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Effect of Oyedeji Problem-Solving Model on Nigerian Secondary School Students' Achievement and Retention in Further Mathematics

By

Adebola S. Ifamuyiwa

Abstract
This study, which adopted pre-test, post-test, control group quasi-experiment design involving a 2 x 2 factorial matrix, investigated the effect of Oyedeji Problem-Solving Model on Nigerian secondary school students' achievement and retention in Further Mathematics. The moderating effect of gender was also investigated. Eighty senior secondary two (SS2) students from two purposely selected schools participated in the study. The three instruments developed, validated and used to collect data for the purpose of testing the six null hypotheses formulated in the study are; Further Mathematics Achievement Test (FMAT) (r = 0.76), Student Retention Test (r = 0.75) and Teachers' Instructional Guide. Data collected were analyzed using analysis of covariance (ANCOVA) at the .05 level of significance. Findings showed that problem-solving model, as a strategy, recorded significant effect on the students' achievement and retention in Further Mathematics. This showed that problem-solving modelis more effective in enhancing students' achievement and retention in Further Mathematics than the conventional teaching method. Thus, Mathematics and Further Mathematics teachers are advised to use Oyedeji problem-solving model to teach Mathematics and Further Mathematics in schools.

Keywords: Oyedeji Problem-Solving Model, Gender, Achievement and Retention in Further Mathematics

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Introduction and Literature Review

The need to acquire knowledge in Mathematics in the world over has become very obvious. This is because of its usefulness in everyday living and in various disciplines. This explains in part why Mathematics was made a compulsory subject both at primary and secondary school levels in Nigeria. Its usefulness in technological development of all nations as well as to mankind is no longer news at conferences, workshops and different academic forum (Azuka, 2003; Badru, 2017; Ifamuyiwa, 2007; Imoko, 2004 and Uloko, 2006). As important as the subject is, the tremendous and persistent failures of Nigerian students in Further Mathematics has remained a major threat to its learning (Abakpa & Agbo-Egwu, 2008; Ifamuyiwa, 2000 and Sanni & Ochepa, 2002). The failure rate in Mathematics and Further Mathematics is so high that Nigeria was found to occupy the second to the last position when compared with the eleven other English speaking West African countries in the West Africa Senior Certificate Examination (WASSCE) (Abakpa & Agbo-Egwu, 2008).

This study is against the backdrops of increased annual high percentage of students in Nigeria that fail Mathematics and Further Mathematics examinations conducted by the West Africa Examination Council (WAEC) and the inability of prospective undergraduates to gain admission to tertiary institutions due to poor marks scored in Mathematics at the Universities Matriculation Examination (UME). This is in addition to the question of what learners find easy or difficult to retain (in terms of meaningfulness of materials) after Further Mathematics instruction. According to Mayer (2003), certain materials are better remembered than others. He submitted that meaningful materials stand a better chance of being remembered than non-meaningful materials and that since understanding comes from meaning, things that are understood are better retained and recalled than things that are not meaningful. Thus, for the content and concepts of a subject to be retained and recalled, there is need to make the subject meaningful to the students by presenting it in a meaningful way using appropriate instructional strategies.

Attempt at finding solution to the incessant students' failure in Mathematics have led researchers in Mathematics education to consider a number of factors. One of such factors is inappropriate method or approach to teaching. According to Azuka (2003), the problem of effective teaching and learning Mathematics and Further Mathematics in Nigeria Secondary Schools have eaten deep to the very foundation of the nation's technological growth and need urgent surgical operation. The current state of malaise in these two subjects has to be discontinued: otherwise, the nation's technological development would be greatly impeded.An important question to ask at this juncture is: how would the nation be able to realize her vision of economic and technological development, if the present situation with performance in

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Mathematics and Further Mathematics is not improved upon? The answer lies in the preparation and production of man power with sound mathematical background at the secondary school level. The situation in Nigeria todayis still the opposite of the probable answer. Badru (2017) reported that low achievement in Mathematics is caused by the teachers' over-dependence on inappropriate approaches to teaching Mathematics with seemingly lack of basic mathematics principle that result in rote-learning and consequently low achievement in Mathematics and Further Mathematics.

Findings from Kehinde (2014) showed that students do not know how to interpret problems that involve pictures, stories and which required students' creativity. Consequently, many approaches to teaching were introduced so that teaching would focus more on the students and one of such is the use of problem-solving models as instructional strategy through which students learn how to find solution(s) to mathematical problems systematically and logically. Educators do not only focus on what to teach the students but also to teach them how to learn and think. As a matter of fact, the experiences acquired in solving the problems in Mathematics is very important to develop students' thinking skills and help them gain more skills in solving other problems in daily life (Chapman, 2005 & Ifamuyiwa, 2007). According to Awodeyi and Udo (2017), to achieve success in learning Mathematics, students should be given the opportunity to communicate mathematically, reason mathematically, and develop self-confidence to solve Mathematics questions. One of the ways this can be achieved is through the use of problem-solving skills.

Problem-solving includes integration of concepts and skills to get over the unusual complete situations (Ogunyemi, 2010) and trial by error. Solving a problem means to find or create new solutions for the problem; or to apply new rules to be learned (Schommer-Aikins, Duell & Hutter, 2005). Problem-solving according to (Ogunyemi, 2010) involves systematic application of acquired knowledge to overcome any obstacle perceived by an individual as a problem. Problem-solving refers to the efforts needed in achieving a goal or finding a solution when no automatic solution is available. Hence, problem-solving could be seen as the ability to use acquired knowledge to find solutions to identified problems by carrying out sets of action. A problem solver needs to make use of the relevant information, carry out some sets of actions and logically think out the solution to the problem. The knowledge and information one possesses coupled with appropriate strategy and conscious management are important in problem-solving. Problem-solving model (when used) as an instructional strategy thus enables the student to be active participant in the teaching learning process, where he thinks out solution to problems by himself while he is assisted by the teacher who only guides by giving hints or suggestion as the need arises. Thus, a student using problem-solving strategy develops the ability to discover the required knowledge by himself through trial and error method. By this, a student understands the nature of the problem and applies his knowledge to solve other problems. Problem-solving,when used as instructional strategy, presents a constructivist classroom that provides students with the opportunity to explore, speculate and brainstorm in an emotionally supportive atmosphere where they engage in activities and participate in discussions towards obtaining solutions to given problems.

An exemplified student-centered teaching strategy where the description above is practically embraced is the use of problem-solving model also specifically referred to as heuristics. Heuristics describes the stages or the sequences of steps used in problem-solving that allows students to fully exploit their resident knowledge and skills cum available information to solve the problem at hand. It provides opportunity for students to determine, challenge or add to existing beliefs and understanding. For the purpose of this study, the researcher identified and used Oyedeji problem-solving model as instructional strategy (Oyedeji, 1997). Problem-solving is considered as the heart of Mathematics learning because the skill is not only for learning the subject but also for possible development of thinking skills and method, a special hallmark of Oyedeji problem-solving model. The model identified and suggested six heuristics steps as problem-solving instructional strategy (PSIS). The steps/stages are:

Step I Presentation of the problem
Step II Questioningto assess students' understandingof the problem
Step III Identifying the prerequisite skills needed to solve the problem (by teacher and students)
Step IV Solving the problem using the identified prerequisite skills (supplied by students)
Step V Stating rules arising from the solution to the problem
Step VI Students copying the solutions in their note books

The phases of problem-solving, when used as instructional strategy, identified by other researchers and educators are by no means different from those stated above. The major difference is in the number of steps and style of application. Polya for instance identified four linear problem-solving stages; West suggested three cyclic phasesof problem-solving while both Osborne Parnesand Gallagher et al. identified six linear problem-solving stages (Kehinde, 2014). Students with problem-solving skills can apply their knowledge in daily life since the processes of solving mathematical problem are similar to the general problem-solving (Schommer-Aikins, Duell, & Hutter, 2005).

In the past few decades, research has repeatedly reported gender differences in Mathematics performance on a number of standardized Mathematics tests such as the Scholastic Assessment Test Mathematics (SAT-M) (Badru 2017; Gallagher & DeLisi, 1994; Halpern, 2000; Keller, 2002; Royer, Tronsky, Chan, Jackson & Marchant, 1999). The results from these studies are however not consistent: some found that males generally outperformed females on mathematical tasks (Halpern, 2000 & Keller, 2002); some showed different shades of gender differences with respect to type of mathematical tasks (Voyer, Voyer & Bryden, 1995). Gallagher & DeLisi (1994) reported small or null gender difference in Mathematics performance on these tests. Gallagher & Kaufman (2005) even argued that the link between gender and Mathematics performance was very weak. Pajares (1996) found that gifted girls outperformed gifted boys in mathematical problem solving. Therefore, to find gender differences in mathematical problem-solving patterns if any, and to investigate these patterns from the perspective of instructional strategy with possible link to educational practice which may have significant consequences for Mathematics teachers and educators needs further investigation, especially in Further Mathematics. This is the reason for the inclusion of gender in this study. Moreover, the teaching of Mathematics is not just about dispensing rules, definitions and procedures for students to memorize, but that of engaging them as active participants through discussion and collaboration among themselves (Royer & Garofoli, 2005). Learning will be more successful if students are given the opportunity to analyze and clarify ideas irrespective of their gender.

Statement of the Problem

Students, parents, educators, government and the populace are worried because of the poor achievement of students in Mathematics and Further-Mathematics. Evidence shows that this condition is deplorably high, to the point that Nigeria students now compete for the last position instead of first in Mathematics in School Certificate Examination among the eleven English-speaking West African Countries. Also there is evidence to lend support to the fact that this poor achievement and retention is as a result of non-utilization of appropriate teaching strategies. Despite the application of different problem-solving strategy (PSS) in many school subjects, there is dearth of research on the use of PSS for teaching and learning Further Mathematics in Nigerian secondary schools. Therefore, this study provides empirical evidence on the effect of Oyedeji problem-solving model when used as instructional strategy (OPSS) on secondary school students' achievement and retention in Further Mathematics as well as the moderating effect of gender.

Hypotheses

The following hypotheses were formulated and tested in the study:

i. There is no significant main effect of treatment (OPSS) on the students' achievement in Further Mathematics.
ii. There is no significant main effect of gender on the students' achievement in Further Mathematics.
iii. There is no significant interaction effect of treatment and gender on the students' achievement in Further Mathematics.
iv. There no significant main effect of treatment on the students' retention of Further Mathematics contents.
v. There is no significant main effect of gender on the students' retention of Further Mathematics contents.
vi. There is no significant interaction effect of treatment and gender on the students' retention of Further Mathematics contents.

Methodology

Research Design

The study adopted the pre-test, post-test, control group quasi-experimental design involving a 2x2 factorial matrix.

In the study, treatment was done at two levels (OPSS and conventional method) while gender occurs at two levels (male and female).

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Target Population

The target population for this study comprised all the senior secondary school two (SS2) students offering Further Mathematics in Ogun State, Nigeria.

Sample and Sampling Procedure

In all, eighty SS2 students (made up of 40 boys and 40 girls) participated in the study. Two co-educational senior secondary schools that have been presenting students for school certificate examinations in Further Mathematics in the last five years were purposively selected from Ijebu Division of Ogun State. This is to ensure that the experimental treatment is properly administered and monitored by the researcher whose place of work was within the division. Stratified sampling technique was used to select 20 boys and 20 girls from the population of SS2 Further Mathematics students in each of the two selected schools. Simple random sampling technique was used to assign the schools to the experimental group and control group. The school used as the experimental group was monitored by the researcher to ensure that the treatment was properly and effectively administered. Students in the control group were taught using conventional method while those in the experimental group were taught using Oyedeji Problem-Solving Model as instructional Strategy (OPSS).

Instruments

Three research instruments, namely: Teacher's Instructional Guide (TIG), Further Mathematics Achievement Test (FMAT) and Student Retention Test (SRT)were used for data administration and collection.

Teacher's Instructional Guide (TIG)

The TIG is an operational guide used as procedural instrument for the experimental group. The TIG consists of the activities, behaviours and specific instructions guiding the teacher who instructed and supervised students in the experimental class. The students in the control class were instructed using the conventional method of the Further Mathematics teacher in the school for teaching the subject. The problem-solving teaching guide was developed by the researcher based on the six heuristics in Oyedeji problem-solving model and was used for the administration of instruction in the experimental class.Two experienced Further Mathematics teachers subjected the developed TIG to expert scrutiny. The experts adjudged the TIG adequate and useful for the study.

Further Mathematics Achievement Test (FMAT)

This refers to a set of 10-item Further Mathematics theory test. The FMAT was designed, constructed and validated by the researchers to measure student's achievement in Further Mathematics on the contents covered during instruction. The test covered two major topics selected from the SS2 Further Mathematics curriculum. FMAT was constructed following the due process of test construction. The draft of the developed FMAT, containing 16 items initially, was presented to three Mathematics education experts for scrutiny, criticism and comments towards ensuring its face and content validity. The perusal and suggestions of the experts led to the removal of 6 items, thus leaving 10 items on the FMAT. A test-retest technique was used to determine the reliability of the 10-item FMAT. The tests were administered on a sample of 39 SS2 students with similar characteristics (age, sex and class) to the students used as samples (but not the participants), two times within three weeks interval. A reliability coefficient of 0.87 was obtained. The FMAT was administered on the students to obtain pre-test and post-test scores.

Student Retention Test (SRT)

Students' retention in Further Mathematics was measured with the use of SRT. The instrument was divided into two sections. The first section sought data on the student's bio-data (age, class and sex) while the second section contained 10-item Further Mathematics theory test. The SRT was constructed and validated by the researcher to measure students' retention of Further Mathematics contents. The SRT covered the two topics selected from the SS2 Further Mathematics curriculum that was taught during the treatment period. Like the FMAT, the draft of the SRT was also subjected to experts' scrutiny, criticism and comments towards ensuring its face and content validity. A test-retest technique was used to determine the reliability of the SRT, yielding a reliability coefficient of 0.79 from its administration on a sample of 39 SSII students with similar characteristics (age, sex and class) to the students used as samples twice within three weeks interval.

Data Collection Procedure

The treatment period commenced with a week's training of the two cooperating Further Mathematics teachers in the selected schools. During the training, the cooperating teachers were taught how to use the instructional guide for the experimental group and the control group as well as how to create the right environment for the use of OPSS and the use of the conventional teaching method in the control group. The researcher was present to monitor the administration of instructions in the two groups.

This was followed by pre-test activity where in students in the experimental and control classes were exposed to FMAT. This was done at the beginning of week 2.

The actual treatment took 6 weeks in each of the selected schools during which the two contents, Binary Operations and Partial Fraction, were taught by the cooperating teachers in the two classes (experimental and control). During the six weeks of teaching, students in the experimental class were taught using Oyedeji problem-solving model as instructional strategy while those in the control class were taught using conventional teaching method. The cooperating teachers were closely monitored by the researcher to avoid deviation from the use of the teacher's guide for the experimental group and the control throughout the treatment period.

At the end of the treatment period, all the students in the experimental and control classes were exposed to the achievement test (FMAT) as post-test. The FMAT administered on the students as post-test was a reshuffled FMAT administered as pre-test at the beginning of the experiment. Post experimental phase involved scoring the students' response to the FMAT to generate both pre-test and post-test scores to serve as achievement in Further Mathematics.

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Thereafter, specifically two weeks after the post-test was conducted, the researcher administered the SRT (as delayed post-test) on the students in the selected schools. The test was used to determine the retention capacity of the students, especially of Further Mathematics contents.

Procedure for Data Analysis

The six hypotheses formulated in this study were tested using the analysis of covariance (ANCOVA)test with pre-test scores serving as covariates. ANCOVA was used to enable the researcher test the hypotheses on interaction effects while the independent *t*-test was used to compute the magnitudes of the mean achievement and retention scores and for comparison of the two groups (treatment and gender) where significant difference was obtained. All the tests were computed at the 0.05 level of significance using version 20 SPSS package.

RESULTS

Hypothesis 1: There is no significant main effect of treatment (OPSS) on the students' achievement in Further Mathematics.

The result of the ANCOVA test in table 1 shows significant outcome of main effect of Oyedeji Problem-Solving Strategy on the students' achievement scores in Further Mathematics ($F_{(1, 75)} = 125.081$, $p < 0.05$). This outcome implies that the post-test mean achievement scores of the students exposed to the experimental and control treatments are significantly different. Hence, the null hypothesis one is rejected. The result of the independent *t*-test of significance in table 2 shows the magnitude of the post-test mean achievement scores of the students exposed to the experimental and control treatment.

Table 1: Summary of Analysis of Covariance of Students' Achievement Scores in Further Mathematics by Treatment and Gender

Source of variation	Sum of Squares	df	Mean Square	F	Sig. F
Intercept	5 041.330	1	5 041.330	72.233	0.000
Covariates (pre-test)	47.737	1	47.737	0.685	0.411
Main Effects					
Treatment (strategy)	8 729.764	1	8 729.764	125.081	0.000*
Gender	13.127	1	13.127	0.188	0.666
2-way Interaction					
Treatment x Gender	2.477	1	2.477	0.035	0.356
Explained	10 536.924	4	2 634.231	37.744	
Residual	5 234.463	75	69.793		
Total	15 771.387	79			

* Indicates significant F at $p < 0.05$ R squared = 0.668 (Adjusted R squared = 0.650)

Table 2: Difference in the Post-Test Achievement Scores of Students Exposed to the DifferentTreatment Conditions

Treatment Group	N	Mean	S.D	Error	df	*t*	Sig.t
Experimental (OPSS)	40	27.85	11.39	1.80	78	12.403	0.000*

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Control (conventional)	40	4.98	2.47	0.39			

Table 3: Gender Difference in the Students' Post-Test Achievement Scores in Further Mathematics

Gender	N	Mean	S.D	Error	df	*t*	Sig.t
Male	40	16.93	14.87	2.35	78	0.323	12.403
Female	40	15.90	18.50	2.13			

The result in table 2 shows the magnitudes of the post-test mean achievement scores of the students exposed to the two treatment conditions. With a post-test mean achievement score of 27.85, the students exposed to OPSS outperformed their counterparts exposed to conventional method whose post-test mean achievement score was 4.98. The outcome thus shows that OPSS had the greater potency at improving students' achievement in Further Mathematics. The result in table 1 further revealed that the independent and moderator variables jointly accounted for 66.8% of the variance in the students' post-test achievement scores.

Hypothesis 2: There is no significant main effect of gender on the students' achievement in Further Mathematics.

The result in table 1 shows no significant main effect of gender ($F_{(1, 75)} = 0.188$, $p > 0.05$) on the students' achievement scores in Further Mathematics. This outcome implies that the post-test mean achievement scores of male and female students exposed to the treatment conditions are not significantly different. As a result, the null hypothesis two is retained. The magnitude of the post-test mean achievement scores of the students according to gender is shownin table 3 by the summary of the independent *t*-test of significance on gender.
The result of the *t*-test in table 3 shows that the boys with post-test mean score of 16.93 performed better thanthe girls with post-test achievement score of 15.90. However, the difference in the obtained post-test mean achievement scores according to gender is not statistically significant. Hence, there appears to be no significant gender difference in the performance of boys and girls in Further Mathematics.

Hypothesis 3: There is no significant interaction effect of treatment and gender on the students' achievement in Further Mathematics.

The result of the 2-way interaction effect in table 1 shows no significant interaction effect of treatment and gender on the students' post-test achievement scores ($F_{(1, 75)} = 0.035$, $p > 0.05$).
This outcome shows that students' achievement in Further Mathematics do not vary significantly between the male and female participants after exposure to the experimental and control treatment. Hence, the null hypothesis three is retained. Thus, there is no significant interaction effect of treatment and gender on the students' achievement in Further Mathematics.

Hypothesis 4: There no significant main effect of treatment on the students' retention of Further Mathematics contents.

The result in table 4 shows significant main effect of Oyedeji problem solving strategy on the students' retention scores in Further Mathematics ($F_{(1, 75)} = 196.345$), $p < 0.005$). This shows that the mean retention scores of the students exposed to OPSS differed significantly from the mean retention scores of the students exposed to the conventional method. As a result, the null hypothesis four is rejected. The magnitude of the mean delayed test of the students exposed to the experimental and control treatment is presented in the summary of the independent *t*-test of significance in table 5.

Table 4: Summary of Analysis of Covariance of Students'Scoresin Retention of Further Mathematics Contents by Treatment and Gender

Source of variation	Sum of Squares	df	Mean Square	F	Sig. F
Intercept	4 023.775	1	4 023.775	89.663	0.000
Covariates (pre-test)	9.627	1	9.627	0.214	0.000
Main Effects					
Treatment (strategy)	8822.234	1	8822.234	196.345	0.000*
Gender	55.569	1	55.569	1.237	0.270
2-way Interaction					
Treatment x Gender	89.415	1	89.415	1.990	0.162
Explained	10 446.064	4	2 611.516	58.121	
Residual	3 369.923	75	44.932		
Total	13815.987	79			

* Indicates significant F at $p < 0.05$ R squared = 0.756 (Adjusted R squared = 0.743)

Table 5: Difference in the Delayed Test Achievement Scores of Students Exposed to Different Treatment Conditions

Treatment Group	N	Mean	S.D	Error	df	*t*	Sig.t
Experimental	40	22.45	9.32	1.48	78	15.008	0.000
Control	40	2.78	1.59	0.25			

Table 6: Gender Difference in the Students' Retention Scores in Further Mathematics

Gender	N	Mean	S.D	Error	df	*t*	Sig.t
Male	40	15.00	14.32	2.26	78	0.598	0.552
Female	40	13.23	12.13	1.91			

The result in table 5 shows that the students exposed to OPSS, with mean retention score of 25.45 performed better than the students exposed to conventional method whose mean retention score is 8.78. This outcome shows that OPSS as aninstructional strategy is more effective in sustaining the retention of Further Mathematics contents than the conventional method. The result in table 4 further shows that the independent and moderator variables jointly accounted for 75.6% of the variance in the students' retention scores.

Hypothesis 5: There is no significant main effect of gender on the students' retention scores of Further Mathematics contents.

The result in table 4 shows no significant main effect of gender ($F_{(1, 75)} = 1.237$, $p > 0.05$) on the students' retention scores in Further Mathematics. This outcome shows that there is no significant difference in the retention scores of the male and female students exposed to the two treatment conditions. As a result, the null hypothesis five is retained. The result of the independent *t*-test of significance in table 6 presents the magnitudes of the delayed test achievement scores of the male and female students exposed to the experimental and control treatment.

The result in table 6 revealed the magnitude of the delayed test mean achievement scores of the male and female students in Further Mathematics. With a mean score of 15.00, the male students recorded better mean retention score than the female students whose mean retention score was 13.23. However, the difference between the mean retention scores of the male and female students in Further Mathematics is not statistically significant. Thus, there is no significant main effect of gender on the students' retention scores in Further Mathematics.

Hypothesis 6: There is no significant interaction effect of treatment and gender on the students' retention of Further Mathematics contents.

The result of the 2-way interaction effect in table 4 shows no significant interaction effect of treatment and gender on the students' retention scores ($F_{(1, 75)} = 1.99$, $p > 0.05$). This outcome shows that students' retention in Further Mathematicsdo not vary significantly between the male and female participants after exposure to OPSS and conventional method. By the outcome, the null hypothesis six is retained. Thus, there is no significant interaction effect of treatment and gender on the students' retention of Further Mathematics contents.

Discussion of Findings

The finding that Oyedeji problem model when used as instructional strategy has the potency of improving students' achievement in Further Mathematics than the conventional method provides empirical support to some earlier findings which established that problem-solving strategies are associated with high degree of successes in school subjects (Kehinde, 2014; Mahir, 2009 & Ogunyemi, 2010). The finding here also supported the view of Akinlaye (1998) that the teaching method employed by a teacher reflects on students' understanding of the subject; and Ajelabi

(1998), who reported that the teaching method adopted by the teacher in order to promote learning is of topmost importance to enhance the academic performance of learner. In addition, as reported by Ogunyemi (2010), this finding has confirmed that problem-solving strategies are learner-centered and are capable of making remarkable impact on instructional practices. Likewise, the finding that the main effect of treatment on the students' retention scores in Further Mathematics is significant gave credence to Mayer's (2003) assertion that meaningful materials are better understood and remembered than non-meaningful materials; and since understanding comes from meaningfulness, things that are understood are better retained and recalled than things that are non-meaningful. Thus, OPSS as a student-centered approach was found to be more effective in this study because of its creative nature which gives students in the experimental class the opportunity to brainstorm (a problem-solving technique) in its simplest from to identify goals, gather data, clarify problems, generate ideas, select solutions and plan for actions as they went through each of the topics treated in the study. More so, the strategy was easier for the students to comprehend and use than the conventional method of instruction.

The findings that the main effect of gender on the students' achievement and retention scores in this study was not significant is at variance with the findings of Royer, Tronsky, Chan, Jackson & Marchant (1999) and Keller (2002)which reported significant relationship between gender and Mathematics performances on a number of standardized Mathematics Test. The finding however corroborated the findings of Ifamuyiwa (2007) and Kehinde (2014) that there seems to be a very small or null gender difference in Mathematics performance on achievement in Mathematics. The non-significant main effect of gender in this study cannot be said to be unconnected with the problem-solving model used, the OPSS, which does not discriminate among male and female students when used as instructional strategy.

The non-significant interaction effect of treatment and gender in this study has shown that the effect of gender is not significant enough to affect students' achievement and retention in Further Mathematics irrespective of the instructional strategy used. This particular finding is attributed to the nature of the strategy (OPSS) used. This includes the stage-wise arrangement of the strategy, the orderliness of the stages, the simplicity in theadaptability of the stages to the topics learnt as well as the use of brainstorming technique used in the course of data collection. Thus, the presentation of instruction using OPSS enhances understanding while ensuring gender equality during the teaching-learning process.

Conclusion

This study was carried out to determine the effect of Oyedeji Problem-Solving Strategy on Secondary School Students' achievement and retention in Further Mathematics in Ijebu-Ode Local Government Area, Ogun State. The interaction effect of gender was also investigated. The study discovered that students taughtusing OPSS recorded better and significant post-achievement and retention scores than those taught using conventional method. The study however found no significant difference between the achievement and retention scores of male and female students in Further Mathematics when OPSS was used as strategy of instruction. This implied that Oyedeji Problem-Solving Model has proved that it is capable of removing gender inequality in students' performance in Further Mathematics, if properly used.

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Hence, Oyedeji Problem-Solving Model is hereby recommended for Further Mathematics and Mathematics teachers to use as instructional strategy during the teaching and learning process to promote problem-solving skills and activity among secondary school students; and to also enhance their achievement and retention in the subjects. It is also suggested that teachers should adapt problem-solving strategy in teaching Further Mathematics so that seemingly clumsy concepts in the subject can be analyzed step by step for easy comprehension and assimilation by the learners. Teachers should also use brainstorming technique while employing problem-solving strategy or model with suggestion in form of guided questions to help students during the teaching-learning process. Authors of Mathematics and Further Mathematics textbooks should be informed to present the contents and concepts alongside worked examples using problem-solving approach. Students should be encouraged to work in groups and ask questions when in doubt while using Oyedeji problem-solving model as strategy during the teaching-learning process in Further Mathematics andMathematics. More so, principals of public and private secondary schools should encourage their Further Mathematics teachers, through sponsorship, to attend refresher courses and other forms of in-service training to enable them acquire the needed problem-solving skills that can help them use or apply the strategy in the classroom.

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