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BOOSTING ACHIEVEMENT USING INDIVIDULISED AND DEMONSTRATION STRATEGIES IN BIOLOGY: HOW DO MALE AND FEMALE STUDENTS BEHAVE IN NIGERIA?

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ABSTRACT: *This study determined the effectiveness of demonstration, individualized and conventional methods and Gender on the achievement of Secondary School Two students in biology. The study employed a multi stage sampling techniques; in the first stage, three schools were randomly selected out of the twenty Secondary Schools in Abeokuta South Local Government of the state. At the second stage, sample sizes of sixty students were randomly selected from the list of students and their gender. In the same manner, thirty students were male while the female constitute the same number. The study which lasted six weeks made use of two valid and reliable instruments: Biology Achievement Test (BAT) and Operational guide for instruction (OGI) Stimulus instrument. Students were exposed to different methods (Demonstration and Individualized) while those in the control were not exposed to any treatment but were rather taught in the Convectional way. Data analysis involved the use of Analysis of Covariance, Descriptive Statistics and t-test.The result indicated that the demonstration method is a more potent method of improving achievement in biology. ($F (1.167) = 42.838; P < 0.05$), ($F (1.167) = 486.287; P < 0.05$), $F (2.167) = 90.389; P < 0.05$). Moreover, there was a significant difference in the academic achievement of male and female students when exposed to the two experimental methods and control, hence female students performed better than their male counterparts. Arising from these findings, demonstration method and individualized method where recommended for teachers use in biology classrooms.*

KEYWORDS: Achievement, Demonstration Strategies, Biology, Male and Female Student, Nigeria

INTRODUCTION

Biology studies living matter, structure, function and behaviours of organisms. It is concerned with evolution, distribution and taxonomy of life. A corner stone that cannot be over emphasized in-terms of nation's technology and industrial development, no wonder, (Bilesanmi- Awoderu, J. B, Afuwape, M. O. and Jolaosho, F. A, 2015) affirmed that "the development so far attained by man has been winged on advancement recorded in science and technology". Life science through science education provides a platform for teaching students the ability to apply learned science-related problems (Nwachkwu and Nwosu, 2007).Taking note of the importance in life science, the concern of any good science educator should be how to sustain interest of learners in the subject. In that wise, the consideration for demonstration and individualized system of instruction after a thorough research is an attempt to salvage the challenges of students' poor performance in the subject as shown in the statistics of biology achievement in May/June secondary school certificates examination from 2002 to 2011 in Nigeria.

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Table 1: Students' Achievement in the May/June Biology between 2002 and 2011.

Year	Total of candidates	No of credit pass	Percentage
2002	882,119	278,112	31.53
2003	1, 025,572	392,249	38.25
2004	832,689	287,484	34.52
2005	1,055,710	377,693	35.77
2006	1,149,400	568,202	49.43
2007	1,239,829	414,408	33.82
2008	1,244,242	420,923	33.82
2009	1,518,220	499,432	32.90
2010	1,995,223	531,564	26.64
2011	2,076,675	556,132	26.78

Source: Bilesanmi-Awoderu, (2012) Science Education in Nigeria: Drowning but Waving

Table 1 shows the statistics of biology achievement in May/June secondary school certificate examination (SSCE) from 2002 to 2011. It should be noted that at no time in the ten years under review did the students record 50 percent credit pass. This is most disheartening as Nigeria hope to join the league of scientifically and technologically advanced countries of the world by 2020. It is in view of this that stakeholders are intensifying efforts at ensuring performance in biology is positively enhanced and empirical evidence abound to attest to the fact that poor academic performance of students in biology is a function of various factors.

Prpic and Hadgraft (2009) addressed the key ingredients of Demonstration method and postulated that it should not be confused with design projects or case studies where the focus is predominantly on the application of existing knowledge and integration of what is already known. Demonstration method is always used to show something works. Accurate procedures and operations are shown in models, mock-ups and actual equipment are used to accomplish the successful demonstration while individualised method has been proven to be a very vital method in transferring knowledge from teachers to students. It began with the achievement of Keller in 1968. The approach composed of small self-paced modularized units of instructions where study guides direct learners through the modules. Unit tests are given on each module where the learners must show mastery by scoring at least a 90 percent. Student proctors are used to help with individual problems and lectures are given for motivational problems only. Personalized instruction combines mastery learning with principles of reinforcement learning theory. Mastery learning requires that the desired student performance by stated precisely using performance or learning objectives.

Demonstration and individualised methods could be most encouraging for both male and female students social attributes and opportunities in life as issue of gender differences remains a crucial concept to science educators (Afuwape, M. O & Oludipe, D. L., 2008). In this study gender is a moderating variable because it is important to find out if the treatments are truly sensitive to gender in order to yield useful practical information.

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Research Hypotheses

- There is no significant gender difference in the academic achievement of students taught using the Demonstration, Individualized and conventional methods of teaching in life science.
- There is no significant difference in the academic achievement of male and female students taught using the Demonstration method.
- There is no significant difference in the academic achievement of male and female students taught using the conventional method.
- There is no significant difference in the academic achievement of male and female students taught using the Individualized method.

METHODOLOGY

The study uses a non randomized pretest-posttest control group design in a quasi-experimental setting. Where treatment at three levels (Demonstration, Individualized and Control) are crossed with gender at two levels (male and female)

Sample and Sampling Techniques

The study employed a multi stage sampling techniques. In the first stage, three schools were randomly selected out of the twenty public secondary schools in Abeokuta south local government of the state. At the second stage, sample sizes of sixty students were randomly selected from the list of students and their gender. In the same manner, thirty students were male while the female constitute the same number.

Instrumentation

Instruments were developed for the measurement of variables of this study.
Biology Achievement Test (BAT)
Operational guide for instrument (OGI) stimulus instrument

Biology Achievement Test (BAT)

The Biology Achievement Test items were selected from the past senior school certificate examination (SSCE) question papers. The test covered three selected topics treated in the study. The topics are:

i. Alimentary canal and digestion of food in human,
ii. Vitamins required by humans
iii. Blood types, functions and clothing formation mechanism

The question administration consist of 50-item-multiple-choice test with four options per item. The BAT was used for both pre-test and post-test exercise. However in the post test, the items were re-arranged and the colour of the paper changed to present a false impression that they are writing a different test from the earlier one presented.

Operational Guide for Instruction (OGI) stimulus instrument

This is a treatment package prepared for the experimental groups. It is a package that promotes active learning, increasing retention and application, as well as promoting continuous and

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permanent learning. The OGI were developed on the three topics that were taught during the period of the study.

Validation and Reliability of the Instrument

Biology Achievement Test were validated using test- retest method to determine the reliability of the instrument. The tests were administered on the same respondents twice, within two weeks, the first and the second responses were compared using Person Product Moment Correlation coefficient test- retest reliability is 0.74

RESULT AND DISCUSSION

The results of this study which were obtained using spreadsheet; Microsoft Excel, Descriptive Statistics and Analysis of Covariance.

Table: 1. Main and Interaction Effect on Students' Achievement on Biology

Table: 1. Main and Interaction Effect on Students' Achievement on Biology
Source: Field survey, 2014
R Squared= .858 (Adjusted R Squared=.848)

Source of variation	Sum of Square	df	Mean Square	F	Sig.	Partial Eta Squared
Present (Covariate) Main Effect	20.697	1	20.697	5.917	.016*	.034
Main Effect Gender Subject Specialization Treatment	 149.833 1700.848 632.293	 1 1 2	 149.833 1700.848 316.146	 42.838 4.86.287 90.389	 .000* .000* .000*	 .204 .744 .520
Two Way Interaction Gender * Subject Specialization Gender* Treatment Subject Specialization Treatment	 16.923 44.523 380.291	 1	 16.923	 4.838	 .029*	 0.28 0.71 .394
Three Way Interaction Gender* subject Specialisation* Treatment	 380.291	 2	 190.145	 54.364	 .000*	 .394
Error Total Corrected total	584.103 171078.00 4120.644	167 180 179	3.498			

Hypothesis 1 (H_{01})

There is no significant difference in the academic achievement of students taught using the Demonstration, Individualized and Control methods of teaching in biology.

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The levene's test for the ANCOVA analysis to examine how the independent factors (teaching methods and gender) accounted for variation in the dependents factor (post-test scores) revealed that there was no significant variation across the variance of the different groups. The adjusted R-square of 84.8% also confirmed that the model specified was good fit and that 84.4% variation observed in the scores of the students were accounted for by the variations in the examined independent factors i. e gender and treatment (Table 1). The table also showed that there was a significant difference in the achievement scores among the three intervention groups after adjusting for pre-intervention scores (covariates) as shown by the significance of the F-values fo the three factors examined at $p<0.05$.

a. Gender (F 1.167)= 42.838 and partial Eta Squared= 0.204\
b. Treatment (F (2.167)= 90.389 and partial eta squared= 0..520

There was however a weak relationship between the pre-intervention and post-intervention scores in Biology test, as indicated by a partial eta among the factors examined were significant. From Table 1 and both the estimates and pair wise comparison result, it is obvious that there is a significant relationship among the three intervention groups (Demonstration Individual and Convectional) at $p < 0.05$ with a mean of 33.4; 29.6 and 28.3 for the Demonstration, Individual and Convectional methods respectively. The scores clearly showed that Demonstration and Individualized methods produced a better achievement score for the students on the average compared with the control though Demonstration recorded the highest mean score. This observation may not be unconnected with the opportunity given to students to participate effectively in demonstration method. Therefore, the null hypothesis 1 is rejected. The result is consistent with the findings of Nwachkwu and Nwosu (2007) as well as Uhumuavbi and Mamudu (2009).

Table 2: Descriptive Statistics of the Post Academic Achievement Mean Scores and Standard Deviation According to Treatment.

Dsex	N	Mean	Std. Deviation	Std. Error Mean
Dposttest 0	30	35.43	6.202	1.132
1	30	32.00	5.311	.970
Iposttest 0	30	30.33	3.575	.653
1	30	28.80	2.772	.506
Cposttest 0	30	28.63	2.484	.454
1	30	27.53	2.360	.431

Source: Field survey, 2014

Hypothesis2 (H_{02})

There is no significant difference in the academic achievement of male and female students taught using the demonstration method. The results of the t-test for the demonstration method as revealed in Table 2 showed there is a significant difference between the academic performance of male and female students at 5% with t-values of 2.30 and a mean of 35.43.

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Hypothesis 3(H_{03})
There is no significant difference in the academic achievements of male and female students taught using the individualized method.

With respect to the individualised method the female still performed better than the male though with smaller deviation in the range of their scores compared with the Demonstration method as shown in Table 3. This could have been a reflection of the fact that the Individualized method gives greater cognizance to the potential capacity of the individual learning ability with t-value of 1.86. The result confirmed a significant difference between the female performance and their male counterpart using the individualized method at 1 0% level of significance. The female students performed better than male when exposed to individualized method therefore the null hypothesis 3 is rejected.

Hypothesis 4 H_{04}
There is no significant difference in the academic achievement of male and female students taught using the control method. Just as in the Individualized method the performance of the sexes is only significant different at 1 0%. The average score of the female was only marginally higher than their male counterparts compared with the Demonstration and Individualized. The scores of the candidates were also clustered around the mean with a standard deviation of 2.48 (female) and 2.36 (a male) as revealed in Table 2. Therefore hypothesis 4 is rejected. The result clearly confirmed a wide variation in the range of the female scores compared with that of their male counterparts and the fact that the female students performed better than the male students. This result confirmed the growing trend in the performance of female compared with male even at higher level of education. The null hypothesis 2 is rejected; the female achievement is higher than that of male when exposed to Demonstration method.

Table 3: Student t-test comparism of mean difference of Experimental and Control groups.

	Levene's Test for Equality		t-test for Equality of means	
	F	**Sig.**	**T**	**Df**
Dposttest Equal variance assumed Equal variance not assumed	8.654	.005	2.303 2.303	58 56.660
Dposttest Equal variance assumed Equal variance not Assumed	7.563	.008	1.857 1.857	58 54.610
Dposttest Equal variance assumed Equal variance not Assumed	.491	.486	1.758 1.758	58 57.847

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DISCUSSION

The study was conducted to investigate the use of Demonstration and Individualized methods on the teaching of biology in the selected secondary schools.Result from Table 1 indicated that there was a significant difference in the academic achievement of students taught using the Demonstration, Individualized and Conventional methods of teaching in biology. As a result, Demonstration method recorded a- highest mean score, followed by Individualised method with conventional method recording the least mean score. The observation may not be unconnected with the fact that students participated actively and effectively in Demonstration method which is an attention inducer and a powerful motivator when employed. In the same vein, Individualized method also involved active participation of learners whereas the Conventional method did not cater for learning of' manipulative skill or promotion of students' scientific interest and attitudes. The result is consistent with the findings of Nwachkwu and Nwosu (2007) as well as Uhumuavbi and Mamudu (2009) granting that the two experimental methods (teacher-led and student-led) groups performed better than the control group. This is also corroborated by the finding of Laoye (1994) in Bilesanmi-Awoderu (2012) and Bilesanmi-Awoderu (1996b) who emphasized that demonstration is one of the mostly employed strategies by the teachers.

Results from Table2 revealed that there was significant difference in the academic achievement of male and female students taught using the Demonstration method. The female students outperformed their male counterparts when exposed to Demonstration method. The achievement of female resulted from the diligence nature associated with them. This confirmed the growing trend in the achievement of female compared with male even at high level of education. It may not be unconnected with the attitude of male to social media and sport that have taken their attention. This is in line with studies such as Duyiemi 1997, Bilesanmi-Awoderu(l998), and Bilesanmi-Awoderu(2007b), who found that female students outperformed their male counterparts. This is also consistent with the Mamudu and Umuavbi (2009) who observed that female students demonstration gave a better performance than their male counterparts.

Likewise, Erinosho (2005) and Afuwape and Oludipe (2008) research studies shows that girls' interests are around academics and life science activities. The better performance of the female resulted from the diligence nature associated with females and this is also consistent with the findings of Nwachukwu and Nwosu (2007) who reported that the better performance of the female in the experimental group when they were exposed to demonstration resulted from the inherent diligence associated with feminine ways of handling materials.

Table 3 revealed that there was significant difference in the academic achievement of male and female students taught using the Individualized method. The female students performed better than male when exposed to Individualized method. It showed the active participation of female in teaching-learning process. This is in line with the studies of Duyilemi(l997), Bilesanmi-Awoderu (1998) and Bilesanmi-Awoderu (2007b) who found that female students outperformed their male counterparts. This findings is consistent with the studies of Uhumuavbi and Mamudu(2009) who concluded from their investigations that programmed instructions method produce significant positive gains for academic achievements, process skills and analytic abilities.

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Results from Tables 2 & 3 showed that there was a significant difference in the academic achievement of male and female students taught using the conventional method. The female students performed better than male student when exposed to conventional method. Despite the limitation of the teaching method, the females' higher achievement may be as a result of their diligence and study habit. This result is consistent with Bilesanmi-Awoderu (2007 & 2012) which claimed that girls performed better than boys.

CONCLUSION

Conclusively, students in the two experimental groups (Demonstration and Individualized) performed better than the conventional group. Demonstration method was also observed to be best of the three methods. This is because the method can enhance students achievement in biology. Furthermore, Individualized method promoted positive attitude towards the students studying habit. Student's involvement in Demonstration and Individualized methods in class can increase their interest in biology and improve their efficiency towards the subject.

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