Proceedings of International Conference on Teacher Profession Education Yogyakarta, 29 July 2023

ISSN: 3025-020X

Mathematical Communication through Problem Based Learning Model using Question Card Media

Nurlia Agustin[1*], Kristi Wardani[2], Indaryati[3], Herlina Apriyanti[4]

[1,2]*Sarjanawiyata Tamansiswa University, Indonesian*

[3,4]*Ngupasan Elementary School, Yogyakarta*

**Corresponding Author e-mail: nurliaa245@gmail.com*

1. Abstract

The research objective is to improve mathematical communication skills regarding addition material through the application of the PBL model using question cards as media. This study used a collaborative Classroom Action Research (PTK) method with the Kemmis and Mc. Taggart models, which consists of 4 stages, is planning, action, observation and reflection. The research subjects were the first grade students of SD N Yogyakarta, totaling 29 students. Data collection techniques using observation and tests. Data analysis includes data reduction, data presentation, and conclusions. The results of this study indicate that the use of the PBL model with question card media can improve students mathematical communication skills in the math subject of first grade summation material, evidenced by an increase in the quality of the learning process seen from students who are more active and enthusiastic and an increase in the percentage results of mathematical communication ability tests in cycle I was 58.62% and increased to 86.21% in cycle II.

Keywords: *problem based learning, question card media, mathematical communication*

ISSN: 3025-020X

2. Introduction

Mathematics is one of the scientific disciplines that underlies the development of modern science and technology in the world of education in Indonesia, and is directly related to various aspects of human life. The important role of mathematics is recognized by Yunarti and Amanda (2022: 46) that in the 21st century, someone will experience difficulties in making judgments and decisions, without the slightest use of mathematics. Mathematics is a study material with abstract concepts that are built from deductive reasoning processes, meaning that the truth is obtained as a result of previously received truths, so that it is very strong and clear (Wahyudi, 2015: 68).

Mathematics learning that takes place in elementary schools is expected not only to emphasize how to count and give formulas to students, but also to be able to train and equip students to have more abilities in students, in helping solve problems, reasoning, and communicating mathematical ideas so that learning mathematics is meaningful to students. According to Rahmalia, Hajidin, and Ansari (2020: 138), mathematical communication skills are one of the skills in the learning curriculum, which a person must possess to convey information and ideas in the form of mathematical language during the mathematics learning process.

According to NCTM, students' mathematical communication abilities during learning can be seen from the ability to: (1) organize and integrate students' mathematical thinking through communication; (2) communicate students' mathematical thinking logically and clearly to other students, teachers, and other people; (3) analyze and evaluate the mathematical thinking or strategies used by others; and (4) using the language of mathematics in expressing mathematical ideas and ideas correctly (Nasution, 2018: 128).

In reality on the ground, the mathematics learning process that takes place in schools has not been able to show satisfactory results and optimize students' abilities properly.

ISSN: 3025-020X

This is in accordance with the results of a survey by The Trends in International Mathematics and Science Study (TIMSS) and the Program of International Student Assessment (PISA) in 2015, which showed that the level of mathematical communication ability of Indonesian students was at a low level (Nuranisa, Putra, and Fisher, 2022: 61). The results of observations on Thursday-Friday, 13-14 April 2023 regarding the ongoing learning process and mathematical communication skills, found problems in class I elementary school students, namely that the learning that took place still did not involve students directly in the material being taught, only a portion of students were active and already understand the material, the limitations of the media or tools used by the teacher also make students less active, the lack of accuracy of students in representing mathematics such as symbols or language when working on problems in the form of summation stories (stacked), and low student understanding of mathematical communication skills which can be seen from the results of the test of the mathematical communication ability of the first grade students of elementary school with an average score of 64.14.

Based on the description of the problem, it is necessary to find a solution to help improve students' mathematical communication skills. One solution to this problem is to use the right model and learning. One effective model to apply in learning mathematical communication skills is through the Problem Based Learning (PBL) model with question card media. According to (Aspini, 2020: 77) states that learning activities using the PBL model with question card media, can be done by giving a problem orientation on the question cards, so that students will analyze and communicate ideas to solve problems in the question cards.

According to Kurniawati, Rosita, and Koswara (2023: 25) learning using the problem-based learning model is able to train students to express ideas in the form of symbols or mathematical language that they can understand to solve problems. To assist students

ISSN: 3025-020X

in communicating their ideas, media in the form of question cards is also needed. Question card media is a visual media made of paper containing questions that students must work on. Question card media as a means to build an active classroom atmosphere and have discussions, thereby training students to communicate problem solving ideas (Nugroho, Harjono, and Airlanda, 2018: 200). In line with this opinion, according to Aspini (2020: 77), the PBL model can be implemented with the help of question card media, which is able to provide opportunities for students to analyze, construct knowledge, and evaluate ideas according to their understanding.

Based on the explanation above, it is necessary to carry out research actions to improve mathematical communication skills through the PBL model with question cards in class I SD N Yogyakarta in academic year of 2022/2023. The application of the PBL model with the media of question cards in learning mathematics in addition material is expected to improve the learning process and the results of students mathematical communication skills.

3. Methods

3.1 Participants and context

The subjects of this study were 29 class I students at SD N Yogyakarta for the academic year 20222/2023.

3.2 Material

This research is a Collaborative Classroom Action Research (PTKK) between researchers and class I teachers, using the Kemmis and Mc. Taggart models which consists of 4 stages, namely planning, implementation, observation, and reflection. The type of research data is quantitative data in the form of using the Problem Based Learning (PBL) model with question cards media and qualitative data in the form of students' mathematical communication skills in mathematics.

ISSN: 3025-020X

3.3. Data Collection and analysis

The instrument for testing mathematical communication skills is in the form of a description test, which is obtained from the development of indicators of mathematical communication ability according to Kadir (Damayanti, Zulkarnain, and Sari, 2020: 55) including indicators of writing, drawing, and mathematical expressions.

4. Results and Discussion

This research was conducted in two cycles, consisting of 4 learning meetings. The learning implementation that takes place applies the Problem Based Learning (PBL) model with question card media, using the following steps: (1) problem orientation through question card media; (2) organizing students to learn; (3) guiding student investigations; (4) present the results of the discussion; and (5) evaluate the problem solving process. In this case, the researcher took the results of the first grade students' mathematical communication ability tests through pre-action activities (knowing students' initial abilities on mathematical communication ability questions), cycle I, and cycle II.

Overall, the process of learning mathematical communication about the sum of class I students in both cycle I and cycle II gives us an illustration that each student's mathematical communication skills have different levels both orally and in writing. The role of the teacher as a student guide in the process of learning mathematical communication using the PBL model with question card media is able to facilitate the needs of student assistance seen from the varying levels of students' mathematical communication skills. The existence of the application of the PBL model with the media of question cards which are made different and interesting in each lesson, is able to help the learning process communicate mathematical ideas so that it is easier for each student. This is supported by the results of each student's work in the learning steps of the PBL model with question card media, whose achievements are continuously monitored by the

ISSN: 3025-020X

teacher. This activity contributed to an increase in student activity and enthusiasm, in the learning process using the PBL model with question card media, so that the results of the discussion indicated a successful process in this study.

Meanwhile, the success of the product in this study was indicated by an increase in the average student score and ≥ 75% of the total number of students achieved the specified KKM score of 75. The results of the overall mathematical communication ability test can be seen in the following table.

Table 1. Preaction Mathematical Communication Ability Test Results, Cycle I, & Cycle II

Preaction		**Cycle I**		**Cycle II**	
C	**IC**	**C**	**IC**	**C**	**IC**
37.93%	62.07%	58.62%	41.38%	86.21%	13.79%
Class Average		**Class Average**		**Class Average**	
64.14		74.41		88.45	

Information:
C : Complete
IC : Incomplete

Based on the table above, the pre-action results show an average value of 64.14. There were 11 students who completed the KKM or 37.93% and 18 students who did not complete the KKM or 62.07%. Based on the results of the pre-action, the mathematical communication skills of class I SD N Yogyakarta students in solving math problems need to be improved. Therefore, researchers took action in the form of applying the PBL model with question card media which was able to increase product success. This is evidenced by an increase in the average score of the mathematical communication ability test of 10.27 from pre-action to 74.41 in cycle I. Students who have completed their studies also experienced an increase of 20.69% to 58.62%. However, the results of the mathematical communication ability test in cycle I also did not reach the product success criteria because, the number of students who completed the KKM had not yet reached 75% of the number of students in class I. In cycle I, only 58.62% of students achieved a score

ISSN: 3025-020X

of 75. By Therefore, researchers and teachers continued research in cycle II with recommendations for improvement resulting from the reflection stage of cycle I. Although not all of the recommendations for improvement in cycle I could be used, the learning cycle II that was carried out produced a good impact on students. The following is a comparison diagram of student learning completeness starting from pre-action, cycle I and cycle II.

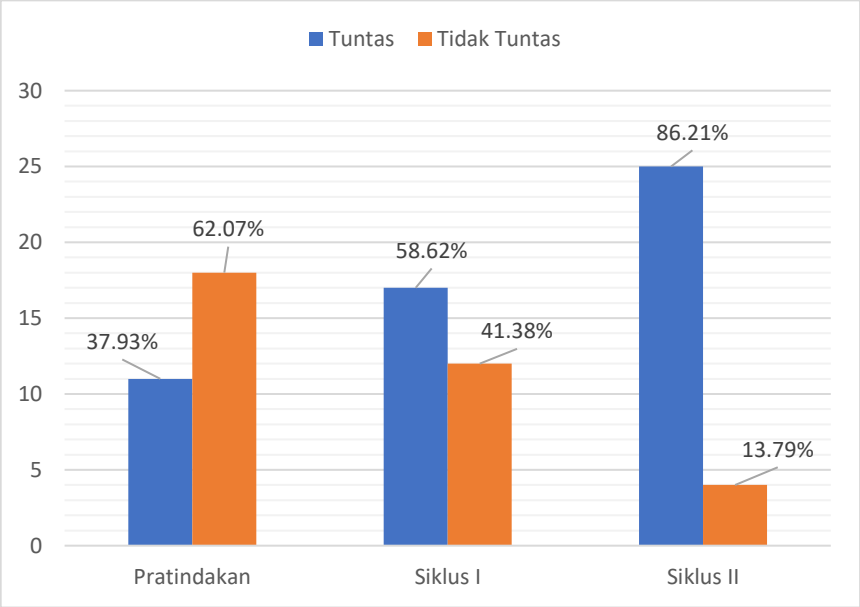

Figure 1. Diagram of Comparison of Student Completeness in Preaction, Cycle I & Cycle II

Based on the diagram above, the test of mathematical communication skills in cycle II on the average student score increased by 14.04 from the average score in cycle I of 74.41 to 88.45 in cycle II. In addition, students who achieved KKM scores also increased to 86.21%. From the data obtained in cycle II, this study was said to have succeeded in achieving the specified product success criteria, namely an increase in the average value and ≥ 75% of the number of students participating in learning to achieve the specified KKM score.

ISSN: 3025-020X

Thus, it can be seen that there is an increase in mathematical communication skills both from the success of the process and the success of the product. The results of the mathematical communication ability test, after the implementation of learning using the PBL model with the media of question cards continued to increase and showed that the PBL model with the media of question cards was effective in improving the mathematical communication skills of class I students at SD N Yogyakarta. This, in line with the results of research conducted by Nubatonis, Koeswanti, and Giarti (2019) proved that the use of the Problem Based Learning (PBL) model was able to improve students' mathematical communication skills with a significant percentage of tests of 31.8% in cycle II. In addition, the Problem Based Learning (PBL) model with the help of question card media is able to increase students' interest, activity, and understanding of the problems presented, so that students are able to communicate problem solving ideas well (Aspini, 2020: 75).

5. Conclusion

Based on the results of the study, it can be concluded that the application of the PBL model with question card media was able to improve the mathematical communication skills in addition material for class I SD N Yogyakarta students, both in terms of process and product. The increase in mathematical communication ability is indicated by an increase in the quality of the learning process and an increase in the results of tests of mathematical communication ability. Improving the quality of the learning process can be seen from students who are more active and enthusiastic in participating in learning activities using the PBL model with question card media.

The increase in the results of mathematical communication skills, as evidenced by the average value of the mathematical communication ability test results which continued to increase, starting from the pre-action and after being given the action in cycle I and cycle

ISSN: 3025-020X

II. The average value in cycle II increased compared to the pre-action of 24.31. In addition, the percentage of students who were categorized as having completed KKM or scored ≥ 75 also increased by 20.69% in cycle I compared to pre-action which only reached 37.93%. In cycle II, the completeness of student scores has reached 86.21% of the total number of students.

In connection with the research results that have been achieved, the researcher proposes the following suggestions: (1) for teachers, it is hoped that they can develop a Problem Based Learning model with the media of question cards on other materials or subjects; (2) for schools, it is expected to complete learning support facilities and infrastructure; and (3) for other researchers, the success of this research can be used as a basis for developing research that applies the Problem Based Learning model with question cards as media to improve students' mathematical communication skills in other subjects.

6. Acknowledgement

Thank you to the lecturers, principals, tutors, and class teachers and not forgetting all the students and the extended family of SD N Yogyakarta, who have given permission, assistance, and participated in carrying out this research. Thank you also to all parties who have provided support and assistance so that this research can be completed properly.

7. References

Aspini, A. (2020). Implementation of PBL Learning Assisted by Question Card Media to Improve HOTS Ability in Grade VI Elementary School Students. Journal of EDUTECH Ganesha University of Education, 8(1), 72-79.

Damayanti, RR, Zulkarnain, I., & Sari, A. (2020). Mathematical Communication Skills of Students in Learning Mathematics Using the Quick on The Draw Model . EDU-MAT: Journal of Mathematics Education, 8(1), 54-61.

Kurniawati, D., Rosita, NT, & Koswara, U. (2023). The Use of Problem Based Learning

ISSN: 3025-020X

(PBL) Problem -Based Learning Models to Improve Students' Mathematical Communication Skills. PI-MATH Journal: Eleventh Mathematics Education April, 1(2), 23-36.

Nasution, M. (2018). Process Standard Concepts in Mathematics Learning. Journal of Logarithms, 6(1), 120-138.

Nubatonis, SV, Koeswanti, HD, & Giarti, S. (2019). Improving Mathematical Communication Skills Through Problem Based Learning Models in Elementary Schools. Basicedu Journal, 3(4), 2009-2015.

Nugroho, DF, Harjono, N. & Airlanda, GS (2018). Improving Mathematics Learning Processes and Outcomes Using Problem Based Learning Models (PBL) Assisted with Question Card Media for Grade 5 Students of SD Negeri Sidorejo Lor 03 Salatiga Even Semester 2017/2018 Academic Year. Journal of Character Education, 1(1), 197-206.

Nuranisa, PD, Putra, BYG, & Fisher, D. (2022). Analysis of Mathematical Communication Ability and Student Self-efficacy in Implementing Relating, Experiencing, Applying, and Transferring (REACT) Learner Strategies . Pasundan Journal of Research in Mathematics Learning and Education, 7(1), 60-70.

Rahmalia, R., Hajidin, H., & Ansari, BI. Improving the Mathematical Communication Ability and Mathematical Disposition of Middle School Students Through the Problem Based Learning Model . Journal of Numeracy, 7(1), 137-149.

Yunarti, T. & Amanda, A. (2022). The Importance of Numeral Ability for Students. Sinapmasagi Proceedings, 2, 44-48.

Wahyudi. (2015). Elementary School Mathematics Learning Guide (for Elementary School Teachers and Prospective Teachers). Surakarta: UNS Press.