

PAPER • OPEN ACCESS

Students' collaborative ability in learning geometry transformation using a scientific approach based on learning community

To cite this article: Hobri *et al* 2018 *J. Phys.: Conf. Ser.* **1088** 012027

View the [article online](#) for updates and enhancements.



IOP | ebooks™

Bringing you innovative digital publishing with leading voices to create your essential collection of books in STEM research.

Start exploring the [collection](#) - download the first chapter of every title for free.

Students' collaborative ability in learning geometry transformation using a scientific approach based on learning community

Hobri, J Safitri, S Romlah, E Nazareth and Susanto

University of Jember, Jl. Borneo No. 37, Campus Tegalboto, Jember, East Java, 68121, Indonesia

E-mail: hobri.fkip@unej.ac.id

Abstract. The central concept of the 2013 curriculum is the scientific approach based on the logical explanation of the fact; students are expected to be able to solve problems through a structured scientific process. However, students often make mistakes in addressing the questions about geometry transformation. Therefore, learning involving multi parties, such as friends and parents, is required. In this paper, we proposed learning based on the learning community. This research aimed to explore the improvements in student's collaborative ability by applying Learning Community-Based Scientific Approach on the topic of geometry transformation. The study was conducted in three cycles, with three steps in each cycle (plan-do-see), based on the learning cycle in the lesson plan. This research was done in one of the high schools in the East Java, Indonesia, in the academic year of 2017/2018. The research subjects were Year 11 science students. The data were analysed using a qualitative descriptive method consisting of data reduction, data presentation, and conclusion. The data were gathered using observation, test, and documentation. The result shows that there is an improvement in their ability to learn mathematics collaboratively. They could work together and appreciate the opinions of their group members and another group.

1. Introduction

21st-century learning demands the students acquire the characters, often addressed as 4C, communication, collaboration, critical thinking and problem solving, creativity and Innovation [1]. In the scientific approach, learning is conducted based on facts which can be logically explained. Therefore, the students can find the answers that may not be making sense but are achieved through the structured scientific process. The success of a curriculum depends on its implementation at schools. Hence, schools are demanded to facilitate the establishment of a learning community in which students and teachers are learning from each other [2]. One of the ways to implement a learning community based scientific approach is through collaborative learning.

Learning community requires collaboration in the classrooms and encourages teachers' collegiality to work together to achieve the goal [3]. Collaborative learning is learning in a group; however, the purpose is not achieving unity through group works. The students in the group are encouraged to find various arguments or thoughts of everyone in the group [4]. The vision of the learning community is that no student can be left on their own or 'no students are to be neglected.' The teachers are demanded to know, care and educate the troublesome students by facilitating them to work collaboratively [5]. There are three important elements for success full learning community: focus on learning,



collaborative culture, and result oriented. One of them is creativity, which oriented to National Council of mathematics teacher [6,8]. The established learning community helps the students to communicate with each other and to the teachers, which encourages students to be more responsible. It may also motivate the students that they find their learning process exciting. The students will often express their opinion and thoughts in transformation geometry learning through the problems related to their environment and will interpret them in answer to their misunderstanding of the forms of transformation geometry [9]. Moreover, the student may often respond to the statements or problems in the form of convincing arguments. Therefore, the research questions in this study are ‘is there any significant improvement in the students’ collaborative ability in learning transformation geometry in mathematics lessons in the class of XI science 1 through learning community-based scientific approach learning? Improving the students’ collaboration ability can be done by applying learning community-based scientific approach to the transformation geometry material.

2. Method

This research adopted a qualitative approach with classroom action research design. The research involved three cycles of plan-do-see, following the learning cycle in the lesson. This study was conducted in one of the high schools in the east of Java during the even semester of the academic year 2017/2018. The research subject was 32 Year 11 students (18 male 12 female). The learning materials were the introduction into the types of transformation geometry in cycle 1; understanding translation and reflection in cycle 2, and were rotation and dilatation in the cycle 3. The data generation methods were observation, test, and documentation.

The observation was conducted directly on students' teaching and learning activity especially in the phases of the plan, do and see. The activities in the plan phase were creating the lesson plan and students’ worksheet together with the experienced mathematics teacher. In the do phase, the teaching and learning activities were conducted based on the plan in the plan phase. Meanwhile in see phase, researchers reflected on the teaching and learning activity which has been conducted concerning students’ activities to collaborate with other students and the outcome of the collaboration. Test data was used to understand students’ learning outcome, while, documentation was implemented to record the teaching and learning process. The instruments used in this research were the observation guide and the achievement test questions. Data validity was obtained from sources and method triangulation. Data analysis was conducted in a descriptive qualitative method with the following procedure: data reduction, data presentation and conclusion or verification [7].

3. Results

The research is conducted for 32 Year 11 students. The summary of the observations is presented in Figure 1.

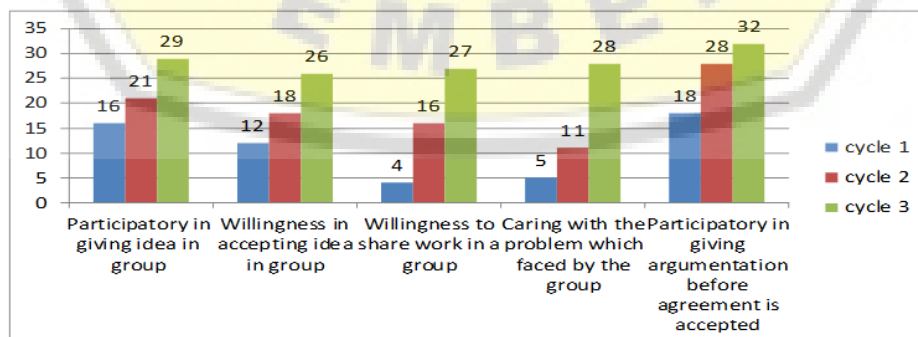


Figure 1. Diagram of the learning process based on learning community.

The student’s participation in giving an idea in a group, cycle 1: 16 Students, cycle 2: 21 students, increasing by 31.25%, and in cycle 3: 29 students, increasing by 38.09%. The willingness in accepting the idea in a group on cycle 1 is 12, and in cycle 2 is 18 students, increasing by 50%, and in cycle 3:

26 students raising by 44.44%. Willingness to share work in a group on cycle 1 is 4, in cycle 2: 16 increasing four times from cycle 1, in cycle 3: 11 raised by 68.75%. Caring about the problems faced by the group in cycle 1 is 5, in the cycle 2 is 11 increasing by 120%, in cycle 3 is 28 students increasing by 154.5%. The participation in giving arguments before accepting the arguments is 18 in cycle 1, 28 in cycle 2 raising by 55.56%, and 32 students in cycle 3, increased by 14.28%. Meanwhile, students' learning outcome is as follows:

Table 1. Students' achievement.

Range score	Students		
	Cycle 1	Cycle 2	Cycle 3
< 50	4	0	0
50 – 59	3	1	0
60 – 69	9	4	0
70 – 79	14	18	9
80 – 89	2	8	15
90 – 100	0	1	8
Total	32	32	32

On the first cycle, 16 students achieved 70 or higher, and 16 students achieved lower than 70. Half of the students reached the score below the minimum mastery level. The average of students score in the cycle 1 is 65.1. On the cycle 2, 27 students achieved 70 or higher, and five students scored lower than 70. The average test score on the cycle 2 is 75.1. On the cycle 3, 32 students scored 70 or higher, and the average test score is 83.5. There is an increasing percentage of cycle 1 to cycle 2 by 15.36%, and cycle 2 to cycle 3 by 11.19%.

4. Discussion

4.1. Cycle 1

Cycle 1 began by applying the plan phase conducted by the researcher and the other mathematics teacher, EP and TP. The plan phase started with creating the lesson plan, students' worksheet and a test on transformation geometry material. The activity on this phase was designing the steps of learning community-based scientific approach to the transformation geometry material following the 2013 curriculum, preparing supporting media, and determining how many meeting would be required [10]. After the plan phase finished, the do phase of cycle 1 was conducted on 24 January 2018, at 06.30-08.00 WIB in the class of XI Science 1.

The teacher prepared the class and conducted the pre-activity. The students were divided into eight groups. Each group consisted of 4 students arranged by designing the students' desk at the beginning of the lesson and U-shaped in group discussion as presented in Figure 2.

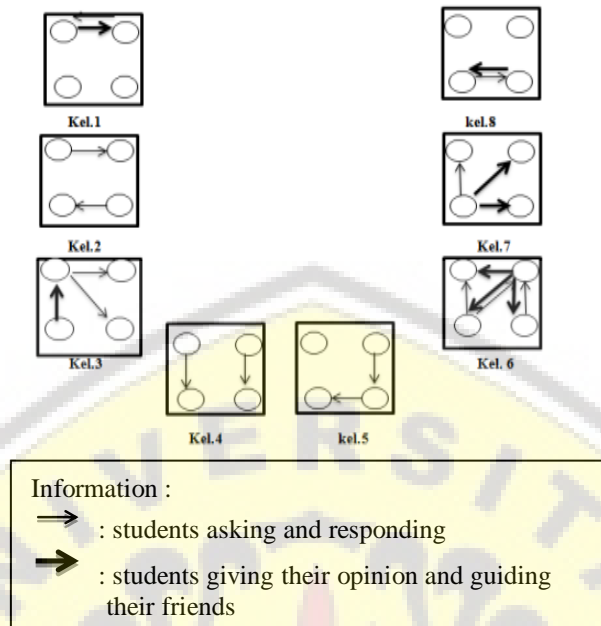


Figure 2. The illustration of teaching and learning process in cycle 1.

The teacher gave stimulus materials by providing the kind of geometry transformation in the form of pictures and another thing which needs to be filled dealing with learning community-based learning geometry transformation, in dealing with group discussion, between the group, and consultation with the teacher. Geometry provides an opportunity for students to stimulate their ways of thinking, critical thinking, and problem-solving, finding differences, generalizing and summarizing the development of student skills [11]. After the do phase, then continued to the see phase. A few things obtained from the discussion in this cycle: the learning did not run well based on the plan, for example in learning community-based the students were still accustomed to working by themselves and did not get used to ask and give opinion to his friend because they assume that the correct answers derived from the teachers. However, there was a group which participated actively in the discussion, i.e., group 6 as can be seen in the figure 3..

One question from the student in group 6 "why there are three pictures of different sizes?". One student named Rdt seemed to understand the purpose of the different sizes of the pictures and he explained to his friend that the real map is minimized twice from the original size of the map and the other is maximized 2 times so that there was a change from the original picture after being maximized and minimized 2 times. However, the others group were still passive, and there was a student who was unable to accept the opinion of a friend from a different group. In this case group 2, 4 and 5 were unable to give theirs, and they intended to be passive. A learning community (LC) requires collaborative learning in the classroom that encourages collaboration between teachers to achieve the goals [3]. However, in this first cycle, there is no communication between the groups. Hence, in the cycle 1, there was no significant improvement in the learning community. The student was not used to conducting group discussions, the students did not optimally show their courage, and they still got used to having the lecturing method from the teacher, and their thinking maturity was still low.

As the results of observation and test, sense of care against the problem faced by the group still did not emerge. Also, the willingness to share the work in a group, either asking or giving an opinion was still way beyond caring and collaborative which are the implementation of the learning community. This resulted in the still low understanding and mastery of transformation geometry of the students, and many (16 students out of 32) achieved scores below the minimum criterion, 70. The average score

from the test was 65.1, still below the 70 (minimum score). Due to the weaknesses found in cycle 1, there was a need to conduct a remedial action in cycle 2.

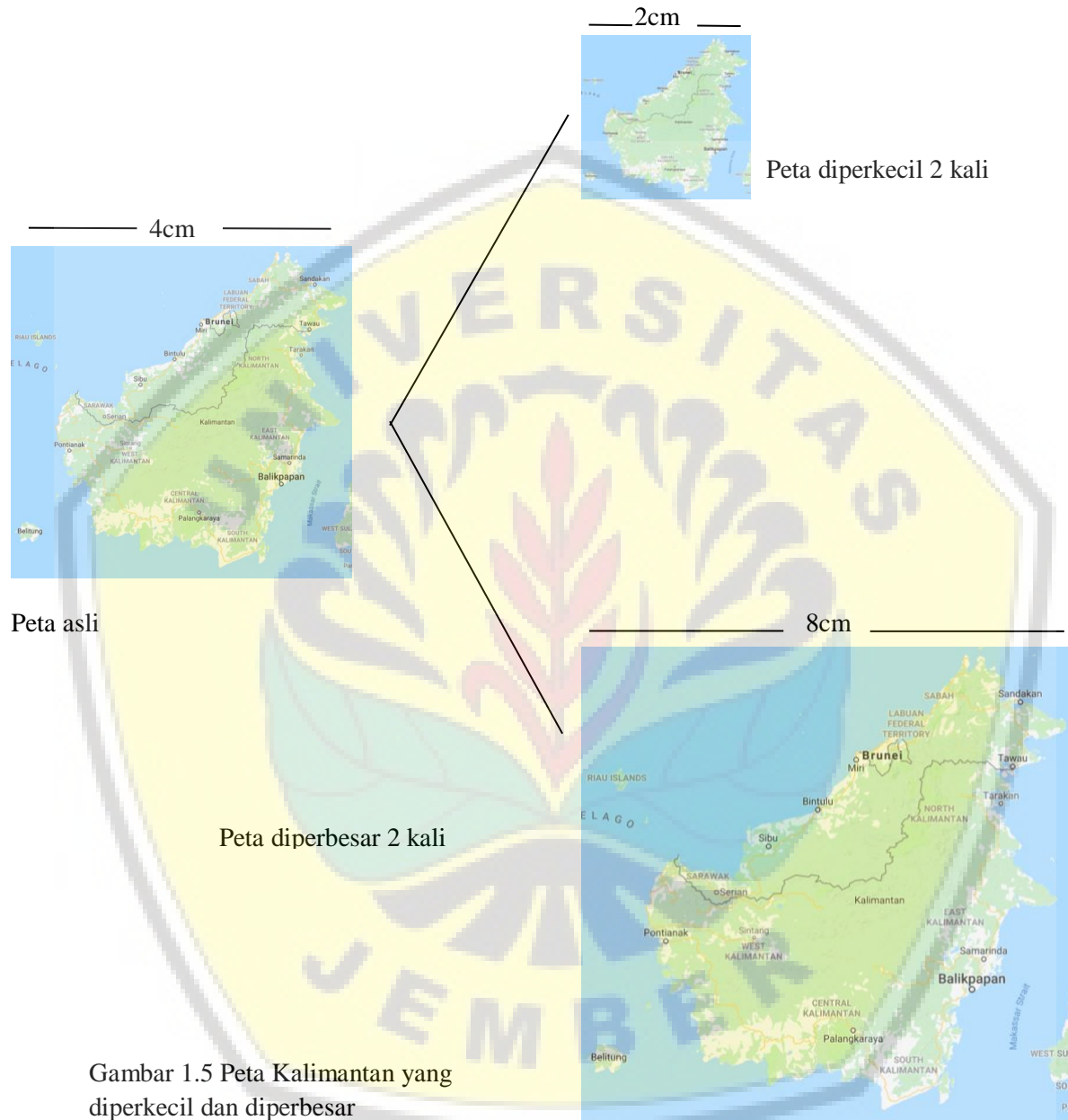


Figure 3. The example of dilatation question

4.2. Cycle 2

Cycle 2 began with doing the do phase by creating a remedial plan on the cycle 1. Phase plan started with revising the lesson plan and adjusting with the results of Cycle 1, and created the lesson plan and student worksheet on translation and reflection material, and designed the steps of learning community-based scientific approach. The do phase of cycle 2 was conducted on 25 January 2018. The implementation of the do phase of cycle 2 was better than of in cycle 1. In cycle 2, the teacher

was able to design the students' U-shaped seats on the beginning of teaching and learning process in Figure 4.

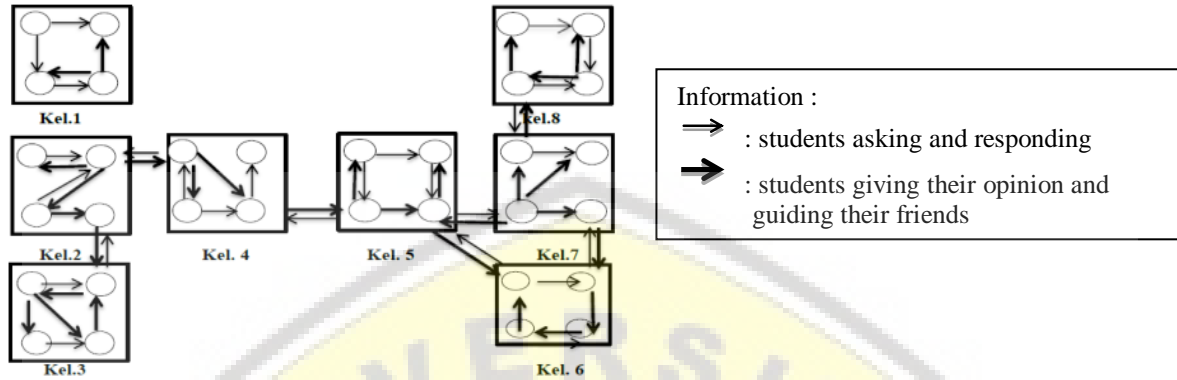


Figure 4. Illustration chart of the learning process in cycle 2.

From the illustration above, we can see that students were participating in giving their ideas in a group and giving their opinion before an agreement was increasing. The students started to get used to delivering their idea. In the cycle 2, almost half of the students got used to asking, give their idea in a group, work together with the members of their group and of the other groups. Many interactions happened in Cycle 2 even though group 1 still discussed with their own member. In cycle 2, there was an exciting event when members of group 8 actively expressed their arguments to solve this following problem:

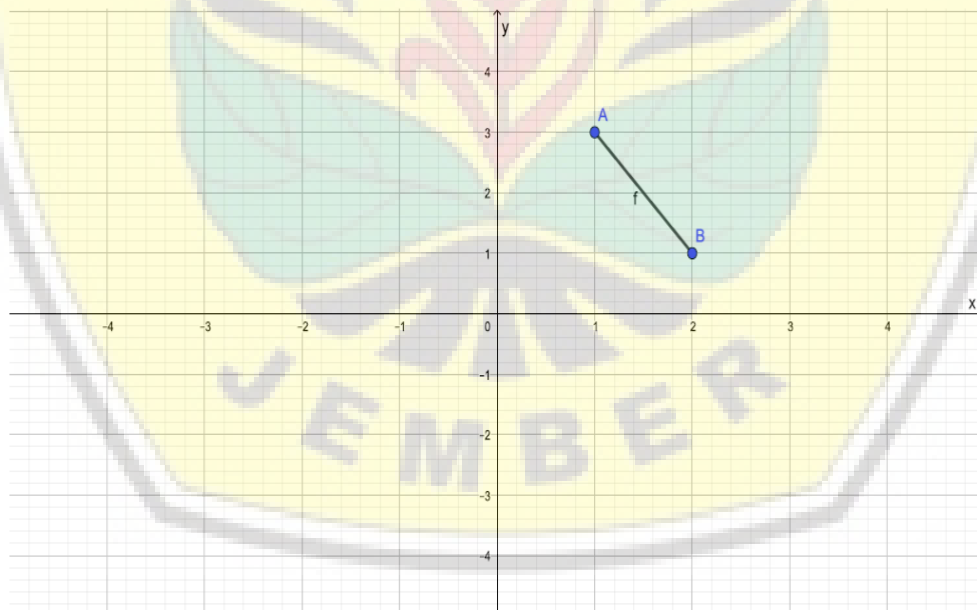


Figure 5. The example of dilatation question.

The student was asked to find the shadow of point A and B. One member of the group, called Prmd, stated that the reflection for point A (1,-3) and B is (2,-5). This made his fellow group member, named Vndn, argued that his answer was wrong, and the correct shadow point for point B (2,-1). But Prmd still insisted that his response was right, and then he asked the opinion from another group, which was group 7, and he also stated that Pond's answer was incorrect. Apparently, Prmd still did not understand reflection, which was elaborated again by his group. Then Prmd started to identify the characteristic of reflection.

The do phase was followed by the see phase. A few things obtained from the discussion on reflection i.e., the teaching and learning process was already conducted by the teacher chronologically; the teacher managed the time well and conditioned the students in the group and the class well. All students in the class participated actively in listening to the teacher’s explanation, were willing to do the job assigned to each group. No student kept talking to this friend, no students who were not listening to the teacher and no student went out of the class without any permission. This shows that every student was engaged in the teaching and learning process and did as what the teacher said. Every student was concentrating, taking note and doing their work. Therefore, no student disturbed his friend, made noises and left the class due to any reasons.

The remedial plan on cycle 1 for cycle 2 had already been conducted. The teaching and learning process was better than the previous. The three most essential elements for a thriving learning community: focus on learning (ensuring that students learn), collaborative culture, and results-oriented [12]. However, the student achievement was still not optimum because there were 5 students who achieved the score below the minimum criterion. Many students who actively asked questions cycle 2 is 18, increasing from 12 in Cycle 1. While, the student who gave their ideas and guiding their friends were 18, dramatically improved from cycle 1 with only four students. This affected the students’ understanding and mastery of translation and reflection material as shown by the fact that 27 students achieved 70 (the minimum criterion score). The average score in cycle 2 was 75.1, which was better than cycle 1 65.1. It means that in cycle 2 there was an increase in the caring community-based learning for about 15.36% from cycle 1. However, there were still weaknesses in cycle 1 and 2, and then remedial action on cycle 3 was necessary.

4.3. Cycle 3

Just like in the previous cycle, Cycle 3 begins with plan phase conducted by the researcher in collaboration with mathematics teachers by looking at the remedial plan of cycle 2. Plan phase began with revising the lesson plan and student worksheet on translation and reflection material, designing the steps of learning community-based scientific approach. Do phase of cycle 3 conducted on 31 January 2018 and attended by the whole student. Doing the do phase of cycle 3 the students were divided into eight groups and on cycle 2 the teacher was able to design the student U-shaped seat on the beginning of teaching and learning process. However, the student Ddt faster than usual, which can be seen below.

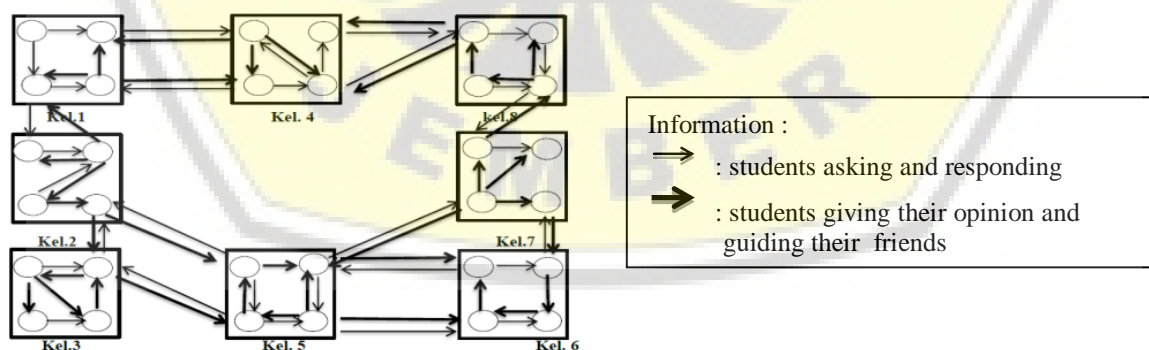


Figure 6. The teaching and learning process illustration in cycle 3.

From the figure above, we can see that the discussion in every group was running well, each student delivered their idea and those who understood guided their friends in their group. Likewise, when another group did not understand, the other group would help them. In cycle 3, as we can see from the picture above that group 5 and 6 had more opportunities than another group to collaborate with another group because of their position in the middle of the four groups. This suggests that collaborative learning is a learning that is carried out in groups, but the goal is not to achieve unity

gained through group activities; however, students in groups are encouraged to find the diverse opinions or thoughts expressed by everyone in the group [4]. The results of observation, caring to the problem which faced by the group is shown through the activity. Furthermore, the willingness to share their work on the group, asking and giving their idea is fit caring and collaborative which are the implementation of the learning community. Inbuilt learning community, we can see the interaction and care among the student is rising.

5. Conclusion

It can be concluded that learning geometry transformation through learning community-based scientific approach can enhance students' collaboration ability and their learning achievement. It also increases their confidence to communicate. The result of the observation on teaching and learning process shows that there is an improvement from cycle 1 to cycle 2, and cycle 2 to cycle 3. Students' achievement also increases from cycle 1 to cycle 2 by 15.36%, and in cycle 2 to cycle 3 by 11.19%.

Using appropriate learning models may create a better learning environment to improve students' learning outcome. The application of Learning community-based scientific approach in teaching geometry transformation is a shred of evidence that learning also demands students' and teacher activity to develop students' potential.

Acknowledgment

The authors gratefully acknowledge the Faculty of Teacher Training and Education of Jember University for all the support provided for the completion of our project and the writing of this paper.

References

- [1] Wijaya E Y, Sudjimat D A and Nyoto A 2016 *21st Proceedings of The National Seminar on Mathematics Education 2016-Universitas Kanjuruhan Malang I* 263
- [2] Saito E and Atencio M 2015 Lesson Study for Learning Community (LSLC): Conceptualising teachers' practices within a social justice perspective *Discourse: Studies in the Cultural Politics of Education* **36** 795
- [3] Widjajanti and Djamilah B 2008 *Semnas Mathematics and Mathematics Education: FMIPA UNY*
- [4] Hobri 2016 *Proceedings of The National Seminar on Mathematics Education, Theme: The Role of Mathematics and Learning in Developing Local Cultural Wisdom to Support Nation Character Education*
- [5] Sudirtha I 2017 Building learning community and increasing competence through lesson study *Journal of Indonesia education* **6** 30
- [6] Hobri et al 2018 *J. Phys.: Conf. Ser.* **1008** 012065
- [7] Wang F and Burton J 2010 Collaborative learning problems and identity salience: A mixed methods study *Journal of Educational Technology Development and Exchange (JETDE)* **3** 2
- [8] Tohir M et al 2018 *J. Phys.: Conf. Ser.* **1008** 012072
- [9] Yilmaz G K and Koparan T 2016 The effect of designed geometry teaching lesson to the candidate teachers' van hiele geometric thinking level *J. Educ. Train. Stud.* **4** 129
- [10] Hobri and Susanto 2016 *Proceedings of the National Seminar*
- [11] Avci M, Yavuz A and Aidin B 2016 The van hiele levels at czech secondary schools *Eur. J. Educ. Stud.* 59
- [12] Battistich V, Solomon, Watson and Schaps E 1994 Students and teachers in caring classroom and school communities *American Educational Research Association (AERA)*