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Student Mathematical Connection Ability in Representing Multiplication at the Elementary School

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Abstract. The Mathematical Connection Ability is part of the thinking ability that must be possessed by a person. Therefore this ability should be customized to be applied in everyday problem-solving apps. The purpose of the research is to determine the strength of mathematical connection in multiplications at the 3rd grade of Nurmada Elementary School, Pekanbaru Indonesia. The subjects consisted of 28 students (10 male and 18 female). The research uses descriptive-qualitative approach and classroom action research. Data were collected using a form of activity data of teachers and student during the learning process and interview. This study consists of 2 cycles. The results showed that 80% of students could use multiplication in everyday life, and 92% of the students could represent that multiplication as a form of repeated addition.

1. Introduction

The basic concepts of multiplication and division are part of the critical areas that must be completed by elementary students. The 3rd-grade elementary school studies the idea of repetition as a basis for conducting operations to solve problems [13]. Students are expected to memorize facts, use models for multiplication, and use their knowledge of arithmetic to explain patterns and solve problems that are applied [10]. Problems that occur in learning mathematics in the 3rd grade, one of which is



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multiplication. Two the 3rd-grade Nurmadani Elementary School teacher states that most students experienced difficulties in repetition. Students find it difficult when they are asked to relate the multiplication concepts that have been learned in everyday problems [7]. [11] argue that, so far when working with adults often suggests that multiplication depends entirely on rote-learned symbolic knowledge. Some of the 3rd-grade students when interviewed stated that when learning multiplication, they were asked to memorize many numbers. Students cannot connect the addition and multiplication problems [20]. Starting in early elementary school, children are drilled with multiplication tables to learn their single-digit multiplication facts, and then they move to procedural strategies for solving multi-digit multiplication problems [13]. Students were unable to answer the concept of multiplication related to daily issues.

In addition to the above problems, the score of 3rd-grade students on multiplication tests for the 2015/2016 academic year Nurmadani Elementary School showed an average rating of 59 and <65% reaching 70. Also, it was also found that multiplication learning activities were still dominated by teachers, teachers not yet innovation in the practice of learning [3]. Student learning becomes less meaningful, teacher-centered learning makes students less likely to think creatively. Learning activities are dominated by teachers and training continuously. The effect that occurs is that the evaluation provided by the teacher is only a matter of knowledge. Besides that, according to [15], the learning resources used are only limited to elementary mathematics textbooks. The learning process is more focused on students to memorize, so they do not understand the concept of multiplication fundamentally.

Based on the regulation of the Minister of Education and Culture of the Republic of Indonesia (Permendikbud RI) no. 67 of 2013, stated that the necessary competencies that must be had in the study of numbers in 3rd grade are multiplication and number division operations <100 through activities exploration with concrete objects. Besides having to meet the applicable curriculum standards, the learning process must also meet the standard of mathematics content with the rule of material being studied. The skills that must be learned in the process standard include problem solving and connections [4].

Connection capability is one of the skills emphasized by process standards. The ability to connect in mathematics is introduced to children from an early age to elementary school. One of the lessons that can facilitate connection skills is by adding students to various topics related to everyday problems. Connection capabilities also include intervention, negotiation, collaboration and evaluation [14]. Mathematical applications in everyday issues provide opportunities for students to be able to understand the benefits of mathematics as part of the motivation of the importance of learning mathematics.

Mathematics is abstract, has patterns and sequences and relates to specific groups [18]. Objects that are studied in multiplication are abstract. For example, $4 \times 3 = 12$, is a fact that is understood as "four times three equals twelve." Another fact that must be understood is that $4 \times 3 = 3 + 3 + 3 + 3 = 12$, which is understood as "four times three equals three plus three plus three plus three equals twelve. Almost 80% of students did not understand the meaning of multiplication as repeated addition. The simplest example is understanding the meaning of 3×1 . Students do not understand that 3×1 is one plus one plus one ". Students understand that 3×1 is one of three. To follow the example of this problem,

students are shown prescription drugs from doctors that must be taken by patients who are sick every day. This indicates that in studying multiplication material, students must understand the relationship between addition and multiplication material [20].

Facts that occur in the field, especially in 3rd grade Nurmadani Elementary School have not been carried out learning about multiplication as expected. Therefore, this research is considered essential to be carried out. The connection capability referred to in this study is represented in the multiplication material, namely the ability to relate the concept of repeated summation as a representation of multiplication and the ability to use arithmetic in the application of everyday problems. The indicator of students' mathematical connection ability is the ability to intervene, negotiate, collaborate, and evaluate with other students in the class on the multiplication topic.

2. Method

Elementary School, Pekanbaru Indonesia. The subjects are living of 28 students (10 male and 18 female). Data were collected using a form of activity data of teachers and students during the learning process and interview. This study consists of 2 cycles.

Data analysis used in this study is qualitative and quantitative analysis. Steps analyzed the data in this study; describe data about the ability of mathematical connections, analyze data quantitatively in the form of scores, and conclude the final data. The drawing of conclusions on the data is adjusted using predetermined criteria. The success criteria for action are determined by two things, namely: (1) enhancing students' mathematical abilities to connect in the form of interventions, negotiations, collaborations, and evaluations among students 3rd grade Nurmadani Elementary School, Pekanbaru, Indonesia. Students' evaluation in representing multiplication understanding as a form of repeated summation, as well as students' ability to use multiplication in the application of daily life; (2) the success of the action is determined using the criteria of mastery learning. The work is considered successful if the percentage of students who get a score of 70 is more than 80%.

3. Results and Discussions

The learning process consists of 2 cycles with three meetings in each period. Implementation of learning is based on multiplication lesson plans that had been developed previously[12]. The necessary competencies studied are the result of multiplying two digit numbers. The indicator of the success of the learning process is if students can understand the concept of multiplication, the results of multiplication of two-digit numbers and tables up to 5, using simple arithmetic in the problems of everyday life.

The learning experience provided is a problem related to events known to students in this case, is a variety of food available on the market. Students learn to interact using the cake presented. Students recognize the concept of multiplication. Students learn multiplication from repeated addition. This is where they learn to connect [14].

On a market day, every student gets one cake box. In each problem given, each student receives various kinds of cakes. In the end, each student determines how much of each type of food served on the table in each tray is the same type, and the same amount of food is available in several boxes. In the learning process, students are facilitated by using worksheets. Students pay attention to various kinds of food pictures on the table [2]. When receiving LKS, some students enjoy playing and looking

at the images on LKS. The teacher directs students to look at the LKS and check together with the group members. The following is an overview of various traditional foods served in the shop (Fig.1).



Figure 1. The food at the market day

After students review the results of their work in the LKS, the teacher asks students to pay attention to the teacher in front of the class. The teacher writes on the blackboard $2 \times 2 = 4$, and then the teacher asks several students to mention other examples of calculations. Some designated students have said "multiplication." Next, the teacher rewrite on the board "there are two boxes and five cakes in each box, so there are ten cakes how to express this statement in the form of multiplication? Some designated students answer" two times five equals ten. "The classroom then approves that the calculation of " $2 \times 5 = 10$ " is called "multiplication" [13]. In the learning process using various types of traditional food, students also realize the relevance of significant everyday events with the multiplication concept. To be able to use multiplication in daily life that is simple [1].

Once the concept of multiplication began to be understood by students, an assessment is made on LKS. The teacher gives further advanced tasks, so students understand the idea of repetition in everyday life. Relying on the concept of repetitive addition alone is not enough to fully understand multiplication [5]. Students work LKS in pairs so that they can discuss and work together. While working on LKS, the teacher observes and facilitates students who need help.

In the next activity, some students representing their group were asked to write their work from each number assigned by the teacher on the board, other students were enthusiastic to write on the board. This is because there are rewards given by the teacher for each student who wants to work in front of the class. Gifts given in the form of pencils, rulers, erasers and the like encourage students to be more motivated to learn. Of the five students who wrote their work on the board there were two students who did not write a complete answer, AR wrote the response for number 1, namely " 2×3 " the right answer was " $2 \times 3 = 6$ " then the hospital wrote down the answer for task number 2, namely " $5 \times 3 = 15$ " the right answer is " $3 \times 5 = 15$ ". Students are given the opportunity to compare their work with other students until finally, the two students can do the task correctly.

In the final stage of learning, the teacher facilitates students to understand the concept of multiplication better. The teacher describes the form of expression and asks students to express it in multiplication. Before closing the lesson, the teacher gives individual homework to students.

Homework given by the teacher is intended to evaluate whether students have achieved the learning indicators specified in the lesson plan. And then, the teacher closes learning by greetings.

Some things that still need to be reflected in cycle 1 are in the learning process in the first cycle, students are relatively new to know the concept of multiplication and understand multiplication as a representation of repeated sums. Repeated addition is a heuristic used by many elementary mathematics textbooks in their initial lessons on multiplication [19], and this is the first step to reasoning about multiplication in many educational settings [9]. Some students cannot understand the concept between 2×4 and 4×2 . The ability of students in collaborate and negotiate obtained based on observation data shows that the results still need to be improved. Based on the results of student evaluation tests, 72% of students can represent multiplication as a form of repeated summation. However, in everyday problem-solving applications, 50% of students still need to learn about repetition in full.

Noting the shortcomings in cycle 1, learning for the second cycle was designed to provide opportunities for students to become more familiar with multiplication by completing multiplication tables of up to 5 and providing sufficient learning experience to students using arithmetic to solve everyday problems that are relevant to the world of students. Therefore, the class atmosphere is designed as a market day game scene.

Based on observations, several students had difficulties. After further exploration, students who experience problems are students who are still focused on individual learning. Students like this mostly come from middle to upper-class families, who are less accustomed to socializing in the community. At this stage, the student intervention category based on observations shows an average score. This indicates that mathematical connection abilities are starting to develop and there is an increase in student learning outcomes in the next cycle.

As an introduction to the second cycle, the teacher explained again about how students learn mathematics at this meeting. They will learn in pairs and have more opportunities to interact in learning. The teacher motivates them to ask questions that are not understood. The teacher arranges students in pairs according to their academic abilities and activities [17].

The assignments given to students through LKS make students compete for achievement. In cycle 2, students appear to be some students can't wait to learn to use LKS. Students are asked to work on the multiplication tables in LKS. At this stage, students begin to question the teacher about the results of their work actively. The learning atmosphere becomes noisy because some students are scrambling to ask the teacher. In such conditions, the role of the teacher is significant in paying attention to the terms of learning and facilitating students in the learning process. The teacher uses strategies to organize the class by selecting group representatives for presentations. All students raise their hands to appear in front of the class. Finally, through teacher guidance, students can choose a group representative to present their work. Students who represent their group advance alternately to read the multiplication table as requested by the teacher.

In the next stage, after a class discussion about the multiplication table is given a question and answer session between students, student groups and the teacher to negotiate whether the multiplication list read in front of the class is correct. The teacher asks students to look back at the multiplication table and ask several students, finally it was agreed that the multiplication table presented was accurate. The next activity is discussion and teamwork in groups to solve daily problems using a 25-minute multiplication run. After that, each group representative was asked by the

teacher to read out their results and other students were asked to respond. By doing assignments in the worksheets, students get experience using multiplication in everyday life.

In the final stage of learning, the teacher gives students the opportunity to read and understand the multiplication tables that students have filled correctly. Students are also directed to summarize the use of multiplication in daily life in the tasks that are in the LKS. Based on the work of LKS, 28 students were able to connect multiplication as a representation of repeated addition. Also, the market scene can foster students' ideas to join multiplication material in daily life [8]. The results of student evaluation tests support this, 80% of students can connect in representing multiplication in daily life problems, 92% of students can relate the understanding of multiplication with repeated sums. Other data as support is from the results of interviews with five research subjects, on average able to connect in repetition. Seeing an increase by predetermined criteria, finally, the study was stopped in the second cycle.

Some significant input provided by observers in the learning process is, students are noisy because they often ask the teacher. As a result, the learning atmosphere becomes disrupted. Therefore, teachers should pay more attention to students with specific strategies. In addition to reflection on the implementation of the second cycle, students are also given a test. Giving Tests in the second cycle is to measure students' ability to use multiplication in the application of daily life which in period one has not been achieved according to predetermined criteria. Tests in the second cycle used test instruments that had been developed in the form of short descriptions. The number of item questions as much as 5 and must be done in full by the student. Assessment of test results is adjusted to the criteria specified in the lesson plan.

The learning test results of students in the second cycle are 90,% students average score and 95% of students can complete the task. Based on observations, the connection ability in period 2 shows that the capacity of students' mathematical connections in the form of intervention, negotiation, collaboration, and evaluation has increased. In cycle 2, the ability to intervene, negotiate, collaborate and evaluate skills on good criteria and the ability to consult and work are perfect criteria. Coupled with the support of interview results for five students as research subjects, shows that students can connect in representing multiplication through market day activities, completion of assignments and also student presentations. It can be concluded that the study ends in cycle 2.

Student activities and study groups have been proceeded according to lesson plans. Students have intervened, negotiated, collaborated and evaluated in market day activities, completing assignments in LKS and also presentations. Furthermore, students conduct discussion and collaboration activities in achieving LKS. This shows that LKS can direct students to perform their learning bill [2]. The existence of worksheets, students' attention is no longer just focused on the teacher. Students are more focused on completing the assignment given.

Finally, the students dare to express their opinions and improve the views of others who are not by the actual answers [6]. Negotiation, collaboration, and intervention in groups can foster an active atmosphere and the spirit of learning in students to complete assignments in LKS. Students become more active in asking questions and answering questions given by the teacher. The use of worksheets in learning helps students to work and study independently with their partners [15]. The provision of sheets in education can also make students interested in learning. This is evident when the learning process in cycle 2, some students immediately ask to learn to use LKS.

Some students who are not yet active in cycle one learning become active when given the opportunity to learn by collaborating with their friends. One of the other positive things the student wants to

complete the assignment is given. Students who still experience errors in written tests, when interviewed verbally can respond to questions well. When studying negotiation, collaboration, multiplication intervention skills, students develop very well. The ability of students to evaluate presentation skills in front of the class is also well developed. Learning objectives can be achieved and learning that runs smoothly. Student activity in learning is better than previous education. The atmosphere of the market day class can foster students' ideas to connect multiplication material with everyday life[8][16]. The learning atmosphere becomes more meaningful for students. Finally, learning can improve the ability of student connections in representing multiplication material.

4. Conclusion

Paying attention to the results of the study, the presentation of data, analysis, and discussion of the results of the study concluded that the students of grade 3rd Nurmadani Elementary School, Pekanbaru Indonesia had increased connections ability. In cycle 1, 72% of students can represent multiplication as a form of repetitive addition. But in solving everyday problems, only 50% of students can do it. While the learning test results of students in the second cycle are 90,% students average score and 95% of students can connect repeated summation with the understanding of multiplication. Negotiation, collaboration, and intervention skills are in an outstanding category while evaluation skills are in a good group. The learning atmosphere experienced by students becomes more meaningful and ultimately improves the ability of students' mathematical connections to represent multiplication.

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