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Improving the Numeracy Mathematics Ability: The Role of Abacus Learning Model

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Abstract. The addition and subtraction materials in mathematics were considered to be difficult to understand by most elementary school students. The aimed of this study was to improve the ability to calculate the addition and subtraction of numbers in mixed count material in mathematics using the Abacus learning model in second grade students of Elementary School Kebraon II Surabaya, Indonesia. This study was an action research employing the Abacus learning model with the Kurt Lewin model approach with two cycles and consists of four main steps for each cycle: planning, action, observation, and reflection. The data were gathered through documentation, interview, observation, and tests. The data analysis was done by using the individual and classical learning mastery. The results of this research indicated that the implementation of the Abacus learning model can improve the second grade students score of Elementary School Kebraon II Surabaya, Indonesia up to 86.66% and can raise the learning achievement process as “Good” criteria between teachers and students.

Keywords: Numeracy Mathematics, Abacus Learning Model

1. Introduction

The high level of apprehensive in learning mathematics leads student to feel antipathy to mathematics. In this case, students generally have low enthusiasm to understand mathematics [1]. Mathematics is first become compulsory subject in the elementary school. Elementary school pupils have a good possibility to dislike or like mathematics. Elementary school as the first gate in the journey of mathematics is an important thing to investigate [2]. Many elementary school pupils have trouble in understanding mathematics taught by the teacher. Numeracy is known as a hard subject to comprehend, without function and usefulness. Students usually experience indifference, confusion and burnout whenever they are given numeracy lessons [3].



In general, students who study mathematics face many problems in sharing the form of calculation problems. Numeracy is part of mathematics which includes dividing, multiplication, addition, and subtraction [4]. The case that most commonly faced by elementary school pupils is subtraction and addition [5]. Generally, problems in subtraction and addition are caused by: 1) Submission of mathematical concepts including reduction of whole numbers by teachers that was not use teaching aids that were suitable with the material. Even the learning media that are provided was limited. Even though the learning media was available, the teacher does not know how to use the teaching aids, 2) the teacher lacks mastery of evaluation methods and tools, 3) the teacher is accustomed to conveying the material with only one method, such as the lecture method, 4) the teacher often assumes that students have already understood so they quickly move to other materials, 5) the teacher often gives homework, while the material has not been mastered by students, and 6) the teacher checks homework and gives grades without giving a correction by making completion of the work [6]. Every child has different abilities to solve arithmetic problems [7]. Students commonly make mistakes and have difficulties in learning mathematics, including solving calculation problems [8]. Action Research is a contextual research activity carried out to solve learning problems faced by teachers, increase the standard and learning outcomes of pupils and try new things in learning for the sake of improving the learning outcomes and quality especially in primary schools [9]. The main focus is the interactions between students with different students in the class, interaction between students-teacher, students-math assignments and students-learning tools [10]. One of mathematics problems facing by the second grade of Elementary School Kebraon II Surabaya, Indonesia, was that the conventional learning method-lecture method. The lecture method is the most common method used by teachers at all levels starting from elementary school, junior high school and high school. However, this method has been considered to be ineffective since some students tend to remember things through objects and visuals [11].

One learning model that can be applied by teachers in the learning process to improve students' thinking skills in mathematics is the Abacus media model. The Abacus model can help students to understand mathematics which has the following parts: a frame, a divider, a lane of 13 lanes and beads where each row contains five beads, four beads for the bottom and one bead for the top, under the lane, a base made of carpet or similar cloth is aimed at keeping the beads from sliding easily when used in working counts. Abacus media length ± 20 cm and width ± 10 cm. Abacus functions to: 1) recognize place values, 2) perform operations of multiplication, addition, division, and subtraction of whole numbers and decimal numbers, 3) length measurement conversions in the metric system, 4) Lighting in buying and selling and precisely determining cash back. Abacus media users who are accustomed to apply the Abacus were able to calculate without those media, but only by imagining it [12].

The implementation of Abacus learning model can improve the numeracy skills of second-grade students of Elementary School 52 Tokang Sekayan, Indonesia. The the pre-test and post-test result indicated an increased in the number of students after the application of the Abacus learning model to the 2nd grade students of Elementary School 52 Tokang Sekayan [13]. The education implementation can enhance the student achievement [14]. Efforts are needed to make improvement, in curriculum development, and the quality of education and skills in learning and teaching activities gradually and continuously. Since the growth of education in a nation is one of the tangible proofs to the successful country. The role of educational management is to utilize all resources to support the achievement of educational progress that starts from improving the caliber of learning in the classroom. Therefore, the purpose of this study is to improve the ability to calculate the addition and subtraction of numbers in mixed count material in mathematics using the Abacus method in the second grade of Elementary School Kebraon II Surabaya, Indonesia. In short, students are expected to easily understand the teaching of mathematics provided by the teacher by using Abacus learning model.

2. Research Methods

This study employed an action research by using Abacus learning model with two cycles. Each cycle contains four main actions as followed: planning, acting, observing, and reflecting. The population of

the research was the second grade student of Elementary School Kebraon II Surabaya, Indonesia in the academic year of 2018/2019. The observation data were gathered through 30 students, 14 female and 16 male students. This research started from April to Mei 2019. The variable used by researcher was X variable – Abacus learning method as the main variable and Y variable was the students' numeracy mathematics ability as a supporting variable. The data were gathered through observation, test and documentation. To analyze the achievement level of the students, the written test was done in the end of cycle. The students should achieve the score > 75 to reach the minimum criteria of mastery learning. If the most students in the class (85%) were able to operate the addition and subtraction and were achieved the Minimum Criteria of Mastery Learning (MCML) that was 75% from tests that were given by the teacher, then the students were assumed to achieve the MCML and should stop the cycle. The formula of the minimum criteria of mastery learning with equation 1. \bar{X} = average score, $\sum X$ = the total of students score, and $\sum N$ = the total of students.

$$\bar{X} = (\sum X) / (\sum N) \times 100\% \quad (1)$$

Table 1. Criteria for the learning process of students and teachers show the criteria of the learning process between students and teachers, there are four categories indicating the success index of the application of learning methods .

No	Level of success	Predicate of Success
1	85-100 %	Very well
2	84-75 %	Good
3	74-65 %	Enough
4	< 65	Less
5	Range 15 %	

3. Result

In this area will described about advancement of counting ability on addition and subtraction of numbers for elementary school pupils with Abacus action research.

3.1. Description of Pre-Cycle Results

The observations results before applying the Abacus method indicate that students' mathematics learning scores are still low based on the Minimal completeness criteria. The MCML Score in the second grade of Elementary School Kebraon II Surabaya, Indonesia in mathematics is 75. Students who achieved the number of MCML were 23.33%. The results of these data indicate that there are still students who have not reached MCML.

3.2. Description of Cycle I Research Result

Researchers began to apply the Abacus learning model in the first cycle to improve the achievement of MCML. Classification of Learning Outcomes of addition and subtraction material demonstrates the amount of students who received a range of grades 100-85 or very good criteria is 5 students (16.12%), the range of grades 84-75 or good criteria is 5 students (16.12%), the range of grades 74 - 65 or sufficient criteria is 4 students (12.90%), the range of grades <64 or less criteria is 18 students (58.10%). From the results of the first cycle test shows that there are still students who have not met the MCML. Furthermore, a second cycle of research was conducted with the time determined by the class teacher II because the value of learning outcomes is still below the MCML.

3.3. Description of Cycle II Research Result

The observations results In the cycle II shows that the number of students in the range of 100 - 85 or having a good criterion was 13 students (41.93%), 84 - 75 or good criterion was 10 students (32.25%), 74 - 65 or average criterion was 4 students (12.90%), the score <64 was 4 students (12.90%). From the results of the cycle II test, it shows that there is an increase in student value compared to the results of the pre and cycle I test.

4. Discussion

Based on the value of pre-cycle learning outcomes, cycle I and cycle II then can be compared between pre-cycle, cycle I and II in the Table 4. The comparison of the Pre-Cycle Learning Outcomes, Cycle I and Cycle II experienced improvement from pre cycle 23.33%, cycle I 60% and cycle II 86.66% was as followed

Table 2. the comparison of student learning outcomes in per cycle

Description	Mastery Students		Not Mastery Students	
	Frequency	%	Frequency	%
Pre-Cycle	7	23,33%	23	76,66%
Cycle I	18	60%	12	40%
Cycle II	26	86,66%	4	13,33%

Based on Table 2. the comparison of student learning outcomes in per cycle, cycle I with a total of 30 students who have completed as many as 18 students (60%) while 12 students who have not completed (40%). In the second cycle with a total number of 26 students 86.66% had been completed. The implementation of Abacus learning is able to improve student learning achievement of second grade students at Elementary School Kebraon II Surabaya [15]. This is in line with the results of the study of Fauziya et al in 2017, in her research the result revealed an increase of 94.44% [16] and as well as Wahyu in 2017 the result showed an increase of 84.78% [16].

5. Conclusion

We can learn that the application of the Abacus learning model that is equipped with teaching aids on Mathematics on the addition and subtraction, mixed calculation is able to improve the students score at Elementary School Kebraon II Surabaya, Indonesia. It can be proved by the improvement of students score from pre-cycle, cycle 1 and cycle II. In the first cycle, there were 18 students or 60% who were reach MCML. While in the second cycle, there were 26 students or 86% who were reach MCML. This result indicated that the implementation of Abacus learning model was able to improve the learning standard between students and teachers which was categorized as “good”.

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