give the results of their work to their friends without any process of interaction on how to solve these problems.

Table 1. Answering activity, explaining, and providing assistance to friends who are having problems.

| Number | Questions                                      | Answers                                      |
|--------|------------------------------------------------|----------------------------------------------|
| Before the application of collaborative learning | What do you think of the learning model that has been used so far? | Sometimes monotonous learning makes me less interested. |
| 1      | Do you feel quickly understand the material with the learning that has been used so far? | Sometimes it's quick to understand, sometimes it's a bit longer. |
| 2      | Has collaborative learning been implemented before? | Never before |
| After the application of collaborative learning Students have finished learning | How do you feel about collaborative learning being used? | I am very happy with learning like this, so that it is easier for me to understand the material through discussions with friends. |
| 1      | What difficulties did you encounter when working with your group members and other groups in completing the worksheet (LKS)? | There are some friends who are difficult to work with and tend to be passive |
| Students have not yet finished studying | What do you think of the learning model used? | Actually interesting, but because before I was often weak in mathematical concepts so I found it hard to catch up. |
| 1      | What difficulties did you encounter when working with your group members and other groups in completing the worksheet? | Feeling awkward asking other friends. |
| 2      | What causes you to get less points? | Lack understanding of material concepts. |

5. Expressing and defending opinions activities
After the collaborative learning process takes place, it can be seen the interactions that occur in the learning process. Students close to one another in a group have mutually discussed, express their opinions and provide assistance to other friends. This can be seen in Figure 2.
Figure 2. Illustration of the learning process after collaborative learning occurs.

4.2. Caring Element
On learning based on Caring Community, students are first directed to think individually then collaborate with friends in groups in accordance with the caring community's vision that is in student learning should not be left alone or "no student is neglected" so that the ability of children's social interaction can develop which is then followed by the development of children's academic abilities [13]. Therefore, students are guided to be in groups, ask each other questions, and explain to their friends so that caring among friends arises. The caring community elements must appear in the learning process. These elements include the activity of providing responses between students, providing assistance and providing direction and guidance among fellow friends if there is no understanding of the concept of the material. Student activities in the class in groups are presented in the following picture (taken from one group as a sample).

Figure 3. Illustration of group discussion.

In Figure 3, the group discussion went quite well. Student A gives an explanation to all group members. In fact, there was only one student who dared to ask the group namely student B. At the meeting, it appeared that student C was still less active in the group because student C still lacked
understanding of the material, but friends in his group (Students A, B, and D) has understood the material and tried to explain the material to student C. This shows the feeling of caring between students in the group [19],[20]. On the next meeting, students seemed to be able to collaborate well, which was marked by a feeling of caring about the inability of their peers in the group by exchanging seated positions. Student C sits side by side with student A who is more active and understands the material. Thus, student C begins to develop the courage to ask questions or share related material that he does not understand even he starts to develop the courage to help his friends who have difficulty understanding the material. At this meeting all students seemed active in the study group. They become accustomed to collaborating, caring for each other, and sharing in group learning. At meeting 3 and meeting 4, the group discussion also went well. This condition shows that students have been able to collaborate and build care for one another [21],[22].

The following is an explanation of the elements of caring community in this study, as follows.

1. Activities giving responses between students
   Student activities in learning are the involvement of students in the form of attitudes, thoughts, attention, and activities in learning activities to support the success of learning activities. The involvement or response between students is marked by the interaction in the discussion activities in solving problems presented by the teacher, dare to ask material that is not yet understood and respond to the explanation of his friend. In this interaction between students one with other students help each other and need to obtain better learning outcomes. The interaction of student responses in caring community-based learning is explained in the following figure.

2. Provision of direction and guidance among peers if anyone does not understand the concept of the material
   Provision of direction and guidance among peers occurs when there are friends who do not understand the material provided by the teacher. Provision of directions and instructions including teaching to peers slowly to understand little by little. It shows caring for friends who have difficulties, which is a vision of caring community-based learning. The students' sense of care here is very visible because students help one another to understand each other in trigonometric learning.

3. Providing assistance (Scaffolding)
   Providing assistance (scaffolding) to a friend in this study is shown by the existence of assistance in the form of problem solving instructions and giving examples. Students develop higher-ability thinking when getting guidance from someone more expert or through peers who have higher abilities.

4. Lending notes and learning tools to friends
   There are many ways of students can do to help their friends who have difficulty in understanding the subject matter, including lending lesson notes. Not only lending notes to friends, in this study students also seem to lending stationery for students who do not have learning tools.
5. Jumping Task

**Figure 5.** Student activities at meeting 1.
Student activities at meeting 1 went well, in discussion activities all group members were active working on the jumping problem even though there was only one-way interaction. At this meeting 1, there were two students who were enthusiastic and more active than their two friends and the collaboration that had not been maximized, students with low ability were still shy to ask other friends.

**Figure 6.** Student activities at meeting 2.
Student activities at meeting 2 are more interactive because there has been a discussion between group members. So that each student works hand in hand to solve the problem with passion and enthusiasm. The activity of each student is more active, thus encouraging low-ability students to try to work on the jumping problem by discussing with their group friends.

**Figure 7.** Student activities at meeting 3.
At the meeting 3 student activities are better than at the meeting 2, each group member communicates with each other in solving the jumping problem. Each student at the meeting 3 had begun to get used to working on the question of jumping by having a good discussion with their group friends. So that each group member has established effective communication, working together to solve the problem with enthusiasm and enthusiasm even though not all students communicate in both directions.
At the meeting 4 students’ activities were much better than at the meeting 3, each group member was very active and enthusiastic in solving the jumping problem. Each student at the meeting 4 was able to do the jumping problem by having a good discussion with his group friends. So that each group member has established effective communication, working together to solve the problem with passion and enthusiasm.

1. A PLN technician will repair the transformer found on one of the electricity poles using a ladder, as shown in the illustration beside. If the height of the transformer is 5 meters from the ground level, what is the minimum length of stairs needed by the technician to repair the transformer?

2. A group of grade X students of MIPA are playing a circle game in determining the prize choice. Each participant has the opportunity to determine the choice of prizes by turning the circle board. Prizes to be obtained by each participant are determined by the following rules:
   - if the sine value of the angle produced by the round is 1/2 \( \sqrt{3} \), then the participant gets a prize of a book and stationery
   - if the cosine value of the angle produced by the round is 0, then the participant gets a book prize
   - if the tan value of the angle produced by the round is 1, the participant will get a stationery prize

The angle is determined by the number of rotations (1 rotation = 360 °) plus the angle shown when the circle board stops (see picture).

- Rajis got the first turn, from the experiments he carried out as many as 3 turns of the rotating board and the board stopped at an angle of 120 °. The next turn is Ana, the board rotates for 4 turns and stops at an angle of 60 °.
Daren did the experiment and stopped at an angle of 225 °. Check whether they managed to get a prize? If so, what prize did they get?

Figure 10. Students’ answer.

5. Conclusion
The results of this study were analyzed based on 4 aspects, including the description and quality of the CL integrated with the JT, the description and quality of the CC, the quality of students' self-confidence and students' abilities. The quality of CL in this study is relatively high. This can be seen from the collaboration of groups of 3-4 students able to provide solutions to the problems presented. The quality of student presentations is also quite high. This can be seen from the systematic presentation process and the excellent discussion process. Discussions conducted by teachers and students, and students with students in JT are also classified as very good.

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