

METHOD AND GENDER DIFFERENCES IN ALGEBRA PERFORMANCE OF JUNIOR SECONDARY SCHOOL STUDENTS

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Abstract

The focus of this research work is the use of two approaches in the teaching of algebraic word problems. It also examined how boys and girls exposed to some approach (strategy) of teaching utilized the available opportunity. Among other things, it was found that the use of problem solving approach though beneficial to both genders, helped to make the study of algebra more appealing to male students.

Introduction

A lot of interest has been generated on the study of the relationship between gender achievements in Mathematics in Nigeria and the world over (Backman, 1970; Fennema, 1984; Bolaji, 1985; Armstrong, 1986; and Adeniyi 1987). In most cases, it was reported that boys achieved significantly better than girls (McLean, 1984 and Surafford, 1986). Some other studies, (Marshall, 1983; Fennema and Sherman, 1984; and Fennema and Carpenter, 1990) have observed no significant differences or approximately equal performance of boys and girls in mathematics.

Performance of learners, irrespective of gender differences in any subject or content area, when critically examined, is a function of the classroom environment as well as student's variables (Hansen, 1986). The approach or method of learning to a large extent could influence positively or negatively the performance of the learner. A good number of teaching approaches have been developed recently, the problem solving approach in teaching and in text is a recent innovation developed in an effort to ensure improvement in the quality of mathematics instructions and subsequent better performance of learners. Although some of the results of the students are inconclusive, many researchers have found the use of problem solving approach in teaching of mathematics, an effective tool for enriching the quality of instruction for learners. For instance, Goldin and Caldwell (1990) and Bolaji (1995) have successfully used this approach to improve learner's performance in some mathematics topics.

Mathematics is a discipline of different components and these components are more or less related. Algebra is one of the oldest branches of mathematics. Historical evidence shows that the Babylonians of more than 3000 years ago were versed in algebraic approaches from ancient time until the end of the 18th century A. D. Algebra can roughly be described as that part of mathematics which deals with the solution of equations. In addition to its concern with solving equations, modern algebra supplies a language and patterns of reasoning to the rest of mathematics (Beckman, 1970).

Mathematics is a compulsory subject and hence algebra is being taught in all Secondary Schools in Nigeria today. Understanding of algebraic representation is a prerequisite to further formal work in virtually all mathematically related subjects. The researcher is aware, from his teaching experiences; that algebra is difficult to comprehend. This difficulty might not be uncommended with the way it is being taught to students, poor instructional approaches employed by the teachers could be responsible for students' lack of interest, hence their poor performance in algebra.

The present study, however, is designed to find the influence of sex-differences and the use of problem solving approach in the teaching of algebraic word problem.

Methodology

Sample

Three hundred and six (306) Junior Secondary (JSS) III students were randomly selected for the study. They constituted one hundred and sixty (160) boys and one hundred and forty-six (146) girls drawn from six secondary schools in Zaria, Kaduna State of Nigeria. In each of the six schools used as sample, one class formed the control group while the other was used as the experimental group.

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Design and Procedure

A pilot study was undertaken prior to the main study. To ensure that content and face validating were properly taken care of the researcher gave five experts each of whom have had a minimum of ten years teaching experience with minimum qualifications of masters degree. Their comments and observations were fully integrated in the final draft.

The blue print constructed cause out with 30 items, which was systematically split into two parallel tests. To test for parallelism, analysis of variance was used. It was found that no significant differences exist between the scores of type A and type B ($X_A = 6.04$, $SD_A = 2.25$, $n_A = 100$, $X_B = 6.32$, $SD_B = 2.20$, $n_B = 98$).

The two sets of tests were administered to 100 students of St. Andrew's Seminary Secondary School, Zaria. The results of the pre-test were subjected to item analysis and from there, 25 items were used for both pre-test and post-test respectively. The discriminating power and difficult level ranged from 0.45 to 0.69 and this was considered satisfactory.

A pre-test was administered to the students and after 2 weeks, a post-test was administered to **the** same group and the coefficient of 0.81 was found to be significant. The essence of the exercise was **meant** to establish the evidence of equivalence of the pair of tests. After being assigned to each of **the** techniques, the students were first pre-tested. The pre-test served as a measure of the level of **students'** prior familiarity with the selected learning materials content on which the test was based.

Data Collection

The post-test was administered to all the twelve within three days. The researcher ensured he personally visited each school where he taught each experimental classes using problem solving - approach, while the other six control classes were also taught by the regular class teachers using expository approach. The experiment lasted eight weeks (of 4 periods a week). Each lasted for forty minutes.

Problem - Solving Approach

The problem-solving approach with the experimental classes was formulated on the basis of **the** work of Polya (1975) and is described below.

- (i) students read the problem once or twice or more to gain an understanding of the problem.
- (ii) After students have understood the problem, the teacher asks students what they are required for find out.
- (iii) Using letter to represent what the students are asked to find, the students translate the **verbal** sentence into mathematical equation.
- (iv) Having obtained the equation, the students solve the equations in the usual manner.
- (v) Students check the answer.

The students are taught to SEE, PLAN, DO AND CHECK

Expository Approach

The regular class teacher using expository approach presentation of ideas taught the control classes, or concepts were developed and evaluated. While main points were summarized at the end, students listened and took down notes. During the cause of the lesson, student's questions were not normally encouraged; and in cases where question arise they were usually intended for clarification of facts and information and not for further discussion. One or two problems were solved as example, and later, students were given problems to solve.

Data Analysis and Results

The data obtained from the investigation were subjected to parametric techniques of statistical analysis. Mean and Standard deviation of the scores of both experimental and control classes were

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calculated in order to determine whether significant differences existed between the means of the two groups. Results of the analysis of the data obtained for the study are presented in Tables 1-3 below.

Table 1: Summary of the Mean, Standard Deviation of Post-Test Scores According to Gender and Method.

	Problem Solving Approach Experimental		Expository Approach Control	
	M	F	M	F
Group 1	$\bar{X} = 14.32$ SD = 4.30 n = 28,	$X = 11.37$ SD = 4.56 n. = 27	$X = 11.12$ SD = 3.91 n. = 26	$X = 8.34$ SD = 3.62 n. = 23
Group 2	$X = 12.83$ SD = 4.37 n. = 28	$X = 9.98$ SD = 2.72 n. = 25	$X = 9.62$ SD = 2.90 n. = 24	$X = 6.34$ SD = 2.64 n. = 24
Group 3	$X = 10.27$ SD = 3.76 n. = 29	$\bar{x} = 10.02$ SD = 3.43 n. = 25	$X = 9.86$ SD = 2.64 n. = 26	$\bar{X}' = 5.67$ SD = 2.37 n. = 22

From Table 1 obtained the gender columns show that the performance of the students was not influenced by their gender, rather, it was influenced by the teaching approach. The boys and girls taught with problem solving approach did not differ much in performance. However, boys and girls in the control groups differed in performance. The boys taught with expository method performed significantly better than the girls taught with the same method (Boys 10.72, girls 6.34).

From Tables 2 and 3 the following interactions were significant at 0.05 levels.

Table 2: The Summary of 2-way? f ANOVA: Sex and Treatment

Source of Variation	SS	DF	MS	F	P
Main effect	1443.82	3	481.27	24.39	0.001*
Factor 1 (sex)	358.91	1	358.91	18.19	0.001
Factor 2(Teaching Approach)	71.03	1	71.03	3.60	0.056*
Interactions	975.25	3	325.08	16.48	0.001*
Sex	337.89	1	337.89	17.13	0.163
Explained	2419.08	6	403.18	20.43	0.001
Residual	5902.16	299	19.73		
Total	8321.69	305	305		

• Significant at 0.005

Table 2 reveals that there is a significant difference in the performance of the experimental and control groups in the post-test. The experimental group who were taught using problem-solving approach performed better than those in the control group taught by expository approach. Problem solving approach is also more effective than expository approach in teaching verbal problems to an average student. The translations of word problems into mathematical sentences or meaningful diagram constitute a great impediment to the students' performance. This could mean that the language as well as the

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underlying concepts of mathematics is not well coordinated to the students during the course of imparting knowledge. The significant difference was further subjected to Scheffe's method test to show the directed of significance (see Table 3).

Table 3: The Scheffe's Test for Students Performance According to Group and Sex

Comparison	F.Value	P-value
M. Vs F.	0.93	0.78 Ns
M. Vs F ₁	2.88	0.001*
M ₁ Vs F ₁	1.32	0.98Ns
M. M ₁ Vs F. F ₁	0.79	0.001*
M ₁ M ₂ Vs F ₂ F ₂	2.89	0.001*

*** Significant at 0.05**

From Table 3, the result shows that there was a significant difference in the post-test scores of the male and female students, hence the hypothesis was rejected. While the study examined if there are gender differences in the acquisition of algebra contents and abilities. The male students performed significantly better than the females irrespective of treatment in the algebraic word problem.

These findings support Becker (1947), Nitchelmore (1973) Obioma (1988), and Bolaji (1995), that male students are consistently superior in mathematics achievements test to their female counterparts.

A limitation of this study is that it was carried out in Zaria Education Zone of Kaduna State only and therefore does not permit generalization for the population of class students in Nigeria.

Discussion

One main observation, wen students were asked to translate verbal sentences into mathematical equations when the problems have phrases like:

.... 3 less than

... 5 times as old.....

.... 2 more than 3 times... was that many students encountered the greatest difficulty whenever any of the phrases were used in the tests. Having obtained the correct equation, most of the students were able to solve the equation partially apart from minor error in computations.

Based on the findings of this study, the following conclusions can be drawn:

- (a) On the whole students in the experimental group performed better than those in the control group. These findings are not surprising, since problem-solving approach is a stepwise procedure to make sure students understand the given problem. This approach allows the teacher-researcher to give necessary assistance such as explaining the meaning of difficult words or statements. The questioning technique involved in a problem solving approach ensure students understanding of the problem before proceeding to solve it.
- (b) It also revealed a significant difference in the performance between male and female students. Gender issue is still prominent in the mathematics achievements.
- (c) Although significant differences have been found between one group and another. It is noteworthy to point out that the performance was poor. It is necessary to find out the underlying factors responsible for the general poor performance of the students with regard to algebra teaching.

The researcher therefore, strongly recommends that more research work is needed on this field of problem solving approach in algebra and other topics in mathematics.

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References

Adeniyi, . E. (1987), "Sex Difference in Mathematics Performance, Possible Causes and Suggestions for Improvement". Paper presented at the International Conference on Mathematics and its Applications by the Nigerian Mathematical Society and the Mathematical Association of Nigeria. Held at Ahmadu Bello University, Zaria, Nigeria March 1 - 9.

Armstrong, J. M. (1986), "Achievement and Participation of Women in Mathematics: Results of Two National Surveys." *Journal of Research in Mathematics Education* 4(5) 356 - 372.

Becker, J. R. (1947), "Gender and Mathematics in the United States", in *Journal of Research in Mathematics Education* by Hanna, C. 3, 234-37, NCTM.

Beckmann, M. W. (1970), "Basic Competences - Twenty five years ago, Ten years ago and Now" *Mathematics Teacher* Feb. 71, 102-5.

Bolaji, C. (1985), "Strategies Used by Secondary Schools Students to Solve Word Problems". Paper presented during a workshop for Secondary School Teachers in Zaria, held at Educational Resource Centre, Zaria, Kaduna State.

Bolaji, C. (1995). Effects of Three Instrumental Approaches on Students' Achievement in Algebraic Word problems in JSS III^d. Unpublished Ph.D Dissertation. Ahmadu Bello University, Zaria, Nigeria.

Fannema, E and Carpenter, T. (1984) "Mathematics and the Sexes". In *NCTM Classroom Ideas From Research on Secondary School Mathematics* 45 - 52.

Fannema, E. and Sharman, J. A. (1984), "Sex Related Differences in Mathematics Achievement and Related Factors: A Further Study". *Journal for Research in Mathematics Education* 9(3) , 186 — 201.

Fannema, E. (1994) "Sex-Related Differences in Mathematics Achievement Where and Why" *Journal for Research in Mathematics Education* 5(6), 126-130.

Goldin, R. and Caldwell, E. (1990) "An Evaluation of Selected Aspects of a Tri-semester Algebra Problem", *Journal for Research in Mathematics Education*, 8(2), 142- 149.

Hansen, V. P. (1986). "Elementary Algebra Achievement in Relation to Teaching Method". *Mathematics Teacher*, March 69, 226-232.

Marshall, S. P. (1983) "Sex - Differences in Mathematical Errors an Analysis of Distracter Choices". *Mathematics Teacher* October 49, 14-19.

McLean, L. R. (1984). "Sex-Differences in Mathematical Ability: Fact or Artifact?" *Arithmetic Teacher* 13, 6-10.

Mitchelmore, M. C. (1973) "Performance in Modem Mathematics Curriculum". *West African Journal of Education*. 1, 84 - 85.

Obioma, G. O. (1988), "Some Predictors of Mathematics Differences in Junior secondary Schools" *Abacus, Journal of Mathematical Association of Nigeria* 18(1), 14-16.

Polya, G. (1977) *How to Solve It* ". New Jersey: Princeton University Press.

Swafford, J. D. (1996) "Sex-Differences in First year Algebra". *Journal for Research in Mathematics Education* 11(4), 125 - 146.