Using Constructivist Approach of Teaching to Improve Students' Performance in Mathematics at SDA College of Education

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Abstract

This study sought to use the Constructivist Approach of teaching to enhance and improve students' competence and understanding in solving mathematical problems. Mathematics has been an intimidating subject for many people, particularly in the area of mathematical problems. This research study was action research which involved a sample of forty (40) students of S.D.A. College of Education, Agona – Ashanti, selected purposely for the study. Prior to the study, it was observed that the students were not able to understand and solve mathematical problems due to the teaching strategy (traditional) previously used in teaching them and it took the lecture – form of teaching. The intervention strategies conducted involved a series activity in phases, which were carried out on the sample using the constructivist approach of teaching and learning. The pre – test and post – test scores obtained by the students were analyzed qualitatively based on the research questions that preceded the study. The inferential analysis showed that the intervention activities helped improve students' competency in understanding and solving Mathematical problems. It was then concluded from the findings that the constructivist approach of teaching and learning employed during the intervention promoted students' participation and improved their academic achievements.

Keywords: Constructivist approach; mathematical problems; mathematics education; problem solving strategy.

1.0 INTRODUCTION

In every society today, Mathematics is widely regarded as one of the most important school subjects and a central aspect of the school curriculum. Sherrod *et al.*, (2009) ascertained that there simply cannot be any meaningful development in virtually any area of life without knowledge of Science and Mathematics. This makes Mathematics one of the most important subjects within the list of foundation subjects that make up the core curriculum for basic education in most countries throughout the world including Ghana (Atteh *et al.*, 2014). Nabie (2002) mentioned that Mathematics is part of life and without its man cannot function. Mathematics serves as a critical filter for students seeking admissions to second circle and tertiary institutions such as Colleges of Education and Universities in Ghana (Adetunde, 2009).

Research by Asiedu–Addo and Yidana (2001) mentioned that the study of Mathematics is seen as a means of sharpening the mind, shaping the reasoning abilities, and developing the personality of the individual to become a more scientifically and technologically minded person in the society. "That is why most countries put a great emphasis on the study of a well–planned and effectively implemented mathematics education program especially those that are concerned about their scientific and technological development" (Atteh *et al.*, 2017).

The importance of Mathematics calls for the introduction of constructivist approach of teaching as a backbone of the mathematics curriculum. For many years the constructivist approach to teaching has appeared in textbooks, curriculum frameworks and literature. Constructivist's Mathematics curriculum encourages the use of different teaching methods in the mathematics classroom. In a Mathematics classroom, teaching should allow students to wonder why things are, to inquire, to search for solution and to resolve incongruities. In a constructivist classroom, effective learning can only take place when learners are given the chance to grapple with problems, to reflect on their solution procedures and then check the reasonableness of their results.

The intent of this research is to obtain empirical data in a form of evidence to show that active learning strategies in the classroom will motivate and engage students in the learning process, thus resulting in an enhanced understanding of Mathematics.

1.1 Statement of the Problem

The fundamental essence of Mathematics teaching and learning is to help develop students' ability to solve a wide range of complex Mathematics problems and also to apply Mathematics ideas to real life situations. Atteh *et al.*, (2014) share their view that "Concept-representation of all Mathematical ideas needs to be taught with the use of practical activities and guidance from the teachers so that students can develop the concepts for themselves." The shift of focus to the teaching of theoretical aspect of Mathematics could be the cause of students' poor performance in Mathematics over the years. The problem then is: what must be looked at on the students to help them improve upon their competences and skills as well as acquiring new concepts and methods to solve Mathematical problems?

1.3 Research Hypothesis

The hypothesis designed to guide and direct the study is: Null hypothesis, *Ho*: There is no significant difference in the mean scores of the pre–test and the post–test of the students at α = 0.05 level of significance (P < 0.05).

$$H_0: \mu1 = \mu2$$

Alternate hypothesis, *Hα*: There is significant difference in the mean scores of the pre–test and the post–test of the students at α = 0.05 level of significance (P < 0.05).

$$H\alpha: \mu1 \neq \mu2$$

2.0 METHODOLOGY

2.1 Research Design

The research design for the study is "Action Research" which is designed to deal with a classroom practice. The authors adopted action research as a preferred research design for this study because it deals with small scale intervention which is appropriate for a one classroom situation in the context of which the study was carried out. It is believed that action research is a process by which practitioner's attempt to study their problems scientifically in order to guide, correct and evaluate their decision and actions (Kannae, 2004).

2.2 Population and Sampling

The population is S.D.A. College of Education, Agona – Ashanti Region, Ghana, which has a student population of six hundred and forty (640). For the purpose of this research, the authors selected forty (40) level 100 students offering Bachelor of Basic Education programme in the school. The sample comprised twenty-two (22) males and eighteen (18) females.

2.3 Instrumentation

For this research, tests were used as instruments for the collection of data. The tests were used in two folds, that is, pre-test and post-test. The pre-test and the post-test were task given to students to carry out in order to know their level of performance. These tests also served as basis for evaluating the students.

3.0 DATA ANALYSIS AND RESULTS

The data analysis was divided into two parts, the first part dealt with the Descriptive analysis and the second part also looked at the Inferential analysis of the data. Statistical Package for Social Scientist (SPSS) was used for the Inferential analysis of the study.

3.1 Pre – test Scores

The pre – test consisted of six (6) questions which were marked over thirty (30) and was conducted for the forty (40) students. Table 1 below shows the frequency distribution in percentages of the raw scores of the pre – test obtained by the students.

Table 1: Frequency distribution of Pre – test Scores in Percentages

Scores	Frequency	Percentage (%)
1 – 6	14	35
7 – 12	20	50
13 – 18	4	10
19 – 24	2	5
25 – 30	0	0
Total	40	100

It can be realized from the analysis that, out of the total of 40 students who were involved in the test, 36 students obtained scores less than half of the total marks, and this represents 90% of the total. The remaining 4 students representing 10% scored half or more than half of the total marks for the test. From the students' perspective, these shortfalls were as a result of the lack of their basic understanding of the questions meted out to them as the pre–test. To address these challenges of the students, a series of intervention activities, using the constructivist approach of teaching and learning were organized by the researcher for the students and a post–test was administered to them.

3.2 Post – test Scores
The post – test on the other hand was conducted to see how the intervention activities helped the students to improve upon their competences and skills as well as acquiring new concepts and methods to solve Mathematical problems. The total number of students who were involved in the post–test was the same as that of the pre–test. Table 2 is the frequency distribution in percentages of the marks obtained by the students in the post–test.

Table 2: Frequency distribution of Post – test scores in Percentages

Scores	Frequency	Percentage (%)
1 – 6	0	0
7 – 12	8	20
13 – 18	10	25
19 – 24	16	40
25 – 30	6	15
Total	40	100

Analysis drawn from Table 2 showed a tremendous improvement in the performance of the students in relation to the solving of the questions administered to them and this was evidence of the good use of the constructivist approach of teaching and learning through numerous activities that they were exposed to. Out of the 40 students involved in the post – test, 30 of them scored marks more than half of the total marks of 30 and this represented 75% of the total number of students whiles the remaining 10 students scored marks less than half of the total marks, also representing 25% of the students.

3.3 Inferential Analysis of the Pre–test and Post–test Scores
The data used in the analysis were the pre–test and post–test scores obtained by the students. The table below indicates the mean, standard deviation and standard error mean of the paired samples.

Table 3: Paired Samples Statistics of Pre – Test and Post – Test Score

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PretTest	7.8750	40	4.93646	.78052
	PostTest	18.4750	40	5.80887	.91846

Results from Table 4.5 indicate that, the mean score of the pre–test scores and the post–test scores were 7.8750 and 18.4750 respectively. The standard deviation of the pre–test scores was also 4.93646 whiles that of the post–test was 5.80887. With this, a conclusion can be drawn from the mean scores of both the pre–test scores and the post–test scores. Comparatively, the means scores showed an improvement in students' performance in solving the questions administered to them in the post–test. The intervention process using the constructivist approach of teaching and learning has helped the students in improving their performance.

3.4 Testing of Hypothesis

Asiedu – Addo, Awanta and Amppiah (2004) were of the view that, hypothesis concerns comparing means of two small dependent samples, when the same respondent or person is measured under the two conditions or when matched paired are measured under the same condition. In this research study, we compared the mean scores of the pre–test and the post–test. The means of the dependent samples, pre–test and post–test, are given in Table 4.6 below. The P – value for the statistical test for the hypothesis was set at P < 0.05.

Null Hypothesis, H_0: There is no significant difference in the mean scores of the pre–test and the post – test of the students at α = 0.05 level of significance (P < 0.05).

H_0: $\mu_1 = \mu_2$

Alternate Hypothesis, H_a: There is significant difference in the mean scores of the pre–test and the post – test of the students at α = 0.05 level of significance (P <0.05).

H_a: $\mu_1 \neq \mu_2$

Table 4: Paired Samples Test for Pre – Test and Post – Test Scores

	Paired Differences							Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	
Pair 1 PretTest – PostTest	-1.060E1	4.03701	.63831	-11.89110	-9.30890	-16.606	39	.000

Decision: The result from the statistical test for the hypothesis from Table 4 yielded a value for P = 0.000, which indicated that the difference in the means was significant. Since P is less than 0.05 (95% confidence interval), the level of significant; we reject the Null Hypothesis and rather accept the Alternative Hypothesis. We therefore conclude that there is a significant difference between the pre–test scores and that of the post–test which is in favour of the post-test and this could be attributed to the intervention processes the authors took the students through.

4.0 DISCUSSIONS

The improvement in the performance of the students, which was evident in the post – test scores they obtained, was not by chance, but through the constructivist teaching strategy that the researcher employed during the intervention activities. With the constructivist approach, the authors designed a well

– planned intervention activity in the lessons with the students. The constructivist approach of teaching enabled the students to participate actively in the lessons and also encouraged cooperative learning among the students. And in effect, each student in a group was not only responsible for learning what was being taught alone, but also helped group mates who were still having problems and thus created a conducive learning atmosphere and environment.

In the event of all these, the authors found out that the students were motivated and also inspired by the way the lessons were taught. The constructivist approach of teaching used in this research study enabled the students to comprehend the conceptual knowledge and the procedural understanding of Mathematical problems which the students were able to solve them successfully.

5.0 CONCLUSION

The performance of the students for the study in the post-test was higher than that of the pre-test. Considering the performance of the students in solving the Mathematical problems confirms the assertion that the constructivist approach of teaching and learning represents an effective way of teaching Mathematics.

Thus, the constructivist approach of teaching and learning could therefore serve as a practical way of teaching for promoting the simplification and utilization of Mathematical equations/expression and principles in solving Mathematical problems.

Moreover, the study could add to the existing knowledge in the use of the constructivist approach in the teaching and learning of Mathematics. The study could also promote the active participation and intellectual involvement of learners in the principles of solving Mathematical problems using the constructivist approach of teaching and learning.

Competing Interests
Authors have declared that no competing interests exist.

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