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EFFECT OF GENDER-RELATED DIFFERENCES IN ACADEMIC ACHIEVEMENT AND RETENTION OF SENIOR SECONDARY SCHOOL STUDENTS TAUGHT GEOMETRY USING PROBLEM SOLVING APPROACH

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ABSTRACT: This study investigates the effect of gender related differences on Geometry Achievement and retention of senior secondary school students. A pretest-posttest experimental control group research design was used. A total of 70 SS3 students were selected from about 9,540 students of Jigawa state using stratified random sampling techniques. Both male and female group were treated using problem solving approach. The instruments used for data collection were Researchers Made Test (RMT), Geometry Achievement Test (GAT) and Geometry Retention-Test (GRT). Data collected were analyzed using t-test statistic. Finding statistically showed the existence of significant difference between male and female students' performance in Geometry Achievement Test, while there is no significant difference in male and female performance in Geometry Retention-Test. Based on the findings, Mathematics Teachers are encouraged to use problem solving approach (polya model) in teaching Mathematics.

Key Words: Gender related difference, achievement, retention, geometry, secondary school

INTRODUCTION

The role of Mathematics in the scientific, technological and economic development of any nation can never be overemphasized. It is based on this notion that Adetula (1988) identified Mathematics as the key to National development. This view is also supported by Ibrahim (1998) who states that if any nation wants to achieve scientific and technological development, Mathematics should be properly taught to prepare the minds of students toward scientific and technological reasoning.

However, the perpetual global Scientific and Technological development and extraordinary world population growth rate continue to throw a challenge to Mathematics educators and researchers to come up with most effective and suitable method of teaching Mathematics at all levels of education, so that, Millennium Development Goals of Education For All (EFA) and promoting gender parity could be achieved (MDGs 1990). In Nigeria, 2006 census figures indicated that females outnumbered males in the country (NPC, 2006). As such, all concerted efforts have to be made to encourage female to acquire more knowledge as their male counterparts. It is for this view that Fennema in Adetula (1988) stresses the need to continue research that documents the status of gender differences as they exist in Mathematics education. In response to this call, attempts were made by various scholars to justify stereotype about female inferiority or otherwise in learning of Mathematics.

Literature in and outside Nigeria shows that male students performed significantly better than their female counterpart in secondary school Mathematics (Abbas, 2008 ; Batista, 1990 and Cassey, Nuttail & Pezaris, 2001). Even though, Adeleke (2007) argue that, the difference in performance occurred only in higher order knowledge. In the same course Manger (1996) investigated the relationship between gender and mathematical achievement with Norwegian 3rd graders in Numeracy, Fraction and geometry. He found that male score more than female even though the difference was small. On the other hand Mulli (1998) and Awang & Noor (nd) found that

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females significantly scored higher than males in the overall average achievement in Mathematics. These parallel results indicated that, the issue of gender factor on cognitive achievement in Mathematics seems inconclusive.

Lassa (1986); Kajuru (1995) and West African Chief Examiners report (WAEC, 2010) have separately claimed that the performance of students in geometry is lower than in other aspect of Mathematics. Scholars have attributed this difficulty in learning geometry to various factors. Kajuru (1995) explain that, the reason for this difficulty may be due to lack of proper link between geometry and numerous applications as it relates directly to the learners such as building, engineering and architecture. But Inekwe and Hassan (2002) related the problem to the problem of semantic use of geometric concepts. While in a meta-analysis that covers more than 100 countries Nicole, Marcia and Janet (2010) found that, the quality of instruction and curriculum affect children's Mathematics learning. They added that female is likely to perform as well as male when they are encouraged to succeed.

Records show that, in Nigeria the prevailing method of Mathematics instruction among secondary school Mathematics teachers are expository lecture method (Adetula, 1988). He further commented that, yet the method doesn't yield the desired result. Nevertheless, in search for qualitative and viable approach of Mathematics instruction, researchers advocated for the use of problem solving approach (Obodo, 1997; Bolaji, 1999 and National Council of Teachers of Mathematics, 2000). They individually argued that, the approach not only engages students in thinking, exploring and actively doing Mathematics, it also helps the learners to retain Mathematics knowledge for longer period. Due to the role of retention in learning process, Davis (1979) maintained that, if the learner cannot retain the effects of previous learning experiences, there could be no progress from one practice period to another.

Hence, it is the focus of this study to ascertain whether problem solving approach can bridge the gap between male and female mean achievement and retention of geometry concepts (assumed difficult topic). Consequently the following research questions are generated.

- i. What is the nature of the difference between the mean scores of male and female achievement when taught geometry using problem solving approach?
- ii. Is there any significant difference between the mean scores of male and female students in geometry retention test when taught using problem solving approach?

To answer the above questions, the following null hypotheses were formulated for testing:

HO₁: There is no significant difference in male and female students mean score in geometry Achievement test when taught using problem solving approach.

HO₂: There is no significant difference in male and female mean scores in geometry retention-test-when taught using problem solving approach.

METHODOLOGY

The research design adopted for this study was pre-test post-test experimental control group design. The population of this study was all year 3 Senior Secondary school students in Jigawa state government owned schools. Thus, the total population of this is 9,540 from 42 senior secondary schools. A sample of 70 students comprising of 35 male and 35 female were selected from one male and one female using stratified and "drawing from the hat" random sampling techniques in line with (Akuizulo, 1993)

In this study the experimental group was taught geometry using problem solving approach (Polya, 1962) model by the researcher. While the control group was treated the same topics using traditional method by a trained colleague, whose qualification and experience are equivalent to that of the researcher, in order to control teacher factor variable. For the two groups the teaching lasted for six weeks. Three instruments were used for data collection in this study. Researcher made test (RMT) was used as pre-test to determine the entry level of the subjects. Geometry Achievement Test (GAT) was used to measure the students Geometry Achievement Test. While Geometry Retention Test (GRT) items were generated by shuffling and rotating GAT items, and were used to measure geometry retention level which was conducted two weeks after administration of post-test.

The GAT and GRT consist of 20 multiple choice geometry questions sorted and adapted from WAEC past question papers. And they cover essential geometry topics in senior secondary school Mathematics curriculum. The reliability coefficients of GAT and GRT for this study were obtained to be 0.67 and 0.66 respectively using K-R-21 Kuder-Richardson formula. Three experienced degree- holders' secondary Mathematics teachers validated the items and their inputs were incorporated.

Scores from the instruments were collected and statistically analyzed using t-test statistic at 0.05 level of significant.

RESULTS

Table 1: Performance of the Experimental and the Control Groups in Pre-test.

GROUP	N	X	Sd	Df	T _{cal}	T _{crit}	P	Remark
MALE	35	37	12.6					
FEMALE	35	35.4	12.6	68	0.88	1.96	0.38	NS

Not significant at $P > 0.05$

From Table 1: p-value = 0.38 which is greater than 0.05. This implies that there is no significant difference between male and female in their pretest scores. This also means that, the two groups could be assumed to have equivalent prior knowledge on geometry at the point the investigation commenced

HO₁: There is no significant difference between male and female student mean scores in Geometry Achievement Test when taught using problem solving approach.

Table 2: Comparisons between males' and females' mean scores in geometry achievement test (GAT)

Group	N	X̄	Sd	df	T _{cal}	T _{crit}	P	Remarks
Male	35	63	15					
Female	35	49	13.2	68	4.12	1.98	0.01	S

Significant at $P \leq 0.05$

The result from table 2 shows a p-value 0.01 which is less than p of significant level. This shows that, there was significant difference between males' and females' performance in the post-test. Moreover, the calculated t-value of 4.12 which is greater than critical value of t which is 1.98 with $df = 68$ at $p \leq 0.05$. Thus the null hypothesis is rejected. This implied that the approach favoured male.

HO₂: There is no significant difference between males and females mean scores in geometry retention test (post-post test) when taught using problem solving approach.

Table 3: Comparison Between Males' And Female's In Geometry Retention Test (GRT)

Group	N	X̄	Sd	df	T _{cal}	T _{crit}	P	Remarks
Male	35	57.3	12.5					
Female	35	51.4	13.4	68	1.9	1.98	0.06	NS

Not significant at $P > 0.05$

The result from table 3 revealed a p-value of 0.06 which is greater than p of significant level; this shows that, there is no significant difference in the performance of female and male taught geometry using problem solving approach in retention test. Moreover, the obtained t-value is 1.9 which is less than the $t_{critical}$ value 1.98 with $df = 68$ at $P \leq 0.05$ level of significance. Thus null hypothesis is therefore accepted.

DISCUSSION OF THE RESULT

The results in table 2 shows that, there was significant difference between the performance of male and female with respective mean scores of 63% and 49% respectively. However the mean score of 49% is appreciable in normal scores. The implication of this result is that, problem solving approach tends to promote homogeneity of male and female performances. The findings of Abbas (2008), Batista (1990) and Casey et al (2001) are consistent with the findings of this study. Possible explanation, could be due to the fact that problem solving approach makes female to participate, interact, collaborate more than when treated through traditional approach, yet the method favoured males in terms of geometry achievement.

Table 3 shows that, the difference in performance of male and female in the retention test is not significant with p-value 0.06 at $P \leq 0.05$ significant level. This shows that the method tends to bridge the wide gap that exists between male and female performances in Mathematics.

The findings agrees with that of Awang & Noor (nd) and Mulli (1998) who discovered that problem solving approach is not sensitive to gender difference. On the other hand it disagrees with the findings of Fennema & Sharma (1978) and Bolaji (1999) that confirmed the existence of gender difference in learners' cognitive

performance. This will probably be as result of latent feature of problem solving approach; where the concept learnt are not allowed to be forgotten through use and over-use of the concepts in solving a given problem. Moreover, in respect of sex, students are motivated and compelled to participate fully in the process of learning. Hence, the more the female participate in learning process the better in retaining the concept learnt.

CONCLUSION

This study has shown that Problem Solving Approach (Polya model) can be used to bridge the gap between male and female performance in geometry achievement and retention.

RECOMMENDATIONS

From the findings of this study, the following recommendations were made.

1. Mathematics teachers should be trained and encourage to incorporate the use of problem solving approach in their lessons.
2. Professional bodies like Mathematics Association of Nigeria (MAN), Science Teachers Association of Nigerian (STAN) should put more effort in organizing workshops and conferences to teach Mathematics teachers on how to employ problem solving approach effectively.
3. Mathematics educators and curriculum developers should also encourage the production of text books and teachers guide; to aid and facilitate teaching and learning through the problem solving approach.

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