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Improving of Students' Performance on the Four Basic Mathematical Operations on the Set of Rational Numbers: The Case of Selected First Year Students of Fitch College of Teachers Education, Ethiopia

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Abstract:

The main objective of this study was to improve students' performance on the four basic mathematical operations on the set of rational numbers. The study was carried out on 15 selected first year students of Fitch College of Teachers Education who had scored below 50% in basic mathematics I course. To identify the real existence of the problems, pretest was given to the students and the result revealed that the students have poor performance in basic mathematical operations. To improve the students' performance in basic mathematical operations, the action set carried out using different active learning methods with sufficient examples and working activities. Data were gathered through systematic observation, pre and post-test. The data gathered through observation was analyzed qualitatively and the performance test was analyzed using paired t-test. The result from the observation and pre-post test revealed that there was a significant change on the four basic mathematical operations. Even if there were changes, the performances of the students were below average in the performance test. Since the action research by itself is cyclic; if the intervention was repeatedly carried out, the students will improve their problem on basic mathematical operations.

Keywords: Four mathematical operations, basic mathematics course I, systematic observation, performance test, cyclic

1. Introduction

Mathematics is an indispensable human endeavor that allows individuals to describe, analyze and understand the world we live in. Furthermore, mathematics is deeply embedded in the modern world and in everyday life. Thus having the knowledge of mathematics is crucial to educational and financial success in contemporary society and is becoming ever more so (Sieglert et al., 2012).

Mathematics is a form of reasoning. Thinking mathematically consists of thinking in a logical manner, formulating and testing conjectures, making sense of things, forming and justifying judgments, inferences and conclusions. We demonstrate mathematical behavior when we recognize and describe patterns, construct physical and conceptual models of phenomena, create symbol systems to help us represent, manipulate, and reflect on ideas, and invent procedures to solve problems (Battista, 1999).

All the importance of mathematics can be obtained through the application of four fundamental operations. Acquisition of these four fundamental operational concepts and their relations enables students to develop their understanding for numbers and calculating strategies as well as associating them with daily life activities (Vula, 2011). The four fundamental operations addition, subtraction, multiplication and division, and their relations are basic mathematical concepts to be taught at primary education level.

In spite of the aforementioned importance and wide applications, students do not perform well in mathematics. Many other studies have also revealed that most students encounter difficulties and performed poorly in mathematics (Fuys et al., 1988; Gutierrez et al., 1991; Adamu, 2004).

According to the Ethiopian Education Statistics Annual Abstract (2010/11) only 14.7% of grade 10 students and 57.7% grade 12 students have scored above 50% in mathematics. This is a great problem in the country and majority of the students who joined college are those completed grade 10 and fail to join preparatory program. Hence there is no doubt to say some of them have poor mathematical knowledge and skill gap. Since mathematics is embedded in different disciplines such as chemistry, biology, physics, geography and other disciplines, teachers of these different disciplines described from their experience that their students encounter difficulties in performing simple mathematical operations.

In the same manner, some students in our college scored below 50% in basic mathematics I (Math 101). Therefore this action research was carried out to improve the performance of students on the four basic mathematical operations.

1.1. Objective

The main objective of this study was to improve students' performance on four basic mathematical operations on the set of rational number.

Basic questions

- To what extent the intervention bring changes on students' performance of adding rational numbers?
- To what extent the intervention bring changes on students' performance of subtracting rational numbers?
- To what extent the intervention bring changes on students' performance of multiplying rational numbers?
- To what extent the intervention bring changes on students' performance of dividing rational numbers.

2. Methodology

2.1. Sampling

This study was designed to seek answers to the under stated research questions by employing an action research. The target groups of this action research were 25 first year students who scored below 50% in Basic Mathematics I of first semester offered in 2009(2017 G.C) academic year. But only 15 students were interested to be the participant of the study as target group. While selecting these students, the researchers also prepared a test on four basic mathematical operations and gave to the entire regular first year students before starting the intervention. After correcting the test it was observed that 80 students were scored below the average. From those students scored below 50% in basic mathematics I course had basic mathematical operation difficulties, because they scored below average in this test. Thus, 25 students who scored below 50% in basic mathematics were selected purposively from those who scored below average in this test because the problem was series with them.

Method of Data Collection

Data were collected in two ways. One is from pre and post-test. The test given to the entire first year students serves as a pre- test. Data were also collected by systematic observation while they were doing together in groups, in pair and individually throughout the intervention.

2.2. Data Analysis

The collected data from performance test was analyzed using Statistical Package for Social Science (SPSS) of Version 20 in light of the research questions. Hence to observe students' improvement, independent sample paired T test was used to observe significant difference between pre and post-test with confidence level 95%. Additionally, the data collected through observation was analyzed qualitatively.

2.3. Intervention

After the students were clearly identified, intervention was carried out for six days, 3 hours per day. Before starting the possible intervention, planning and selecting appropriate active learning methods, materials and sufficient examples and practical activities related to addition, subtraction, multiplication and division were developed. The delivery approach was designed to be an activity-based center providing the students with many opportunities to solve different problems in different ways. At the very beginning of the intervention, orientation which emphasizes on readiness of the students and on purpose of intervention was given to the target group. Then after, implementation of the planned activities was given step by step starting from addition, subtraction, multiplication and division consecutively. During the course of the intervention, the students' mathematical solutions, their arguments or representations (verbal or written), including misconceptions were evaluated and directed. At the end of intervention, post-test was given.

3. Result

3.1. Improvement of Students' Performance on Addition

According to the data gathered from observation during intervention, the target groups had some drawback on addition operations in different aspects. For instance, some students do not know the place value of numbers and have misconception on carrying numbers and add to the next digit number. But after they practiced, the students show improvement.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	2.5067	15	1.53086	.39527
	Posttest	4.0667	15	1.27988	.33046

Table 1: Paired Samples Statistics

		Paired Differences				T	Df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre-test - post-test	-1.56000	1.58466	.40916	-2.43755	-.68245	-3.813	14	.002

Table 2: Paired Samples Test

On the other hand, from Table 1, the t value is 0.002 which is less than 0.05 and the mean of post- test ($M = 4.07$, $SD = 1.28$, $N = 15$) was statistically significant different from that of pre- test ($M = 2.51$, $SD = 1.53$, $N = 15$). This indicates that students' performance on addition on the set of rational numbers was improved.

3.2. Improvement of Students' Performance on Subtraction

From observation, during intervention, the target groups had difficulties like subtracting large number from the smaller one, problem of writing numbers in appropriate place value and the concept of borrowing number from the preceding while subtracting larger number from the smaller. After appropriate teaching/learning methods was conducted with sufficient examples and practical activities, they shown progress.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	1.6667	15	1.17514	.30342
	Posttest	3.6667	15	1.58865	.41019

Table 3: Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	pretest - posttest	-2.00000	1.30931	.33806	-2.72507	-1.27493	-5.916	14	.000

Table 4: Paired Samples Test

In line with this, Table 3 and 4 also indicate that the t value 0.000 which is less the 0.05 and the mean of post-test ($M = 3.67$, $SD = 1.58$, $N = 15$) was statistically significant different from the pre- test ($M = 1.67$, $SD = 1.18$, $N = 15$). This reveals that there was an improvement on subtraction on the set of rational numbers.

3.3. Improvement of Students' Performance on Multiplication

While carrying out the intervention, it was observed that some of the target group encounter difficulties with simple multiplication like place value and carrying numbers. After they had got the concept of multiplication and provided with many examples in a very simple way students practiced and finally they shown improvement.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	1.3000	15	1.04881	.27080
	Posttest	2.2667	15	1.04994	.27109

Table 5: Paired Samples Test

		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	pretest - posttest	-.96667	1.15676	.29867	-1.60726	-.32607	-3.237	14	.006

Table 6: Paired Samples Test

As observed from Table 5 and 6 the t value is 0.006 which is less the 0.05 and the mean of post-test ($M = 2.27$, $SD = 1.05$, $N = 15$) was statistically significant different from the pre-test ($M = 1.30$, $SD = 1.05$, $N = 15$). This indicates that there was an improvement on multiplication on the set of rational number.

3.4. Improvement of Students' Performance on Division

During intervention, it was observed that at the beginning, students were unable to divide small number to large number. Even they had difficulty in writing numbers in place value. After they had gotten concepts on division and presented with sufficient examples it was observed that there was an improvement.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	.8333	15	.85912	.22183
	Posttest	2.2000	15	1.27895	.33022

Table 7: Paired Samples Statistics

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	pretest – posttest	-1.36667	1.20218	.31040	-2.03241	-.70092	-4.403	14	.001

Table 8: Paired Samples Test

The above Table 7 and 8 indicate that the t value 0.001 which is less than 0.05 and the mean of post-test ($M = 2.20$, $SD = 1.28$, $N = 15$) was statistically significantly different from the pre-test ($M = 0.83$, $SD = 0.86$, $N = 15$). This shows that there was an improvement on division on the set of rational numbers.

4. Conclusion

The importance of mathematics can be obtained through the application of the four fundamental operations: addition, subtraction, multiplication, and division. Acquisition of these four basic operations' concepts and their relations enable the students to develop their understanding for numbers and calculating strategies as well as associating them with their daily life activities. Since mathematics is embedded in different disciplines such as chemistry, biology, physics, geography and other disciplines, the teachers of these different disciplines described from their experience that some of their students encounter difficulties in performing simple mathematical operations. As a result of their poor performance, some students in our college scored below 50% in basic mathematics I (Math 101). Therefore, this action research was carried out to improve the students' performance in the four basic mathematical operations.

The main objective of this study was to improve students' performance on the four basic mathematical operations: addition, subtraction, multiplication, and division on the set of rational numbers.

The study was carried out on some selected (15) first year students of Fitch CTE who had scored below 50% in basic mathematics I (Math 101). To identify the real existence of the problems, pre-test was given to the students and the result revealed that the students have poor performance on basic mathematical operations.

To improve the students' performance in basic mathematical operations, the action set carried out intervention using different active learning methods with sufficient examples and working activities. The students were directed or guided to the right track when they were out of the logic.

Data was collected by observation and performance test. The data gathered through observation was analyzed qualitatively and the performance test was analyzed quantitatively using SPSS version 20.

According to the result obtained from observation and performance test (pre-test and post-test), the students have shown significant improvements in performing mathematics using the four basic operations.

Even though the students shown progress in their performance, some of them still score below average. This tells us that they need more remedial time for help and on the other hand, some students were improved well in performing the operations after the intervention.

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