Building a caring community in problem based learning to improve students’ mathematical connection capabilities

To cite this article: M Tohir et al 2021 J. Phys.: Conf. Ser. 1839 012008

View the article online for updates and enhancements.
Building a caring community in problem based learning to improve students' mathematical connection capabilities

M Tohir¹, M Atikurrahman¹, M Maswar¹, L A Daualay², M Minhaji¹, A Albadri¹, W Sardjono³

¹Universitas Ibrahirmy, Situbondo, Indonesia
²Institute Agama Islam Negeri Takengon, Aceh, Indonesia
³Bina Nusantara University, Indonesia

E-mail: matematohir@ibrahimy.ac.id

Abstract: This research aimed to describe the results of the implementation of Problem Based Learning (PBL) done by researchers on Caring Community-based students so that their impact can improve students' mathematical connection abilities. This research was a Classroom Action Research (CAR) done through 2 cycles, where was in each cycle includes planning, implementation, observation, and reflection. The instruments were used the Package Book and Student Worksheets given to Grade VII students of Ibrahirmy Junior High School at Sukorejo. Data Collection technique were used by observation, testing, and documentation. Analysing data was used by qualitative descriptive methods through three steps, namely are data reduction, data presentation, and drawing concluding. The results of this research indicated that: (1) there was a significant difference between the results of the cycle I (without worksheet) and cycle II (with worksheet); (2) the statistical results showed that was the significance of Sig. (2-tailed) is 0.00 < 0.05; then it can be concluded that the implementation of PBL based on Caring Community has a significant effect on the ability of students' mathematical connections; (3) the results of the achievement of indicators of students' mathematical connected ability among students in the high, medium, and low categories occurred significant differences starting from indicator I, II, and III.

1. Introduction

Mathematics is seen as having a very important and active role in the world of education and is very influential on other subjects, so mathematics are likened to the queen of all science. This was conveyed by Carl Friedrich Gauss that mathematics is the queen of science [1]. This is made clear by Talhah, Tohir, Nguyen, Shankar, & Rahim saying that mathematics is the main foundation of every contemporary scientific order [2]. This is in line with the results of several studies conducted by the National Council of Teachers of Mathematics (CTM). There are five basic mathematical abilities that students should have, namely: (1) mathematical communication; (2) mathematical reasoning, (3) mathematical problem solving, (4) mathematical connections, and (5) mathematical representation [3]. Thus, someone who can master mathematics well and correctly has headed the path that is ready to follow the development of increasingly sophisticated science and technology.

Every student and educator must have these five basics abilities (CTM) so that mathematics learning runs as expected. These are in following with the learning objectives of mathematics set out in the 2006 curriculum in Indonesia. It also refers to the five basics mathematical abilities which the essential include: (1) connections between concepts in mathematics and their use in problem-solving, (2) reasoning, (3) problem-solving, (4) communication, representation, and (5) effectively factors [4]. This
result also emphasize in the 2013 curriculum who said that the activities emphasizes in the implementation of learning are students trained to learn to connect material that has learned at school by applying it in daily life [5]. Thus, the ability of mathematical connections is one of the elementary capabilities of a person association between previous Mathematical material with Mathematical material that is being discussed and can link the Mathematical Material in everyday life.

Mathematical Connection is a learning program where students can discuss how to solve, and mathematical ideas that are related to each other formed mathematics, as well as students, can apply. There are several results of previous studies that are carried out and have a relationship between the ability of mathematical connections and learning that is supported by Problem Based Learning (PBL), namely: Al Jabbar, Hadi, Wangguway, & Sulistiyono shown that there is an effect of used problem based learning in creative innovative skills on solving rainbow anti magic coloring [6]; Atikurrahman, Hobri, & Yuliati shows that the implementation of Problem Based Learning which also based on Caring Community had a significant effect on the students' connection abilities [7]; Rohmah, Mahardika, & Setiawan shows that the achievement of students' mathematical connection ability on the material of Linear Equation System Two Variables in grade VIII students of SMP Darul Falah can be improved through Problem Based Learning approach [8]; and Kartikasari & Widjajanti shows that the learning approach using problem-based learning based on multiple intelligences was effective in terms of student's achievement, mathematical connection ability, and self-esteem [9]. However, some results of this study still do not address the problems in the study obtained by Mukhlis et al. shows that the ability of students to make mathematical connections is still relatively low [10]. It has caused by the results of research obtained by Tohir, Abidin, Dafik, & Hobri, who discusses the matter of thinking ability in compiling and developing theories in mathematics needed to foster student support for the material and seek useful learning [11]. Atikurrahman et al. show that improving students' understanding, and overcome problems that occur in problem-solving, improve learning through the study of community-based lessons that care for the learning community [7]. It is confirmed by Hosnan, Hobri, & Dafik, is said to Caring Community is honing social sensitivity related to students in group activities. In essence, students support to pay attention to each other, related to the state of being in groups, to learn and develop with mutual trust and comfort, a place to knit and can guarantee the right of learning for each child [12].

Regarding PBL, Arends revealed that PBL is a learning model with student learning approaches on authentic problems so students can compile their knowledge, develop higher skills, develop students' independence and increase self-confidence [13]. Therefore, this study tries to answer these unresolved problems, namely by implementing PBL learning based on Caring Community aims to improve students’ mathematical connection abilities. Accordingly the advantages of this research compare to previous studies are to implement PBL following 21st-century learning based on Caring Community when using learning tools that are developed by Moh. Atikurrahman, which aims to improve students' mathematical connection abilities [7].

2. Research Methods

2.1 Research design

This research used a Classroom Action Research (CAR) of the qualitative approach. Qualitative research adheres to the natural background in which a study takes place (it views the context as a whole). In this regard, human serves as an instrument. Qualitative method requires inductive data analysis and theory development, which are all based on the data, which is descriptive in nature and more concerned with the process under investigation. The research is limited by its focus, the specific criteria for ensuring data validity, and its temporary design. Also, qualitative data are generated through joint decision [11]. Srisa,ard, Luanganggoon, & Malasi said that CAR was an innovation that was expected by people from some sectors including educators, researchers, school administrators, and teachers as a strategy to develop professional knowledge teachers to be strengthened due to research classroom actions including reasons, and methods facilitate the development of learning [14]. This class action research focused on efforts to change present real conditions towards expecting conditions. The material in the cycle I (without worksheets) was about the comparison of two quantities and value comparisons, and the cycle II (with worksheets) was about the comparing of the reversal of values and the application of value. The following Figure 1 displays a model of a CAR cycle in this researcher.
2.2 Participants

This class action research conducted on grade VII students with 36 students of Ibrahimy Junior High School at Sukorejo. Indicators of success has two cycles in this study, they are were: (1) mastery of comparative material at the end of this study increased to reach 80% of students have reached a value above the minimum completeness limit of 75 and (2) the effectiveness of learning by using PBL in building Caring Community attitudes significantly increased at comparison material, this can be marked by an increase in learning outcomes for each student. While the indicator of student's mathematic ability can be measured by showing three aspects that are: (1) able to use mathematical connections between ideas in mathematics with related concepts; (2) being able to use mathematical connections between one idea and another so as to produce a link between mathematical principles and different material; and (3) able to use mathematical connections between mathematical concepts with problem-solving related to problems of everyday life.

2.3 Data collection

Data collection technique was the most important stage in research because it determined the success of obtaining accurate data, then it is analyzed based on students' answers to the questions given. The data collection method used was the test and non-test. To determine the improvement of students' mathematical relationship skills was a test technique. Meanwhile, non-test techniques are used to build a Caring Community during the mathematics learning process. The research instruments were; (1) observation and question of guidelines, (2) achievement test questions, (3) documents consist of syllabi, lesson plans, student worksheets, and student data.

2.4 Data analysis

The data that has collected then analyzed using an interactive analysis model. Observation guidelines, questionnaires, and test questions have been declared valid by the validators [7]. Data validity to be able by method triangulation, peer checking, and extended observation. Data analysis was performed descriptively qualitative through data reduction, presenting data, and drawing conclusions. Presentation of data includes the classification and identification of data, stating organized and categorized data sets so that a conclusion can be drawn. The conclusions obtained will be additional and supporting material in conducting further research.

Figure 1. Model of a CAR cycle.
3. Research Results and Discussion
The first data obtained with the results of observation and learning outcomes, but before that action was given in Grade VII students of Ibrahimy Junior High School at Sukorejo. The second and third data obtained based on the results of treatment in cycle I and cycle II. Teachers and students can describe their performance in detail with PBL learning syntax, and it was about the performance of teachers was told and students in Table 1 below.

| Activities | Pre Cycle | Cycle I | Cycle II |
|------------|-----------|---------|----------|
|            | Meeting I | Meeting II | Meeting III | Meeting IV |
| Teacher    | 74.6      | 77.2    | 85.4      | 91.8      | 97.2      |
| Students   | 68.2      | 73.6    | 87.2      | 93.6      | 96.4      |

Based on Table 1, it showed that the teacher's performance and student activities in building a caring community on the application of the PBL model increased significantly with students' mathematical abilities. The pre-cycle, the teacher's performance gets a score of 74.6; while the student activity scores 68.2. In the first cycle, the first meeting on the results of observations of teacher performance got a total score of 77.2; and the score obtained on student activity was 73.6. In the first cycle of the second meeting, the results of observations of teacher performance got a scoring of 85.4; and in students, activities got a score of 87.2. After reflecting in the first cycle and applying improvements to the second cycle using student worksheets, then experiencing an increase in the results of observing the performance of the second cycle teachers meeting a score of 91.8; and the result observations of student activities get a score of 93.6, the second cycle of the fourth meeting is the observation of the results of teacher performance and student activity again increased with the results observations of teacher performance getting a score of 97.2, While the results observations of student activities get a score of 96.4.

While improving the quality of students' mathematical connection abilities and student learning outcomes during the learning process by using PBL is marked by the achievement of all research indicators. Based on data collected during the study, it found that the attitude of the Caring Community and students' mathematical connection abilities continued to improve. Table 2 is shown by results in class action research.

| Cycle | Minimum Statistic | Maximum Statistic | Sum Statistic | Mean Statistic | Std. Error | Std. Deviation Statistic |
|-------|-------------------|------------------|--------------|----------------|------------|-------------------------|
| Pre Cycle | 32                | 77               | 2180         | 60.5556        | 1.85568    | 11.13410                |
| Cycle I  | 37                | 89               | 2473         | 68.6944        | 2.25474    | 13.52842                |
| (without worksheet) |         |                  |              |                |            |                         |
| Cycle II | 40                | 95               | 2762         | 76.7222        | 2.29167    | 13.75004                |

In Table 2 above, it showed that the average pre-cycle test score is 60.5556; with a minimum value of 32; and a maximum rate of 77. Then, through these data, it is known that the average test scores obtained are still very far from the average minimum completeness value expected. The average rate of the test during the first period was 68.6944 within a minimum rate of 37 and was the maximum rate of 89. This result also has not yet reached the expected minimum completeness value. The average test score during the second cycle was 76.7222 with a minimum rate of 40 and a maximum rate of 95. So based on these data, it is known by the average rate of the tests obtained has reached the average minimum expected completeness value. The standard deviation of the pre-cycle of 11.13410, cycle 1 of 13.52842, and a period 2 is 13.75004. The results of this study indicate that achievement in building a Caring Community in each cycle can increasingly improve students' mathematical connection abilities.
The process of learning mathematics by applying the PBL model by build to Caring Community can improve students' mathematical connections and can be used certainly as a solution to the problems that have formulated.

The results of this study reinforce the results of research conducted by Hermawan & Prabawanto that the application of the Problem Based Learning model has a positive influence on the ability of students' mathematical connections so that, the Problem Based Learning model can be an alternative model of learning approaches that can be used in Schools [4]. In line with the results of research conducted by Fariana shows that the implementation of the Problem Based Learning model can improve understanding of concepts and activities, this can be seen from the percentage of completeness of cycle I and cycle II [15]. The results of this study also reinforce the results of previous studies conducted by Atikurrahman et al. that the application of Problem Based Learning that also, based on the Caring Community has a significant influence on student connection abilities [7]. The results of this study are also in line with the results of research conducted by Al Jabbar, Hadi, Wangguway, & Sulistiyono show that there is a significant influence between the implementation of PBL by using Student Worksheets can improve students' creatively innovative skills [6].

The pre-requisite test used to determine the influence of the pre-cycle, cycle I, and cycle II in applying the PBL model to develop Caring Community attitudes is the Kolmogorov-Smirnov statistical test. The normality test results of research data using Kolmogorov-Smirnov obtained a significance value of 0.200. Due to the significant score of 0.200 > 0.05, so that the conclusion of the residual value can be ordinarily distributed. Thus it can be continued in parametric statistical tests to determine the influence of the pre-cycles that are I and II.

### Table 3. Paired sample test.

| Cycle           | Mean  | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | t     | df  | Sig. (2-tailed) |
|-----------------|-------|----------------|-----------------|------------------------------------------|-------|-----|----------------|
| Pre Cycle - Cycle I | -8.13889 | 6.42830 | 1.07138 | -10.31391 - 596387 | -7.597 | 35  | 0.000 |
| Pre Cycle - Cycle II | 16.16667 | 6.68260 | 1.11377 | -18.42773 - 13.90560 | -14.515 | 35  | 0.000 |
| Cycle I - Cycle II | -8.2778 | 4.28610 | 0.71435 | -9.47798 - 6.57757 | -11.238 | 35  | 0.000 |

### Basis of Decision Making

1. If the value of Sig. (2-tailed) < 0.05, then there are significant differences in learning outcomes between pre-cycle with cycle I, pre-cycle with cycle II, and cycle I with cycle II.

2. If the value of Sig. (2-tailed) > 0.05, there is no significant difference in learning outcomes between pre-cycle with cycle I, pre-cycle with cycle II, and cycle I with cycle II.

Based on the test results of the third table showed that the test results are different in the increase in students' connection skills in both cycles using the Paired test showed the Sig. (2-tailed) 0.000 < 0.05, so that it can be concluded by differences in the average increase between cycle I and cycle II. Then this shows that there is a significant difference in students' mathematical connection ability between cycle I (without worksheet) and cycle II (with worksheet) to build a Caring Community attitude in implementing PBL. Then, Table 4 below can be displayed by the results of students' completeness tests in each cycle based on a minimum completeness score of 75.

### Table 4. The list of student mastery test results.

| Score | Number of Students |
|-------|--------------------|
|       | Pre Cycle | Cycle I | Cycle II |
| 0 - 50 | 6         | 3       | 2        |
| 51 - 74 | 27       | 15      | 5        |
| 75 - 100 | 3       | 18      | 29       |
Based on Table 4 showed that in the pre-cycle, a lot of 33 students received grades below the minimum standard of limitations (75). It means that as many as 50% of students did not reach the minimum completeness standard. While in cycle II, on 7 students achieved grades less than 75. It means that there were as many as 80.56% of students who have got a minimum completeness score. However, on 2 students still got scores below 50, so this becomes a special note for the teacher concerned and for researchers to conduct further research on the implementation of PBL and how to develop Caring Community attitudes in other mathematical material with sub-material subject matter different. Relevant to the results of the study of Hosnan et al. (2018) which shows that the implementation of Caring Community research on mathematical material can be continued with different materials, or the same it but with different subjects, so that a sense of concern, confidence, and communication of students arose in learning.

3.1 Cycle I

Cycle I begins with planning actions which include: (1) making a syllabus of comparative learning materials; (2) making the design of teaching programs needed for teaching students in groups, each group consist of 4 students; (3) preparing textbooks for grade VII mathematics subjects, Student Books [16], and Teacher’s books [17], (4) making evaluation tools that are used to obtain student ability data after getting action in implementing PBL intended for each student, and (5) making solutions and steps to be conveyed to students regarding student weaknesses in solving problems that have tested by researchers.

The implementation phase of the action in the first cycle has the objective to find out the effectiveness of mathematics learning using the textbooks published by the Ministry of Education and Culture. According to Eggen and Kauchan suggested that the effectiveness of learning is characterized by the activeness of students in learning, especially in organizing and finding information [18]. The learning process is carried out following what has been planned, starting with an explanation to students about the activities that must be carried out by students in following the activities. In the learning process students are directed to think in individually first, then collaborate with friends in a group without having one friend left out (Caring Community). When building a Caring Community on the ongoing implementation of PBL, it assumes that every student can be accepted and cared for regardless of circumstances, beliefs, or shortcomings they have.

The results of the observation intend to evaluate various weaknesses, difficulties, or strengths faced by students in completing the comparison material that tested to be using the question and answer method. Then according to the textbook to groups of students are given by assignment to discuss together in each group. When students are discussing duties in each group while researchers observed of them, and interviews are conducted occasionally about the activities are being discussed.

When the researchers were observing each group of students, the researcher noted the strengths and weaknesses then weaknesses in the use of this textbook. Based on the observations of researchers, students experienced problems when doing assignments. Besides, the researcher also noted students who were active in group discussions. Then the researchers instruct students who have been able to solve the problems contained in the textbook to share with other groups by presenting to the class.

Based on the observations of researchers, in general, students were found enthusiastic in discussing assignments in textbooks, and there were no more students who were absorbed in playing alone or with their friends. So that in cycle I. Students are preoccupied with the activities to contain in the package book. Moreover, the teacher always goes around each group to ensure all students are active in the discussion. But, in doing the working task still appears that there are groups who experience obstacles in discussing their completion because that is known with the researcher that the researcher finally comes to the group who then asks him, “Is there a problem with the discussion?”. Finally, they answered, “yes, sir” Only then will the researcher give direction to other problems that are on par with the problems in the textbook. After the assignment finished to discuss, then one group of students presents in front of the classroom, then a question and answer session is held.

Other findings produced by researchers on the results of the corrected assignment turned out to be a group of students who still did not understand the basic concept of division in the form of other questions. The learning process that occurs in class who work together and ask each other questions in
an atmosphere of mutual concern between friends. The condition of students who ask each other questions, explain each other, and exchange opinions can be presented in Figure 1 below.

![Figure 1: Group discussion activities in Cycle I](image)

Based on Figure 2 showed the group discussion of cycle I went quite well and smoothly. It seems clear in each group. There is one student who is the center of exchange of opinions to explain to other students in the group. They are also clearly seen that students are very anthropological, helping one another explaining, exchange opinions, and ask questions. It can be concluded by students have been able to collaborate quite well in building a Caring Community in the PBL learning process. The results of this first cycle, there still needs to be an increase in the form of aids used, namely Student Worksheet (SW) based on Caring Community. It is necessary to choose the right strategy to support learning based on Caring Community-based SW. Caring Community-based is a student activity sheet whose contents guide student activities in the teaching and learning process in an organized, systematic manner, and through mutual care between one another.

3.2 Cycle II

In the planning stage in cycle II, the researcher planned the action in four steps, namely: (1) making small groups, each group led by children who have more abilities and can lead, (2) making the design of learning material distribution; (3) create a Caring Community-based worksheet, (4) compile learning strategies that can support Caring Community-based worksheet-assisted learning, and (5) plan an evaluation tool in the form of test questions used to measure student abilities. The selection of the right evaluation will affect student learning outcomes. Nana Sudjana suggested that mathematics learning outcomes are abilities students have after they have gained learning experience [18]. Meanwhile, Gagne groups learning outcomes into five parts in the form of capabilities as are intellectual skills, cognitive strategies, verbal information, motor skills, and attitudes [19].

The cycle II of the implementation phase of the action aims to determine the effectiveness of the implementation of PBL by using Caring Community-based SW. Caring Community-based worksheets are student activity sheets that can help students optimally and continuously in a scientific manner, process skills, and knowledge. According to Hobri & Susanto, Caring Community is a learning activity that can build groups of students who care about each other and are environmentally sensitive [20]. The cycle II of the action begins with an explanation to students about the procedures to be carried out in learning for them, determine the leaders/leaders of each group, and students gather according to the
group. After students gather with their groups, the researcher distributes Caring Community-based worksheets to each group for discussion.

When students are discussing worksheets in each group, then the researcher observes each of them. Occasionally, the activities are conducted and are discussed by interviews. During the tour, the researcher notes the mistakes made by the group to guide so that all students can be active in group discussions. Then, it is instructed by group representatives to present their work, and other groups asked to respond to what has presented. On this occasion, the researcher guided the discussion and are together the students formulated answers.

Based on observations on the implementation of the second cycle, it seems that students are very enthusiastic about doing group work. All students look active with their groups in completing assignments in the worksheet. When discussing the discussion of material given by one group to be responded to by other groups, sometimes it can be seen the differences in the thinking patterns of each individual in conveying the problem-solving ideas provided.

Based on the results of the evaluation of the cycle II, there are still on 6 students who get grades below the minimum completeness standard and are still some mistakes made by a small number of students due to the lack of scrutiny in working students. The problem of skill and accuracy in taking steps to work on still needs to be improved so that the mastery of comparative material can be even better. While the activeness of the students as a whole has been as expected by the researchers because in discussing Caring Community-based SW as a group, it has reached 83.33% and has been active in PBL activities that take place. The flow of the learning process in cycle II can be presented in Figure 3 below.

**Figure 3.** Group discussion activities in cycle II

Based on Figure 3 in addition to this, it can be shown that building a Caring Community attitude in learning by using the PBL model obtained satisfactory results. Because learning activities in the second cycle emphasizes the concern between one student and other students, both in their own groups and with other groups. This can be seen clearly in every group, which is all students actively asking each other, exchanging opinions, exchanging, and responding. So it can be concluded that this learning model triggers good learning enthusiasm, has a high curiosity, has caring among others, and has confidence in asking questions, and has a high sense of responsibility.
3.3 Achievement of Student Mathematical Connection Ability Indicators

Next are the results of student A's work in applying his mathematical connection skills when working on problems.

Based on Figure 4, the group category shows that student A in the medium group category has not been able to show the three indicators of their mathematical connection ability. It can be concluded that students cannot yet reach the level of perfection. Student A does not understand the overall comparison, so that the three indicators of students' mathematical relationship ability are not fulfilled completely. This reinforces the results of research obtained by Tohir showing students with the ability to try to dig up information, identify problems that are asked well but are less consistent in choosing the information needed and information that is not needed in problem solving [21]. This is also in line with the opinion of Gartmann & Freiberg saying that in problem solving there is a process of being aware of and organizing thinking about how students make approaches to problems, choosing strategies used to find solutions and asking themselves about the problem [22].

The following also presents the results of student B's work in applying his mathematical connection abilities when working on problems.

**Figure 4.** Student A achievement of mathematical connection capabilities.

**Indicator 1**

Based on Figure 4 showed that student A in the medium group category has not been able to show the three indicators of their mathematical connection ability.

**Indicator 2**

Student A can use mathematical connections between one idea and another to produce a link between mathematical principles and different material.

**Figure 5.** Student B achievement of mathematical connection capabilities.
Figure 5 above, shows that student B in the high group category is able to show all three indicators of their mathematical connection abilities. It can be concluded that student B already has the ability to level upwards. Student B already understands the comparison as a whole, so that all three indicators of the ability of the student's mathematical connection can be fulfilled completely. Relevant to the results of Tohir research, students with high ability in the preparation stage of students identify the problem being asked well, students choose the information needed and information that is not needed in solving the problem correctly [21]. Reinforced by the opinion of Hasan said that students' thinking processes will run correctly as expected if the theoretical information processing components that exist from stimulus to long-term memory in students function properly and correctly too [23]. While the results of the overall analysis of students' mathematical connection abilities can be described in Figure 5 as follows.

![Achievement of students' Mathematical Connection Ability Indicators](image)

**Figure 6.** Student's mathematical connection ability indicator achievement.

Based on the results of the percentage achievement of indicators of students' mathematical connection ability in Figure 6 above, it is known that the ability of students' mathematical connections between high, medium, and low group subjects shows significant differences starting from indicator I to indicator III. So it can be concluded that high category students indicate that they can pass all indicators, medium category tends to miss 2 or 3 indicators, and the low category tends to only pass the first 2 indicators. Relevant to the results of Guntur, Aliyyatunnisa, & Kartono that high category students indicated that they passed through all stages, the medium category tended to skip 2 or 3 stages, and the low category tended to only pass the last 2 stages [24]. In line with the results of research Munawwarah et al. shows that subjects in different categories have different critical thinking skills also based on their personal characteristics and prior knowledge. Because, the average subject in the high category is able to provide an explanation of what was done [23]. Therefore, individual with mathematical understanding will be able to use this ability to learn mathematics without any significant difficulties and can think mathematically where the way of thinking is very useful in everyday life [25].

4. Conclusions

Based on the results of CAR that has carried out, it can be concluded that; (1) Building a Caring Community in the PBL method has a significant effect on students' mathematical connection abilities, and student learning outcomes statistical results are evidenced by it and showed that the significance of Sig. (2-tailed) is 0.00 < 0.05; (2) The application of PBL in building a Caring Community attitude is very effective and efficient in improving students' mathematical relationship knowledge and can increase students' self-confidence in expressing opinions; (3) used of Caring Community-based SW was more effective than using a textbook (without worksheet) in learning activities. This was shown in the evaluation results experienced a significant increase from pre cycle to cycle I, and from cycle I to cycle II; (4) the use of Caring Community-based worksheets in PBL could help students to master the
comparison material; and (5) the results of the achievement indicators of students' mathematical connection ability starting from indicator I, indicator II, and indicator III respectively obtained by 83.33%; 69.44%; and 58.33%.

The author's suggestion based on the results of the study is: (1) For teachers, especially mathematics teachers, in building a Caring Community. They should use the PBL model as an alternative to learning in an effort to develop students' mathematical relationship skills so that the learning process is creative, innovative, effective, and efficient; (2) In building a Caring Community, the teacher must try to use other learning models to obtain more information in an effort to develop students' mathematical relationship skills; and (3) for future researchers, the implementation of PBL with the help of Community Care Worksheets can be continued on the same material or other mastery without eliminating the characteristics of Lesson Study for Community Learning (LSLC) based learning.

Acknowledgments
The authors gratefully acknowledge the Mathematics Tadris Study Program, Faculty of Tarbiyah, and Ibrahimy University for all the support provided for the completion of our project and the writing of this paper.

References
[1] M. Maswar 2019 Student fun mathematics learning strategies (MLS) based on mathemagic game methods, puzzles and mathematical stories Alifmatika: Jurnal Pendidikan dan Pembelajaran Matematika 1(1) pp 28–43.
[2] S. Z. Thalhah, M. Tohir, P. T. Nguyen, K. Shankar, and R. Rahim 2019 Mathematical issues in data science and applications for health care. International Journal of Recent Technology and Engineering 8(2) pp 4153–4156.
[3] M. Mukhlis and M. Tohir 2019 Measuring instrument of creativity and innovation skills for high school students in the industrial revolution era 4.0 Indonesian Journal of Mathematics and Natural Science Education 1(1) pp 65–73.
[4] D. Hermawan and S. Prabawanto 2016 The effect of the application of the problem based learning model assisted by information and communication technology media on the mathematical connection ability of elementary school students EduHumaniora| Journal of Basic Education, Cibiru Campus 7(1) pp 1–9.
[5] M. R. Ramdhani, E. Widiyastuti, and F. E. Subekti 2016 Analysis of mathematical connection capabilities of grade VII students of SMP negeri 1 kembaran flat building material Proceedings of the Mathematics and Mathematics Education Seminar pp 403–414.
[6] Z. L. Al Jabbar, A. F. Hadi, Y. Wangguway, and B. Sulistiyo 2020 The analysis of problem-based learning implementation and its effect on students creative innovative skills in solving rainbow antimagic coloring based on cognitive style Journal of Physics: Conference Series 1538(1) p 12089.
[7] M. Atikurrahman, H. Hobri, and N. Yuliati 2019 The development of comparison material tool with problem based learning based on caring community and its effect on the students’ connection ability Journal of Physics: Conference Series 1211(1) p 12091.
[8] G. S. Rohmah, N. G. Mahardika, and W. Setiawan 2018 Improving the mathematical connection capabilities of middle school students through problem based learning approaches JIML (Journal of Innovative Mathematics Learning) 1(4) pp 591–598.
[9] A. Kartikasari and D. B. Widjajanti 2017 The effectiveness of problem-based learning approach based on multiple intelligences in terms of student’s achievement, mathematical connection ability, and self-esteem Journal of Physics: Conference Series 812(1) pp 12097.
[10] A. Muchlis, E. S. Komara, W. Kartiwi, N. Nurhayati, H. Hendriana, and W. Hidayat 2018 Improving mathematical connection of junior high school students through the open-ended
approach with nht type cooperative settings Kalamatika: Journal of Mathematics Education 3(1) pp 81–92.

[11] M. Tohir, Z. Abidin, D. Dafik, and H. Hobri 2018 Students creative thinking skills in solving two dimensional arithmetic series through research-based learning Journal of Physics: Conference Series 1008(1) p 012072.

[12] H. Hosnan, H. Hobri, and D. Dafik 2018 Algebraic learning through caring community based on lesson study for learning community International Journal of Advanced Engineering Research and Science 5(4) 40–45.

[13] H. S. Pelawi and K. Sinulingga 2016 The effect of problem based learning model and learning motivation on student learning outcomes in class X sinar husni private high school Journal of Physical Education 5(1) pp 32–37.

[14] B. Srisa-ard, N. Luanganggoon, and A. Malasi 2012 The development of standards, factors, and indicators for evaluating the quality of classroom action research Procedia-Social and Behavioral Sciences 69(1) pp 220–226.

[15] M. Fariana 2017 Implementation of Problem Based Learning Models to Improve Understanding of Student Concepts and Activities Journal of Medives: Journal of Mathematics Education IKIP Veteran Semarang 1(1) pp 25–33.

[16] A. R. As’ari, M. Tohir, E. Valentino, Z. Imron, and I. Taufiq 2016 Matematika untuk SMP/MTs Kelas VII Semester 2 Jakarta: Pusat Kurikulum dan Perbukuan, Balitbang, Kemdikbud.

[17] A. R. As’ari, M. Tohir, E. Valentino, Z. Imron, and I. Taufiq 2017 Buku Guru Matematika (Revisi). Jakarta: Pusat Kurikulum dan Perbukuan, Balitbang, Kemendikbud.

[18] M. Tohir 2017 Improving mathematical learning effectiveness by using active learning strategy in aljabar material in SMPN 2 jember FKIP E-Proceeding pp 39-54.

[19] A. Setyowati 2020 Strategies of active learning for increasing the effectiveness of trigonometric learning WUNY Scientific Journal 2(1) pp 1–13.

[20] H. Hobri and S. Susanto 2016 Collaborative learning, caring community, and jumping tasks assisted by student worksheets based on scientific approach: one alternative to mathematics learning in the MEA era Proceedings of the National Mathematics Seminar and Learning pp 1-14.

[21] M. Tohir 2019 Students' creative thinking skills in solving mathematics olympiad problems based on metacognition levels Alifmatika: Jurnal Pendidikan dan Pembelajaran Matematika 1(1) pp 1–14.

[22] Z. Abidin and M. Tohir 2019 High-order thinking skill in solving two-dimensional arithmetic series based on bloom's taxonomy Alifmatika: Jurnal Pendidikan dan Pembelajaran Matematika 1(1) pp 44–60.

[23] M. Munawwarah, N. Laili, and M. Tohir 2020 Students' critical thinking skills in solving math problems based on 21st century skills Alifmatika: Jurnal Pendidikan dan Pembelajaran Matematika 2(1) pp 37–58.

[24] M. Guntur, A. Aliyyatunnisa, and K. Kartono 2020 Creative, critical, and mathematical communication skills for students in academic-contructive controversy (AC) Prisma, Proceedings of the National Mathematics Seminar 3(1) pp 385–392.

[25] M. Tohir, M. Maswar, M. Atikurrahman, S. Saiful, and D. A. R. Pradita 2020 Prospective teachers’ expectations of students’ mathematical thinking processes in solving problems European Journal of Educational Research 9(4) pp 1735–1748.