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EFFECTS OF INDIVIDUALIZED AND CONVENTIONAL INSTRUCTION ON MATHEMATICS ACHIEVEMENT OF LOW-ACHIEVING STUDENTS

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Abstract:
Education is the process of making every individual functional. It entails developing the innate potential of every individual irrespective of his/her needs and challenges. The need to cater for every child in the school learning environment is therefore imperative. Education administrators, educators, educational psychologists and other stakeholders hold it a duty to ensure that no child is left out in the teaching learning process. Besides the cognitive/intellectual development, the school has the duty of ensuring that the child has an all-round development – academic, social, emotional, psychological, leisure, spiritual and total wellbeing. This has to be done within the learning environment. The desire to ensure that an individual is balance both academically and socially centre on devising a unique, effective, efficient and appropriate teaching and learning strategy that will be able to achieve the above stated desire.

Introduction

Education is the process of making every individual functional. It entails developing the innate potential of every individual irrespective of his/her needs and challenges. The need to cater for every child in the school learning environment is therefore imperative. Education administrators, educators, educational psychologists and other stakeholders hold it a duty to ensure that no child is left out in the teaching learning process. Besides the cognitive/intellectual development, the school has the duty of ensuring that the child has an all-round development – academic, social, emotional, psychological, leisure, spiritual and total wellbeing. This has to be done within the learning environment. The desire to ensure that an individual is balance both academically and socially centre on devising a unique, effective, efficient and appropriate teaching and learning strategy that will be able to achieve the above stated desire.

All the instructional strategies developed over the years have their effects on the students and take care of their individual differences based on the uniqueness of the subjects, including Mathematics. Mathematics is a language of orderliness and ordered thinking. Awofala (2010) stated that Mathematics is a language of precision while according to Adeneye, Awofala, Abayomi, Arigbabu, Awoyemi and Awofala (2013) Mathematics is a "whetstone of creativity, thinking and problem solving needed essentially to bring harmony, exactness, compactness and accuracy into the knowledge of science, technology and engineering their products. It requires skilful trained teachers, sound programme of mental aptitude coupled with effective instrumental methods (Olaogun, 2001). Students with little sense of belonging because of low academic performance in Science related subject and Mathematics in particular tend to have behavioural problems and lower interest and achievement, leading them to drop out of school (Anderman, 2003).

Instructional approaches which personalize instruction to the needs and individual learning styles of the learner is Individualized instructional strategy, aimed at ensuring that the learner interacts with every object that is related to the concept being taught within his environment and determines his learning pace as the lesson progresses. This is unlike mass instruction or conventional form of instruction in which content, materials and pace are the same for all students in a classroom instruction. It does not require one-to student/teacher ratio (Wikipedia, 2012). It is a method of instruction in which there is one-to-one teaching and self- paced learning based on an outline of progressive goals leading to achieving the content of the curriculum. Individualized instruction is also helpful, to students with disabilities as small, sequential steps are used in structured materials to teach the learner in English Language and Mathematics. They explained that students can receive individualized instruction through exposure to specially designed instructions like Computer Assisted Instruction (CAI) with the use of audio, video, multimedia, and can always rehearse module and learn more about it, as against group classroom instruction from the teacher in the area of subject concerned. Block (1977) stated that one of the advantages of individualized instruction is that learners whose progress towards mastery is with unsatisfactory can be identified by the teacher. He emphasized that individualized instruction affords the teacher the opportunity to offer a variety of corrective procedures and measures that will help the learner to overcome learning difficulties. McClelland (1971) emphasized that individualized instructional strategy is adapted to the individual learner ability and capabilities; it provides for alternate remedial instructional inputs and behavioural output modes. Fernald and DuNann (1975), posit that individualized instruction is of more benefits to low achieving than to high achieving students; promotes improved study behaviour which is maintained under conventional instructional situation and students in individualized instruction are more accurate in evaluating their mastery of course materials than students receiving conventional instruction.

Conventional instructional strategy is otherwise known as teacher's own style of teaching. This is a strategy the teacher is familiar with while teaching the students mathematics.

Gender was included as a moderator variable of interest in this study because past studies in Nigeria had indicated gender as one of the most important variables in mathematics education (Abakpa & Iji, 2011; Abiam & Odok, 2006). Some research findings in gender showed that males performed better on achievement measure than their female counterparts (Awofala, 2011b; Awofala, 2010; Ogunneye, 2003; Akinsola & Awofala, 2009; Duru, 2000) while others (Abakpa & Iji, 2011; Ogunleye & Babajide, 2011; Arigbabu & Mji, 2004; Agommuoh & Nzewi, 2003) observed no significant effect of gender on students' mathematics achievement.

Educational Psychologists have the duty to evaluate teaching methods, learning environment, social interaction within the classroom, behavioural problems and other indices that may either affect the overall performance of the learners and their well-being. Owing to increasing low academic performance in Science subjects and Mathematics in particular it becomes necessary to investigate the relative effectiveness of instructional strategies that can aid assimilation and understanding of mathematical concepts and learning among low achieving subjects students in regular schools setting and ensuring that their potentials are tapped and they become better off than when they were outside the school environment. It also aimed at ensuring a peaceful co-existence and maintaining the serene environment that the school system is known for. Achieving academic achievement in mathematics through individualized and conventional strategies and ensuring that the better of the two instructional strategies is applied in our school system is a noble task that needed attention.

Purpose of the Study

The purpose of the study is to determine the effects of individualized and conventional instruction on Mathematics achievement of low-achieving secondary school students.

Specifically, the study is designed to:

1. determine the difference in mathematics achievement of low achieving subjects in the experimental and control groups.
2. ascertain whether gender is a factor in the extent to which individualized instruction effects Mathematics achievement of the subjects.
3. ascertain whether gender is a factor in the extent to which conventional instruction effects Mathematics achievement of the subjects.

Research Questions

The following research questions guided the work.

1. What are the effects of individualized and conventional instructional strategies on Mathematics achievement of low-achieving subjects as measured by their pre-test and post-test scores in Mathematics Achievement Test? MAT?
2. What is the difference in Mathematics achievement of low-achieving subjects in experimental and control groups as measured by their post-test scores in Mathematics Achievement Test (MAT)?
3. How does gender influence the effect of individualized instructional strategy on Mathematics achievement of low-achieving subjects as measured by their post-test scores in Mathematics Achievement Test (MAT)?
4. How does gender influence the effect of conventional instructional strategy on Mathematics achievement of low-achieving subjects as

measured by their post-test scores in Mathematics Achievement Test (MAT)?

Hypotheses

The understated null hypotheses were tested at 0.05 alpha level.

1. The effects of individualized and conventional instruction on Mathematics achievement of low achieving subjects do not differ significantly as measured by their pre-test and post-test scores in Mathematics Achievement Test (MAT).
2. There is no significant difference in Mathematics achievement of low achieving subjects in the experimental and control groups as measured by their post-test scores in Mathematics Achievement Test (MAT).
3. Gender does not significantly influence the effect of individualized instructional strategy on Mathematics achievement of low achieving subjects.
4. Gender does not significantly influence the effect of conventional instructional strategy on Mathematics achievement of low-achieving subjects.

Method

The study adopted the quasi-experimental research design to determine differential effects of individualized and conventional instruction on Mathematics achievement of low-achieving students in a public secondary school in Port Harcourt metropolis of Rivers State. The population of the study consisted of one hundred and seventy-eight (178) Junior Secondary School Two (JSS2) students of a public secondary school. It has three classes and with an average of 44 students in each of the classes. The public school is a mixed school. The sample of the study consisted of 35 students (purposively selected as low achieving students) through a Diagnostic Mathematics Test (DMT) into two intact classes: A & B of the class under study. A "Diagnostic Mathematics Test" (DMT) was used to determine low-achieving students. Subjects who scored below 40 percent were regarded as low achieving students. Group A –

15 students (Individualized Instructional Strategy of low achieving students while Group B – 20 students (Conventional Instructional Strategy of low achieving students) were selected through balloting. Two instruments for data collection were used. They are Diagnostic Mathematics Test (DMT) and Mathematics Achievement Test (MAT). The two instruments (DMT and MAT) consisted of two parts A and B. Part A was designed to elicit personal information from the respondents in respect to Class and Gender; while Part B contained items of the Diagnostic Mathematics Achievement Test (DMT) and Mathematics Achievement Test (MAT). The two instruments have multiple choice of 50 items, with five-answer options A – E, with only one correct option as answer to a question. Each corrected answer was scored 2 (two) marks and zero (0) for a wrong answer. That is, the instrument was scored in a dichotomous way. Thus, 100 will be the maximum score obtainable while zero was the minimum. The instrument was face validated by 3 (three) experts one in each of Educational Psychology, Guidance and Counselling and Measurement and Evaluation. A pilot test was administered to subjects from a different school. The Diagnostic Mathematics Test (DMT) and Mathematics Achievement Test (MAT) revealed its reliability coefficient of 0.73 and 0.87 using Kuder Richardson Formula 21 (KR_{21})) after its administration on a set of 40 students once and items scored dichotomously, different from those in the study. The Diagnostic Mathematics Test (DMT) was administered as the pre-test, while Mathematics Achievement Test (MAT) was administered as post-test after treatment to the experimental and control group. The data collected using the two instruments were analyzed using Mean (x), Standard Deviation (SD), t-test analysis and Analysis of Co-variance (ANCOVA). The null hypotheses were tested at 0.05 alpha level.

Results

The analyzed data and result of the study were presented below:

Effects of individualized and conventional instructional strategies on Mathematics achievement of low-achieving subjects as measured by their pre-test and post-test scores in Mathematics Achievement Test (MAT)

Table 1: Mean (X) and Standard Deviation (SD) of the effects of d individualized and conventional instructional strategies on Mathematics achievement of low-achieving subjects as measured in their pre-test and post test scores in Mathematics Achievement Test

Instructional Strategy	Pre-Test			Post-Test		
	n	X	Sd	n	X	Sd
Individualized	15	36.53	1.51	15	56.40	5.50
Conventional	20	31.45	4.22	20	46.70	5.67

Data in Table 1 indicated that the pre-test and post-test mean (x) scores of effects of individualized instructional strategy on low achieving students were 36.53 and 56.40 respectively. Also, for low-achieving students taught with conventional instructional strategy, their pre-test and post-test means (x) scores were 31.45 and 46.70 respectively. The above result implied that an effect of individualized instructional strategy on low achieving students was better than conventional instructional strategy.

The difference in Mathematics achievement of subjects in experimental and control groups as measured by their post-test scores in Mathematics Achievement Test (MAT)

Table 2: Mean (x) and Standard Deviation (SD) of Mathematics Achievement of Mathematics Students in the Experimental and Control group

Group	N	X	S.D
Individualized Instructional Strategy	15	56.40	5.50
Conventional Instruction Strategy	20	46.70	5.67

Table 2 showed that subjects in all the experimental group obtained higher Mean (x) scores than their counterparts in control group. This means that greater Mathematics achievement was recorded among low-achieving subjects in experimental group than those in the control group.

Gender influence the effects of individualized instructional strategy on Mathematics achievement of low-achieving subjects as measured by their post-test scores Mathematics Achievement Test

Table 3: Mean (x) and Standard Deviation (SD) of influence of gender on the effects of Individualized instructional strategies on Mathematics achievement of low-achieving students.

Instructional Strategy	Gender	N	X	SD
Individualized	Male	8	58.00	6.07
	Female	7	54.57	4.50

Data in Table 3 indicated that male and female subjects taught using

Individualized Instructional strategy had mean (x) scores of 58.00 and 54.57 respectively in Mathematics Achievement Test (MAT). This implied that male subjects had higher mean (x) score than their female counterparts.

Gender influences on the effect of conventional instructional strategy on Mathematics achievement of low-achieving subjects as measured by their post-test scores in Mathematics Achievement Test (MAT)?

Table 4: Mean (x) and Standard Deviation (SD) of influence of gender on the effects of conventional instructional strategies on Mathematics achievement of low-achieving students.

Instructional Strategy	Gender	N	X	SD
Conventional	Male	10	50.40	4.70
	Female	10	43.92	1.24

Data in Table 4 indicated that male and female subjects taught using conventional instructional strategy had mean (x) scores of 50.40 and 43.92 respectively in Mathematics Achievement Test (MAT). This implied that male subjects had higher mean (x) score than their female counterparts.

The effect of individualized and conventional instruction on Mathematics achievement of low achieving subjects do not differ significantly as measured by their pre-test and post-test scores in Mathematics Achievement Test (MAT).

Table 5: Analysis of Covariance (ANCOVA) of the effects of individualized and conventional instructional strategies on Mathematics achievement of low achieving students.

Sources of Variation	Type III Sum of Squares	df	Mean Square	F	Sig.	Remark
Corrected Model	949.816 [a]	2	474.908	17.066	.000	S
Intercept	1679.287	1	1679.287	60.347	.000	S
Preindivicon	143.331	1	143.331	5.151	0.30	S
Varpreindivicon	887.471	1	887.471	31.892	.000	S
Error	890.469	32	27.827			
Total	92366.000	35				
Corrected Total	1840.286	34				

a. R Squared = .516 (Adjusted R Squared = .486)

The results shown in Table 5 indicated that the group source (VarPDIC on the SPSS output) evaluates the null hypothesis that the population adjusted means are not equal. The results of the analysis indicate that this hypothesis should be rejected $F(1, 34) = 31.892$, $p<0.05$. The test assesses the difference among the adjusted means (x) for the four groups. The null hypothesis one was therefore rejected. This implied that there is a significant effect of individualized and conventional instruction strategies on Mathematics achievement of low-achieving Mathematics subjects in favour of those taught with individualized instruction.

Difference in Mathematics achievement of low achieving subjects in the experimental and control groups as measured by their post-test scores in Mathematics Achievement Test (MAT).

Table 6: t-test analysis of difference in Mathematics achievement of low achieving students in experimental and control groups.

Instructional Strategy	Gender	N	X	SD	Df	Cal. t	Crit. t	Remark
Individualized	Male	8	58.00	8.07	33	2.04	2.04	Rejected
	Female	7	54.57	4.50				

Table 6 indicated that all calculated t-value of 5.07, showing extent of difference in Mathematics achievement of students in experimental and control groups, was respectively greater than the t-critical value of 2.04, at 0.05 alpha level 33. The null hypothesis 4 was therefore rejected. This implied that significant difference in Mathematics achievement existed among low achieving students in the experimental and control groups, in favour of those in the experimental groups.

The effect of individualized instructional strategy on mathematics achievement of low achieving subjects is not significantly different due to gender.

Table 7: t-test analysis of difference in effect of Individualized instructional strategy on Mathematics academic achievement of low achieving subjects due to gender.

Instructional Strategy	Gender	N	X	SD	Df	Cal. t	Crit. t	Remarks
Individualized	Male	8	58.00	8.07	13	1.23	2.18	Accepted
	Female	7	54.57	4.50				

An observation of Table 7 revealed that the calculated t-value of 1.23 is less than the critical t-value of 2.18, at 0.05 level significance at df of 13. Null hypothesis 3 was accepted. This showed that there is no significant difference in the effect of Individualized instructional strategy on Mathematics achievement of low achieving male and female subjects.

The effect of conventional instructional strategy on Mathematics achievement of low-achieving subjects.

Table 8: t-test analysis of difference in effect of conventional instructional strategy on Mathematics academic achievement of low achieving subjects due to gender.

Instructional Strategy	Gender	N	X	SD	Df	Cal. t	Crit. t	Remarks
Individualized	Male	10	50.40	4.70	18	3.83	2.04	Rejected
	Female	10	43.00	3.92				

An observation of Table 12 revealed that the calculated t-value of 3.83 is greater than the critical t-value of 2.04, at 0.05 level significance at df of 18. Null hypothesis 4 was rejected. This showed that there is a significant difference in the effect of conventional instructional strategy on Mathematics achievement of low achieving male and female subjects, in favour of males.

Discussion

Effects of individualized and conventional instruction on Mathematics achievement of low-achieving students was investigated in this study. Findings indicated that students taught with Individualized instructional strategy group achieved (X = 36.53) at pre-test to (56.40) at post-test while conventional group obtained (X = 31.45) at pre-test to (X = 46.70) at post test. This showed

that subjects taught with individualized instruction performed better than subjects taught with conventional instruction.

Statistical analysis showed that there was significant difference in the post-test scores of students taught using individualized and conventional instructional strategies with $F(1,34) = 31.892$, $p<0.05$ in favour of individualized instructional strategy group. This result corroborated the finding of Awofala, et al (2012) and Adeneye et al (2013) who found that after treatment of students with Team assisted individualized instrument, there was a significant effect of the treatment on achievement of students in mathematics. Also, Mofeed (2011) found students taught with the use of Computer Assisted Instruction (Individualized instruction) performed better that students taught with traditional method as students taught with CAI scored higher than students their counterpart taught with traditional methods.

Moreover, Result of effect of individualized instructional strategy on Mathematics achievement of low achieving students due to gender showed that male and female subjects taught using Individualized Instructional strategy had mean (x) scores of 58.00 and 54.57 respectively in Mathematics Achievement Test (MAT). This implied that male subjects had higher mean (x) score than their female counterparts.

Statistically, the result revealed that the calculated t-value of 1.23 is less than the critical t-value of 2.18, at 0.05 level significance at df of 13. This showed that there is no significant difference in the effect of individualized instructional strategy on Mathematics achievement of low achieving male and female subjects. The result corroborated with Ekeh (2003) who reported that male secondary school students performed better than females in science and Mathematics. The finding is in line with Awofala, Adeneye, Nneji and Majorleen (2012) who found that there was no significant effect of gender on team assisted individualized instructional strategies on students' achievement in Mathematics.

Conclusion

From the findings of this study, it was concluded that

- Individualized instructional strategy was found to be effective compared to conventional instructional strategy.
- The difference in Mathematics achievement of students in the experimental groups were found to be statistically significant; in favour of those taught using individualized instructional strategy.
- Subjects in the experimental groups obtained higher Mathematics scores than their counterparts in the control group.

- Male subjects who were taught mathematics with individualized instructional strategy performed better than their female counterpart, however the difference was not statistically significant.
- Male subjects who were taught with conventional instructional strategy performed better than their female counterpart, and the difference was statistically significant.

Recommendations

Based on the results the following recommendations were made:

1. Teachers in the field of Mathematics and Science should vary/differentiate instructional strategies in consideration to the topic, content, nature, interest academic trait and the environment of learners in order to determine which one will be most suitable at improving Mathematics achievement of low achieving students.
2. Regular in-service training should be given to teachers (Mathematics and subjects) on new instructional strategy and teaching skills that will improve students academic achievement, most especially the low-achieving ones.
3. Teachers should be encouraged to join membership of their professional subject areas where seminars and workshop are organized to enlighten members on the current trend in academic development and skills in lesson/subject delivery and approaches of ensuring assimilation and optimal performance of their respective students in various subject areas.

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