JOURNAL
OF
STM EDUCATION

**DEPARTMENT OF SCIENCE EDUCATION
NNAMDI AZIKIWE UNIVERSTY,
AWKA.
UNIZIK JOURNAL OF STM EDUCATION
(Vol. 6 No. 1)**

Editorial Board

Call for papers

Research articles are invited from interested scholars and researchers for publication in the above journal. The editorial board welcomes empirical articles that are of relevance to Science, Technology and Mathematics Education. This journal is an annual publication of the Department of Science Education, Nnamdi Azikiwe University, Awka, Nigeria.

Notes to Contributors
- Contributors should submit their articles electronically through the email address co.obialor@unizik.edu.ng
- Articles should not exceed 12 pages of A4 paper typed double-spaced on one side only.
- The title page should contain the title of the articles, names, addresses, phone numbers and email of the authors.
- The articles should be preceded by an abstract of not more than 250 words
- The referencing should be in the current APA format all works cited in the text must be listed in alphabetical order by the authors surname.
- Tables and figures should be clearly drawn and kept to the barest minimum.
- An assessment fee of N5000.00 should be paid into the bank (details below).
- All manuscripts accepted for publication become the copyright of Unizik Journal of STM Education Editorial Board and Publishers.

Please send all correspondences to:
Dr.N. N. Achufusi-Aka
The Editor-in-chief
Department of Science Education
Nnamdi Azikiwe University, Awka
07034931126; nn.achufusi@unizik.edu.ng

Or

Dr. Chris O. Obialor
Secretary Editorial board
Department of Science Education
Nnamdi Azikiwe University, Awka
08037328449; co.obialor@ unizik.edu.ng

Bank: Access Bank
Acc. Name: Unizik Journal of STM Education
Acc. Number: 0050261921

EDITORIAL COMMENT

The Unizik Journal of STM Education publishers reports of empirical research in Science, Technology, Engineering and Mathematics (STEM) Education as well as related studies in education generally. The publication is a medium of communicating well researched works for the science community as a forum for communication and cooperation among STEM teachers and students, policy makers, educators and other educational practitioners across the globe.

This sixth edition of the journal contains nineteen (19) articles that have passed through peer-review by professionals. The opinions expressed are not necessarily those of the editorial board but of individual authors. These papers are very informative, educative and instructive and I therefore invite the readers to enjoy reading the contributors.

The editorial board of UNIZIK Journal of STM Education appreciates those who subscribe to the journal, reviewers and the consulting editors for their contributions.

Dr.N. N. Achufusi-Aka
Editor-in-Chief

CONTENTS

DIFFERENTIAL ITEM FUNCTIONING OF 2020-2021 NIGERIAN BASIC EDUCATION CERTIFICATE EXAMINATION MULTIPLE CHOICE QUESTIONS IN MATHEMATICS IN ABIA STATE

Ihendinihu, Uchechi Ezinwanyi
Department of Science Education, College of Education,
Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.
E-mail:ihendinihu.uchechi@gmail.com; Tel: +2348063938750

Abstract
The study identified the Mathematics multiple choice test items of the Basic Education Certificate Examination (BECE) administered by the Nigerian National Examination Council (NECO) in 2020-2021 that exhibited Differential Item Functioning (DIF) with respect to gender and socio-economic status, using ex-post facto research design. Participants of the study consists of three hundred and fifty (350) Junior Secondary School year three (JSS 3) students selected from two coeducational schools in Abia state of Nigeria. Data collected from the responses of students to the 120 Mathematics multiple-choice questions were analyzed using Scheuneman modified chi-square test statistic, chi square statistic and independent sample t-test to answer the four research questions and test the four hypotheses that guided the study. Result showed that Mathematics multiple-choice test items administered by NECO for BECE in 2020 and 2021 contain items that functioned differentially for examinees based on gender and socio economic status (SES). Whereas no significant difference exist in the percentage of items that functioned differentially in favour of both gender, the examination contain test items that significantly functioned differentially for examinees based on SES in favour of the high SES. The research recommends continual conduct of pilot study to analyze DIF for possible modification, replacement or equitable distribution of bias items among notable subgroup, especially socio economic status. In addition, the researcher advocates for the use of very simple English while setting mathematics BECE questions to avoid misinterpretation2.
Key words: Differential item functioning, gender, socio-economic status, multiple choice questions, mathematics, and Basic Education Certificate Examination.

Introduction
The relevance of assessment in the teaching and learning process makes it imperative that assessment tools should be carefully developed and scrutinized. Assessment plays a very important role in the educational process and development as it is the basis for taking most decisions in the educational sector and society at large (Ihendinihu, 2020). In education and indeed in the school system, test is crucial in ascertaining students' academic success. Test is the most prominent tool for assessing cognitive achievement of students.

A test is an instrument of measurement, the administration and scoring of which leads to the quantification of psychological characteristics. (Ihendinihu, 2022). Test scores are basis for promotion, certification, appraisal, recruitment and placement. To ensure further validity of tests, it is pertinent that test developers present items that are unbiased and fair, that could be used to examine the ability of test-takers from both homogenous and heterogeneous settings, as the value of such measure would be domiciled in its quality (Kelani & Faleye, 2022). Test fairness and equality are crucial issues in testing because the scores obtained from it have important consequences for all examinees, the authors noted. Test items should be carefully analyzed in a bid to ensuring that no individual or group of examinees responding to the instrument is disadvantaged/deprived in anyway. A fair test should not discriminate against sub-groups of candidates or give an advantage to other groups.

In other to ensure that psychometric qualities of test items are maintained, item analysis, which includes differential item functioning (DIF) of test items should be investigated, established and incorporated in test construction. DIF is a statistical characteristic of an item that shows the extent to which the item might be measuring different abilities for members of separate sub-groups (Agbaegbu, Akanwa & Ihechu, 2022). According to shepherd, Camilli and Averill (2011), DIF specify whether individuals of equal ability have the same probability of getting a given item correct. DIF occurs when different groups of examinees with similar over all ability, or similar status on an appropriate criterion, have, on average, systematically different responses to a particular item. Put simply, the presence of DIF in test items means that two people who are at similar levels of the latent construct being measured but who belong to two different cultural, race or gender groups, respond differently to a particular question purporting to measure that construct, resulting in differences in the level of 'Performance' measured.

Testing in education and psychology is an attempt to measure examinee's knowledge, intelligence or other characteristics in a systematic approach (Aituariagbon & Osarumwense, 2022). Testing various performances of examinees could be based on local language or it could be based on unfamiliar format or emphasis on a learning domain (affective, cognitive and psychomotor) that is not stressed in the education system of the examinees school or location. (Yaghoobi in Ihendinihu, 2022). It is unreliable for a test to be fair. It can only be equitable, hence, the reason why examinees respond to an item differently. Test fairness in the context of test items does not prevent items from functioning differentially for different subgroups. More so, DIF can be regarded as a statistical difference between the probability of a specific population group getting the item right and a comparison population group getting the item wrong given that both groups have equal level of expertise with respect to the content being. Hisehfeld, Moore & Brown (2005) noted that difference in students' test scores in some subjects such as Mathematics could be attributed to social and cultural influences.

Analyzing test items for DIF is a core step to determine if subgroups (gender, school location, socioeconomic status, and school type) to which candidates belong substantially bias any item score. The study of DIF has become an integral part of determining the

validity and reliability of standardized tests, which cut across different groups of examinees. One of such examination is Basic Education Certificate Examination organized by NECO. The students that write this examination come from different socio-economic backgrounds, (high and low) different locations (urban and rural), different ethnic groups and they belong to different gender (male and female). This creates the need to investigate whether the items in these tests function differentially among these groups and whether biased items are distributed equitably among the groups with Mathematics as a focal subject.

Okeke in Ihendinihu (2022) described gender as socially or culturally constructed characteristics, qualities, behaviours and roles, which different societies ascribe to female and males. Therefore, with the introduction of differential item functioning in the BECE mathematics multiple choice item validation process, it is expected that male and female students will respond to the test items equally irrespective of their groups. Thus, the call for the detection of DIF in order to maintain valid assessment items for proper decision-making. Socioeconomic status is a way of describing people based on their education, income, type of job, family size and relationships. Socioeconomic status can be low, medium, and high. People with a lower socioeconomic status have less access to financial, educational, and social and health resources than those with a higher socioeconomic status. Students' socioeconomic status is directly linked to, that of their parents or guardians.

Several scholars have investigated the DIF of various subjects in examinations conducted by different bodies. Kasali and Adeyemi in Ihendinihu (2022) estimated item parameter indices of 2016 NECO mathematics and further investigated the presence of items that functioned differentially across cultural environments in Nigeria and gender. The study adopted ex-post facto design with a sample size of 276,338. The results showed, among others, that the items functioned differentially in cultural environments and gender.

Madu (2012) studied Differential Item Functioning (DIF) by gender in mathematics examination conducted by West African Examination Council (WAEC) in 2011 in Nigeria using a descriptive survey research design. Data obtained from a sample of 1,671 students and analyzed using Scheuneman modified chi-square statistics indicated that items significantly function differently by gender in 39 items and 11 items did not exhibit DIF.

Aituariagbon and Osarumwense (2022) analyzed and compared non-parametric methods of detecting Differential Item Functioning in NECO Senior Secondary Certificate Examination 2019 Economics Multiple Choice items using survey research design. Three (3) DIF methods considered are Mantel Haenszel, standardized P-diff and transform item difficulty (delta plot). The study showed that the three (3) methods displayed DIF. However standardized p-difference and transform item difficulty are most suitable methods than Mantel Haenszel statistics in detecting DIF of 2019 Economics multiple-choice items.

Agbaegbu, Akanwa and Ihechu (2022) examined the differential item functioning of National Business Technical Examinations Board Agricultural Science multiple-choice test items in (2015-2017) in South East zone using descriptive and ex-post-facto research design. Data were collected from a sample of 728 SSS3 students and analyzed using Scheuneman modified chi-square statistics and chi-square test statistics. Results showed

that Agricultural Science multiple-choice test items used in NABTEB 2015-2017; contain test items that significantly functioned differentially for examinees based on gender and school location.

Furthermore, Kelani and Faleye (2022) identified the Economics items of the Osun state Unified Promotion Examination that exhibited Differential Item Functioning (DIF) with respect to gender and school location. The study, which adopted ex-post facto research design, collected data from a sample of 2500 senior secondary school two students. Result of analysis done using Mantel-Haenszel statistics indicated that six items exhibited DIF in items of school location.

Odili (2014) studied the effect of language manipulation on differential item functioning in Biology multiple choice test items used by West African Examination Council (WAEC), in the Senior School Certificate Examination (SSCE), in Delta state of Nigeria through a descriptive survey design and post-test only control group experimental design. Data were collected from a sample of 1,022 students and analysed using Scheuneman modified chi-square statistics and t-test statistics. The study revealed that Biology multiple-choice questions used by WAEC in SSCE contain test items that significantly function differently for students from high and low socio-economic status, urban and rural geographical locations and male and female examinees.

Orhiwene and Queensoap (2019) used DIF approach to detect item biased in Chemistry Achievement Test (CAT)using descriptive comparative research design to describe and compare examinees of the four ethnic groups. A statistical and contact analysis were done with Scheuneman modified chi-square. Based on the analysis, the study established that the CAT has some items that showed biases and not all items that exhibited differential functioning were flagged biased. The study concludes that there was an ethnic bias in the CAT.

A look at literature review shows that investigation of DIF in various subjects centered on examinations administered to senior secondary school students with less emphasis on examinations administered to JSS. There is need to extend the investigation to examinations administered to junior secondary schools, a gap which this study intends to fill. In addition, literature is depleting with investigation of SES as a group in DIF. This accounts for its inclusion as a variable of study.

Purpose of the study

The purpose of this study is to investigate differential Item Functioning of 2020-2021 Nigerian Basic Education Certificate Examination Multiple Choice Questions in Mathematics Specifically, the study sought to determined:

1. Determine if the Mathematics multiple choice test (MCT) items in 2020 - 2021 NECO BECE function differentially among test takers based on gender.
2. Determine if the Mathematics MCT items in 2020-2021 BECE function differently among the examinees based on socio-economic status.
3. Compare the mean value of items that functioned differentially in 2020 and 2021 NECO BECE Mathematics test items based on gender.

4. Compare the mean value of items that functioned differentially in 2020 and 2021 NECO BECE Mathematics test item about Socio Economic Status of students.

Research Question

The following research questions guided the study:

1. What percentage of items in the 2020-2021 NECO Basic Education Certificate Examination (BECE) Mathematics multiple choice test items functioned differentially by gender?
2. What percentage of items in the 2020-2021 NECO BECE Mathematics multiple choice test items functioned differentially by socio-economic status?
3. What is the difference between the mean value of items that functioned differentially in 2020 and 2021 NECO BECE Mathematics test items based on gender?
4. What is the difference in the mean value of items that functioned differentially in 2020 and 2021 NECO BECE Mathematics test item based on SES?

Hypotheses

The following null hypotheses guided the study and were tested at 0.05 level of significance

1. The 2020-2021, NECO BECE Mathematics multiple choice test items do not significantly function differentially with respect to gender.
2. The 2020-2021, NECO BECE Mathematics multiple choice test items do not significantly function differentially with respect to SES of students.
3. There is no significant difference in the mean value of items that functioned differentially in 2020 and those of 2021 NECO BECE Mathematics multiple choice test items with respect to gender.
4. There is no significant difference in the mean value of items that functioned differentially in 2020 and those of 2021 NECO BECE Mathematics multiple choice test items based on SES.

Methods

The researcher adopted the ex-post facto research design, as the variables (gender and socio-economic status) of the study cannot be manipulated. Besides, the study also based on instrumentation design because it involved analyzing the items of an instrument, that is, determining the extent to which each of the items function differentially by gender and socio-economic status. The participants of the study consist of 350 junior secondary school three (JSS 3) students selected from two coeducational schools in Abia state of Nigeria. Purposive sampling technique was used to select the only coeducational unity secondary school and one private secondary school (coeducational) that participate in NECO BECE. All the JSS3 students were expected to participate, but only those who agreed to participate were used. The distribution is 151 males and 199 females with 217 from high SES and 133 from low SES. The study used two instruments for data collection. The first is a multiple choice test items used for junior secondary schools certificate examination for 2020 and 2021 in mathematics. The instrument is a standardized test administered by NECO for all

unity secondary schools and some private and state schools that opted for it. It contains 120 items of options A-D with only one correct answer. There are 60 items for 2020 and 60 items for 2021 giving at 120 items. Since the BECE by NECO is a standardized instrument, and is considered valid and reliable. However, the instrument was trial tested on a sample of 60 students outside the participants for the study for purposes of reestablishing its reliability. Kudar Richardson -20indicated a coefficient of .76. The second instrument used for the study is socio-economic status questionnaire developed by the researcher. It comprised 15 items on a 4-point scale of Strongly Agree =4 points,   Agree=3 points, Disagree = 2 points and Strongly Disagree =1 point. The researcher used this instrument to isolate or distribute students according to socio-economic background. Three experts from measurement and evaluation validated the SESQ. The internal consistency of the items of the instrument was determined using Cronbach alpha and a coefficient of .72 obtained. Data obtained for the study were analyzed using the Scheuneman modified chi-square statistic to answer all the research questions and chi-square test statistic was used to test null hypothesis 1 and 2 while hypotheses 3 and 4 were tested using t-test all at .05 level of significance.

Results
Research question 1
What percentage of items in the 2020-2021 NECO BECE Mathematics multiple choice test items functioned differentially by gender?

Table 1: Scheuneman chi-square Gender Differential Item Functioning Indices for 2020-2021 BECE Mathematics multiple choice test items

Items	2020 x^2	2021 x^2	Items	2020 x^2	2021 x^2
1	5.98	$15.87^{**}{}_m$	31	7.27	$16.07^{**}{}_m$
2	$15.54^{8*}{}_m$	$13.86^{**}{}_f$	32	$10.66^{**}{}_m$	$11.03^{*}{}_f$
3	0.87	1.97	33	5.74	7.03
4	$14.76^{**}{}_m$	0.76	34	7.32	$10.32^{*}{}_f$
5	2.64	5.23	35	6.53	$14.63^{**}{}_m$
6	$12.32^{*}{}_f$	8.12	36	1.76	$10.61^{*}{}_m$
7	$9.96^{*}{}_f$	$15.65^{**}{}_m$	37	$16.98^{**}{}_m$	$12.05^{*}{}_f$
8	0.95	$12.98^{*}{}_f$	38	8.61	8.61
9	$10.16^{*}{}_m$	$13.82^{**}{}_m$	39	$9.87^{*}{}_f$	$12.71^{*}{}_m$
10	$11.85^{*}{}_m$	$17.86^{**}{}_f$	40	$17.04^{**}{}_m$	4.21
11	4.87	1.54	41	7.23	$14.51^{**}{}_m$
12	$12.20^{*}{}_f$	6.98	42	2.53	3.42
13	7.96	$10.85^{*}{}_f$	43	.98	1.49
14	$12.35^{*}{}_f$	$17.86^{**}{}_f$	44	$13.98^{**}{}_m$	4.21
15	$9.98^{*}{}_f$	0.97	45	4.34	3.63
16	2.84	5.32	46	2.34	0.54
17	$11.71^{*}{}_m$	$13.87^{**}{}_f$	47	2.67	1.37

18	6.24	6.77	48	2.56	2.43
19	$10.21^{*}{}_{m}$	8.65	49	6.45	1.35
20	$10.85^{*}{}_{m}$	$14.53^{**}{}_{m}$	50	6.45	5.36
21	$13.71^{**}{}_{f}$	$9.98^{*}{}_{m}$	51	5.12	4.14
22	3.22	9.05	52	5.12	4.46
23	$14.85^{**}{}_{m}$	7.82	53	2.34	$15.34^{**}{}_{m}$
24	$17.63^{**}{}_{f}$	3.86	54	$10.43^{*}{}_{f}$	3.91
25	2.88	1.87	55	7.58	2.74
26	$10.54^{*}{}_{m}$	$10.54^{*}{}_{m}$	56	4.66	4.61
27	3.14	1.89	57	$11.45^{*}{}_{m}$	3.77
28	$14.73^{**}{}_{m}$	5.31	58	6.09	2.37
29	$15.91^{**}{}_{f}$	$11.76^{*}{}_{f}$	59	$10.17^{*}{}_{f}$	5.74
30	6.76	3.88	60	3.56	3.54

Table 1 indicates that 48 out of 120 items representing 40% in 2020-2021 NECO BECE Mathematics multiple choice test items significantly function differentially for testes based on gender. In 2020 examination, 26 items representing 43 % significantly functioned differentially for testes based on gender, while 22 items representing 37% significantly functioned differentially for testes based on gender in 2021. Generally, the Scheuneman modified chi-square comparing NECO BECE Mathematics multiple choice test items for female and male, flagged 48 items with significantly differential item functioning (P< 0.05). The result showed that, 26 items out of 48 items representing 54 % in NECO BECE 2020-2021, that displayed DIF favored male while 22 items out of 48 items representing 46 % were in favor of female.

Hypothesis 1:
The 2020-2021 NECO BECE Mathematics test items do not significantly function differentially with respect to gender.

Table 2: Chi-square Summary of 2020-2021 NECO BECE Mathematics Differential Item functioning by gender

GENDER	OBSERVED DIFFAVOURED ITEMS	EXPECTED DIFFAVOURED ITEMS	DF	CHI SQUARE VALUE CALCULATED	SIG/CHI SQUARE VALUE FROM TABLE
MALE	26	24			
FEMALE	22	24	1	.3334	3.84

From table 2, the chi-square calculated value of 0.3334 is less than the tabulated chi-square value of 3.84 at .05 level of significance. Hence, the null hypothesis is not rejected. The implication is that there is no significant difference between male and female students on

the percentage of items which functioned differentially in the 2020-2021 NECO BECE Mathematics multiple choice test items.

Research Question 2
What percentage of items in the 2020-2021 NECO BECE Mathematics multiple choice test items functioned differentially by socio-economic status.

Table 3: Scheuneman chi-square SES Differential Item Functioning Indices for NECO BECE Mathematics multiple choice test items used in 2020 - 2021.

Items	2020 x^2	2021 x^2	Items	2020 x^2	2021 x^2
1	17.54^{**}_h	8.97	31	7.88	12.29^{*}_h
2	11.98^{*}_h	4.88	32	9.89^{*}_h	17.37^{**}_h
3	15.13^{*}_h	5.65	33	6.02	5.66
4	6.88	12.19^{*}_t	34	5.18	8.32
5	5.65	17.11^{**}_h	35	8.04	14.67^{**}_l
6	5.20	14.67^{**}_l	36	12.45^{*}_h	17.11^{**}_h
7	11.32^{*}_t	8.32	37	3.91	12.19^{*}_l
8	16.43^{*}_h	5.66	38	15.46^{**}_h	5.65
9	6.32	17.37^{**}_h	39	15.39^{**}_t	4.88
10	4.62	12.29^{*}_h	40	6.77	8.97
11	7.38	6.45	41	9.13	6.43
12	14.81^{**}_h	11.65^{*}_l	42	6.41	4.65
13	6.63	4.86	43	14.76^{**}_l	13.66^{**}_h
14	5.97	15.54^{**}_h	44	13.65^{**}_h	11.89^{*}_h
15	15.43^{**}_h	10.19^{*}_l	45	8.12	13.87^{**}_h
16	8.26	7.94	46	4.76	6.22
17	12.22^{**}_t	7.05	47	14.76^{**}_h	9.89^{*}_h
18	4.32	10.87^{*}_h	48	13.94^{**}_h	7.32
19	17.56^{**}_h	16.18^{**}_h	49	8.80	15.54^{**}_h
20	10.87^{*}_h	5.76	50	10.44^{**}_l	11.03^{*}_l
21	10.44^{*}_t	8.37	51	4.62	5.76
22	8.80	6.06	52	6.32	16.18^{*}_h
23	13.94^{**}_h	14.87^{**}_h	53	16.43^{**}_h	10.87^{*}_h
24	14.76^{**}_h	9.97^{*}_h	54	11.32^{*}_l	7.05
25	4.76	12.02^{*}_h	55	5.20	7.94
26	8.12	5,74	56	5.65	10.19^{*}_l
27	13.65^{**}_h	7.12	57	6.88	15.54^{**}_h
28	14.76^{**}_l	16.03^{**}_h	58	15.13^{**}_h	4.86
29	6.41	14.21^{**}_t	59	11.98^{*}_h	11.65^{*}_l
30	9.13	8.37	60	17.54^{**}_h	6.45

Result of analysis presented in table 3 shows that a total of 29 items representing 43 % of Mathematics multiple choice test items used in NECO BECE in 2020 differentially functioned for students with respect to socio-economic status. In 2021 examination, 30

items representing 50% showed evidence of differential item functioning for examinees based on SES. Generally, the Scheuneman modified chi-square comparing NECO BECE for 2020-2021 mathematics multiple-choice test items for SES flagged 59 items with significantly differential item functioning (P<0.05), representing 49% of all the items. The result showed that, 40 items out of 59 representing 67.8 % in NECO 2020-2021 BECE, displayed DIF in favor of students in high SES while 19 items out of 59 items representing 32.2% were in favor of students from low SES status.

Hypothesis 2
The 2020-2021 NECO BECE Mathematics test items do not significantly function differentially with respect to SES of students.

Table 4: Chi-square Summary of 2020-2021 NECO BECE Mathematics multiple choice test items.

SES	OBSERVED DIF FAVORED ITEMS	EXPECTED DIF FAVORED ITEMS	DF	CHI SQUARE VALUE CALCULATED	CHI SQUARE VALUE FROM TABLE
HIGH	40	29,5			
LOW	19	29.5	1	7.48	3.84

Data in table 4 showed that the chi-square value calculated (7.48) is greater than the chi-square value from table (3.84) at .05 significance level. Hence the null hypothesis is rejected. The implication is that there is a significant difference between students from high and low SES on the percentage of items that functioned differentially in 2020-2021 NECO BECE Mathematics multiple choice test examination in favor of high SES group.

Research Question 3
What is the difference between the mean value of items that functioned differentially in 2020 and 2021 NECO BECE Mathematics test items based on gender?

Table 6: Mean and standard deviation of DIF of 2020 and 2021 NECO BECE test items based on gender.

Variable	Observation	Mean	SD	Standard Error mean
2020 DIF items	26	12.6862	2.51890	.49400
2021 DIF items	22	13.4864	2.39778	.51121
Mean diff		0.8002		

The mean and standard deviation of gender based DIF for 2020 are 12.6862 and 2.5189 respectively, whereas the mean and standard deviation of gender based DIF for 2021 are

13.486 and 2.39778 respectively. This shows a mean difference of 0.8002 in favour of 2021. A test of hypothesis will ascertain the statistical significance of the difference.

Hypothesis 3: There is no significant difference in the mean value of items that functioned differentially in 2020 and 2021 NECO BECE Mathematics multiple choice test items with respect to gender.

Table 6: Independent sample t-test analysis of DIF of 2020 and 2021 NECO BECE Mathematics items based on gender.

variable	Observation (N)	Df	t- value	Sig	remarks
DIF for 2020	26				
DIF for 2021	22	46	1.121	.268	Accept Ho

Result from table 6 show that t-value of 1.121 is not significant at .05 level (P= .268 > .05). Hence, H_o is not rejected. The conclusion is that the mean of DIF for 2020 and 2021 based on gender is not statistically different.

Research Question 4
What is the difference in the mean value of items that functioned differentially in 2020 and 2021 NECO BECE Mathematics test item with regards to SES of students?
Table 7: Mean and standard deviation of DIF of 2020 and 2021 BECE Mathematics test items based on SES.

Variable	Observation	Mean	SD	Standard Error mean
2020 DIF items	29	13.9303	2.24738	.41733
2021 DIF items	30	13.5603	2.47960	.45271
Mean diff		0.3700		

Result shown in table 7 indicates that the mean and standard deviation of SES based DIF for 2020 ar 13.9303 and 2.24738 respectively while the mean and standard deviation of SES based DIF for 2021 are 13,5603 and 2.47960 respectively. This shows a mean difference of 0.3700 in favour of 2020. A test of hypothesis will confirm the significance of this difference.

Hypothesis 4
There is no significant difference in the mean value of items that functioned differentially in 2020 and 2021 NECO BECE Mathematics multiple choice test items based on SES of testees.

Table 8: Independent Sample t-test of DIF of 2020 and 2021 NECO JSCE Maths items based on SES.

Variable	Observation (N)	Df	t- value	Sig	remarks
DIF for 2020	29				
DIF for 2021	30	57	.600	.551	Accept Ho

From table 8, t-value of .600 is not significant at .05 level (P= .551 >.05). Hence, H_o is not rejected. The implication is that the mean of DIF for 2020 and 2021 with respect to SES is not statistically different.

Discussion of findings

The findings of this study based on analysis done using Scheuneman modified chi-square indicates that there were cases of gender and socio-economic status differential item functioning in the 2020 and 2021 NECO BECE Mathematics test items. The result also showed that the differences in the means of DIF for gender and SES for the two years are not significant. Hence, the DIF issues for the two years are the same.

The fact that more items functioned differently in favour of the students from high socio-economic status than those from low socio-economic level is in line with a priori expectation. Students from this group may have access to additional study materials that will expose them to diverse modes of constructing questions in the content area. Some of them may have home tutors that will provide additional enlightenment, which will be of advantage to them.

The findings of this study align with the findings of previous studies. Kasali and Adeyemi (2022) reported differential item functioning of 2016 NECO Mathematics multiple test items based on gender. Similarly, Kelani and Faleye (2022) found that economics items of the Osun state unified promotion examination exhibited differential item functioning with gender. The result also agrees with Madu (2012) who worked on the analysis of gender-related differential item functioning in Mathematics multiple choice items administered by WAEC and reported that male and female examinees function differentially in 39 items out of 50 items. The finding also corroborate that of Agbaegbu, Akanwa and Ihechu (2022) who found that Agricultural Science multiple-choice test items used in NABTEB 2015-2017 contain test items that significantly functioned differentially for testees on the basis of gender. In addition, Adediwura (2013) identified differential item functioning in relation to gender and student's course of study using IRT and GLM methods. Orluwene and Queensoap (2019) also used Differential Item Functioning via Scheuneman chi-square statistics to detect item bias based on ethnic groups in Chemistry Achievement Test. The results of this study agree with Adedoyin (2010) who identified gender-biased items in Botswana Junior Certificate Examination. The methodology of detecting DIF adopted in this study is in line with that of Agbaegbu, Akanwa and Ihechu , Orluwene and Queen soap (2019), Odili (2014), Madu (2012).

Conclusion

Based on the findings of the study, it is concluded that the BECE Mathematics multiple choice test items administered by NECO in 2020 and 2021 functioned differentially among the examinees on the basis of the subgroups of gender and socio-economic status. In addition, the DIF based on gender and SES in 2020 and 2021 is not significantly different.

Sequel to the findings and conclusion, the researcher recommends that test practitioners should conduct trail testing and perform DIF analysis prior to test administration. This will help test developers to modify, replace or equitably distribute items that function differentially for different test taking groups. In addition, the researcher advocates for the use of very simple English while setting mathematics BECE questions to avoid misinterpretation. A similar study should be conducted that will consider other subgroups like school location, school type, ethnic groups and so on, in Mathematics or other subjects in both junior and senior secondary school levels.

REFERENCES
Adediwura, A.A (2013). A comparative study of item response theory and generalized linear model method of detecting differential item functioning in dichotomous test. *Research journal in organizational psychology and educational studies* 2 (6):308-316

Adedoyin, O.O (2010). Using IRT approach to detect gender biased items in public examinations. *Educational research and reviews academic journals* 5 (7): 385-399

Agbaegbu, C.N, Akanwa, U.N & Ihechu, K.J.P (2022). Differential item functioning of 2015-2017 Agricultural Science multiple-choice questions conducted by the National Business Technical Examination Board. *Journal of evaluation* 7 (1):11-24

Aituariagbon, K.E & Osarumwense, H.J (2022). Non-parametric method of detecting differential item functioning in senior school certificate examination (SSCE) 2019 Economics multiple-choice items. *Kashere journal of education* 3 (1):146-158

Hisehfeld, M, Moore, R.L & Brown, E (2005). Exploring the gender gap on the GRE subject test in economics. *Journal of economic education.*26:316-322

Ihechu, K.J &Madu, A.O (2016). Differential Item functioning of National Examination Council Agricultural science questions for 2015. *Journal of education and leadership development* 8 (2):21-16

Ihendinihu, U.E (2022). Cognitive levels, task numbers and facility indices of mathematics multiple-choice questions in basic education certificate examination conducted by National Examination Council in Nigeria. *Rivers state university journal of education* 25:1-11

Ihendinihu, U.E (2020). Assessment of secondary school mathematics teacher's knowledge and utilization of multiple-choice test construction guidelines and procedures. *ASSEREN journal of education* 5 (1):175-190

Jimoh, K & Adediwura, A.A (2022). Gender and culture-related differential item functioning in 2016 National Examinations Council mathematics multiple-choice questions in Nigeria. *Ife journal of behavioral research* 10 (1):55-72

Kelani, K.O. & Faleye, B.A (2022). Differential Item Functioning of 2016 multiple-choice economics items of Osun state Unified Promotion Examination. *Ife journal of behavioral research 10 (1):1-9*

Madu, B.C (2012). Analysis of gender-related differential item functioning in Mathematics multiple-choice items administered by West African Examination Council (WAEC). *Journal of education and practice* 3(8):71-78

Odili, J.N (2014). *Effect of Language manipulation on Differential Item Functioning of Biology multiple-choice test* unpublished PhD Thesis submitted to the department of Science Education, University of Nigeria Nsukka

Orluwene, G.W &Queensoap, M (2019). Detecting item bias with Scheuneman chi-square in a chemistry achievement test in Nigeria. *International journal of innovative social & science education research*7 (1):88-101

Shephard, C, Camilli, G & Averill, M (2011). Comparison of procedures for detecting test item bias with both internal and external ability criteria. *Journal of educational statistics.* 6(4):317-375

Swaminathan, H & Rogers, H.J (2010). Detecting differential item functioning using logistic regression procedures. *Journal of educational measurement* 27 (4):362-370.

EFFECT OF GEOGEBRA APPLICATION ON ACADEMIC ACHIEVEMENT AND INTEREST OF JUNIOR SECONDARY SCHOOL STUDENTS IN MATHEMATICS IN AKWA IBOM STATE, NIGERIA

BASSEY, UBONG EFFIONG
ubongebassey@uniuyo.edu.ng
School of Basic Studies, University of Uyo, Uyo, AkwaIbom State, Nigeria
+2348064648860
&
OGBONNA, CECILIA CHINYERE (Ph.D)
ogbonna.cecilia@mouau.edu.ng
Department of Science Education, College of Education
Michael Okpara University of Agriculture, Umudike, Abia State
+2348037785289

Abstract
The study investigated the effect of GeoGebra application on academic achievement and interest of junior secondary students in Mathematics in Akwa Ibom State, Nigeria. The research questions guided the study and two null hypotheses were tested at 0.05 level of significance. The study adopted a pretest, posttest quasi experimental design. The population consisted of 13,157 junior secondary two (JS2) Students made up of 5,876 males and 7,281 females. Two schools were purposively sampled and simple random sampling technique (toss of coin) were used in selecting two intact classes of junior secondary two (JS2) Students of 2021/2022 academic session for experimental and control groups. Two validated instruments Mathematics Achievement Test (MAT) and Mathematics Interest Scale (MIS)were used for the data collection in the study. Kuder-Richardson Twenty (K-R)$_{20}$ formula was used to determine the reliability coefficient of 0.85. The research questions were answered by descriptive statistics; mean and standard deviation while the hypotheses were tested using Analysis of Covariance (ANCOVA) statistic at $p < 0.05$ level of significance. The findings revealed a significant difference between the achievement of the experimental group and control group in favour of the experimental group. The result also showed that the use of GeoGebra enhanced greater motivation and positive attitude towards mathematics. Based on the findings, it was recommended that Mathematics teachers should intensively employ the use of Mathematical software such as GeoGebra that will actively involve both the teachers and students during teaching learning processes.
Keywords: GeoGebra, Achievement, Interest, Geometry, Mathematics

Introduction

Mathematics, coined from the Greek word or language "Mathema" meaning "knowledge, study or learning" is the study of areas such as quantity (numbers), structure, space and change. Mathematics is a way of describing relationships between number and other measurable quantities. Azuka (2013) sees Mathematics as not only language of the science, but an important nutrient for thought, logic, reasoning and progress. Some of its main sub-

divisions are arithmetic, algebra, geometry, trigonometry and calculus. Kajuru (2006) observed that since the beginning of recorded history, Mathematics discovery has been at the forefront of every civilized society. He further emphasized that the need for Mathematics arose based on the wants of the society, the more complex a society, the more complex the Mathematical needs. Thus, every nation needs mathematics.

Various nations across the world are classified as first – world, second – world or third – world on the basis of each nation's level of development in Science and Technology, which are power-driven by refined numerical manipulation that always employ Mathematics as its basic tool. The central position of Mathematics to national development has resulted in education policy makers resolving to position Mathematics as a required subject for admissions and even employment purposes (Kolawole, 2013). Odili(2002) explains that Mathematics is the bedrock of many professional courses. Mathematics is accepted in the present world of science and technology as the "queen of science and the language of nature" and no nation can hope to achieve any measure of scientific and technological advancement without foundation in mathematics (Uko, 2016). For this reason, the researcher ventured into innovative teaching approach through the use of GeoGebra strategy to investigate the extent it will reduce the problem associated with learning mathematics among junior secondary school students.

GeoGebra is a mathematics software that learners operate and navigate to represent a variety of conceptual relationships to real life situation (Kalu, 2015). GeoGebra is one form of instructional material that offers unique opportunities for learners to build and communicate mathematical ideas. Markus (2008) defined GeoGebra as dynamic mathematics software used for teaching and learning of mathematics in schools which includes: geometry, algebra, and calculus. However, GeoGebra is an interactive geometry system. Through the use of GeoGebra, one can carry out constructions with points, vectors, segments, lines, and conic sections as well as functions while changing them dynamically afterwards. Consequently, equations and coordinates can be entered directly. Thus, GeoGebra has the ability to deal with variables for numbers, vectors, and points. It finds derivatives and integrals of functions and offers commands like Root or Vertex. There are two characteristic of GeoGebra: an expression in the algebra window that corresponds to an object in the geometry window and vice versa.

For the purpose of this study, the researcher defines GeoGebra as a software representation of mathematical concept that can be seen and navigated about by both teachers and learners to aid them validate and explain their mathematical ideas and for the purpose of making mathematics enjoyable, effective and interesting in order to enhance teaching and learning of mathematics. GeoGebra was invented by Markus Hohenwarter and Julius Hohenwarter in the year 2008. GeoGebra was created as a free, open-source dynamic mathematics software, which is used for both teaching and learning mathematics from middle school through college to the University level (Hohenwarter & Preiner, 2008). GeoGebra offers geometry, algebra and calculus features in a fully linked, compressed and easy-to-use software environment. In other words, this device spreads the concepts of dynamic geometry to the fields of algebra and mathematical analysis. GeoGebra is designed specifically for educational purposes, which can help learners grasp experimental,

problem-oriented and research-oriented learning of mathematics, both in the classroom and at home. Students can simultaneously use a computer algebra system and an interactive geometric system to increase their cognitive abilities in the best way.

GeoGebra in this usage is such a device that the teacher will use to present mathematical concepts to the learners in the software form in order to make visualization and understanding very clear and real. The West African Examination Council (WAEC) and National Examination Council of Nigeria (NECO) Chief Examiner's report between 2020 and 2022 has consistently drawn attention to poor achievement of students in certain mathematics topics at the senior Secondary certificate Examination. Such areas of weakness include: Mensuration, trigonometry, geometry and statistics. However, research studies attributed the poor achievement of students in examinations mostly to the teaching approach adopted by mathematics teachers in presenting instructions (Ogbonna, 2004). Explaining further, Ogbonna lamented that even students who are capable of demonstrating success, who pass tests with high marks and obtain "honours", diplomas, frequently do not connect the information they receive in school to interpretations of the world around them. This is attributed to the method of teaching (conventional teaching method) adopted by most mathematics teachers. The teaching and learning of mathematical concepts especially in geometry at secondary level of education still remain a serious problem due to the abstract nature of the concepts.

Geometry is a branch of Mathematics concerned with shape, size, relative position of figures and the properties of space. In particular, geometry has come to play great roles in science. For example in Physics, it is in the study of relativity. Geometric ideas are a2lso of great importance to engineering, surveying, geologist and navigation (Obilor, 2020). According to Obilor, the relevance of Geometry in life has awarded it a central place in mathematics curriculum. It has become the pivot on which main scientific and technological innovations center. It helps a learner in the development of aesthetics around his environment as well as inductive reasoning skills and is taught in schools right from primary level to tertiary level (Yosoff, 2013). Geometry is the branch of mathematics in which visualization is one of the most essential elements for understanding definitions and theorems, as well as solving the given tasks and problems. According to Steven in Prakash (2013), early advancement of Babylonians and Egyptians used geometrical concepts in their everyday lives to do many things like building structures such as the pyramids, plot square corners of fields and so on. Owing to the aforementioned, it is obvious that the importance of geometry in everyday life cannot be over emphasized. It is because of this importance that Geometry is included as one of the core topics in primary and secondary school mathematics.

However, geometry is one of the mathematical concepts that mostly require instructional materials like GeoGebra for its teaching and learning at all level of education. Teaching of geometry with GeoGebra at all education levels can help in understanding the basic facts such as angles, shapes, lines, line segments, curves in geometric figures (plane and solid shapes) and can also help in understanding the basic facts about geometric transformation such as reflection, rotation and translation. The implication is that, for geometry to be effectively communicated there is need to apply teaching aids that will

assist the teacher in making connection between its abstract nature and real life applications. When the learners use and interact with GeoGebra and interact with one another, learning can become interesting and achievement improved (Hohenwarter & Preiner, 2008).

Achievement means to reach a required standard of performance, or to carry out a task successfully. In the context of this study, achievement refers to reasoning progress of students in terms of passes gotten from teacher-made test/standardized test in mathematics. Hence, the researcher upholds the view that, students' Academic achievement entails successful academic progress attained through effort and skill (Ajai, 2015). It involves the determination of the degree of performance and attainment of individuals in tasks, courses or programmes to which the individuals were sufficiently exposed. The academic achievement of secondary school students in mathematics has not been encouraging (Alio and Okafor, 2018). Teaching with mathematics software such as GeoGebra helps the teacher to employ variety of strategies and approaches to meet learning needs of learner, whereby students have equal opportunities to learn irrespective of their abilities, location or gender. For mathematics achievement to be awakened in students, they must have interest in the subject which is worth exploring.

Interest according to Imoko and Agwagah (2006) is a personal feeling of attention or persisting tendency to pay attention and enjoy some activities or content. Obodo in Alio and Okafor (2018) opined that it is the feeling of intentness, concern or curiosity about an object. Interest refers to the condition of being eager to know or learn about something. It is an important variable in the teaching and learning of mathematics. This is because when a student becomes interested in an activity, they are likely to be more totally involved in that activity. Okigbo and Okeke (2011) stated that, "a student may be intellectually and physically capable to learn, he/she may never learn until his/her interest is stimulated". Once the interests of students are stimulated, they will continue to learn as long as their teacher is capable of sustaining their interest in the subject matter. Okigbo and Okeke further states that interest is a mother to attention, and once there is direct interest, attention is guaranteed and learning is assured. Psychological disposition like interest could be a factor in determining the relative interest of the students, the role of interest in the learning process has been x-rayed by Okorie (2016) when he noted that the zeal with which students enters into any learning activity is in order of their interest in the particular activity. Students appear to learn more effectively those things that appear to interest them. Mamman and Isa (2018) recommended that interest –boosting activities such as use of models during lessons, formation of discussion groups, use of appropriate innovative methods and strategies be adopted in the mathematics classrooms.

Though interest may influence students' achievement in Mathematics, type of exposure and many other variables may also influence students' achievement in Mathematics. Hence, it is in the light of this that the researchers decided to investigate the effect of GeoGebra Application on Mathematics Students' Academic Achievement and interest in AkwaIbom State.

Purpose of the study

The purpose of this study was to investigate the effect of geogebra application on academic achievement and interest of junior secondary school students in mathematics in Akwa Ibom State, Nigeria. Specifically, the study sought to determine:

1. the mean achievement scores of students taught mathematics using GeoGebra application and those taught using conventional method?
2. the mean interest scores of students taught mathematics using GeoGebra application and those taught using conventional method

Research Questions

The following research questions were posed to give direction to the study:

1. What are the mean achievement scores of students taught mathematics using GeoGebra application and those taught using conventional method?
2. What are the mean interest scores of students taught mathematics using GeoGebra application and those taught using conventional method?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance

1. There is no significant difference in the mean achievement scores of students taught mathematics using GeoGebra application and those taught using conventional method.
2. There is no significant difference in the mean interest scores of students taught mathematics using GeoGebra application and those taught using conventional method.

Method

This study adopted quasi-experimental research design. Specifically; a pre-test and post-test design was used for the study. The design is considered appropriate because the researcher used intact classes as experimental and control groups respectively. The use of intact classes is to ensure none alteration of regular class periods since secondary school authority in AkwaIbom State does not allow their lesson periods to be altered. The experimental group was taught geometry using GeoGebra and the topics taught are: properties of plane shapes, perimeter of plane shapes and area of plane shapes. On the other hand, the control group was taught the same topics without using GeoGebra. The area of the study was AkwaIbom state. AkwaIbom is a state in Nigeria. The population of the study was thirteen thousand, one hundred and fifty seven (13,157) Junior Secondary Two Students (JS2) in AkwaIbom State Public Secondary Schools in 2018/2019 academic session. This population figure of 13,157 JSS2 Students consists of five thousand eight hundred and seventy six (5,876) male Students and seven thousand two hundred and eighty one (7,281) female students. The sample for this study was 104 JSS2 Students in intact classes of Junior Secondary Two (JS2) 2021/2022 academic session purposively drawn from two public secondary school in Uyo Local Government Area of AkwaIbom State. The researcher adopted simple random sampling technique to select the intact classes for

experimental group and the one for control group respectively. These schools were selected because they are better equipped with ICT facilities than other schools in the area. Two instruments, namely; Mathematics Achievement Test (MAT) and Mathematics Interest scale (MIS) were used for data collection in the study.

The following procedures were used in order to ascertain the face and content validity of the research instruments. The Mathematics Achievement Test and Mathematics Interest scale were given out for validation to three (3) Lecturers, One from science Education Department in University of Uyo, Uyo and two from Michael Okpara University of Agriculture, Umudike; one from Mathematics Education and one from Measurement and Evaluation at Michael Okpara University of Agriculture, Umudike for critical assessment and suitability of the test questions. Their comments and corrections were used as directed before the production of the final copies of the instruments.

To obtain the reliability of the instruments, a trial testing was carried out. Twenty four (24) Junior Secondary two (JS2) students from Co – Science Secondary School in Uyo, which is within the Education Zone of the study were used for trial testing of the instruments. Thereafter, Kuder-Richardson Twenty $(K-R)_{20}$ formula was used to determine the reliability coefficient of 0.85. The Kuder-Richardson Formula Twenty $(K-R_{20})$ was used because responses to the MAT and MIS entailed right or wrong answers, that is, they are dichotomously scored.

The Mathematics Achievement Test (MAT) items were developed based on the behavioural objectives pre-stated to be achieved at the end of the lessons. From the sub-topics forty (40) multiple choice questions were constructed. The forty (40) multiple choice questions have four (4) options (A-D) and each correctly answered question was scored 1 mark, while an incorrect answer attracted zero mark. Thus, answering all the questions correctly gave a total 40 marks.

The second instrument is the Mathematics Interest Scale (MIS) that contained 20 items structured to find out the students' interest in learning mathematics. The interest scale modified was structured on a four-point likert scale of Strongly Agree (SA) (4-points), Agree (A) (3-points), Disagree (D) (2-points) and Strongly Disagree (SD) (1-point). The negative statements was scored in the reverse format i.e Strongly Agree (SA) (1-point), Agree (A) (2-points), Disagree (D) (3-points) and Strongly Disagree (SD) (4-points).

The study lasted for six weeks; first week was for pre-test (administration of the instrument to both experimental and control groups), while the actual treatment for both the experimental and control groups lasted for four weeks. The last week was used for re-administration of the 40 items MAT test items (post-test) and 20 items in Mathematics Interest Scale.

Mean and standard deviation were used in answering the research questions and analysis of Covariance (ANCOVA) was used in testing the hypotheses at alpha level of 0.05

Results
Research Question One
What are the mean achievement scores of students taught mathematics using GeoGebra application and those taught using conventional method?

Table 1: The mean achievement scores of Students taught mathematics using GeoGebra and those taught using conventional method.

Variables	N	Pre-Test Mean	SD of Pre-Test	Post-Test Mean	SD of Post-Test	Difference in Mean
Experimental Group	54	27.04	2.36	53.45	5.45	26.41
Control Group	50	33.87	3.10	41.91	3.59	8.04

Table 1 shows that the pre-test and post-test mean achievement scores of Students taught with GeoGebra are 27.04 and 53.45 respectively with a difference mean score of 26.41. This indicates that learning actually took place. Furthermore, the table also presented the pre-test and post-test mean achievement scores of Students taught mathematics using Lecture method as 33.87 and 41.91 with mean difference of 8.04. The pre-test mean achievement scores of the two groups (27.04 and 33.87) revealed that the Students from control group appeared to have higher level of knowledge on what they were to learn than the Students from the Experimental group before the experiment took place. The mean achievement score (post-tests) of Students taught mathematics with GeoGebra were higher than the mean achievement scores of Students taught mathematics using conventional method (53.45 and 41.91).

Hypothesis One
There is no significant difference in the mean achievement scores of students taught mathematics using GeoGebra and those taught using conventional method.

Table 2: Analysis of covariance on the mean achievement scores of Students taught using GeoGebra and those taught using conventional method.

Source	Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1222.825[a]	2	611.413	78.749	.000	.607
Intercept	1998.969	1	1998.969	257.463	.000	.913
PRETEST	.092	1	.092	.012	.000	.319
Groups	1033.188	1	1033.188	133.073	.000	.570
Error	791.937	101	7.764			
Total	100455.000	104				
Corrected Total	2014.762	103				

a. R Squared = .607 (Adjusted R Squared = .599)

Table 2 shows that the F-ratio is 133.073 with 1 degree of freedom. However, since the associated alpha level of .000 is less than the p-value of 0.05 ($p > 0.05$), the null hypothesis which states that there is no significant difference in the mean achievement scores of students when taught mathematics using GeoGebra and when taught using conventional method is not accepted. This implies that there is a significant difference in the mean achievement scores of Students taught mathematics using GeoGebra and those taught using conventional method.

Research Question Two
What are the mean interest scores of students taught mathematics using GeoGebra application and those taught using conventional method?

Table 3: The mean interest scores of Students taught mathematics using GeoGebra and those taught using conventional method.

Variables	n	Pre-Test Mean	SD of Pre-Test	Post-Test Mean	SD of Post-Test	Difference in Mean
Experimental Group	54	47.80	3.44	66.98	7.20	19.16
Control Group	50	46.98	2.83	56.92	5.32	9.94

Table 3 shows that the pre-test and post-test mean interest scores of Students taught with GeoGebra are 47.80 and 66.98 respectively with a difference mean interest scores of 19.16. This indicates that Students' interest was enhanced. Furthermore, the table also presented the pre-test and post-test mean interest scores of Students taught mathematics using conventional method as 46.98 and 56.92 with mean difference of 9.94. The pre-test mean interest scores of the two groups (47.80 and 46.98) revealed that the Students from Experimental group appeared to have greater interest level towards mathematics than that of the Control group before the experiment took place. The mean interest scores (post-tests) of Students taught Mathematics with GeoGebra were higher than the mean interest scores of Students taught Mathematics using conventional method (66.98 and 56.92).

Hypothesis Two
There is no significant difference in the mean interest scores of students when taught mathematics using GeoGebra and when taught using conventional method.

Table 4: Analysis of covariance on the mean interest scores of Students taught mathematics using GeoGebra and those taught using conventional method.

Source	Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	10035.504[a]	2	5017.752	530.892	.000	.912
Intercept	1785.826	1	1785.826	188.945	.000	.952
PRETEST	398.923	1	398.923	42.207	.000	.391
Groups	1539.743	1	1539.743	162.909	.000	.821
Error	964.058	101	9.452			

| **Total** | 362366.000 | 104 | | | |
| **Corrected Total** | 10999.562 | 103 | | | |

a. R Squared = .912 (Adjusted R Squared = .911)

Data in table 4 shows that the F-ratio is 162.909 with 1 degree of freedom. However, since the associated alpha level of .000 is less than the p-value of 0.05 (p > 0.05), the null hypothesis which states that there is no significant difference in the mean interest scores of students when taught mathematics using GeoGebra and when taught using conventional method is not accepted. This implies that there is a significant difference in the mean interest scores of Students taught mathematics using GeoGebra and those taught using conventional method.

Discussion
Result from the tables showed that Students who were taught using GeoGebra performed significantly better than those taught using conventional method. This study is in tandem with Uko (2016), which discovered that GeoGebra improves students' performance in mathematics more than ordinary conventional method. This implies that getting learners involved through the use of GeoGebra encourages learners to actively participate in teaching and learning of mathematics. This study is in support of Nanang (2017) who in his study stated that the use of GeoGebra in teaching during mathematics lessons is better than the conventional method at improving Mathematical Representation Ability by students' performance in geometrical construction. The finding made an emphatic premise which gave support to what was earlier stated by Pellumb (2010), that GeoGebra software is a tool and a platform that can be used by the students of any level. It can be used by the young people, even by the students of the primary school. This is because of the great number of varieties of the exercises and of different types like puzzle and entertaining, construction, testing, research, problem-solving and so on, that can be accomplished by using GeoGebra tools and its platform. Young people are game-driven and curiosity problem-driven. GeoGebra software is the right tool and the platform meeting the trends and the needs of this generation not only in the school but in their homes as well or elsewhere, suffice to have internet access. GeoGebra is an open source for teaching and learning, free of charge and for all. The outcome of the findings is instructive to teachers, Students, administrators and government. It implies that instructional materials like GeoGebra among others should be made available by government, school administrators and teachers during teaching of mathematical concepts to improve level of understanding mathematical concepts by students. This will in turn reduce poor achievement in mathematics especially at junior secondary school level of education.

The results of table 3 and 4 showed that Students who were taught using GeoGebra had higher mean interest scores than those taught using conventional method in mathematic. This could be as a result of contributory factor of hands-on instructional

approach in using GeoGebra in learning mathematical concepts. This is because some researchers have found that when one becomes interested in an activity, one is likely to be more deeply involved in that activity (Okigbo and Okeke, 2011).This finding is in conformity with Dogan (2010), who's work found that the use of GeoGebra Software in teaching increased higher thinking skills among learners of Mathematics. The software was also observed as having a positive effect in motivating students towards learning and retaining their interest and knowledge for a longer period. The result of the findings concurs with Yusuf (2016) who identified dynamic software (Geometer's Sketchpad) as one of the influential Mathematical Software in the teaching and learning of mathematics. According to Yusuf, the dynamic software had a positive effect on students' achievement and interest towards learning of graph functions. The recent findings means that, school administrators and teachers who are in constant search for lasting solution to persistent poor achievement and interest of pupils in mathematics, should pay more attention in use of instructional materials, especially those that give students participatory opportunity during teaching and learning of mathematical concepts. There is therefore need for teachers to shift from conventional approach of teaching where talk and chalk method are used in teaching mathematical concept, to other approaches like using Mathematical Software like GeoGebra that gives students participatory opportunity during teaching and learning of mathematical concepts. This will go a long way in providing solution to poor academic achievement and interest of students' in teaching and learning of mathematics.

Conclusion
The study was carried out in Uyo Education Zone of Akwa Ibom State. The results of the study showed that the use of GeoGebra in teaching mathematics to Junior secondary school Students improved their achievement and interest in mathematics. The result also showed that the use of GeoGebra enhanced greater motivation and positive attitude towards mathematics which led to improved achievement and interest.

Recommendations
Based on the findings of this study, the following recommendations were made:
1. Mathematics teachers should intensively employ the use of Mathematical software such as GeoGebra that will actively involve both the teachers and students during teaching learning process. This will provide participatory opportunity for Students to interact with the objects and one another to enhance Students' understanding, and achievement in mathematics.
2. To ensure that teachers of Mathematics are equipped with the usage of GeoGebra Software. Mathematics teachers should be trained on the use of GeoGebra Software during their training process by the teacher educators.
3. Ministry of Education policy makers should organize seminars, workshops and conferences on the use of computer-based instructional package such as GeoGebra for serving teachers, teacher educators, textbook writers and curriculum developers.
4. Curriculum splaners should incorporate the use of GeoGebra instructional package in restructuring Mathematics curriculum in Nigeria.

REFERENCES

Ado, 1.B &Umoabasi A (2014).Effect of Practical Approach on Basis Mathematics Student's Interest Performance in Fraction in Uyo, AkwaIbom State of Nigeria.*Journal of Education and Practice,* 5 (28): 77-80.

Ajai, J.T., I.I. (2015). Gender differences in mathematics achievement and retention scores: A case of problem-based learning method. *InternationalJournal of Research in Education and Science (IJRES), 1*(1), 45- 50.

Alio, B. C. &Okafor, P. C. (2018).Effects of Some Mathematical Games on Primary School Pupils' Achievement and Interest in Mathematics in Anambra State.*Journal of Mathematics Association of Nigeria*ABACUS (Mathematics Education Series)Vol. 43(1), 3-6.

Alio, B. C (2012).The effect of polya problem solving Technique on Secondary School StudentAchievement in Mathematics. Abacus, *Journal of the Mathematics Association of Nigeria,*39(1), 20 -25.

Azuka,B. F. (2013). Mathematics and Technology Development: Focus on the next millennium – Implication of Secondary education, *Abacus, Journal of MAN*, 25 (1) pp. 77.

Dogan, M. (2010). The role of dynamic geometry software in the process of learning: GeoGebra example about triangles. Retrieved from: *http://www.time2010.uma.es/Proceedings/Papers/A026_Paper.pdf.*

Eshiet, I. T. (2012).Scientific Concepts and Application.*In methodology of Science Teaching (Historical and Conceptual Approach).*Abak, Belpot (Nig.) Co. 107.

Etsu, S. M. & Ahmad, M. (2018). A Survey of Primary School Mathematics Teachers' Qualifications and Instructional Effectiveness for Achievement of National Development Goals in Rivers State.*Journal of Mathematics Association of Nigeria,*ABACUS (Mathematics Education Series), Vol. 43(1), 272 – 282.

Hamza, B. K. &Timayi, J. M (2018). Effect of Enriched Expository Method on Interest and Performance in Geometrical Construction Among Junior Secondary School Students Kaduna State, Nigeria.*Journal of Mathematics Association of Nigeria*, ABACUS (Mathematics Education Series), Vol. 43,(1), 491-497

Hohenwarter, M., & Preiner, J. (2008). Dynamic mathematics with Geogebra.*Paper presented at the International Conference for Technology in Collegiate Mathematics*. Boston,USA: ICTCM Jacob and Linus, 2017

Imoko, B. I. and Agwagah, U.N. V. (2006). Improving Students' Interest in Mathematics Achievement of JSS 3, Kwara State. *ABACUS: Journal of Mathematical Association of Nigeria*, 26(1): 53-58.

Kajuru, A. (2006). An educational–psychological conceptualization of interest. *International Journal for Educational and Vocational Guidance, 7,* 5-21.

Kalu, A. C. (2015). Self Concept and Mathematics Achievement of Primary School Pupils. An Unpublished M.Sc. *Thesis Submitted to Department of Psychological Foundation, Abia State University, Uturu.*

Kowale, E. B. &Popoola et al (2013). Effects of Teachers Variables on Academic Performance and Attitude of Junior Secondary School Students towards Computer Science. *Proceeding of MAN.*

Mamman. M. A and Isa. S. G (2018). Effectiveness of Geogebra Software on Performance and Attitude in Mathematics Among Senior Secondary School Students in Municipal Zonal Education Area of Kano State, Nigeria. *Abacus (Mathematics Education Series),Pg 138-147, Vol. 43, No 1, Aug. 2018*

Nanang, P. (2017). The Application Of Brain-Based Learning Principles Aided by GeoGebra to Improve Mathematical Representation Ability; *Proceedings of AIP Conference.* https://doi.org/10.1063/1.4995157

Nwadiae, P.O. (2010). Mathematics Education for all in UNESCO (Ed.) *Report on state of Education in African UNESCO publications,* 95-99

Obilor, W.E (2020). Effects of Geoboard on Academic Achievement and Interest of Primary School Pupils in Mathematics. An Unpublished M.Sc. *Thesis Submitted to Department of Science education, Michael Okpara University of Agriculture, Umudike.*

Odili, G. A. (2002). The Training of N. C. E. Mathematics Teachers: A focus on Instructional Materials. *Abacus Journal of Mathematics Association of Nigeria.* 34(1)   98   – 105.

Ogbonna, C. (2004). Effect of constructivist instructional Approach on Senior Secondary Students' Achievement and Interest in Mathematics. *Unpublished Thesis*, University of Nigeria, Nsukka

Okafor (2013) Poor performance of Nigerian students in mathematics in Senior Secondary Certificate Examination (SSCE): What is not working? *JORIND* 11(2), 1-5.

Okorie, E. U. (2016). Effect of Instructional Package on Students' Achievement and Interest in Chemical Bonding in Nsukka Education Zone, Enugu State, Nigeria. *Unpublished PhD Dissertation,* University of Nigeria, Nsukka.

Ozofor, N. M. (2013). Effects of target task approach on Senior Secondary III student's achievement on conditional probability. *Unpublished M.Ed. Thesis*, University of Nigeria, Nsukka.

Pellumb, K. (2010). GeoGebra: A Global Platform for Teaching and Learning Math Together and   Using the Synergy of Mathematicians; *Proceedings of Communications in Computer and Information Science.*

Prakash, S. (2013).Innovative strategies to develop better schools. Retrieved 17th Feb.2013, from http://www.nmmu.ac.za/prakashsingh

Udousoro, U. J. (2009). Effects of Computer Assisted Co – Operative and Individualistic Learning on Students' Performance in Mathematics Problem Solving. *International Journal of Educational Development.*(IJED).18(1) 163- 171.

Udousoro, U. J. (2011).A Survey of Teachers' Use of Appropriate Instructional Materials for Effective Teaching and Learning of Mathematics in the Senior Secondary School.*Journal of Research in Information and Education, (JRIE)*, 13(1) 40 – 53.

Uko, M. P. (2016). GeoGebra and Students' performance in Mathematics in Secondary Schools in AkwaIbom North West Senatorial District. Unpublished M. Ed Thesis, University of Uyo, Uyo, Nigeria.

Yosoff, J. (2013). How to teach geometry. Retrieved on 17thFeb.2013, from *http://www.wikkkihow.com/teach-geometry.*

Yusuf, F. Z. (2016). Students' attitude towards Mathematics in academic achievement in some selected schools in south western Nigeria. *European Journal of Scientific research.* 36(3); 336 – 341.

EXAMINING THE INFLUENCE OF AUDIO-VISUAL MATERIALS ON CHEMISTRY STUDENTS' INTEREST IN LEARNING CHEMISTRY IN AWKA EDUCATION ZONE, ANAMBRA STATE, NIGERIA

Nnoli, Juliana Nkiru. (Ph.D) & Nwafor, Stephen Chinedu (Ph.D)
Department of Science Education, Nnamdi Azikiwe University, Awka, Anambra, **State.**
jn.nnoli@unizik.edu.ng, sc.nwafor@unizik.edu.ng
08036736987, 08060001469

Abstract
The study sought to examine the influence of audio-visual materials on students' interest in learning chemistry among secondary school students in Awka Education Zone of Anambra state. Four research questions were raised to guide the study. A descriptive survey design was employed. One hundred and twenty four (124) chemistry students drawn from 1,821 senior secondary year two students (SS2) in Awka Education zone in Anambra State formed the sample for the study. Thirty (34) item structured questionnaires on a four-point rating scale developed by the researchers were used for data collection. The instrument used for data collection was questionnaire which was validated by three experts. A reliability coefficient of 0.83 was established using Cronbach Alpha techniques. After the administration of the instrument to the respondents, the data obtained were analyzed using mean, standard deviation, frequency and percentage. The finding among others revealed that some audio-visual materials are available in the chemistry classroom and they are effective in enhancing students' interest in learning chemistry. There are factors that hinder the effective use of audio-visual materials in learning chemistry; they are lack of qualified chemistry teachers with adequate knowledge of modern audio-visual materials. It was recommended among others that government should endeavor to make adequate provision of modern audio-visual materials in schools, teachers should be 8retrained through seminars, workshops and conferences so as to enable them have adequate knowledge of the use of modern audio-visual materials.
Keywords: Audio-Visual Materials, Interest, Learning, Chemistry

Introduction

Chemistry is a very important science subject and a requirement for further learning of a number of science-related professional courses like medicine, agriculture, pharmacy (Samuel, 2017). According to Nwanze and Okoli (2020), chemistry is the study of the composition, properties, changes and uses of matter that form the environment around us. The study of chemistry both at the senior secondary and tertiary education levels of education has however been bedeviled by serious and appalling notes. Chemistry is one of the science subjects that senior secondary school students offer at the senior levels in the Nigerian secondary schools. Chemistry involves experimentation and the learner is required to observe, record, calculate and make intelligent references (Nnoli, 2022). In contemporary Nigeria, greater emphasis is placed on science and technological development. As a result, students are being encouraged to take up science-related subjects. Today, chemistry pervades literally every field of human endeavor, and plays a

fundamental role in educational advancement (Egolum, Samuel & Okonkwo, 2021)). Chemistry is a discipline of science that focuses on the investigation of matter, including its composition, characteristics, and how it transforms. Consequently, a solid foundation in secondary schools, particularly in Nigeria, needs a solid foundation for effective and efficient chemistry education (Nwafor, Eke and Ibe, 2023).

The teaching of chemistry without instructional materials may certainly result in poor academic achievement. Poor academic achievement in chemistry could also be attributed to many factors such as, low interest of students in Chemistry, inadequate motivation from teacher, poor incentives to chemistry teachers, lack of adequate supply of instructional materials, lack of qualified teachers, and use of teacher centered instructional strategies, inadequate use of instructional materials and use of abstract standardized materials (Zhang, 2021). This implies that the mastery of chemistry concepts might not be fully achieved without the use of instructional resources that the students are abreast with (George, 2020). The teaching of chemistry without instructional materials may certainly result in poor academic achievement. Abdeljalil (2021) observed that there is lack of adequate and appropriate instructional resources for effective teaching of chemistry in schools. Professionally qualified chemistry teacher no matter how well trained, would be unable to put his ideas into practice if the school setting lacks the equipment and material resources necessary for him or her to translate his competence into reality. According to Okebukola (2014), the poor state of laboratory facilities and inadequate use of instructional materials has constituted a cog in the wheel of students' achievement in chemistry in the Senior School Examination. The verbal exposition does not promote skill acquisition, objectivity, and critical thinking abilities that will enable the child to function effectively in the society and increase students' interest.

Interest is a feeling which one has for something he/she feels is valuable and beneficial. It is a state of curiosity about something. According to Egolum, Samuel & Okonkwo (2021), interest is an individual behavioural tendency to be attracted towards a certain class of activities Interest promotes intrinsic motivation which has been shown to drive and sustain students engagement in a particular task, Students' interest in chemistry could be achieved by chemistry teachers through careful choice of the most appropriate teaching methods and devices.

Audio-visual media are those devices which are used in the classroom to encourage teaching and learning and make it easier and interesting, the audio-visual media are charts, maps, modules, filmstrip, projectors, radio and television (Bolick, 2003). Audiovisual materials are effective tool that invest the past with an air of realistic experience, which capture their attention and help in the understanding of the historical phenomena, they appeal to the mind through the visual auditory senses (Adukwu and Ezechi, 2021). According to Seo (2020), Audiovisual material are important in education system because they are the best tool for making teaching effective for dissemination of knowledge, so there is no doubt that technical devices have greater impact and dynamic informative system. It is only by the use of audiovisual resources that learners can be offered the opportunity to learn by doing. This is because attention, motivation, concentration and retention of facts are enhanced through the use of audio-visual materials (Poggi, 2021).

However, there has been no consensus on the work ability or otherwise of the use of audiovisual resources in teaching and learning of the numerous works done by researchers and authors of repute. On the contrary, there has been a surge in the number of people who feel worried about the negative aspects in the use of audio-visual resources. In fact, they saw the use of audio-visual resources in teaching and learning as an eccentric in totality.

Statement of the Problem

The act of teaching is fundamentally concerned with passing ideas, skills and attitude from the teacher to the learner (Nnoli, 2023) In Nigeria, for example experience has shown that spoken words alone in the communication of ideas are grossly ineffective and inefficient in producing desired learning outcomes. The reason for this could be ascribed to the fact that there are topics in chemistry that pose serious problem of comprehension to students. There are some topics that cannot be taught effectively without the use of relevant instructional materials like audiovisuals to make the learning practical. On the foregoing, scholars have emphasized the influence of audio-visual materials utilization on teaching and learning. According to them, we learn and remember 10% of what we hear, 40% of what we discuss with others and as high as 80% of what we experience directly or practice (George, 2020). Hinged on this, the problem of the study is to examine the influence of audio-visual materials in chemistry students' interest in learning chemistry in senior secondary school.

Purpose of the Study

This study sets out to investigate the influence of audio-visual materials in chemistry students' interest in learning chemistry in senior secondary school students in Awka Education zone of Anambra state. Specifically, the study sought to examine the;
1. Availability of audio-visual materials in chemistry classrooms.
2. Influence of audio-visual materials on students' interest in learning chemistry.
3. Hindrance to the effective use of audio-visual materials in learning chemistry.
4. Ways of solving the problems to the effective use of audio-visual materials in learning chemistry.

Research Questions

The following research questions have been raised to guide the study:
1. What is the extent of availability of audio-visual materials in chemistry classroom?
2. What is the influence of audio-visual materials on students' interest in learning chemistry?
3. What are the factors affecting the effective use of audio-visual materials in learning chemistry?
4. What are the ways of solving the problems affecting the effective use of audio-visual materials in learning chemistry?

Methods

A descriptive survey design was used for the study. The area of the study was in Awka Education Zone of Anambra State, Nigeria. The population of this study consisted of 1,821 senior secondary year two (SS2) students offering chemistry in all the 61 public secondary schools in Awka Education Zone of Anambra state for the 2021/2022 academic session. Simple random sampling technique by balloting was used to select 124 SS2 chemistry students from three co-educational schools. The sample was drawn from the population of 1,821 SS2 chemistry students in Awka Education Zone of Anambra State. The instrument for data collection was 34 items structured questionnaire on a four-point scale of strongly agreed, agreed, disagreed and strongly disagreed developed by the researcher. The questionnaire had two parts, the first comprised of bio-data of the respondents and the second part was further subdivided into 4 sections according to the 4 research questions. The instrument was validated by two science education lecturers and one expert in measurement and evaluation, dept of education foundation all from Nnamdi Azikiwe university, Awka. Their corrections were effected before the final questionnaire was produced. To establish the reliability of the Instrument, the responses from the respondents not used for the sample were subjected to a reliability analysis using Cronbach alpha which gave a co-efficient of 0.83. The researchers administered the copies of the questionnaire personally to the 124 chemistry students in the three (3) government co-educational schools and all the copies were collected after completion on the spot, this was to avoid instrument mortality rate. The data collected was analyzed using mean and standard deviation. A mean of 2.50 and above indicated that the respondents agreed with items on the questionnaire while a mean below 2.50 indicated that the respondents disagreed with the items. Frequency and percentage were also used to answer questions on availability; 50% indicated availability while below 50% was used as not available.

Results

Research Question One

What is the availability of audio-visual materials in chemistry classroom?

Table 1: Frequencies and percentages of the available audio-visual materials in chemistry classroom

S/N	Items (ICT Facilities)	Available		Not Available		Remarks
		F	%	F	%	
1.	Interactive whiteboard	100	80.6	24	19.4	Available
2.	Infographics	80	64.5	44	35.5	Available
3.	Overhead projector	80	64.5	44	35.5	Available
4.	Opaque projector	60	48.4	64	51.6	Not Available
5.	Motor pictures	30	24.2	94	75.8	Not Available
6.	Flip charts	80	64.5	44	35.5	Available
7.	Bulletin Board	85	68.5	39	31.5	Available
8.	Central Processing Unit (CPU)	60	48.4	64	51.6	Not Available
9.	Monitor	39	31.5	85	68.5	Not Available

10.	Internet	34	27.4	90	72.6	Not Available
11.	Charts	85	68.5	39	31.5	Available
12.	Flashcards	30	24.2	94	75.8	Not Available
13.	Slides	75	60.5	49	39.5	Available
14.	Apparatus	80	64.5	44	35.5	Available
15.	Textbooks	120	96.8	04	3.2	Available
16.	Tape recorder	80	64.5	44	35.5	Available
17.	Virtual classroom	50	40.3	74	59.7	Not Available
18.	Laptop	78	62.9	46	37.1	Available
	Overall Percentage		**55.8**		**44.2**	**Available**

Table 1 revealed that most of the items were considered to be available in chemistry classroom by the respondents. However, items 4, 5, 8, 9, 10 12 and 17 were considered not available by most of the respondents. The grand percentage showed that most items are available since they scored 50% and above which is the percentage criterion.

Research Question Two

What is the influence of audio-visual materials on students' interest in learning chemistry?

Table 2: Mean scores and Standard Deviation of the respondents on the influence of audio-visual materials on students' interest in learning Chemistry.

SN	ITEMS	$\bar{X}$	SD	Decision
19	I am always happy when overhead projector is used during chemistry lessons.	3.32	1.87	Agree
20	I do not like missing any chemistry class because I get to learn using a computer.	3.04	1.41	Agree
21	I spend time to study Chemistry at least once a week in a virtual classroom.	2.92	1.37	Agree
22	I usually come late or avoid coming to school because I don't understand Chemistry textbooks during chemistry lessons.	2.0	1.41	Disagree
23	I indulge in discussions or distract myself so as not to listen whenever a chemistry lesson is going on because my teacher uses motion pictures to teach.	1.54	1.73	Disagree
24	I love to participate in class works during chemistry lessons because I get to work with apparatus.	3.22	1.52	Agree
25	I do not like to solve chemistry calculations using flashcard.	1.67	1.58	Disagree
	Grand mean and standard deviation	**2.5**	**0.74**	**Agree**

Results in table 2 show items 22, 23 and 25 with mean scores below 2.50 (disagreement), while items 19, 20, 21 and 24 had positive response wi2th mean scores above 2.50. The grand mean was 2.53 with standard deviation of 0.74 showing agreement by the respondents.

Research Question Three
What are the factors affecting the effective use of Audio Visual in learning Chemistry?
Table 3: Mean ratings of the respondents on the factors affecting the effective use of Audio Visual in learning Chemistry.

SN	ITEMS	$\bar{X}$	SD	Decision
26	Lack of good quality Audio Visual materials can affect learning.	3.33	1.58	Agree
27	Educational qualification of the teacher can affect learning.	3.28	1.58	Agree
28	Unconducive learning environments can affect learning with audio visual materials.	3.38	1.66	Agree
29	Not using the appropriate Audio Visual material in a lesson can affect learning.	3.26	1.58	Agree
30	Socio economic factors can affect learning with audio visual materials.	3.02	1.41	Agree
	Grand mean and standard deviation	**3.25**	**0.81**	**Agree**

Data in table 3 revealed that the respondents considered all the items as factors affecting the effective use of Audio Visual in learning Chemistry. Hence all the items have mean scores of above 2.50 (agreement).

Research Question Four
What are the ways of solving the problems affecting the effective use of Audio-Visual materials in learning Chemistry?
Table 4: Mean rating on the ways of solving the problems affecting the effective use of Audio-Visual materials in learning Chemistry.

SN	ITEMS	$\bar{X}$	SD	Decision
31	Employment of qualified teachers can help solve the problem.	3.22	1.52	Agree
32	Providing conducive learning environment for effective learning.	3.51	1.38	Agree
33	Provision of good quality Audio-Visual materials by the government, school principal and parents.	3.61	1.40	Agree
34	Proper use of Audio-Visual material in teaching methods.	3.32	1.58	Agree
	Grand mean and standard deviation	**3.41**	**0.59**	**Agree**

Items in table 4 showed that all the items were agree with mean scores above 2.50 indicating that all the items were possible solutions to problems affecting the effective use

of Audio-Visual materials in learning Chemistry. The grand mean was 3.41 (agreement) and standard deviation score of 0.59.

Discussion

The study revealed from research question one that some audio-visual materials are available in the chemistry classroom. Adukwu and Ezechi (2021) reported that teachers only use audiovisual materials when they are explaining concepts that students have not heard before, hence, it shows that audio visual materials are effective in enhancing students' interest in learning Chemistry. This is in line with Poggi, (2021) who reported that a teacher can promote the change of situational interest to personal interest by systematically choosing seductive, vivid, coherent and relevant content in an appropriate context and guide his or her students to autonomy supporting activities in learning Chemistry. There are factors that hinder the effective use of Audio-Visual materials in learning Chemistry. This is in line with Adukwu and Ezechi (2021) who noted that Lack of effective supervision of teachers during instructional process hinders effective use of audiovisual materials by the teachers.

Finally, the findings of this study showed that the hindrance for the effective use of audio visual materials in learning Chemistry should be solved when there is a provision of good quality audio visual materials by the government, school principal and parents, proper use of audio visual materials in teaching methods (Okebukola, 2014). These problems if properly addressed, will improve the effective use of audio-visual material in learning chemistry.

Conclusion

The researchers concluded that Audio Visual materials are useful for facilitating and developing learning, since they promote Students' interest in the lessons and provide teachers with a greater variety of pedagogical tools. It can explained that by the fact that audio visual materials can make the lesson livelier and make teaching and learning of Chemistry more enjoyable and interesting, leads to better understanding. Therefore, we suggest extending this strategy to other subjects in science as well as to other disciplines

Recommendations

From the findings of the study, the following recommendations were made.
1. Government should endeavor to make adequate provision of modern audio-visual materials in schools in Nigeria.
2. Teachers should always make adequate utilization of available audio-visual materials in teaching the students.
3. Teachers should be retrained through seminars, workshops and conferences so as to enable them have adequate knowledge of how to use modern instructional materials like projector and others.
4. Practical activities should be introduced and enforced in the teaching of chemistry topics to remove the abstract nature of chemistry concepts and replaced them with concrete experiences for creativity through the use of audio-visual materials.

5. Chemistry curriculum should be re-structured to enable students relate chemistry to nature.
6. Seminars, Conference and workshops on audio-visual and practical activities should be encouraged among chemistry teachers to help them have confidence and develop creativity skills.
7. Undergraduate education should be made to foster creativities by making changes in the university curriculum human resource policies using research and connecting resources that have sustainable benefits.
8. Professional development of the science teachers should be encouraged in order to keep the teachers abreast of the current issues in education and help them refine their professional practice with a focus on skills development.

REFERENCES

Abdeljalil, R. (2021). The impact of audio-visual material on the motivation and performance of students learning Chemistry. *Chemistry Education Research and practice, 22*(1), 246-258.

Adukwu, B. C. & Ezechi, N. G. (2021). Influence of audiovisual materials in teaching and learning of Chemistry among senior secondary school. *Academic Journal of Current Research, 8*(7), 148-158.

Bolick, C. Berson, M., Coutts, C. & Heinecke, W. (2003). Technology applications in social studies teacher education. A survey of social studies methods faculty. *Contemporary Issues in Technology and Teacher Education 3*(3), 300-309.

Egolum, E. O., Samuel, N. N. C. & Okonkwo, I. G. A. (2021). Enhancing students' interest in Chemistry through inculcation of problem-solving skills. *South Eastern Journal of Research and Sustainable Development, 4*(2), 116-128.

George, A. (2020). Moving images and sound: inclusive and accessible. moving images knowledge and access: In C. Grant & I. Mekere (Eds.), *The BUFVC handbook*. London: British Universities Film and Video Council 29-33.

Nnoli, J. N. (2022). Teaching Chemistry through identification of science process skill involved in the production of perfume using pineapple rind. *Unizik Journal of STM Education, 5*(1). 112-120.

Nnoli, J. N. (2023). Scrutinizing the benefits of entrepreneurial skills on the motivational level of Chemistry students. *BOHR International Journal of Social Science and Humanities Research (BIJSSHR). 2*(1) 185-190.

Nwafor, S. C., Eke, J. A., & Ibe, F. N. (2023). Correlation between test anxiety and students' chemistry achievement. *Journal of Research in Instructional, 3*(1), 31-40. https://doi.org/10.30862/jri.v3i1.93

Nwanze, A. C. & Okoli, J. N. (2020). Path analysis of student-related factors affecting academic achievement in Chemistry among college of education students. *Unizik Journal of STM Education, 3*(2), 1-13.

Okebukola, A. (2014). The use of audio-visual aids in education: *UNESCO chronicles regional seminar on the use of audio-visual aids in adult and school education in Latin America* at Mexico City from 28 September to 17 October 1959

Poggi, G. (2021). Virtual reality technology and audiovisual cues for the rehabilitation of spatial cognition in people with virtual impairment: A review. *Sensors, 21*(5), 1715.

Samuel, N. N. C. (2017). Effects of computer animation and activity based inquiry learning strategy on chemistry students' critical thinking and achievement. *Unizik Journal of STM Education, 2*(1), 51-65.

Seo, E. H. (2020). Effects of audiovisuals materials on stress and emotion state of students. *Journal of Alzheimer's Education, 72*(2), 483-491.

Zhang, J. (2021). The effect of audiovisuals materials on students' learning performance and engagement in online education. *International journal of Educational Research*, 105, 101714.
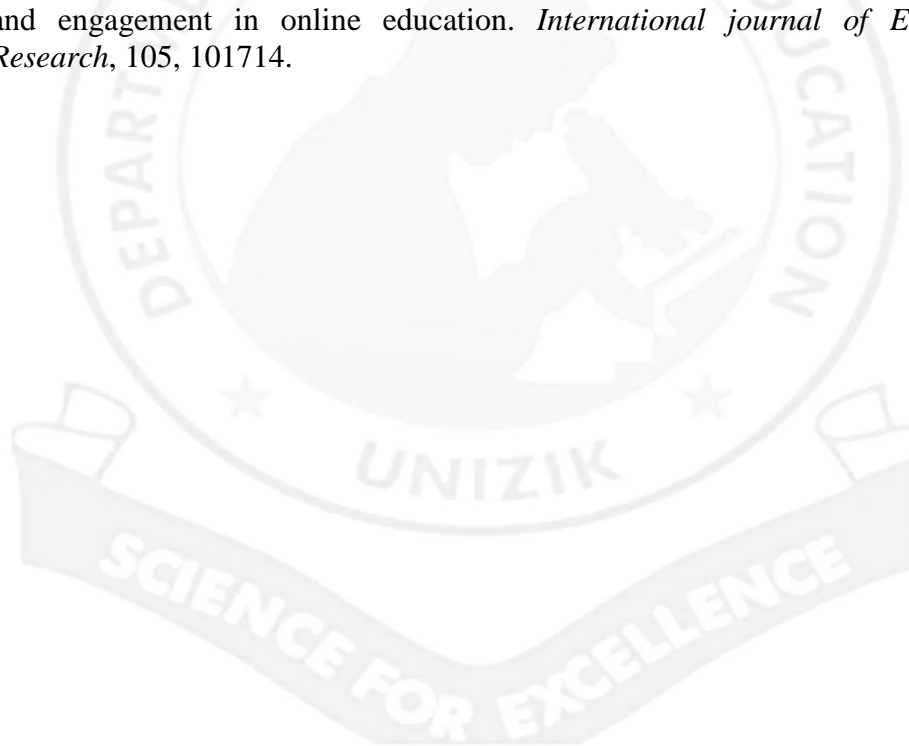
FACTORS AFFECTING TEACHERS EFFECTIVENESS IN TEACHING CHEMISTRY IN SECONDARY SCHOOL IN ONITSHA URBAN OF ANAMBRA STATE, NIGERIA

Ezeanya Maureen Chinyere (PhD)
Department of Science Education, Nnamdi Azikiwe University Awka
mc.ezeanya@unizik.edu.ng 08106719999
&
Egbutu Rita Ngozi (PhD)
egbuturita@gmail.com 08037990862
Community Secondary School, Ukpo

Abstract
The study examined the factors affecting teachers' effectiveness in teaching chemistry in Secondary School in Onitsha Urban, Anambra State. Descriptive survey research design was used for the study. The study was guided by two (2) research questions. The population of the study consisted of all the 35 chemistry teachers in twenty-two public secondary schools in Onitsha urban, Anambra state. There was no sampling because the population is small. The instrument for data collection was a forty (40)-item questionnaire developed by the researcher and sub-headed 'Factors affecting Teachers' Effectiveness in Teaching8 Chemistry' (FATETC). The validity of the instrument was established by two lecturers in the Department of Science Education and expert in measurement and evaluation, Department of education foundation all in Nnamdi Azikiwe University Awka. The reliability index of 0.82 was obtained using Cronbach alpha statistics. Data were analysed using mean and standard deviation. The mean of 2.50 and above indicated agreement while below 2.50 indicated disagreement. The findings revealed among others that poor equipped laboratories, qualification of chemistry teachers, poor incentive to science teachers, inadequate good and current chemistry textbooks in school libraries, inability for the school administrators to make provision for fieldtrips and excursions, lack of technical knowhow in handling some science equipments and inadequate chemistry teachers in secondary schools are factors that affect teachers effectiveness in teaching Chemistry. Based on the findings, the researchers recommended among others that qualified teachers with specialization in chemistry should be allowed to teach the subject, adequate and well equipped laboratories should be provided in secondary schools for sound practical activities and Secondary school library should be equipped with good and current chemistry textbooks.
Keywords: Teachers' Effectiveness, Secondary School, Chemistry

Introduction

Chemistry is one of the science subjects which secondary school students must offer for them to be specialities in any of the science related discipline such as Medicine, Engineering, Pharmacy, Nursing etc. Chemistry is the study of matters and energy and the relationship that exists between them. Ngawang and Norbu (2021) opined that chemistry is a branch of science that is rational and mathematical where some measures and controlled inputs lead to some predictable output(learning things 2014). Chemistry has

gained worldwide recognition because of its importance in the general education of the youth. The knowledge of chemistry has to some extent placed and still placing food on the table of a common man due to its application in the production of many goods like laundry items, textile materials, cosmetics etc. A country's technological development is primarily rooted on the expertise in handling science related subjects in the grass root of their education system.

Chemistry has been identified as a very essential subject as it is important in scientific and technological development of the nation. Burmeister etal, 2012 is of the view that the field of chemistry, science and technology are related to the economic heart of every developed, industrialized and technologically advanced society. The teaching and learning of chemistry as in the case of other science subjects has tre8mendous roles towards technological development in a developing country. Chemistry is everything; the food we eat is chemistry. The air we breathe is chemistry; the water and wine we drink are all chemistry; our body response to both internal and external stimuli is equally chemistry. At this point, one could ask: how is the performance of the students in the subject?

In spite of its importance, students often shy away from offering the subject because of its abstract nature which contributes to their poor performance. They attribute offering of science subjects to only the 'intelligent ones'. Nevertheless, teachers' negative perception of the learners ability, unavailability of chemistry laboratories, limited time for practical activities, lack of in-service training, teaching methods/strategies among others make the subject very difficult by the teacher to teach for better understanding on the part of the students in the subject. In educational system, teachers' role cannot be overemphasized. They are the engineers of education and the channel through which academic activities reach the beneficiaries.

The most important factor in improving the classroom interaction which decides the performance of the students in the subject is the teacher (Ngawang and Norbu, 2021). According to Barineka (2012), teaching problems have been the contributing factors towards the widespread poor performance and negative attitudes of students towards the subject. Student who hates a teacher because of one thing or the other invariably hates his/her subjects. Teachers teaching approach contributes a lot in the internalization of the subject matter by the learners. Edomwonyi-out (2011) stated the following as the problems facing teaching of chemistry: inadequate laboratories, non-professionalism and environmental. A teacher who is able to surmount the above problems facing the teaching of chemistry is an effective teacher.

An effective teacher is one who shows a deep understanding of curriculum of subject in question. He/she plans, teaches and assesses to promote mastery for all students. Effective teacher provides high quality instruction to increase students achievement by providing research-base instruction filled with technology integration (https://www.lee.K12.al.us>page). According to Georgetown University (nd), expertise in academic field is not the only skill needed for teachings to be effective. Effective teaching leads to cordial interaction with the learners thereby helping them to understand a new way of looking at the world. An effective teacher is patient with her students and be able to assess herself on a regular basis. She adjusts her teaching strategies considering the

learners factors and availability of materials. An effective teacher is a role model who set the tone for the class. She puts on a positive attitude by motivating the students to desire to learn. She prepares her lesson, organises her teaching sequentially, and makes a complex idea very clear through the use of different teaching techniques. An effective teacher adopts active learning strategies to make his class active hence enable the students to be actively involved in the teaching –learning processes. An effective teacher is patient and fair with his students. She is equally internet/technologically sound since novel information is mostly assessed in the net through technological gadget. Effectiveness of a teacher is not in the teacher him/herself but in the products of his/her teaching- the students. A sound chemistry student is a product of 8an effective chemistry teacher.

Effective chemistry teacher according to Bluefield University (2021) is the one who possesses strong combination of passion, skills, knowledge and experience in the subject. The teacher must first of all get Chemistry Education Degree which gives the foundation to teach students and feel confident in the subject matter. A chemistry teacher teaches with passion by approaching each lesson with enthusiasm and letting the students know why chemistry is exciting. He/she should equally recognise and admit the fact that many chemistry topics are abstract and so derive the means to make them more concrete and relatable by connecting classroom experience with their real world. For instance, changes in the states of matter can be connected to their daily boiling of water in their various homes. In the research carried out on factors influencing the effectiveness of teaching chemistry in senior secondary school in Nkwere Local Govt. Area of Imo State, the result of the research shows that negative attitude of students towards learning chemistry, lack of modern laboratories, lack of workshop by the chemistry teachers among others are some of the factors influencing effectiveness of teaching of chemistry in secondary schools (Samphina Academy,2023). Effective chemistry teacher resorts to practical activities and gets the students involved.

One area that requires urgent reforms in chemistry is the practical, where it is important to rethink the role and place of chemistry practical in the teaching and learning of chemistry. Practical aspect of chemistry seems to have died natural death in some of our secondary schools today do to some circumstances. Ejidike and Oyelana (2015) opined that the availability of laboratory equipment, chemicals and materials, laboratory personal, safety measures, substantial recommended textbooks, accurate period allocation among others leads to effective teaching of chemistry. Many schools do not have laboratories or a functional laboratory and so the teachers are incapacitated in carrying out practical activities with their students. Some teachers equally are not at home in handling some equipment during practical activities and so resort to chalk and board teaching of chemistry. Chemistry practical can be fun and at the same time dangerous, good chemistry teachers therefore prioritize safety. They make complex topics simpler by breaking down the topics into smaller and more digestible chunk. Chemistry teachers in the verge to be good and effective in carrying out their duty face lots of challenges which sometimes make them ineffective in discharging their duties. Ineffective teaching of chemistry contributes to a greater extent the poor performance of the students in the subject. Students lack interest and are very reluctant in attending the class. The researcher therefore resorts to identify the

factors affecting teachers' effectiveness in teaching chemistry in Onitsha urban (Onitsha North and South LGA) of Anambra State.

Purpose of Study

The purpose of this study is to determine the factors affecting teachers' effectiveness in teaching chemistry in Onitsha urban of Anambra State. The study specifically sort to

i. Identify the factors affecting teachers' effectiveness in teaching of chemistry

ii. Determine the possible solutions to the factors affecting teachers' effectiveness in teaching chemistry.

Research Questions

The following research questions guided the study

i. What are the factors affecting teachers' effectiveness in teaching of chemistry in secondary school?

ii. What are the possible solutions to the factors affecting teachers' effectiveness in teaching chemistry in secondary school?

Methods

A descriptive survey research design was employed in the study. The population of the study consisted of all the 35 chemistry teachers in twenty-two public secondary schools in Onitsha urban, Anambra state. There was no sampling because the population is small. The instrument for data collection was a forty (40)-item questionnaire developed by the researcher and sub-headed 'Factors affecting Teachers' Effectiveness in Teaching Chemistry' (FATETC).FATETC is divided into two parts, A and B. Part A comprises of information on the personal data of the teachers used for the study while part B has questions in which the respondents are required to indicate their level of agreement or disagreement on the factors affecting teachers' effectiveness in teaching Chemistry.

The instrument was validated by two experts in the department of science Education (chemistry option) and in the measurement and evaluation. There corrections and inputs were accepted and this led to the modification of some items before the final production of the instrument. Internal consistency of the items was established using Cronbach alpha technique which gave a coefficient of 0.82 which is a welcome score for the study.

The research adopted the 4-point rating scale of strong Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) to analyse data obtained from the respondents. These have the values of 4,3,2,1 respectively. 40 copies of the questionnaire were distributed and collected on the spot with the help of five research assistants; the data generated was analysed using mean and standard deviation. The criterion mean was placed at 2.5[(4+3+2+1)/4 = 10/4= 2.5]. Therefore, any mean score of 2.5 and above indicated agreement and any mean score below 2.50 was regarded as disagreement.

Results

Results are presented in tables according to research questions

Research Question One

What are the factors affecting teachers' effectiveness in teaching of   chemistry in secondary School?

Table 1: Mean Rating and Standard Deviation Scores of Respondent on the factors affecting teachers' effectiveness in teaching of Chemistry.

S/N	ITEMS	X	SD	DECISION
1.	Qualification of chemistry teachers affects their effectiveness in handling the subject	3.26	0.95	AGREE
2	poor incentive to the science teachers hinders them from teaching effectively	3.20	0.76	AGREE
3	Teachers' inability to source for firsthand information from the internet makes their teaching ineffective.	2.94	0.84	AGREE
4	Poorly equipped laboratories affects the teachers effectiveness in teaching	3.71	0.62	AGREE8
5	Chemistry teachers are not sponsored to attend conferences and seminars	3.17	0.66	AGREE
6	Lack of interest on the part of the students discourages the teachers from teaching effectively	2.97	0.82	AGREE
7	Chemistry teachers lack technical know-how in handling some laboratory equipments	2.60	0.69	AGREE
8	Lack of Team teaching in our secondary schools contributes to ineffective teaching of Chemistry	2.60	0.98	AGREE
9	Teachers handling the subject do not specialize in chemistry education	2.42	0.92	DISAGREE
10	Teachers inability to improvise instructional materials hinders effective lesson content delivery	2.82	0.71	AGREE
11	The time allotted to Chemistry practical is too short for the teacher to effectively teach the subject.	3.34	0.64	AGREE
12	Teachers lack of innovative instructional materials like projectors, slides etc makes their teaching ineffective	3.0	0.85	AGREE
13	Teachers dependent on given support to students to indulge in examination malpractice during external examinations deterred them from teaching effectively.	2.28	0.99	DISAGREE
14	Inadequate good and current Chemistry textbooks in our school library contributes to ineffective teaching of the subject	3.06	0.91	AGREE

15	Teachers do not employ learner- centered teaching strategies in Chemistry classroom	2.45	0.98	DIAGREE
16	Chemistry curriculum is too broad for the teachers.	2.28	0.83	DISAGREE
17	School Administrators' do not make provisions for fieldtrips and excursions for effective Chemistry teaching.	3.4	0.51	AGREE
18	Lack of Chemistry laboratory discourages the teachers from teaching effectively.	3.48	0.74	AGREE
9	Poor salary scale from the government pushes chemistry teachers to indulge in alternative businesses to argument their monthly income thereby distracting them from carrying their primary duty of teaching effectively.	3.54	0.74	AGREE
20	The number of Chemistry teachers in our secondary schools is inadequate to handle the subject effectively.	3.54	0.70	AGREE
	Cluster Mean	**3.01**	**0.27**	**AGREE**

Results in table 1 indicate that the items 1,2,3,4,5,6,7,8,10,11,12,14,17,18,19,and 20 with mean value above 2.5 were accepted by the respondents as factors affecting teachers' effectiveness in teaching of chemistry in Onitsha urban, Anambra Stat8e. Item 9, 13, 15 and 16 with mean value below 2.5 were rejected as factors affecting teachers' effectiveness in teaching of chemistry. The cluster mean of 3.01 and standard deviation score of 0.27 showed that the teachers agreed with most of the factors affecting teachers' effectiveness in teaching of chemistry in Onitsha urban, Anambra State.

Research Question Two
What are the possible solutions to the factors affecting teachers' effectiveness in teaching Chemistry in secondary schools

Table 2: Mean Rating and Standard Deviation Scores of respondents on possible solutions to the factors affecting teachers' effectiveness in teaching Chemistry

S/N	ITEM	X	SD	DECISION
1.	Qualified chemistry teachers should be employed	3.89	0.32	AGREE
2	Improvement in the condition of service for chemistry teachers	3.66	0.54	AGREE
3	Teachers' should be trained in the use of internet to source for novel information.	3.46	0.61	AGREE
4	Provision of adequate laboratories for chemistry teaching and practical activities.	3.69	0.47	AGREE
5	Sponsoring of Chemistry teachers for conferences, seminars and workshops by the school management.	3.57	0.47	AGREE

6	Parents and school authorities should guide their children/wards in choosing of their future carrier	3.34	0.54	AGREE
7	In-service training on handling of some scientific equipment for Chemistry teachers	3.60	0.50	AGREE
8	Introduction of Team teaching in our secondary school	3.20	0.53	AGREE
9	Only the teachers with specialization in Chemistry should be allowed to teach the subject.	3.62	0.69	AGREE
10	Improvisation of Chemistry instructional materials aids effective teaching of the subject.	3.49	0.51	AGREE
11	Adequate time should be allotted to the chemistry practical.	3.54	0.51	AGREE
12	Introduction of electronic gadget like projector, slides etc in teaching and learning of chemistry	3.40	0.49	AGREE
13	Teachers are to discourage their students from indulging in examination malpractice..	3.66	0.48	AGREE2
14	Adequate good and current Chemistry textbooks should be made available in the school library.	3.54	0.51	AGREE
15	Learner-centered teaching pedagogy should be used in the Chemistry classrooms.	3.40	0.51	AGREE
16	Chemistry curriculum should be reviewed 8	3.31	0.58	AGREE
17	School Administrators' should make provisions for fieldtrips and excursions for effective Chemistry teaching.	3.34	0.48	AGREE
18	Every school should provide Laboratory for the practical activities	3.71	0.46	AGREE
19	The salary scale of the teachers should be reviewed and upgraded	3.80	0.41	AGREE
20	Government should recruit more Chemistry teachers.	3.66	0.48	AGREE
	Cluster Mean	3.54	0.27	AGREE

The result from table 2 indicates that the entire item has mean score above 2.5 and so were all accepted as the possible solutions to the factors affecting teachers' effectiveness in teaching Chemistry. The cluster mean and standard deviation of 3.54 and 0.27 respectively indicates that all the teachers strongly agreed that the all the items in table 2 are solutions to the factors affecting teachers effectiveness in teaching of chemistry in Onitsha urban secondary schools.

Discussion

The result from table 1 above indicates that qualification of chemistry teachers, poor incentive to science teachers, teachers' inability to source for firsthand information, poor equipped laboratories, inability to attend conferences and seminars by the chemistry teachers, lack of interest on the part of chemistry students, lack of technical knowhow in

handling some science equipment, lack of team teaching,, inability of the chemistry teachers to improvise for teaching, limited time allocation for chemistry practical, lack of use of innovative instructional materials like projectors, slides etc in the class, inadequate good and current chemistry textbooks in school libraries, inability for the school administrators to make provision for fieldtrips and excursions, lack of chemistry laboratories, poor salary scale of the teachers, inadequate chemistry teachers in secondary schools were indicated by most of the respondents as factors affecting teachers' effectiveness in teaching chemistry. The above findings is in line with findings of Samphina Academy (2023) who identified negative attitude of students towards learning chemistry, lack of modern laboratories, lack of workshop by the chemistry teachers among others as some of the factors influencing effectiveness of teaching of chemistry in secondary schools. The findings of the study concerning the attitude of the chemistry student towards effective teaching corresponds to that of Pyatt and Sims(2012) who identified that success or failure in academic pursuit depends to a great extent on the interest or attitude of the learners involved.

Results from table 2 depict that the respondents agreed that there are many possible solutions towards effective teaching of chemistry. These include employing qualified chemistry teachers to handle the subject in secondary schools, training of teachers in the use of internet for sourcing of novel and firsthand information, provision adequate laboratories for practical activities, sponsoring chemistry teachers for conferences and workshops, introduction of team teaching in secondary schools, allotting adequate time for chemistry practical, intro8duction of electronic gadgets in schools, equipping the school library with current and good chemistry textbooks, provision for field trips/excursions, review / upgrade the salary scale of chemistry teachers and recruitment of more chemistry teachers in secondary schools .

Conclusion

The study investigated on Factors Affecting Teachers' Effectiveness in teaching Chemistry in secondary schools in Onitsha urban, Anambra state. Many factors were identified as factors that hinder effective teaching of chemistry in secondary school. The researcher equally investigated on the possible solutions to the identified problems.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Qualified teachers with specialization in chemistry should be allowed to teach the subject. This is one of the bases that help in achieving effective teaching and learning.
2. There should be improvement in the condition of service of chemistry teachers in secondary school. Government should encourage and motivate the teachers by looking with some considerations into their monthly salaries. This will reduce distractions of engaging into some other businesses that will enable the two ends to meet.
3. Adequate and well equipped laboratories should be provided in secondary schools for sound practical activities. Practical enable the teachers to make some abstract chemistry topics to be concrete.

4. Chemistry teachers should be sponsored for conferences, workshop, seminars and other in-service training at least once or twice a year. This will to a greater extent update their knowledge and makes them to be away of the current innovations like handling of some scientific equipment and using electronic gadget in teaching and learning of the subject.
5. Secondary school library should be equipped with good and current chemistry textbooks for both the teachers and students for effective teaching and learning.
6. Chemistry teachers are encouraged to use learner-centered pedagogy in the classrooms and laboratories. They should consider the interest of the learners in planning their lessons.
7. Teachers should discourage their students directly and indirectly from engaging in any form of examination malpractice which seems to be the order of the day in Senior School Certificate examinations nowadays.

REFERNCES

Barneku N. J. (2012). Analysis of poor performance of Senior Secondary Students in Chemistry in Nigeria. *An International Multidisciplinary journal, 6(4): 324-334*

Bluefield University (2021). How to Be a good Chemistry Teacher. bluefield.edu/blog/how-to-b-a-good-good-teacher/

Burmeister M. Rauch F. and Eilk I. (2012). Education for sustainable Development and Chemistry Education Res and Pract, 13(2): 59-68

Edomwonyi –out and Avaa A. (2011). The challenge of effective teaching of Chemistry: *A case study Leanado Electronic Journal of Practices and Technologies; 18:1-5*

Ejidike I.P. and Oyelana A. (2015). Factors influencing Effective Teaching of Chemistry: A case Study of Some Selected High Schools in Buffalo City Metropolitan Municipality, *Eastern Cape Province, South Africa. International Journal Edu. Sci., 8(3): 605-517 (2015)*

Samphina Academy (2023). https://samphina.com.ng/sitemap.html Georgetown University(nd). Top qualities of an Effective Teacher: endls.georetown.edu/atprogrm/twl/effective-teacher/

Learning things LLC(2014). Teaching Chemistry to Middle School Students. Huge selection of School and Homeschool Curriculum. http://www.learnungthings,com

Ngawang C and Norbu W.(2021). Factors influencing Teaching of Chemistry in class Nine and Otieno O.J. (2012). Determination of students' Poor Performance in Chemistry in Public

Pyatt K. and Sim S.R, (2012). Virtual and Physical experimentation in inquiry-based Science Labs: *Attitude; Performance and Access. J Sci Edu Technol 21: 133-147*

SECONDARY SCHOOL STUDENTS SELF-CONCEPT AS A CORRELATE OF ACADEMIC ACHIEVEMENT IN BASIC SCIENCE IN JUNIOR SECONDARY SCHOOL IN AWKA EDUCATION ZONE, ANAMBRA STATE, NIGERIA

**Obialor, Chris Okwuchukwu (*Ph. D*), Onyemakara,Cynthia I,
Okeke, Augusta O. & Nwankwo Miracle T.**
Department of Science Education,
Nnamdi Azikiwe University Awka, Anambra State, Nigeria
chrisokwuchukwu@yahoo.com, co.obialor@unizik.edu.ng; 08037328449

Abstract
This study investigated Secondary school students' self-concept as a correlate of academic achievement in Basic Science in Awka Education Zone in Anambra State, Nigeria. The research design adopted for this study was correlational survey. The population of the study consists of 5,388 students in junior secondary schools in Awka Education Zone, Anambra State. Simple random sampling technique was used to draw a sample size of 150 junior secondary schools students of 2022/2023 academic session from different schools in Awka Education Zone, Anambra State. The data used for the study were collected using questionnaire and the past annual records of students in Basic Science in 2022/2023 academic session obtained from the sampled schools. Three research questions guided the study and three null hypotheses were tested at 0.05 level of significance. Data collected were analyzed using simple Linear Regression analysis. The findings of the study revealed that there is a moderate positive and significant relationship between secondary school students' self-concept and their academic achievement in Basic Science. The study also revealed that there is a moderate positive and significant relationship between male secondary school students' self-concept and their academic achievement in Basic Science and also there is a moderate positive and significant relationship between female secondary school students' self-concept and their academic achievement in Basic Science. Based on the findings of the study, the following recommendations among others were made: Educational guidance services should be made mandatory in schools and educational stakeholders should equally focus on the self-concept of both high and low achieving students.
Key words: Basic Science, Academic Achievement, Self-Concept

Introduction
Basic science is bedrock of all sciences, engineering and technology courses, which provides the fundamental understanding of natural phenomena and the processes by which natural resources are transformed. Basic science is regarded as an undifferentiated course designed to show the unity, wholeness and interrelationship of disciplines that make up science. Basic science formerly known as integrated science is the first form of science a child comes across at both primary (pupils) and junior secondary school level. It is the first point of teaching children important skills and to solve simple practical problems, which they meet later in life. In a similar affirmation, National Policy on Education in Obialor

(2021) emphasized that basic science and technology helps children to develop their skills especially their ability to handle things. The knowledge of basic science also equipped the students with the necessary means and tools to address global socio-economic and environmental challenges, such as the water crisis, infectious diseases, ocean deoxygenation and climate change.

Basic science has an important contribution to make towards a sustainable world for all, as outlined in the Sustainable Development Goals (SDGs, 2021). The learning of basic science also makes students aware of the essential means to address major challenges such as universal access to food, energy, and sanitation. Basic Science is one among subjects which expresses the fundamental unity of scientific thought (Maduabum, 2011). Irrespective of all the benefits that learning Basic Science provides, it is evident from the Basic Education Certificate Examination (BECE) in the past years that Basic Science students' results have been poor indicating a poor academic achievement (EDC, 2019).

Academic achievement, according to Nwana (2007) is defined as the attained ability or degree of competence in school tasks usually measured by standardized tests and expressed in grades based on wide sampling of students' achievement. Bell (2012) described academic achievement as the tendency to strive for success and to participate in activities in which success is dependent on a person's effort, skills, courage or perseverance and ability. Students' achievement in external examination like BECE is a good source of information about their academic achievement. According to Ibenegbu, Okoye, Adigwe & Ifesinachi (2022), the scholastic status of a student at any particular time has been defined as "academic achievement. It describes how a person can display his or her intellectual ability. This academic status might be explained by the grades earned in a particular course or set of courses. Research has shown that academic achievement is influenced by range of factors, including individual difference in cognitive abilities, motivation, environmental influences and self-concept (Spinath, 2012). Students' academic achievement such as high grades or academic recognition can positively influence their self self-concepts by boosting their self-worth and self-esteem. It equally validates their intelligence, abilities and efforts leading to positive self-concept.

Self-Concept is a general term used to refer to "how someone thinks about, evaluate or perceive oneself" (Okafor, Obialor & Osuafor, 2020). Self-concept refers to our personal knowledge of who we are, encompassing all of our thoughts and feelings about ourselves physically, personally and socially. Self-concept also includes our knowledge of how we behave our capabilities and our individual characteristics (Jackson; 2022). Self-concept encourages students or learners to develop in the study of Basic Science the necessary information needed for provoking inquisitive spirit of enquiring and practical skills for scientific investigation. It also provides the necessary framework for parents and teachers to encourage their wards to build self-confidence in themselves at school and work. It gives the policy makers and educational administrators an insight of the kind of policy to adopt to achieve optimal academic benefit for the overall interest of the country. In the context of educational development, a crucial interplay exists between academic achievement and self-concept. Students' perception of their own abilities and self-worth often play a pivotal role in determining their academic success. When individuals possess positive self-

concept, they tend to approach studies with great confidence and motivation, which can lend to improved academic outcomes. On the other hand, negative self-perceptions might hinder their ability to fully engage in their educational pursuits and academic achievement in sciences, basic science inclusive. Recognizing this intricate relationship is essential for educators and policymakers to create environment that foster both strong academic achievement and a healthy self- concept. However, according to Okafor, Obialor & Osuafor (2020), academic achievement may not primarily be an expression of learner's abilities but also factors on both gender's view of themselves.

Gender is described as the socially, culturally constructed characteristics and roles which are ascribed to males and females in any society (Okeke, 2008). It is the fact of being male or female (Quirk in Obialor, 2016). Studies have been conducted by researchers in the quest to find out the relationship between students' gender and their academic self-concept. It has been reported that 2males and females differ in their beliefs about their academic competences (Ireson & Hallan in Anierobi, 2019), with a wide gap on how males develop their self-concept as compared with their female counterparts (Hanan, Shabana & Mona, 2016). For instance, Okoye (2011) reported that girls had higher English self concept and boys had higher mathematics self concept. On the other hand, Matovu (2012) reported that female students had higher academic effort compared to their male counterparts. SarAbadaniTafreshi (2006) in their study found out that there was a significant difference in the academic achievement of male and female students while Hanan, Shabana, & Mona (2016) as pointed out earlier in their study, found a significant association between academic self-concept and academic achievement. From the above empirical studies, it may be glaring that researchers showed relentless support towards the belief that there is an undeniable relationship between gender, academic self-concept and academic achievements of students. This study, therefore, intends to provide the relationships among gender, academic self-concept and academic achievement of students in Basic Science.

Purpose of the study
The purpose of the study was to find out the secondary school students' self-concept as correlates of academic achievement in Basic Science. Specifically, the study sought to determine the;
1. Relationship between secondary school students' self-concept and their Academic achievement in Basic Science
2. Relationship between male secondary school students' self-concept and their academic achievement in Basic Science
3. Relationship between female secondary school students' self-concept and their academic achievement in Basic Science

Research Questions
The following research questions guided the study
1. What is the relationship between Students' self-concept and their academic achievement in Basic Science?

2. What is the relationship between male secondary school students' self-concept and their academic achievement in Basic Science?
3. What is the relationship between female secondary school students' self-concept and their academic achievement in Basic Science?

Hypotheses

The following null hypotheses guided the study and were tested at 0.05 level of significance.

1. There is no significant relationship between Student's self-concept and their academic achievement in Basic Science.
2. There is no significant relationship between male secondary school student's self-concept and their academic achievement in Basic Science.
3. There is no significant relationship between female secondary school student's self-concept and their academic achievement in Basic Science.

Methods

The research design adopted for this study was Correlational Survey. The study was carried out in public secondary schools in Awka Education Zone of Anambra State. The zone is made up of five local government areas in Anambra State. These five local government areas include; Awka South, Awka North, Njikoka, Anaocha and Dunukofia local government areas. Awka Education Zone was chosen because it is the largest educational zone containing a significant number of secondary schools in Anambra State. The population of this study comprises of 5,388 junior secondary school two (JSS2) basic science students in all the schools in Awka Education Zone. A sample of 150 students was randomly selected from ten secondary schools in Awka education Zone. The simple random sampling method was used to select the ten secondary schools to avoid all forms of selection bias, hence giving each member of the ten schools an equal chance of being selected. Therefore, 15 respondents from each of the ten schools which were selected at random which formed the sample size of the study. The instrument used for data collection was a structured questionnaire developed by the researchers. The questionnaire was tagged Self-Concept Scale. It was made up of two parts, I and II. Part 1 of the questionnaire was used to obtain personal information of the respondents. Part II was further divided into three sections containing item questions in accordance to the specific purpose of the study and research questions developed for the study. The instrument for the study was validated by three lecturers in the department of science education, faculty of Education, Nnamdi Azikiwe University, Awka. To obtain the reliability of the instrument, copies of the questionnaire was tested by administering 20 copies on students from Onitsha Education Zone using single administrative method. The data obtained from the administered questionnaire was analyzed using Cronbach's Alpha method. The reliability was found to be 0.748. The researcher went to the sampled public secondary schools and administered the questionnaire on the respondents on the spot. The data collected was analyzed using Linear Regression.

Results
Research Question One
What is the relationship between Students' self-concept and their academic achievement in Basic Science?
Table 1: Regression analysis of the relationship between secondary school students' self-concept and their academic achievement in Basic Science

Model	r	r^2	Adjusted r^2	Std. Error of the Estimate	Decision
1	.623[a]	.388	.384	10.13715	Moderate positive relationship

a. Predictors (Constant), Students Self-Concept

The result in Table 1 shows that the correlation coefficient between secondary school students' self-concept and their academic achievement in Basic Science is .623. This indicates that there exists a moderate positive relationship between secondary school students' self-concept and their academic achievement in Basic Science. The data in the table also reveals that the coefficient of determination (r) associated with the correlation coefficient of 623 is 388. The coefficient of determination (r) indicates that 38.8% variation in secondary school students' achievement in Basic Science can be attributed to their self-concept.

Research Question Two
What is the relationship between male secondary school students' self-concept and their academic achievement in Basic Science?
Table 2: Regression analysis of the relationship between male secondary school students' self-concept and their academic achievement in Basic Science

Gender	r	r^2	Adjusted r^2	Std. Error of the Estimate	Decision
Male	.687[a]	.472	.466	9.422444	Moderate positive relationship

a. Predictors: (Constant), Students Self-Concept

The result in Table 3 indicates that the correlation coefficient between male secondary school students' self-concept and their academic achievement in Basic Science is 687. This indicates that there exists a moderate positive relationship between male secondary school students' self-concept and their academic achievement in Basic Science. The data in the table also reveals that the coefficient of determination (r) associated with the correlation coefficient of .687 is .472. The coefficient of determination (r) indicates that 47.2% variation in male secondary school students' achievement in Basic Science can be attributed to their self-concept.

Research Question Three
What is the relationship between female secondary school students' self concept and their academic achievement in Basic Science?

Table 3: Regression analysis of the relationship between female secondary school students' self-concept and their academic achievement in Basic Science

Gender	R	r^2	r^2 Adjusted	Std. Error of the Estimate	Decision
Female	.527[a]	.278	.265	10.99505	Moderate positive relationship

a. Predictors: (Constant), Students Self-Concept

The result in Table 5 reveals that the correlation coefficient between female secondary school students' self-concept and their academic achievement in Basic Science is 527. This indicates that there exists a moderate positive relationship between female secondary school students' self-concept and their academic achievement in Basic Science. The data in the table also reveals that the coefficient of determination (r) associated with the correlation coefficient of 527 is 278. The coefficient of determination (F) indicates that 27.8% variation in female secondary school students' achievement in Basic Science can be accounted for by their self- concept.

Hypotheses
Hypothesis 1
There is no significant relationship between Student's self-concept and their academic achievement in Basic Science.

Table 4: ANOVA Regression analysis on significance of the relationship between students' self-concept and their academic achievement in Basic Science

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	9642.231	1	9642.231	93.831	.000[b]
	Residual	15208.763	148	102.762		
	Total	24850.993	149			

a. Dependent Variable: Achievement Score
b. Predictors: (Constant), Students Self-Concept

The result in table 2 shows that at 93.831 F-value the probability value of .000 was obtained which is less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. Hence, there is a significant relationship (P<0.05) between students' self-concept and their academic achievement in Basic Science. This implies that self-concept made a significant contribution to students' academic achievement in Basic Science.

Hypothesis 2:
There is no significant the relationship between male secondary school students' self-concept and their academic achievement in Basic Science.

Table 5: ANOVA Regression analysis on significance of the relationship between male secondary school students' self-concept and their academic achievement in Basic Science

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6985.933	1	6985.933	78.653	.000[c]
	Residual	7816.167	88	88.820		
	Total	14802.100	89			

a. Dependent Variable: Achievement Score
b. Selecting only cases for which Gender-Male
c. Predictors: (Constant), Students Self-Concept Scale

The result in table 4 reveals that at 78.653 F-value the probability value of .000 was obtained which is less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. Hence, there is a significant relationship (P<0.05) between male secondary school students' self-concept and their academic achievement in Basic Science. This implies that self-concept made a significant contribution to the male secondary school students' academic achievement in Basic Science.

Hypothesis 3
There is no significant the relationship between female secondary school students' self-concept and their academic achievement in Basic Science

Table 6: ANOVA Regression analysis on significance of the relationship between female secondary school students' self-concept and their academic achievement in Basic Science

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2698.650	1	2698.650	22.323	.000[c]
	Residual	7011.683	58	120.891		
	Total	9710.333	59			

a. Dependent Variable: Achievement Score
b. Selecting only cases for which Gender-Female
c. Predictors: (Constant), Students Self-Concept Scale

The result in table 4 reveals that at 78.653 F-value the probability value of .000 was obtained which is less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. Hence, there is a significant relationship (P<0.05) between female secondary school students' self-concept and their academic achievement in Basic Science. This implies that self-concept made a significant contribution on the female secondary school students' academic achievement in Basic Science.

Discussion

The findings of the study revealed that there is a moderate positive relationship between secondary school students' self-concept and their academic achievement in Basic Science. The findings of this study is in line with the study carried out by Ajmal, & Rafique (2018) who reported that there is a significant relationship between academic self-concept and academic achievement of distance learners. This implies that positive academic self-concept of students helps them to achieve better in academics. This is also supported by Okafor, Obialor, & Osuafor (2020) in their study on secondary school students' self-concept and gender as correlates of academic achievement in Biology in Imo State who reported that there is a significant relationship between students' self-concept and academic achievement in biology.

The findings of the study also revealed that there is a moderate positive relationship between male secondary school students' self-concept and their academic achievement in Basic Science. Similarly, this finding is in line with the study carried out by Okafor, Obialor, & Osuafor (2020) who studied secondary school students' self-concept and gender as correlates of academic achievement in Biology in Imo State. The authors therefore concluded that students' self-concept can be a contributing factor towards male students' academic achievement in biology. This means that male students with positive self-concept achieve higher than the male students with negative self-concept.

Furthermore, the findings of this study also indicate that there is a moderate positive relationship between female secondary school students' self-concept and their academic achievement in Basic Science. This result is in agreement with the findings of Okafor, Obialor, & Osuafor (2020) who reported that students' self-concept can be a contributing factor towards female students' academic achievement in biology. This also means that female students with positive self-concept achieve higher than the male students with negative self-concept. However, the moderate positive relationship observed in male and female secondary schools students self- concepts and their academic achievement in basic science could be attributed to teaching methods used by their teachers during instructional delivery.

Conclusion:

Based on the findings of this study, it was revealed that self-concept has a positive and significant influence on the academic achievement of students. Similarly, the analysis showed that there is a moderate positive relationship between male and female secondary school students' self-concept and their academic achievement in Basic Science.

Recommendations

Based on the research findings and implication of the study, the following recommendations were made;

8. Both school and family involvement are needed for enhancement of students' self-concept of basic science students for better academic achievement.

9. Educational guidance services should be made mandatory in schools and educational stakeholders should equally focus on the self-concept of both high and low achieving students.
10. Self-concept should be enhanced using appropriate teaching and counseling strategies so as to boost students' self-concept in order to improve academic achievement of both male and female especially in basic science.
11. Government should set up trainings that will enlighten teachers on psychological construct such as self-concept and self-esteem.

REFERENCES

Anierobi, E. J. (2019). Gender differences in science academic self-concept and achievement motivation of secondary school students in Nigeria. *International Journal of Education and Evaluation, 5(1), 24-36.*

Basic Examination Certificate (2019), *Press Release- BECE 2018/2019 Released. Retrieved from http://www.becenigeria. Org/news.com.*

Bell, M.J. (2012). Define academic performance. Retrieved from ehao.com.mobile 16th May, 202

Hanan, A., Shabana, A., & Mona, A. (2016). The effect of academic self-concept and gender on academic achievement of secondary school students. *Journal of Research in Education and Science, 2(1), 63-68.*

Ibenegbu, G., Okoye, N. J., Adigwe, J. O., & Ifesinachi, U. V. (2022). The Influence of Self-Concept on Academic Achievement among Secondary School Students in Anambra State. *Journal of Education and Practice, 13(2), 137-147.*

Jackson, S. L. (2022). Self-Concept. In The Encyclopedia of Child and Adolescent Development (pp. 1-7). Wiley.

Maduabum, M. A. (2011). The contribution of Basic Science and Technology to the achievements of the Millennium Development Goals in Nigeria. *Journal of Emerging Trends in Educational Research and Policy Studies, 2(3), 180-186*

Matovu, M. (2012). The relationship between self-concept, gender, and academic achievement in science among secondary school students in Kampala district. Makerere University

Nwana, O.C. (2007). *Educational Measurement and Evaluation*. Owerri: Boomerang Publishers

Obialor C.O. (2021). *Evaluation of implementation of the minimum standard for NCE biology curriculum in colleges of education in Nigeria*. Unpublished Doctoral Dissertation, Department of Science Education, Nnamdi Azikiwe University, Awka.

Obialor, C.O. (2016). Effect of project work on students' science process skills acquisition and achievemrnt in se secondary school in biology. Unpublished Masters Thesis, Department of Science Education, Nnamdi Azikiwe University, Awka.

Okafor E.O, Obialor C.O & Osuafor A, M (2020). Secondary school students self concept and gender as correlates of Academic Achievement in Biology in Imo State. *Journal*

of Curriculu8m Development Instructional Material Center (J-CUDIMAC). Vol.82 (1) Available online at https://cudimac.unn.edu.ng/volume-8-Number-1-2020.

Okeke E.A. (2008). *Clarification and analysis of gender concepts. Focus on research, reproductive Health Education and Gender Sensitive classrooms*. Science Teachers Association of Nigeria. Gender and STM Education Series No 2, 5-8

SarAbadaniTafreshi, A. (2006). A study of gender differences in students' academic achievement. Journal of Faculty of Educational Sciences and Psychology, 3(3), 57-68.

Spinath, B. (2012). Intelligence and academic achievement. In R. J. Sternberg & S. B. Kaufman (Eds.), *The Cambridge Handbook of Intelligence (pp. 589-610). Cambridge University Press.*

Sustainable Development Goals (SDGs). (2021). United Nations. *Retrieved from https://sdgs.un.org/*

PARENTAL INVOLVEMENT, SCHOOL CONNECTEDNESS AS A CORRELATE TO SPORTS PARTICIPATION AMONG SECONDARY SCHOOL STUDENTS IN ANAMBRA STATE, NIGERIA

Okeke, Elizabeth Chidinma & Nweke Obinna Christian
Nnamdi Azikiwe University, Awka
Department of Human Kinetics and Health Education
ec.okeke@unizik.edu.ng, oc.nweke@unizik.edu.ng
08160668954, 08064785300

Abstract
This study was carried out to examine the influence parents and the school has on sport participation of students in secondary schools in Anambra State. Five research questions and hypotheses guided the study. The research anchored on Green's (2005) Model of Sport Development and Expectancy-Value Theory. The research design used for the study was correlational survey research design. The sample for the study consists of 400 SS1 students in co-educational secondary schools in Anambra State using Taro Yamane formula. Multistage sampling technique was used to select the sample. The instrument used for data collection was questionnaire. Data in this study was analyzed using inferential statistics; Pearson's Product Moment Correlation (PPMC) was used to answer the research questions, Simple linear regression was used to test hypotheses 1 and 2, hypotheses 3 and 4 was tested using Fisher-Z test while hypotheses 5 was tested using multiple linear regression. The result of the study revealed that there is a significant relationship between parental involvement and sport participation of students in secondary schools in Anambra state. It also revealed that the school can affect sport participation of students in secondary schools in Anambra State. It was therefore concluded that the school and parent influences sport participation among secondary school students in Anambra State. It was recommended that Parents, students, teachers and school administrators should be properly educated on the benefits of sport participation to ones' mental, psychological and physical wellbeing. School sport programmes should also be encouraged and organized regularly such as inter-house sport competition with the aim of encouraging sport participation and bringing parent, school and the student together.
Key Words: School sports, secondary school students, Parental Involvement, School Connectedness, Sport Participation

Introduction
Sport as a social entity has grown from being just a form of entertainment and recreational activity to a professional status. Sports develop individuals, society and nations. It makes individuals, families, and communities grow strong and healthy in so many ways: physically, emotionally, socially, and economically. It is also important to note that sport is a significant and integral part of general education programmes in institutions and this has been widely recognized and accepted as a social activity and an indispensable part of the students. Ademola (2014) defined sports as any competitive activity that uses physical and intellectual capacity done by an individual or between individuals in other to

significantly contribute to their physical, intellectual, social, emotional and financial well-being. The European Commission (2013) defines sport as one of the most important health determinants in modern society, and sport constitutes a fundamental part of any public policy approach aimed at improving the levels of physical activity. This is why sport is a fact of life and important aspect of Nigeria culture which popularity and participation cut across the political, social, economic and educational fabrics of the nation.

Sports participation is a means of bringing people of different cultures and creeds together. It serves as an avenue where people of different genders, ages and religious backgrounds and political afflictions meet without any rancour. It is a social agent where people of different ages and political backgrounds meet as either producers or consumers (players and spectators). A considerable amount of literature (Wicker, Hallmann and Breuer, 2012) has revealed that a host of factors impinge in one way or another upon an individual's decision to participate in sport or other forms of physical activity. These determinants include economic, sociological, demographic and motivational factors along with the availability and standard of sport infrastructure. Literature has also revealed that infrastructure-level variables are essential predictors of participation in many sports (Hallmann, Wicker, Breuer and Schönherr, 2012).

It is a matter of fact that every one of us is associated with some type of family in the shape of parents, guardian, wards, and relative. It is also fact that family is the first social institution for every child. Most of the children follow their family rules, customs and tradition, and do as their parents want and directed in all aspects. Similarly, in the arena of sport, support and motivation of the parents and family members for their wards keep great importance to involve them in sporting activities. The children want to participate in sport and wish to make their future in sport, but they are looking for the decision of their parents and family members. Hollins (2016a) disclosed that to participate in organized sport, family must pay organizational sport fees and also to provide proper sport gear for their children to play safely. Siekań-ska (2012) also found that family having sport background always supports and motivate their children as compare to the family having no family background.

The reason why a lack of physical activity is a vital risk factor for humans is that it is a common trigger of various diseases. In addition to risk factors such as high blood lipid levels, tobacco consumption, psychological stress, high blood pressure, and obesity, low physical activity is also associated with the occurrence of coronary heart disease, especially in the form of a heart attack. Therefore, this makes it necessary to introduce sport or physical activities at an early stage which can be mostly achieved through the school.

School is an environment where children and adolescents spend most of their time during the day. School connectedness on the other hand, is the feeling of closeness to school personnel and the school environment. Because schools bear the responsibility of academic education and because it is a place where professional adults educate the young, the environment is different from any other built for work or social gatherings. School environment literally, is the physical and social space within the physical boundary of a school where students spend their school day. Encouraging participation in school sports

can help promotes academic achievement as well as provides an opportunity to achieve health-promoting physical activity (Bradley, Keane, and Crawford, 2013).

Secondary school students' sports participation has long been considered a positive aspect of their secondary school experience. Gråstén (2014) reported that school-based physical activity interventions increased students' physical activity participation and positive attitudes toward physical activities. Gråstén (2014) also underlines the importance of this period saying that it is a period for promoting physical activity. Apart from sufficient equipment and facilities, a safe environment is also indispensable for an effective and attractive school physical education.

Purpose of the Study

This study was designed to examine parental involvement, school connectedness as a correlate to sport participation among secondary school students in Anambra State. Specifically, this study is aimed at examining;
1. The relationship between parental involvement and sport participation of students in secondary schools in Anambra State.
2. The relationship between school connectedness and sport participation of students in secondary schools in Anambra State.

Research Questions

The following research questions will guide the study
1. What is the relationship between parental involvement and sport participation of students in secondary schools in Anambra State?
2. What is the relationship between school connectedness and sport participation of students in secondary schools in Anambra State?

Hypotheses
1. There is no significant relationship between parental involvement and sport participation of students in secondary schools in Anambra State.
2. There is no significant relationship between school connectedness and sport participation of students in secondary schools in Anambra State.

Method

A correlational survey research design was used for this study. The area of the study was Anambra State. The population of this study comprises 12,068 SS1 Students of public co-educational secondary schools in the six educational zones in Anambra State, which is made up of 6,331 male and 5,733 female students. The sample for the study consists of 400 SS1 students in co-educational secondary schools in Anambra State using Taro Yamane formula. Multi-stage 2sampling technique was used to select the sample. Out of the six (6) education zone in Anambra State, two (2) education zones were selected using simple random sampling technique without replacement which is Onitsha and Awka educational zone. One (1) local government area each was selected from the selected education zones using simple random technique which is Onitsha north and Awka South Local Government

Areas. Using proportionate stratified random sampling technique, 113 and 287 SS1 students were selected from Onitsha north local government area and Awka south local government area respectively. The research instrument used for this study was a questionnaire. The instrument is structured on a four-point scale of Strongly Agree (SA); Agree (A); Disagree (D); Strongly Disagree (SD) weighted at 4,3,2, and 1 respectively. In order to validate the instrument for this study, drafts of the questionnaire were given to two (3) experts for face and content validity.

Reliability of the instrument was ascertained using pilot test. Twenty copies of the instrument were distributed amongst 20 secondary school students in Enugu State, who were not part of the current study. Cronbach's Alpha was used to determine the coefficient. The reliability coefficient obtained an overall coefficient of 0.821. Pearson's Product Moment Correlation (PPMC) was used to answer the research questions while Simple linear regression was used to test the hypotheses.

Results

Research Questions one

What is the relationship between parental involvement and sport participation of students in secondary schools in Anambra State?

Table1: Bivariate Correlation between Parental involvement in Sports and Students Sports Participation

Variables	Mean	SD	Correlation	
			Parental involvement	Participate in sports
Parental involvement	3.00	.480	1	.099[*]
Participation in sports	2.43	.570	.099[*]	1

Data presented in Table 1 reveals the correlation between parental involvement in sports and sports participation by students. The table reveals a very low positive relationship ($r = 0.099$) between parental involvement and students' sports participation in secondary schools.

Research Questions two

What is the relationship between school connectedness and sport participation of students in secondary schools in Anambra State?

Table 2: Bivariate Correlation between school connectedness in Sports and Students Sports Participation

	Mean	SD	Correlation	
			School connectedness	Participation in sports
School connectedness	2.91	.432	1	.161[**]
Participation in sports	2.44	.570	.161[**]	1

Table 2 shows the correlation between school connectedness in sports and sports participation by students. The table reveals a very low positive relationship ($r = 0.161$) between school connectedness and students' sports participation in secondary schools.

Hypotheses
Hypothesis One
There is no significant relationship between parental involvement and sport participation of students in secondary schools in Anambra State.

Table 3: Simple linear regression model on the relationship between parental involvement and sport participation

Model	Sum of Squares	df	Mean Square	F	Sig.	Decision
Regression	1.274	1	1.274	3.954	.047	S
Residual	128.256	398	.322			
Total	129.530	399				

Note. R-square = 0.010, S = significant

The data presented in Table 3 shows a significant relationship between parent involvement in sports and sports participation among students: $F(1, 398) = 3.954$, $p = 0.047 < 0.05$, with R-square of 0.010 which indicate that 1.0 percent of variation in sport participated is accounted for by parent involvement in sport. Overall, the null hypothesis is rejected. Hence, there is a significant relationship between parental involvement and sport participation of students in secondary schools in Anambra State.

Table 4: Coefficient of regression on the relationship between parent involvement and sports participation

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
1 (Constant)	2.087	.180		11.615	.000
Parental	.118	.059	.099	1.988	.047

Table 4 further reveals the coefficients of regression estimates ($B = 0.059$, $t = 1.988$, $p = 0.047$), which indicate a significant relationship between parent involvement and sports participation.

Hypothesis Two
There is no significant relationship between school connectedness and sport participation of students in secondary schools in Anambra State.

Table 5: Simple linear regression model on the relationship between school connectedness and sports participation

Model	Sum of Squares	Df	Mean Square	F	Sig.	Decision
Regression	3.376	1	3.376	10.650	.001	S
Residual	126.154	398	.317			
Total	129.530	399				

Note. R-square = 0.026, S = significant

Table 5 shows a significant relationship between school connectedness in sports and sports participation among students: $F(1, 398) = 10.650$, $p = 0.001 < 0.05$, with R-square of 0.026 which indicate that 2.6 percent of variation in sport participated is accounted for by school connectedness in sport. Overall, the null hypothesis is rejected. Hence, there is a significant

relationship between school connectedness and sport participation of students in secondary schools in Anambra State.

Table 6: Coefficient of regression on the relationship between school connectedness and sports participation

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	1.820	.192		9.470	.000
	School	.213	.065	.161	3.263	.001

Table 6 further reveals the coefficients of regression estimates ($B = 0.065$, $t = 3.263$, $p = 0.001$), which indicate a significant relationship between school connectedness and sports participation.

Discussion

The findings of the study revealed that there is a significant relationship between parental involvement and sport participation of students in secondary schools in Anambra State. This implies that parent influences sport participation among secondary school students in Anambra State. The findings are in line with the findings of the study carried out by Yao and Rhodes (2015) who found that support from parents was related to children's physical activity. This finding of the study is also in line with Luban (2017) who stated that family support and encouragement is a key factor which significantly influences adolescents' participation in sport. The findings of the study also align with Sohi (2018) who opined that parents have been observed as more influential in socializing their children into sport. He also observed that, the influence of the family status financially, educationally, occupationally and attitude wise on students' sport participation cannot be underestimated, since family is the first setting for informal education of a child and as well is in the better position to form values which their offspring both male and female should have towards sport participation. The findings are in line with Baker and Cote (2016) who posited that parental behaviour and parenting styles can have both negative and positive influences on children's sport participation and experience, that children who perceive more positive supports, encouragements and less pressure from parents tends to enjoy sport more than other children.

The findings of the study further revealed that there is a significant relationship between school connectedness and sport participation of students in secondary schools in Anambra State. This implies that school connectedness influences sport participation among secondary school students in Anambra State. The findings are in line with the opinion of Leo, Jun, Nan, Kyn-Tore and Eun-Cheol (2016) who asserted that sports facilities is one of crucial thing to consider because it provides a room for better performance in sports and also motivate the adolescents in sports participation and other physical activities. The researchers were of the opinion that to become the best athlete or a

good player, one must be motivated through sports facilities to do what is takes to maximize his or her ability and achieve his or her goals.

The finding is also consistent with Samara, Nistrup, Al-Rammah, and Aro, 2015; Aljaaly, 2017 who confirmed that the lack of available facilities at schools was one of the main hindrances for being active by participating in sports. Based on this, it implies that offering students a good plan for sports programs that they can participate in may not be sufficient if the facilities at the school are less accessible or have limited choices. Thus, access to adequate sports facilities at the school results in a greater level of participation in different types of sports. Moreover, school management has a key role in reinforcing the motivation to engage in sports activities by creating more facilities and structured places that can provide integrated sports facilities for students. The finding is also in line with Abedalhafiz (2013) who identified lack of physical education classes as an obstacle that hindered students from participating in sports activities at schools.

Conclusion

Based on the findings of the study, the school and parents are the two groups that most influences the lives of the students both socially and culturally. The findings of the study have shown that parent and the school influences sport participation among secondary school students in Anambra State. It is therefore important to press down the need for the parent to encourage their children to participate in sport by inculcating in them the benefits of sports, paying their sport levies, purchasing sporting equipment and supplies for them and also attending sporting activities with them. All these will motivate them to participate in sport. It is also imperative to stress that schools should provide suitable and innovative sports facilities and programs that suit students' needs to enhance sport participation at the secondary school level.

Recommendations

Based on the findings of the study, recommendations were made;

1. Students should be influenced positively toward sport participation so as to increase their participation in sport.
2. Special recognition, incentives and awards should be given to students who performed exceptionally in sport so that it can serve as motivation towards sport participation among other students.
3. All students who want to participate and are willing to make the commitment necessary for sport participation should be encouraged to participate, but with the consent of their parents so that the schools are not found liable in case of injuries.
4. The type of sport programmes offered to students should be carefully considered. It must address the unique characteristics of students; sport that encourage students to concentrate on personal improvement, accommodate large number of participants and are inherently safe should take precedence.
5. The state government through the school sport division of the Ministry of Education should invest more in sport facilities and equipment development in secondary schools. This will contribute to grassroot sport development in the state.

REFERENCES

Abedalhafiz, A. (2013). 'Obstacles Face Physical Education at Schools in Al-Madenah Al-Munawarah-Ksa', 9(13), pp. 284–300.

Ademola, M. A. (2014). Participation in sports and physical education in Nigerian secondary schools, *The Journal of Physical Education, Recreation & Dance*, 15(1), 34-41.

Baker, J. and Cote, J. (2016). Learning from the Experts. Practice Activities of Expert. Decision makers in sports. Research Quarterly for Exercise and Sport. 342-344.

Bolarinwa O.M. (2021). Influence of Sports Facilities and Equipment on Sport Participation among Secondary School Students in Ekiti Stated, Nigeria. *International Journal of Education Research.*http://ijojounals.com/index.php/er

Bradley-Geist, J. C., and Olson-Buchanan, J. B. (2014). Helicopter parents: An examination of the correlates of over-parenting of college students. Education + Training, 56, 314-328. doi:10.1108/ET-10-2012-0096

Fatai Y. O and Peter-Ajayi O. M (2021). Impact of sports facilities and safety equipment on sports participation among adolescents in Ikere local government area in Ekiti State. https://www.researchgate.net/publication/354997227

Gråstén, A. (2014). Students' physical activity, physical education enjoyment, and motivational determinants through a three-year school-initiated program. Studies in Sport, Physical Education and Health, (205).

Hallmann, K., Wicker, P., Breuer, C., and Schönherr, L. 2012. Understanding the importance of sport infrastructure for participation in different sports – findings from multi-level modelling. *European Sport Management Quarterly, 12*(5), 525-544.

Hollins, D. K. (2016a). "When Eno-ugh is Enough: The Impact of Parental Involvement in Children's Participation in Organized Sports." B.A., Social Work, Portland State University (Paper 224).

Leo, S., Jun, Y., Nan, J., Kyn-Tore, H., and Eun-Cheol, P. (2016). The relationship between sports facilities and accessibility and physical activity among Korean adults. *British Medical Council Public Health*, 1, 893.

Lubans. D., Sylva, K. and Morgan, P. (2017). Factors associated with physical activity in a sample of British secondary school students. *Austrilia Journal of EducationPsychology*. 1, 2230.

Samara, A., Nistrup, A., Al-Rammah, T. Y. and Aro, A. R. (2015) 'Lack of facilities rather than sociocultural factors as the primary barrier to physical activity among female Saudi university students', *international journal of women's health*. Dove Press, 7, p. 279.

Siekańska, M. (2012). Athletes' Perception of Parental Support and Its Influence in Sports Accomplishments - A Retrospective Study. *Human Movement*, *13*(1), 380-387. https://doi.org/10.2478/v10038-012-0046-x

Sohi, A. S. (2018). *Socialization into competitive sports. Its process, contribution towards promoting excellence in sports and human performance factors in achieving excellence in sports.* Ibadan, Nigeria. 2(2), 62-75.

Wicker, P., Hallmann, K., and Breuer, C. 2012. Micro and Macro level determinants of sport   participation. Sport, Business and Management: *An International Journal*, 2(1), 51-68.

Yao, C.Aand Rhodes, R.E (2015).Parental correlates in child and adolescent physical activity: A meta analysis. *International Journal of Behavioural Nutrition and Physical Activity, 12*, 10. Doi:https//:doi.org.10.1186/s12966-015-0163-y.
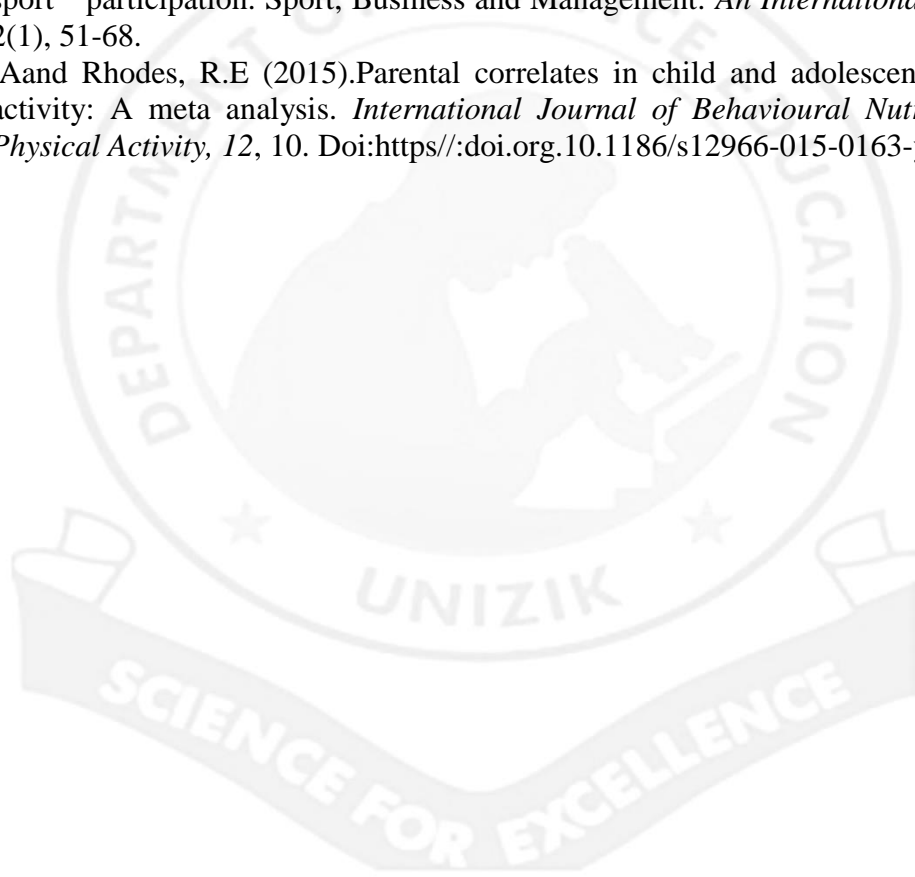
RELATIONSHIP BETWEEN SECONDARY SCHOOL STUDENTS' STUDY HABIT AND THEIR ACADEMIC ACHIEVEMENT IN MATHEMATICS IN GOMBE STATE, NIGERIA

Achufusi Aka Ngozi, N. (Ph.D) & Ethel Chika Emenike
Department of science Education, Nnamdi Azikiwe university, Awka
07032659366

Abstract
In Gombe State, achievement of students in Mathematics in WASSCE had been consistently unsatisfactory based on WAEC Chief Examiners' Report in 2020, 2021 2022. This worrisome trend could probably be linked to the study habits of students in the subject. The purpose of the study was to ascertain the relationship between secondary school students' study habit and their academic achievement in mathematics in Gombe State. Five research questions guided the study while three hypotheses were tested at 0.05 level of significance. Correlational research design was used for the study. The population of this study comprised all the 5, 161 (3, 343 males and 1818 females) Senior Secondary two (SS2) students in all the 71 government-owned secondary schools in Gombe North Education Zone. The sample of the study was made up of 1330 SS 2 students for the 2022/2023 academic session which was made up of 824 males and 506 females obtained via simple random sampling and proportionate sampling techniques. Study Habits Inventory (SHI) and students past annual records in mathematics promotion examination obtained from the sampled schools was used for data collection. The reliability of SHI was tested using Cronbach Alpha method. Coefficient value of 0.88 was obtained which was considered high enough to confirm the instrument as reliable. Data collected were analyzed using Pearson product moment correlation coefficients and t-test of correlation. The finding of the study indicated that a high positive and significant relationship existed between students` study habits and their achievement in Mathematics. Again, the findings of the study showed that across gender lines, a positive and significant relationship existed between students` study habits and their achievement in Mathematics. It was recommended among others that Mathematics teachers should evolve teaching strategies that will sustain students' study habits inorder to enhance their academic achievement in Mathematics.
Key words: Mathematics, Study Habit, Academic Achievement.

Introduction
Education is quite vital in any given society. It is the corner-stone for development. It is a process that promotes the development of the intellectual, emotional, social and physical capabilities of an individual. Ukeje (2012) noted that, education is a process by which any society through schools, colleges, universities and other institutions make deliberate efforts towards the transmission of knowledge, values and skills to the young ones. The schools could be primary, secondary or tertiary.

Secondary school is the next level of education after the primary school. It is the education level at which children within the age of 12 to 18 years are exposed after primary education and before tertiary education. Secondary education prepares students for meaningful living as well as further education. The underlining principle here is that secondary school should be able to provide quality secondary education to all those who can benefit from it. In the course of secondary education, several core subjects are taught mathematics inclusive.

Mathematics is a physical science that deals with quantities, forms, shapes and their 2relationships by the use of numbers and symbols. Singh (2015) defined mathematics as the gate and key of all sciences. Singh added that it is a theoretical discipline that deals with the possible relationships among abstractions with no recourse to apprehension for whether those abstractions have counterparts in the real world. According to Muraina (2013), Mathematics is nurtured by certain qualities such as power of reasoning, creativity, abstract or spatial thinking, critical thinking, problem-solving ability as well as effective communication skills.

In Nigeria, Mathematics is one of the core science subjects in secondary school curriculum. Like other subjects, much emphasis is placed on the teaching and learning secondary school Mathematics. This is to be able to achieve the goal of education as it is spelled out in secondary school curriculum that mathematics is taught as core subject due to its relevance to individual and society at large. Mathematics syllabus is designed to enable the learner to acquire attitudes, skills and knowledge that will be relevant to his or her life after school. Mathematics is a core subject that is key to the understanding of other fields of science and technology and for gaining admission into tertiary institutions in Nigeria (Melvina and Nanjwan, 2019). In recognition of the afore-mentioned, the achievement of students in mathematics should be treated with every sense of seriousness.

Academic achievement is the overall performance outcome of education that indicates the extent to which a learner has achieved set-out goals. It is an index of measurement that shows a student's cognitive, affective and psychomotor domains in an educational setting (Joe, Kpolovie, Osonwa and Iderima, 2014). More so, Verma (2016) defined academic achievement as a measure of knowledge, understanding or skills in a specific subject or a group of subjects. In vast majority of cases, academic achievement serves as a predicator for career growth, acceptance of change, adaptation to new situations and the development of positive self-esteem and self-confidence (Latrintluangi, 2018).

Despite the contribution of study habits to the academic achievement of students in mathematics, Obiero (2018) observed that poor mathematics achievement has been a global concern despite the actual studies that have been devoted to certain factors which have been identified as possible contributors to mathematics achievement. In similar vein, the state of academic achievement especially among secondary school students in mathematics in Gombe State as observed by the researcher is rather 2unsatisfactory. The evidences of this perception could be based on the reports of the examination bodies like West African Examination Council (WAEC), NECO among others which indicated the discouraging performance of students in mathematics. The academic achievement of students in mathematics in Gombe State is not only poor generally but continues to fall

over the years. According to Sharma (2015), performance manifests through academic achievement, which is the depiction of a student's study habit.

Study habits embody the techniques that are adopted by a student outside the classroom to make for better understanding of what was taught in a subject over the course of instructional delivery. According to Hassan, Sadaf, Aly and Baig (2018), study habits refer to study practices such as the frequency of studying, sittings, rehearsals of learned materials, review of material, studying in a favourable surroundings and self- testing. It captures the extent to which a student routinely engages in the act of effective reading and note-taking for the purpose of improving their achievement in a subject. Similarly, Bello and Ariyo (2014) asserted that study habit demonstrates the extent to which the student engages in routine acts of effective study for the achievement of high performances in test scores. Study habits entail the practices used by students outside the classroom for an enhanced comprehension of learned materials. Fan and Matsumoto (2014) noted that study habits are of two types namely: good study habits and poor study habits. Fan and Matsumoto added that good habits study focuses on techniques such as preparing study time table, time management, concentration, obtaining and organizing study materials, reading comprehension, note taking among others.

Good study habits focuses on good organization, keeping good notes, reading your textbooks, listening in class, and working every day (Verma, 2016). Additionally, Ogunduyilemi (2018) stated that good study habits embody four indicators namely: the habits of attending lectures, reading books, visiting the library and facing examinations. The general conception is that students who are exposed to good study habits could achieve better than their counterparts who are exposed to bad study habits. In other words, if study habits are thoughtfully applied, they possess the tendency of improving the academic achievement of students in subjects such as mathematics. Instructively, achievement of students in mathematics can be affected by myriad of factors; gender inclusive.

Gender refers to the social role, responsibilities and behaviours believed to belong to men and women. Unfortunately, no consensus has been reached about the effect of gender in science and mathematics achievement. Many research results found in the literature have varying conclusions. For instance, while Cech (2012) and Das and Singhal (2017) found that males perform better than females in Mathematics, Lee and Kung (2018) found that females have higher mathematics achievement than their male counterpart. In contrast, Derrick (2019) and Amatobi and Amatobi (2013) found that no gender difference existed with respect to performance in mathematics as both boys and girls recorded similar performance. From the foregoing, the findings on gender and students` achievement in mathematics are not in agreement hence, its inclusion as a variable to be investigated in this study. More so, there is need to find out if study habits contribute to the academic achievement of students in mathematics; hence the justification for the current study.

Purpose of Study

The purpose of this study was to find out the relationship between secondary school students' study habit and their academic achievement in mathematics in Gombe State. Specifically, the study intends to find out the:

.
1. Relationship between secondary school students' study habit and their academic achievement in mathematics in Gombe state.
2. Relationship between male students' study habit and their academic achievement in mathematics in Gombe State.
3. Relationship between female students' study habit and their academic achievement in mathematics in Gombe State.

Research Questions
The following research questions guided the study.
1. What is the relationship between the students` study habits and their achievement in mathematics in Gombe State?
2. What is the relationship between the male students` study habits and their achievement in mathematics in Gombe State?
3. What is the relationship between female students` study habits and their achievement in mathematics in Gombe State?

Hypotheses
The study tested the following null hypotheses at 0.05 level of significance.
1. There is no relationship existing between the students` study habits and their academic achievements in mathematics will not be significant.
2. There is no relationship existing between the male students` study habits and their academic achievements in mathematics will not be significant.
3. There is no relationship existing between the female students` study habits and their academic achievements in mathematics will not be significant.

Method
The research design for this study is correlational survey. The study was conducted in Gombe Local Government Area of Gombe State, Northern part of Nigeria. Gombe State was chosen for this study because of the high rate of failure in mathematics by secondary school students in this area irrespective of some positive measures (Extra class lessons, modified classrooms, and qualified mathematics teachers) taken to stop them from mass failure. The population of this study comprised all the 5, 161 (3, 343 males and 1818 females) Senior Secondary two (SS2) students in all the 71 government-owned secondary schools in Gombe North Education Zone as at the time of this study. The sample of the study was made up of 1330 SS 2 students for the 2022/2023 academic session which was made up of 824 males and 506 females. Multi-stage sampling technique was used to select the sample size for the study. First, purposive sampling technique was used to obtain three local government areas out of the five local government areas in the Education Zone as they are the co-educational schools with the highest number of students which will enable the researcher to take care of the gender variables in the study. Proportionate sampling technique was used to obtain 50% of the schools in the local government areas to obtain

18 schools. Then, all the SS II students in the 18 schools were used. The entire exercise gave rise to 824 males and 506 females.

The instrument that was utilized for data collection is questionnaire. The questionnaire is titled Study Habits Inventory (SHI). SHI was adopted from Study Habit Inventory by Bakare (1977). It contains 45 items and divided into eight parts (I-VIII). Part I measures homework and assignments; part II measures time allocation; part III measures reading and note-taking; part 1V measures study period procedures; part V measures concentration; part VI measures written work; part VII measures examination and part VIII measures teachers consultation. The instrument was developed in a manner that the respondents will respond by choosing one of five response options viz: Almost Never, Less than Half of the Time, About Half of the Time', More than Half of the Time and Almost Always. No validation was done. This is because the Study Habit Inventory (SHI) is an adopted instrument. For the academic achievement, documents containing results of students in mathematics promotion examination was used for the study. It is an already existing data containing mathematics promotion examination results of students for the academic session under consideration. The reliability of the instrument was established using Cronbach alpha method. The instrument was administered on a representative sample of 40 SS2 mathematics students randomly selected from Government-owned secondary school in Bauchi State which is outside the area of the study. SHI obtained a high reliability coefficient of 0.88 which falls within the acceptable range of at least 0.8 as recommended by Nworgu (2015) of Cronbach alpha coefficient. The data for the study was collected with the aid of 18 research assistants who are mathematics teachers from the schools that was sampled for the study. SHI was administered on that same day using on-the-spot delivery approach. This ensured that the SHI was administered with the corroborative effort of research assistants and retrieved on the spot to ensure recovery of all the drafts of SHI. More so, the researcher ensured that the students were given codes (numbering from 001 to 760) for ease of matching of their responses arising from their study habits and academic achievement. Data arising from the research questions were analyzed using Pearson product moment correlation coefficients. The correlation coefficient was interpreted based on the recommendations of Nworgu (2015). It is thus; Below 0.30 (Low relationship), Above 0.30 (Moderate relationship), Above 0.80 (High relationship). The hypotheses were tested using t-test of correlation at 0.05 alpha level. While taking decisions regarding the hypotheses, a null hypothesis was rejected if the probability value (p-value) is less than or equal to significant value of 0.05; if otherwise (p>0.05), the null hypothesis will not be rejected.

Result
Research Question One
What is the relationship between the students` study habits and their achievement in mathematics in Gombe State?

Table 1: Pearson r on Relationship between Students` Study Habits and their Achievement in Mathematics.

Source of Variation	N	r	Remark
Study Habit Achievement	1330	0.608	High positive Relationship

Data in Table 3 show that there is a high positive relationship existing between students` study habits and their achievement in mathematics. This is evident by the size of Pearson's Correlation Coefficient r, which is 0.608.

Research Question Two
What is the relationship between male students study habits and their achievement in mathematics in Gombe State?

Table 2: Pearson r on Relationship between Male Students` Study Habits and their Achievement in Mathematics.

Source of Variation	N	r	Remark
Study Habit Achievement	824	0.614	High positive Relationship

Data in Table 4 show that there is a high positive relationship existing between male students` study habits and their achievement in mathematics. This is evident by the 8size of Pearson's Correlation Coefficient r, which is 0.614.

Research Question Three
What is the relationship between female students study habits and their achievement in mathematics in Gombe State?

Table 3: Pearson r on Relationship between Female Students` Study Habits and their Achievement in Mathematics.

Source of Variation	N	r	Remark
Study Habit Achievement	506	0.598	Moderate positive Relationship

Data in Table 5 show that there is a moderate positive relationship existing between female students` study habits and their achievement in mathematics. This is evident by the size of Pearson's Correlation Coefficient r, which is 0.598.

Hypotheses
Hypothesis One
There is no significant relationship between the students study habits and their academic achievement in mathematics.

Table 4: Test of Significance of Pearson Correlation between Students` Study Habits and their Achievement in Mathematics.

Source of Variation	N	r	p-value	Remark
Study Habit Achievement	1330	0.608	0.03	Sig.

Analysis in Table 6 shows that there is a significant relationship between the students` study habits and their achievement in mathematics. The calculated r (0.608) has *P*-value <0.05. The null hypothesis one was therefore rejected.

Hypothesis Two
There is no significant relationship between the male students' study habits and their academic achievement in mathematics.

Table 5: Test of Significance of Pearson Correlation between Male Students` Study Habits and their Achievement in Mathematics.

Source of Variation	N	r	p-value	Remark
Study Habit Achievement	824	0.614	0.00	Sig.

Analysis in Table 7 shows that there is a significant relationship between male students` study habits and their achievement in mathematics. The calculated r (0.614) has *P*-value <0.05. The null hypothesis two was therefore rejected.

Hypotheses Three
There is no significant relationship between the female students' study habits and their academic achievement in mathematics.

Table 6: Test of Significance of Pearson Correlation between Female Students` Study Habits and their Achievement in Mathematics.

Source of Variation	N	r	p-value	Remark
Study Habit Achievement	506	0.598	0.01	Sig.

Analysis in Table 8 shows that there is a significant relationship between female students` study habits and their achievement in mathematics. The calculated r (0.598) has *P*-value <0.05. The null hypothesis three was therefore rejected.

Discussion
The findings of the study revealed that a high positive relationship existed between students` study habits and their achievement in mathematics. This could be attributed to the fact that study habits as a consequence test preparation, lowers the test anxiety level of students in testing situations. Unarguably, any student with low text anxiety level is bound to exude self-efficacy which invariably results in high academic achievement. Corroborating the findings of the current study, Villa and Sebastian (2021) found that study habit is a strong predictor of students' mathematics achievement. More so, Prasetyo, Ridlo and Kartijono (2019) found that a positive relationship existed between the study habits of students and their achievement in biology. Thus, the more studious a student is, the greater the tendency to excel in school subjects.

The findings of the study further revealed that a significant relationship existed between the students` study habits and their achievement in mathematics. In other words, study habit is a significant contributing factor to improved academic achievement of secondary school students in mathematics. Consistent with the findings of the current study

are the findings of Sakirudeen and Sani (2017) that there was significance relationship between note taking, students` use of library, time allocation for study and students` academic performance in Mathematics. The findings of the current study further agree with those of Odiri (2015) that there was significant relationship between students` study habits and Mathematics performance.

Also, from the findings of this study it was revealed that while high positive relationship existed between male students` study habits and their achievement in mathematics, a moderately positive relationship existed between female students` study habits and their achievement in mathematics. This could be linked to the fact that males are more mathematically-inclined than their female counterparts. Supporting this position, Kans and Claesson (2022) posited that male students showed interest in subjects that are precise, logical, and scientific, while the female students emphasized the analytical and challenging aspects to the extent that the subjects forced them to think. Thus, males have more favourable disposition towards Mathematics than their female counterparts. This favourable disposition could be linked to the fact that males appear more motivated to study mathematics than the females. Much as there is paucity of related studies in literature that focused on gender and variables of study habits and academic achievement in Mathematics, Allahnana et al. (2018) found that male students excel in mathematics achievement more than their female counterparts. This lends credence to the fact male students have interest in mathematics than female

This study also indicated that across gender lines, a significant relationship existed between secondary school students' study habits and their academic achievement in Mathematics. The deduction here is that gender is a contributing factor to secondary school students' study habits and their achievement in Mathematics. The findings of the present study are consistent with the position of Olutola and Dosunmu (2016) that there was significant difference between gender and students' science achievement and there was significant relationship between students' study habit and science achievement.

Conclusion

Based on the findings of the study, it was concluded that high positive relationship existed between students` study habits and their achievement in mathematics. Finally, the study concluded that gender moderated the relationship between students` study habits and their achievement in mathematics.

Recommendations

In view of the findings of the study, several recommendations were made which include:
1. Mathematics teachers should evolve teaching strategies that will sustain students' study habits in order to enhance their academic achievement in Mathematics.
2. Parents should make deliberate efforts towards the enhancement of their wards' study habits. This is with a view to improving their academic achievement in Mathematics.

3. Female mathematics students should prioritize the use of effective study habits so as to bridge the achievement gap between them and their male counterparts in Mathematics.
4. Curriculum planners should make conscious efforts towards make revisions in the curriculum contents to encapsulate study habits with a view to enhancing students' achievement in Mathematics.

REFERENCES

Allahnana, K., M., Akande, M. T., Vintseh, I. M. U., Alaku, E. A. and Monica, E. A. (2018). Assessment of gender and interest in mathematics achievement in Keffi Local Government Area of Nasarawa State, Nigeria. *International Journal of Operational Research in Management, Social Science and Education, 4* (1), 127-140.

Amatobi, V.E. and Amatobi, D. A. (2013). The influences of gender and attitude differences to students' achievement in mathematics in Nigerian secondary schools: a case study of Comprehensive secondary school Amurie-Omanze in South Eastern Nigeria. *American Journal of Research Communication, 1* (1).

Bakare, C.G.M. (1977). *Study habits inventory*. Ibadan: Psycho.

Bello, T.O. and Ariyo, B.D. (2014). Secondary school mathematics as determinant of academic performance in university introductory Physics. *Journal of Education and Practice, 5*(39), 102-107.

Cech, E.A. (2012). The role of high school performance in explaining women's rising college enrollment. *The Sociological Quarterly, 46* (2), 299-321.

Das, U. and Singhal, K. (2017). *Gender differences in mathematics performance: Evidence from rural India*. New Delhi, India: IARIW-ICIER Conference.

Fan, C. and Matsumotto, A. (2014). *The importance of good study habits.* Retrieved from www.answer.com. 12/3/2018.

Hassan, U., Sadaf, S., Aly, S.M. and Baig, L. (2018). Study habits: Comparison of scores and study habits of first year MBBS students coming from local system vs general education system. *Professional Medical Journal, 25*(3), 466-472.

Joe, A. I., Kpolovie, P. J., Osonwa, K. E. and Iderima, C. E. (2014). *Modes of admission and academic performance in Nigerian universities*. Retrieved from *http://meritresearchjournals.org/er/content/2014/September/Kpolovie%20et%20al.pdf*.

Kans, M. and Claesson, L. (2022). Gender-related differences for subject interest and academic emotions for STEM Subjects among Swedish upper secondary school students. *Educ. Sci., 12*(1), 553. Retrieved from https://doi.org/10.3390/educsci12080553.

Laltrinttuangi, A. (2018). Study habits and academic achievement of undergraduate students in Aizawl city. *105R Journal of Humanities and Social Science (10SR – JHSS), 23* (7), 9, 1-5.

Lee, C.Y. and Kung, H.Y. (2018). Mathematics self-concept and mathematics achievement: Examining gender variation and reciprocal relations among junior secondary school students in Taiwan. *EURASIA Journal of Mathematics, Science and Technology Education, 14* (4), 1239-1252.

Melvina, A.N. and Nanjwan, J.D. (2019). Academic locus of control, study habits and secondary school students' academic achievement in mathematics. *International Journal of Research and Scientific Innovation (IJRSI), 6* (11), 19-23.

Muraina, M.B., Nyorere, I.O., Emana, I.E. and Muraina, K.O. (2014). Impact of note taking and study habit on academic performance among selected secondary school students in Ibadan, Oyo State, Nigeria. *International Journal of Education and Research, 2* (6), 437-448.

Nworgu, B. G. (2015), *Educational research: Basic issues and methodology.* Ibadan: wisdom Publisher Limited.

Ogunduyilemi, K. S. (2018). The relationship of undergraduate study habits with use of library resources in two universities in Oyo State, Nigeria. *Library Philosophy and Practice*, *4*(1), 1–28. Retrieved from https://digital commons.unl.edu/libphilprac/1862/

Obiero, J. (2017). The relationship between achievement motivation and mathematic performance amongst female learners and in selected urban girls' secondary schools in Kenya. *Global Journal of Social Sciences Studies*, *4*(1), 23 29. https://doi.org/10.20448/807.4.1.23.29.

Odiri, O. E. (2015). Relationship of study habits with mathematics achievement. *Journal of Education and Practice*, *6*(10), 168-170.

Olutola, A.T. and Dosunmu, S.A. (2016). Assessing the impact of study habit and gender on science achievement of secondary school students in Katsina State, Nigeria. *Journal of Science, Technology, Mathematics and Education (JOSTMED), 11*(3), 202-209.

Prasetyo, E., Ridlo, S. and Kartijono, N.E. (2019). Relationship between study habits and academic achievement of students at Biology Department-Mathematic and Natural Science Faculty, Universitas Negeri Semarang. *JPBI (Jurnal Pendidikan Biologi Indonesia), 5* (2), 297-304.

Sakirudeen, A.O. and Sanni, B.K. (2017). Study habits and academic performance of secondary school students in mathematic: a case study of selected secondary schools in Uyo Local Education Council. *Research in Pedagogy, 7* (2), 283-297.

Sharma, R. (2015). Computer assisted learning – A study. *International Journal of Advanced Research in Education and Technology, 2* (1), 45-57.

Ukeje, B.O. (2012). *Foundations of education.* Benin City: Ethiope Pub.

Verma, A. (2016). A study of academic achievement among high school students in relation to their study habits. *International Journal of Research in Humanities, Arts and Literature*, *4*(3), 75-88.

DIGITAL TOOLS UTILIZATION AND CHEMISTRY STUDENTS' ACADEMIC ACHIEVEMENT IN THE TEACHING OF SOAP PRODUCTION IN SECONDARY SCHOOLS IN AKWA IBOM STATE, NIGERIA

[1]MabelIni- Ibehe Eden, [2]Rebecca Ufonabasi Etiubon (*Ph.D*), [3]Anwangaobong Mfon Ekongand [4]Emmanuel Mmah Sampson, [5]Emmanuel Usoudo Umoetuk
[1,4&5]Department of Science Education, Faculty of Education,
Akwa Ibom State University, AkwaIbom State, Nigeria.
[2&3]Department of Science Education, Faculty of Education,
University of Uyo, Akwa Ibom State, Nigeria.
Phone Numbers: 08065601466, 08027068894, 08039847293,
08035075946 and 08037444807
E-mail:[1]mabeleden8@gmail.com, [2]etiubon@yahoo.com, [3]anglolilton@gmail.com,
[4]emmaxlike1@yahoo.com and [5]engratilla@yahoo.com

Abstract
Digital tools in the classroom is nothing new to education. Pioneers in its use in education have much to teach us to enable student acquire knowledge and skills necessary to survive in a digital world. This study investigates digital tools utilization and Chemistry students' academic achievement in the teaching of soap production in secondary schools. The design was a pretest, posttest quasi-experimental design. The population comprised all the 3840 Chemistry students in the 14 public secondary schools of which 100 students were selected from two intact classes by criterion sampling techniques. Achievement Test on Soap Production (ATSP) was used to collect data with a reliability of 0.78 determined by Kuder Richardson test. Mean and standard deviation were used to answer research questions, while independent T-test was used to test the hypotheses at p≤ .05 level of significance. Findings of the study showed that students taught with digital tools performed better than those taught with expository method. There was a significant difference in their achievement mean scores. But there was no significant difference between male and female students' achievement mean scores. It was therefore concluded that the utilization of digital tool was effective in teaching soap production. It was recommended that Chemistry teachers should be encouraged to adopt the use of digital tools such as computers in the teaching. Conferences, seminars and workshops should be organized for teachers to acquaint them with latest digital tools to improve the teaching of soap production and other concepts.
Key words: Digital tools, Utilization, Chemistry, Academic achievement and Soap Production

Introduction

The utilization of digital tools holds global significance and is applicable in all aspects of life. These tools functionally offer a medium for the incorporation of text, images, audio and video files for educational purposes. These computer-based resources are employed by individuals to cater to the information and communication processing requirements of organizations. Digital tools encompass computer hardware and software, as well as

networks and other multimedia devices like video, audio, phone, and camera, which convert information into text, sound, and motion.

The utilization of digital tools encompasses a variety of shapes and sizes, each serving a specific purpose. Notably, among the selection of portable digital tools are Google Chrome books and iPads, which have the versatility to be utilized in both online and classroom activities. Other portable digital tools include computers, clickers, SMART boards and projectors which are implemented for information dissemination, teaching, and learning. The use of computers as digital tools offers students an opportunity to cultivate and apply higher-level thinking skills to address problems that are pertinent to their daily lives. Hillmayr *et al.,*(2020) reiterated that digital tools can enhance students' understanding through interactive and multimedia learning content. Amhag (2017) asserts that digital tools can facilitate teacher-student engagement and motivation across various concepts, making mobile assisted instruction effortless during learning activities

The academic performance of Chemistry students has been comparatively inadequate. Lack of qualified teachers (Okwuduba, 2018); attitudes or personal fears (Wilson *et al.*, 2020; Njiku, 2022): teachers' lack of proficiency in deploying cutting-edge learning tools, including computers, tablets, projectors, and smart boards (Walkowiak &Nehring, 2016) has been identified as the cause of students' poor academic outcomes. This trend of substandard academic performance in the field of Chemistry, coupled with the high failure rate, if not checked, could potentially jeopardize the scientific and technological advancement of the nation. To minimize the failure rate in Chemistry, Coulter, (2019)and Olatunji (2015) suggests that science teachers must undergo appropriate training and retraining, modern laboratory facilities must be adequately provided, and better learning strategies should be embraced.

The teaching of the Chemistry curriculum to students includes the fundamental concept of soap production. Soap is obtained through the hydrolysis of naturally occurring fats and oils using either sodium hydroxide or potassium hydroxide, and it serves as an essential cleaning agent for everyday use. The process of producing soap, known as saponification, is a significant aspect of chemical industrial production. The utilization of digital tools may facilitate students in acquiring the necessary knowledge and practical skills required to thrive in a complex, highly technological, knowledge-based economy.

Gender is a moderating factor that has been examined in this study. A number of studies have demonstrated the discrepancy between male and female students. Ajayi &Ogbeba (2017) and Udu (2018) observed that the interaction between methodology and gender has no significant impact on students' achievement in science. Additionally, Ekon &Amanso (2015) demonstrated that there is no significant difference in the achievement of male and female students in science. While Eden & Mbuk (2019) and Etiubon (2011) observed that female students performed significantly better than their male counterparts in Chemistry. To this end this study sought to investigate the impact of digital tool utilization on students' academic achievement and the moderating effect of gender on learning outcomes.

Statement of Problem

The inadequate performance of students in the Senior School Examination and National Examination Council in Chemistry highlights the possibility of inappropriate instructional

strategies employed by teachers and inadequate acquisition of economically useful skills by the students. This setback may result in a decline in the number of students pursuing higher studies in Chemistry and hinder their ability to become self-reliant, ultimately leading to a shortage of skilled manpower in various sectors of the economy. The use of digital tools has significantly enhanced educational outcomes in various aspects of human life and has become an integral part of the academic landscape. Although previous studies have focused on the use of digital tools to improve students' academic performance, none have addressed the learning of soap production, which is an essential commodity in every household. To examine the effects of digital tool utilization on students' academic achievement, a study involving the use of digital tools and expository teaching method to learn soap production was conducted.

Purpose of the Study
The purpose of study was to examine the digital tools utilization and Chemistry students' academic achievement in the teaching of soap production in secondary schools in Akwa Ibom State, Nigeria. Specifically, the study sought to determine:
1. production in secondary schools when taught using digital tools and those taught with expository method?
2. The difference between male and female Chemistry students' academic achievement in soap production in secondary schools when taught using digital tools and those taught with expository method?

Research Questions
1. What is the difference between Chemistry students' academic achievement in soap production in secondary schools when taught using digital tools and those taught with expository method?
2. What is the difference between male and female Chemistry students' academic achievement in soap production in secondary schools when taught using digital tools and those taught with expository method?

Hypotheses
The hypotheses were tested at .05 level of significance.
1. There is no significant difference between Chemistry students' academic achievement in soap production in secondary schools when taught using digital tools and those taught with expository method.
2. There is no significance difference between male and female Chemistry students' academic achievement in soap production in secondary schools when taught using digital tools and those taught with expository method.

Scope of the study
The study focused on the utilization of digital tools in secondary school Science teaching of soap production. The sample was selected secondary schools in Uyo Local Government Area of Akwa Ibom State. The study covered all the students in the 14 secondary schools in Uyo Local Government. This is because attempt to all the secondary schools in Nigeria will be futile due to limited resources therefore the research work was limited to its present

scope. The study was limited to Chemistry students in the senior secondary schools of the selected secondary schools in Uyo Local Government of Akwa Ibom State.

Methods

The design adopted for the study was pretest, posttest experimental control group design. The population of the study comprised all the 3840 Chemistry students in the 14 public secondary schools in Uyo Local Government Area of Akwa Ibom State. The sample of the study was 100 students drawn by simple random sampling technique from two schools in two intact classes by criterion sampling technique.

A researcher made instrument was used for data collection. It was a twenty-five item Achievement Test on Soap Production (ATSP) with 1 correct answer and 3 distractors scored 1 and 0 respectively. Instrument validation was done by three senior lecturers and above in the Department of Science Education, Physical Sciences and Measurement and Evaluation Unit all from Akwa Ibom State University. The reliability of the instrument was 0.79 determined by Kuder Richardson test.

The ATSP was administered as pretest to ascertain students' entry behaviour before the commencement of the treatment using prepared lesson packages tailored according to the variables considered in the study experimental and control groups. The experimental groups were taught using digital tools of computer laptop with videos downloaded from the internet under the following headings: nature and chemical composition of soaps, laboratory preparation of soaps, production of local soaps and cleansing action of soap, hard water and soap, detergents (soapless) and soap versus soapless detergents according to the senior secondary chemistry curriculum. The researcher gave room for discussions, student's activities, questions and answer sessions while the control group were taught using expository method. After two weeks of treatment, a post test was administered to the two groups to ascertain the level of knowledge gained. Data obtained were analysed using descriptive statistics of mean and standard deviation and independent T-test was used to test the hypotheses.

Results

Research Question one

What is the difference between Chemistry students' academic achievement in soap production in secondary schools when taught using digital tools and those taught with expository method?

Table 1: Mean and standard deviation of students' pretest and posttest achievement mean scores in soap production in secondary schools when taught using digital tools and those taught with expository method

		Pretest		Posttest		
Groups	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean Gain**
Experimental 8	50	7.04	1.64	18.24	2.02	11.20
Control	50	7.22	1.87	15.64	2.66	8.42

Results in Table 1 shows the mean difference (posttest-pretest mean scores) for the experimental and control groups to be 11.20 and 8.42 respectively. This result indicates that students taught soap production with digital tools performed better than those taught with expository method. Table 1 also showed that the standard deviation of students taught soap production using digital tools and those taught with expository methods is 2.02 and 2.66 respectively. This indicates that the scattering of scores from the mean scores of students taught soap production using digital tools were higher when compared to those taught with expository method.

Research Question Two
What is the difference between male and female Chemistry students' academic achievement in soap production in secondary schools when taught using digital tools and those taught with expository method?

Table 2: Mean and standard deviation of male and female students pretest and posttest achievement mean scores in soap production in secondary schools when taught using digital tools and those taught with expository method

		Pretest		Posttest		
Groups	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean Gain**
Experimental						
Male	23	5.70	1.15	17.39	2.02	11.69
Female	27	8.19	1.00	18.96	1.76	10.77
Control						
Male	18	5.22	1.26	14.11	2.63	8.89
Female	32	8.34	1.04	16.50	2.30	8.16

Results in Table 2 show the mean difference (posttest-pretest mean scores) for male students in experimental and control groups to be 11.69 and 8.89 respectively, while those of the female counterparts are 10.77 and 8.16 respectively. This result indicates that male students performed better than female students when taught soap production in the two groups. A comparison of the mean difference of students in the two groups setting by gender shows that the male proved superior to their female counterparts in answer to research question 2.

Table 2 also showed that the standard deviation of male and female students taught soap production using digital tools is 2.02 and 1.76 respectively while the standard deviation of male and female students taught soap production using expository method is 2.63 and 2.30 respectively. This indicates that the scattering of scores from the mean scores of male students taught using digital tools were higher that of their female counterparts while the scattering of scores from the mean scores of male students taught using expository method higher that of their female counterparts.

Hypotheses

Hypothesis one: There is no significant difference between Chemistry students' academic achievement in soap production in secondary schools when taught using digital tools and those taught with expository method.

Table 3: Summary t-test Analysis of Academic Performance Mean Scores of Experimental and Control Groups

Source of Variance	N	Mean	SD	Df	t-value	p-value	Decision
Experimental	50	18.24	2.03				
				98	5.49	0.02	Significant
Control	50	15.64	2.66				

*significant at p<.05

In Table 3, the p- value is 0.02 which is less than 0.05 level of significance at 98 degree of freedom. This indicates that at p<0.05, the difference in using digital tools or not on students' achievement is statistically significant. That is, there is a significant difference between Chemistry students' academic achievement in the teaching of Soap production in secondary schools using digital tools and with expository method. Hence, the null hypothesis was rejected. This means teaching Soap production in secondary schools using digital tools is effective in enhancing student's achievement.

Hypothesis Two

There is no significance difference between male and female Chemistry students' academic achievement in soap production in secondary schools when taught using digital tools and those taught with expository method.

Table 4: Summary of t-test Analysis of Academic Performance Mean Scores of Experimental and Control Groups

Source of Decision Variance	N	Mean	SD	Df	t-Value	p-value	
Male	41	15.95	2.81				
				98	3.21	0.15	Not
Significant							
Female	59	17.63	2.40				

*significant at p<.05

In Table 4 the p- value is 0.15 which is greater than 0.05 level of significance at 98 degree of freedom. This indicates that at p<0.05, the difference in using digital tools or not on male and female students' achievement is not statistically significant. That is, there is no significance difference between male and female Chemistry students' academic achievement in the teaching of soap production in secondary schools using digital tools and with expository method. Hence, the null hypothesis was retained. This indicates that both male and female students had equal achievement.

Discussion

The results obtained from the study indicate that students taught using digital tools achieved higher scores than those taught with expository method. This can be attributed to the fact that computer as a digital tool provide students with the opportunity to develop and use higher-level thinking skills to solve problems that are relevant to their daily lives. It can also be argued that the use of digital tools enhanced students' achievement in soap production, therefore making them to obtain high scores. This is in line with studies by Wohlfart, Wagner & Wagner (2023) that digital tools have the potential to enhance learning outcomes and recommends teacher training and further education as well as future research to focus on developing and supporting opportunities for teachers to implement subject-specific digital tools to create a more dynamic and engaging learning experiences for students.

Findings of this study showed that there is a significant difference between Chemistry students' academic achievement in the teaching of Soap production in secondary schools using digital tools and with expository method. Hence, the null hypothesis was rejected. The findings of this study concur with that of Walan (2020) on embracing digital technology in science classrooms which found out that digital technology improved teaching, motivated the students and made learning easier.

Findings also show that there was no significant difference between male and female Chemistry students' academic achievement in the teaching of soap production in secondary schools using digital tools and those taught with expository method. This is likely due to the keen interest observed in both gender when it comes to learning with digital tools. The findings are in line with Ajayi & Ogbeba (2017) and Udu (2018) who observed that the interaction between methodology and gender has no significant impact on students' achievement in science. This is also in linewith Ekon &Amanso (2015) who demonstrated that there is no significant difference in the achievement of male and female students in science. This finding is in contrast with Eden & Mbuk (2019) and Etiubon (2011) who demonstrated that female students performed better than male showing that there is a significant difference in the achievement of male and female students in science.

Conclusion

Findings in this study indicate that:

(i)   The use digital tools in teaching of Soap production in secondary schools leads to higher student achievement in Chemistry teaching of soap production compared to experimental teaching methods. Digital tools can be used to address the challenge of poor academic performance.

(ii) This study also showed that the use of digital tool reduces gender parity in Chemistry achievement. Digital tools could therefore be used to address the challenges of gender parity towards learning Chemistry concepts. This study revealed that gender does not affect achievement in Chemistry when digital tools are used.

Recommendations

The following recommendations are made based on the result of the study;

1. Chemistry teachers should be encouraged to adopt the use of digital tools such as computers, phones, video and audio devices in the teaching and learning of science concepts.
2. Government should organize conferences, seminars and workshops chemistry teachers to acquaint them with latest digital tools to improve the teaching of soap production and other concepts in Chemistry.

REFERENCES

Ajayi, O. V. & Ogbeba, J. (2017). Effect of gender on senior secondary Chemistry students' performance in stoichiometry using hands-on activity. *American Journal of Educational Research*, 5 (8), 839-842

Amhag, L., Hellström, L. & Stigmar, M. (2019). Teacher educators' use of digital tools and needs for digital competence in higher education. *Journal of Digital Learning in Teacher Education.* 1 (1), 1–18.

Coulter, B. (2019). Science through modelling and simulation connect. Available at http://www.iiste.org. Retrieved on 20th January, 2023.

Eden, M. I. & Mbuk, W. (2019). Students' attitude towards Chemistry and their academic performance in selected concepts in Chemistry among secondary school students in Ibiono Ibom Local Government Area, Nigeria. *International Journal of Innovative Research and Advanced Studies*, 6 (12), 19-26.

Etiubon, R. U. (2011). Employing technological resources to enhance students' performance in Chemistry.*Journal of Education*, 4(1), 230-239.

Ekon, B. B. & Amanso, E. (2015). Gender and acquisition of science process skills among junior secondary school students in Calabar Municipality: Implications for Implementation of universal basic education Objectives. *Global Journal of Educational Research* 14(2), 93-99

Hillmayr, D., Ziernwald, L., Reinhold, F., Hofer, S. I., and Reiss, K. M. (2020). The potential of digital tools to enhance Mathematics and science learning in secondary schools: a context-specific meta-analysis. *Computer. Education.* 153:103897. doi: 10.1016/j.compedu.2020.103897

Njiku, J. (2022). Attitude and technological pedagogical and content knowledge: the reciprocal predictors? *J. Res. Technol. Educ.* 1–16, 1–16.

Okwuduba, E. (2018). Effect of teaching methods on students' academic effect of teaching methods on students' academic performance in Chemistry in Nigeria: Meta-Analytic review. *Bulgarian Journal of Science and Education Policy,* 12 (2), 2–18.

Olatunji, F. (2015). Readability of Basic Science and technology for primary school. *Research Journal in Organizational Psychology and Educational Studies,* 1 (1), 23-36.

Udu, D. A. (2018). Utilization of learning activity package in the classroom: Impact on senior secondary school students' academic performance in organic Chemistry. *African Journal of Chemical Education,* 8(2), 49-71.

Walan, S. (2020). Embracing digital technology in science classrooms—secondary school teachers' enacted teaching and reflections on practice. *Journal of Science Education and Technology,* (20) 29, 431–441

Walkowiak, M. and Nehring, A. (2016). Using ChemDuino, excel, and PowerPoint as tools for real-time measurement representation in class. *Journal of Chemistry Education,* 93, 778–780.

Wilson, M. L., Ritzhaupt, A. D., and Cheng, L. (2020). The impact of teacher education courses for technology integration on pre-service teacher knowledge: A meta-analysis study. *Computer. Education.* 156, 103941. doi: 10.1016/j.compedu.2020.103941

Wohlfart, O. Wagner, A. L. & Wagner, I. (2023). Digital tools in secondary Chemistry education – added value or modern gimmicks? *Frontiers in Education.* 8:1197296. doi: 10.3389/feduc.2023.1197296

EXPERIENTIAL LEARNING STRATEGY AND STUDENTS' PERFORMANCE IN MATHEMATICS ON THE COGNITIVE DOMAIN OF BLOOMS' TAXONOMY IN RIVER STATE, NIGERIA

KWELLE CLIFFORD OBIOMA
Department of Curriculum Studies and Educational Technology
University of Port Harcourt
07035231222
Email: kwelle_clifford @yahoo.com
&
Edith Chinyere Onyeka (PhD.)
Department of Science Education, Faculty of Education,
Nnamdi Azikiwe University Awka,
P.M.B. 5025 Awka, Anambra State.
ORCID: https://orcid.org/0000-0002-2149-560X
Email: ech.onyeka@unizik.edu.ng; 07059936144
&
Okafor-Agbala, Uzoamaka Chimuanya (Ph.D.)
Department of Science Education, Faculty of Education,
Nnamdi Azikiwe University Awka,
P.M.B. 5025 Awka, Anambra State. Nigeria
ORCID: https://ORCID.org/0000-0002-9138-7639
Email: uc.okafor-agbala@unizik.edu.ng: 08036258279

ABSTRACT
This study examined experiential learning strategy and students' performance in Mathematics on the cognitive domain of Bloom's Taxonomy. Two research questions and two hypotheses guided the study. Quasi-experimental design, specifically pretest, posttest non-control group design, was adopted for the study. The population of the study consisted of 13,040 SS2 Mathematics students from 14 public secondary schools in Obio-Akpor Local Government Area, Rivers State out of which, a sample of 78 was drawn from the schools using purposive sampling based on availability and access to adequate facilities for Mathematics teaching and learning. Random sampling was used to select the intact classes for the study. The experimental groups were taught using the experiential learning strategy and while the control group was taught using the lecture teaching method. Mathematics Performance Test (MPT) was used for data collection. A reliability Coefficient of 0.79 was obtained for the instrument using Kudar Richardson 21. Research questions were answered using mean and standard deviation while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. Findings of the study revealed that students taught Mathematics using experiential learning strategies performed better than their counterparts taught with the lecture teaching method at the comprehension and application level. The study recommends among others that the lecture

teaching method of teaching should be adopted to the use of an experiential learning strategy so as to improve the mathematics performance of students at both comprehension and application levels.

Keywords: Experiential learning strategy, students` performance, cognitive domain, Bloom's Taxonomy.

Introduction

Mathematics is the study of associations between numbers, shapes, and quantities. Mathematics is a way of life that allows learners to organize experiences and use them in life endeavors and society. Mathematics gets widely regarded as one of the important subjects for entry into most careers or when intending to get further training. Tshabalala and Ncube (2016) stated that Mathematics is the substratum and a crucial tool for scientific technological and economic for any nation to advance. The importance of mathematics and its role in national development cannot be overemphasized. The knowledge of mathematics gives students practical and valuable life skill which is appropriate and pertinent to numerous human activities and profession. Despite the highly decorated and recognized importance of mathematics and the fact that it is the prerequisite for most of the subjects, poor achievement and lack of interest in mathematics (and STEM) among students remains as an issue of concern in schools, colleges, and universities in developed and developing countries alike (Brown et al., 2020). Mathematics continues to be one of the most challenging subjects in schools as perceived by students (Akhter & Akhter, 2018).

A lot of factors have been attributed to the underachievement of students in Mathematics and the one that is most mutual is poor teaching methods. The challenge in learning mathematics is that the teachers are not adequately prepared to teach the students using suitable learning strategies. Adegoke (2010) observed that the conventional lecture strategy is usually the dominant approach used by teachers in Nigeria and students are not actively tangled in fashioning their knowledge; they generally remain passive listeners throughout the lesson. Hence, the strategy is mainly a teacher-centered approach to learning Mathematics and learners are mainly inactive in the teaching and learning process. In view of the lapses inherent in the conventional lecture strategy of teaching Mathematics and subsequent low achievement by students in the subject, mathematics educators are continually making efforts towards finding ways of improving students' performance in Mathematics. The concept of the thinking process in learning Mathematics has a direct bearing on Benjamin Bloom's Taxonomy.

Bloom's taxonomy is a six-tiered approach to intellectual expectations of Mathematics assessment. Bloom's taxonomy is organized as follows: knowledge, comprehension, application, analysis, evaluation, and synthesis. Mathematics questions asked by teachers have been found to focus mainly on lower-order tasks. Numerous studies have used Bloom's taxonomy as the standard for judging whether test items are Lower-order thinking (LOT) or higher-order thinking (HOT) (Jansen &Möller, 2022; Tsaparlis, 2020). According to Saido, Siraj, Nordin and Al_Amedy (2018), the thinking skills in Bloom's taxonomy are considered Lower-order thinking (LOT) including knowledge and comprehension, while the thinking skills of analysis, synthesis, and evaluation are

considered higher-order thinking (HOT). Samo (2016) revealed that higher-order thinking is a type of non-algorithm thinking which include analytic, evaluative, and creative thinking that involves metacognition. However, lower-order thinking (LOT) is often characterized by the recall of information or the application of concepts or knowledge to familiar situations and contexts.

Lower-order thinking (LOT) tasks require a student to recall a fact, perform a simple operation in Mathematics, or solve a familiar type of problem. It does not require the student to work outside the familiar. Senk, Beckman, & Thompson (1997) categorized Lower-order thinking (LOT) as cracking tasks where the result necessitates smearing a well-known procedure, often with no validation, clarification, or proof required, and where only a solitary right answer is conceivable. In general, Lower-order thinking (LOT) is generally characterized as solving tasks while working in familiar situations and contexts; or, applying algorithms already familiar to the student. Lower-order thinking (LOT) is considered to be core and very important as it helps the students develop their line of thought, acquire knowledge on different topics and apply the knowledge effectively. Based on the description a2bove, it can be said that it is also important to evaluate students' Lower-order thinking (LOT) Mathematics performance in order to determine the extent of students' Lower-order thinking (LOT) in the Mathematics learning process. Accordingly, the purpose of the study is to as well as whether there is any difference between levels of student's comprehension and application level of mathematics performance via the Experiential learning strategy

Experiential learning is the way toward learning through understanding and is all the more explicitly characterized as "learning through reflection on doing (Jeyaraj, 2019). Experiential learning strategy is a strategy in which Mathematics purposefully engage with student in direct experience and focused reflection in order to increase knowledge, develop skills, and clarify values. Experiential learning is also referred to as learning through action, learning by doing, and learning through discovery, and exploration. Experiential learning requires self-initiative, an "intention to learn", and an "active phase of learning (Shi et al., 2020). The benefits of experiential learning as it relates to student learning outcomes in Mathematics provide students with opportunities to have hands-on experiences to aid them in learning abstract mathematics concepts. Edward and Samba, (2020) investigated the effects of graphic organizers and experiential learning with feedback on students' achievement and retention in Basic Science and Technology, Plateau State., Nigeria. The findings revealed that there were significant differences in both graphic organizer and experiential learning achievement.

Also, Chesimet, Githua and Ng'eno, (2016) investigated the Effects of the Experiential Learning Approach on students' mathematical creativity in Kericho East Sub-County. The results revealed that Experiential Learning Approach had a significant effect on students' mathematical creativity. A similar study by Adeniyi and Kuku (2020) showed that achievement in Mathematics differs as a result of exposing learners with hearing impairment to gamification and experiential learning methods of instruction. Anees (2017) examined the assessment levels of students' learning according to the cognitive domain of

Bloom's Taxonomy. The results showed that there were more focused on lower levels of learning while asking questions. There was less implementation of higher-level of questions. Prasad (2020) also carried out a study on student performance based on bloom's taxonomy levels, knowledge, comprehension, application, analysis, synthesis, and evaluation. The result showed that there are few students whose performance is excellent at the first two levels, average at the third level, and poor at the fourth, fifth, and sixth levels. Farzad and Hassan (2010) studied students' mathematical performance based on the cognitive dimension of the Revised Bloom Taxonomy (RBT) and revealed that there was a difference between students' mathematical performance in each category of knowledge dimension according to the cognitive process of the Revised Bloom Taxonomy and students' mathematical performance would be decreased from remembering through creating in each category of knowledge dimensions.

Research studies have shown that experiential learning strategies improve the mathematical creativity of students, enhance the performance of students in Basic technology, and also improved the mathematics achievement of students with hearing impairment. Also, a study has been carried out by Prasad (2021) on student performance based on bloom's taxonomy levels, knowledge, comprehension, application, analysis, synthesis, and evaluation, students' mathematical performance based upon the cognitive dimension of Revised Bloom Taxonomy (RBT), and students' learning according to the cognitive domain of Blooms' Taxonomy. However, the present study focused on Experiential learning strategies on students' performance in Mathematics at the comprehension and application level.

Statement of the Problem

The difficulty in identifying the suitable method of teaching Mathematics has continued to be of great concern to Mathematics teachers as well as the need for improvement in academic achievement of students for the realization of the instructional objectives in teaching and learning of Mathematics. Mathematics is an important subject required to pursue careers that demand logical, investigative, critical, and analytical skills. This is because learning Mathematics gives a student an opportunity to make lasting contributions to society in diverse fields of his or her endeavor. Research has revealed that successful Mathematics learning is dependent on the teachers' ability to adopt the most suitable instructional strategy in the delivery of the Mathematics content to enhance the student's performance at the comprehension and application level. This has brought about some innovative measures that can help bring about the notion of improving performance level of students in Mathematics but the extent to which these measures are efficient in actualizing high performance level of students in Mathematics. Hence this study seeks to determine if experiential learning strategy can affect students' performance in Mathematics on the cognitive domain of Bloom's Taxonomy.

Purpose of the Study

The purpose of the study was to investigate experiential learning strategy and students' pe2rformance in M2athematicson the cognitive domain of Bloom's Taxonomy.

Specifically, the study seeks to determine:
1) the effect of Experiential Learning strategy and lecture method on students' performance in Mathematics at the comprehension level.
2) the effect of Experiential Learning strategy and lecture method on students' performance in Mathematics at the application level

Research Questions
The study answered the following questions:
1) What is the effect of Experiential learning strategy and lecture method on students' performance in Mathematics at the comprehension level?
2) What is the effect of Experiential learning strategy and lecture method on students' performance in Mathematics at the application level?

Hypotheses
The following null hypotheses were tested at a 0.05 level of significance:
1. There is no significant difference between students exposed to the experiential learning strategy and the lecture method in their performance in Mathematics at the comprehension level.
2. There is no significant difference between students exposed to experiential learning and the Lecture method in their performance in Mathematics at the application level.

Methods
Research Design
This study employed a quasi-experimental design. Specifically pretest, posttest non-control group design. Intact classes were then used for the study. Subjects were not randomly assigned to groups rather intact classes were assigned to experimental and control groups. A pre-test was administered to both the experimental group and control group to determine if any difference exists in the ability of the two groups before treatment. The experimental group received treatments after which a post-test was administered to both groups their after.

Population of the Study
The population of the study consists of 13,040 SS2 Mathematics students in fourteen (14) senior secondary schools in Obio-Akpor Local Government Area of River State.

Sample and Sampling Technique
The sample of the study consists of 78 mathematics students in the fourteen senior secondary schools. The sample for this study was obtained using purposive sampling technique, which was used to select two public secondary schools based on availability and access to adequate facilities for Mathematics teaching and learning. The selected schools also have Mathematics laboratories that were needed for the effective completion of this study. Random sampling technique was used to select the intact classes for the study but was not used to assign students to the control and experimental groups.

Instrument for Data Collection
Mathematics Achievement Test (MAT)was used for data collection. The MAT is a 20-item, 4 options multiple choice objective test based on the content of the study in the SS2 Mathematics curriculum.

Validity of Instrument
The instrument was validated by two experts, one lecturer in measurement and evaluation and one in science education, all in the faculty of Education, University of Port Harcourt, Choba. The experts were asked to validate the instrument in terms of clarity of instructions; correct wording of items, and appropriateness and adequacy of the items in addressing the aim of the study. The critical appraisal and comments of the experts were used.

Reliability of the Instrument
The student's responses in the MAT were used to obtain the reliability coefficient using Kudder Richardson's formula 21 (K-R21) procedures. The reliability coefficient for the MAT was 0.89

Methods of Data Analysis
Data collected was analyzed using mean and standard deviations to answer the research questions while Analysis of Covariance (ANCOVA) was used in testing the hypotheses at a 0.05 level of significance.

Results
Research Question 1: What is the effect of Experiential learning strategy and lecture teaching method on students' performance in Mathematics at comprehension level?

Table 1: Performance mean scores of the comprehension level of Mathematics based on strategy

| Strategies | Comprehension level | | | | | |
| | | Pretest | | Posttest | | |
	n	Mean	Std	Mean	Std	Gain
Lecture	48	10.10	2.41	9.29	3.29	-0.81
Experiential	30	10.73	2.08	13.60	2.13	2.87

Table 1 indicates that in the comprehension level of Mathematics, students exposed to lecture teaching method had a mean gain of -081, while the students exposed to experiential learning strategy had a mean gain of 2.87. Summarily, at comprehension level, students exposed to experiential learning strategy performed better than their counterparts who were taught Mathematics with lecture teaching method.

Research Question 2: What is the effect of experiential learning and lecture teaching method on students' performance in Mathematics at application level?

Table 2: Performance mean scores of the Application level of Mathematics based on strategy

Strategies		Pretest		Posttest		
	n	Mean	Std	Mean	Std	Gain
Lecture	48	5.70	2.50	6.43	3.35	0.73
Experiential	30	5.80	1.98	11.93	3.358	6.13

Table 2 indicates that at the Application level of Mathematics, students exposed to the lecture teaching method had a mean gain of 0.73, while the students exposed to the experiential learning strategy had a mean gain of 6.13. Summarily, at the Application level, students exposed to experiential learning strategy performed better than their counterparts who were taught Mathematics with a lecture teaching method.

Hypothesis 1: There is no significant difference between students exposed to Experiential learning strategy and lecture teaching method in their performance in Mathematics at the comprehension level.

Table 4: Analysis of Covariance of students' Comprehension level of Mathematics based on learning strategies

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	349.295[a]	2	174.648	20.644	.000	.355
Intercept	356.834	1	356.834	42.179	.000	.360
Pretest Comprehension	6.617	1	6.617	.782	.379	.010
Groups	323.957	1	323.957	38.293	.000	.338
Error	634.499	75	8.460			
Total	10334.000	78				
Corrected Total	983.795	77				

Analysis of Covariance (ANCOVA) was conducted to determine if a significant difference exists in the comprehension level of students' performance in Mathematics when exposed to lecture teaching method and experiential learning strategy. Table 3 revealed that $F_{(1,75)} = 38.293$, $p < 0.05$, since the p-value of 0.00 is less than 0.05 level of significance, the null hypothesis was rejected, indicating that there was a significant difference in the comprehension of students' performance in Mathematics when exposed to lecture teaching group and experiential learning strategy group.

Hypothesis 2: There is no significant difference between students exposed to Experiential learning strategy and lecture teaching method in their performance in Mathematics at the application level.

Table 4: Analysis of Covariance of students' Application level of Mathematics based on instructional methods

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	560.078[a]	2	280.039	23.357	.000	.384
Intercept	807.660	1	807.660	67.364	.000	.473
Application	2.463	1	2.463	.205	.652	.003
Groups	555.962	1	555.962	46.371	.000	.382
Error	899.217	75	11.990			
Total	7163.000	78				
Corrected Total	1459.295	77				

Analysis of Covariance (ANCOVA) was conducted to determine if a significant difference exists in the application level of students' performance in Mathematics when exposed to a lecture group and an experiential learning strategy group. Table 3 revealed that F(1,75) = 46.371, p < 0.05, since the p-value of 0.00 is less than 0.05 level of significance, the null hypothesis was rejected, indicating that there was a significant difference in the application level of students' performance in Mathematics when exposed to lecture group and experiential learning strategy group.

Discussion
The findings of the study revealed the mean gain scores of students at the comprehension level who were taught Mathematics using experiential learning yielded a higher mean score than those taught using the lecture teaching method. The finding affirmed the study of Edward and Samba, (2020) who investigated the effects of graphic organizers and experiential learning with feedback on students' achievement and retention in Basic Science and Technology. The findings revealed that there were significant differences in both graphic organizer and experiential learning achievement. Furthermore, the findings of Anees (2017) showed that there were more focused on lower levels of learning while asking questions. The results of the study indicate that the experiential learning strategy is useful to improve students' performance in Mathematics at the comprehension level. A possible reason for this result could be that the experiential class enjoyed the way they were taken outside the classroom to the mathematics laboratory to find out things for themselves and were also allowed to share their experiences with one another.

The findings of the study also revealed that the mean gain scores of students who were taught Mathematics using experiential learning strategy at the application level are higher than the mean gain scores of the students who were taught lecture method. Table 4 confirmed that the difference between the experiential instructional learning strategy and lecture teaching method was significant. This improvement in the performance of the students can be attributed to the fact that students were learning through action, learning by doing, learning through discovery and exploration was a propelling force that helps students in paying attention as well as keeping students involved and active in Mathematics classroom activities. The findings of this study support the findings of Chesimet et al

(2016) who revealed that the Experiential Learning Approach had a significant effect on students' mathematical creativity. Also, in consonance with Prasad (2020) who carried out a study on student performance based on bloom's taxonomy levels, knowledge, comprehension, application, analysis, synthesis, and evaluation. The result showed that there are few students whose performance is excellent at the first two levels, average at the third level, and poor at the fourth, fifth, and sixth levels.

Conclusion
The study established that experiential learning strategies can be used to enhance the mathematics performance of students at the comprehension and application levels. Furthermore, it also can be concluded that there is a difference between students' performance in Mathematics in comprehension and application level when exposed to experiential learning strategies and lecture teaching methods in favour of experiential learning strategies.

Recommendations
Based on the findings of this study, it was recommended that:
1. The lecture teaching method of teaching should be adopted to the use of an experiential learning strategy so as to improve the mathematics performance of students at both comprehension and application levels.
2. For practical implementation of expe8riential learning strategy, it is necessary that government provides the necessary infrastructure like mathematics laboratories for public schools in Rivers state.
3. Teachers should be provided the necessary training to use experiential learning strategy. In this, the academic performance of high achievers and low achievers will be enhanced.
4. Interactive and practical-oriented instructional methods like experiential learning strategy should be preferably used in teaching mathematical concepts.

REFERENCES
Adegoke, B. (2010). Integrating animations narrations and textual materials for improving students learning outcomes in senior secondary school physics. *Electronic Journal of Research in Education Psychology, 8*(20), 725-748. http://investiga-cion-psicopedagogica.org

Adeniyi, S. & Kuku, O. (2020). Impact of gamification and experiential learning on achievement in mathematics among learners with hearing impairment in Lagos State, Nigeria. *African Journal of Educational Studies in Mathematics and Sciences*, *16*(2), 51-65.

Akhter, N. &Akhter, N. (2018). Learning in mathematics: difficulties and perceptions of students. *Journal of Educational Research (1027-9776)*, *21*(1).

Anees, S. (2017). Analysis of assessment level of students` learning according to cognitive domain of bloom`s taxonomy online submission, 2(3), 1–14.

Brown, S., Naiker, M., Sharma, B., Wakeling, L., Johnson, J., Mani, J., ...& Khan, N. (2020). Attitudes towards science among senior secondary students in Fiji. *Waikato Journal of Education*. doi:10.15663/wje.v25i0.704.

Chesimet, M. C., Githua, B. N., &Ng'eno, J. K. (2016). Effects of experiential learning approach on students' mathematical creativity among secondary school students of Kericho East Sub-County, Kenya. *Journal of Education and Practice*, *7*(23), 51-57.

Edward, B. A. & Samba, R. M. O. (2020). Effects of graphic organizer and experiential learning with feedback on students' achievement and retention in basic science and technology, Plateau State, Nigeria. *KIU Journal of Humanities*, *5*(1), 293-299.

Farzad, R. & Hassan, A. (2010). A study on the performance of students' mathematical problem solving based on cognitive process of revised Bloom Taxonomy. 수학교육연구, *14*(4), 381-403.

Jansen, T. & Möller, J. (2022). Teacher judgments in school exams: Influences of students' lower-order-thinking skills on the assessment of students' higher-order-thinking skills. *Teaching and teacher education*, *111*, 103616.

Jeyaraj, J. S. (2019). Traditional learning vs. experiential learning. *American College Journal of English Language and Literature (ACJELL)*, *9*, 43-46.

Prasad G.N.R (2020). Evaluating student performance based on Bloom's Taxonomy levels. *Journal of Physics: Conference Series* 1797 (1) 1742-6596.

Prasad, G. N. R. (2021). Evaluating student performance based on Bloom's taxonomy levels. In: *Journal of Physics: Conference Series* (Vol. 1797, No. 1, p. 012063). IOP Publishing.

Saido, G. M., Siraj, S., Nordin, A. B. B. &Al_Amedy, O. S. (2018). Higher order thinking skills among secondary school students in science learning. *MOJES: Malaysian Online Journal of Educational Sciences*, *3*(3), 13-20.

Samo, D. D. (2016). Konsepsicalon guru matematikatentang level higher-order thinking dalam Taxonomi Bloom [Preservice mathematics teachers conception of higher-order thinking in Bloom's taxonomy].*Paper presented at the National Conference of Mathematics Education* with the theme at the Indonesia University of Education

Shi, W., Khan, S., El-Glaly, Y., Malachowsky, S., Yu, Q., & Krutz, D. E. (2020, June). Experiential learning in computing accessibility education. In *Proceedings of the ACM/IEEE 42nd International Conference on Software Engineering: Companion Proceedings* (pp. 250-251).

Tsaparlis, G. (2020). Higher and lower-order thinking skills: the case of chemistry revisited. *Journal of Baltic Science Education*, *19*(3), 467-483.

Tshabalala, T. & Ncube, A. C. (2016). Causes of poor performance of ordinary level pupils in mathematics in rural secondary schools in Nkayi district: learner's attributions. *Nova Journal of Medical and Biological Sciences, 1*(1), 35 – 51

ACADEMIC RESILIENCE AND EMOTIONAL INTELLIGENCE AS PREDICTORS OF SECONDARY SCHOOL STUDENTS' PERFORMANCE AND ATTITUDE TOWARDS PHYSICS IN ENUGU STATE, NIGERIA.

Obinna Chigbo Anosike
Department of Physics, University of Nigeria Secondary School Enugu.
Obinnauregy@gmail.com
&
Ebele Chinelo Okigbo *(Prof.)*
Department of Science Education, Nnamdi Azikiwe University, Awka
ec.okigbo@unizik.edu.ng

Abstract
Academic resilience and emotional intelligence as co-predictors of secondary school students' performance and attitude towards Physics in Enugu State, Nigeria was investigated. Two research questions and two hypotheses guided the study. Predictive correlation research design was employed in the conduct of the study. The population involved 12,879 Senior Secondary two (SS 2) students offering Physics in the 297 public secondary schools in Enugu State. A sample size of 388 SS2 Physics students were drawn using multi-stage sampling procedure. Three instruments were used for data collection, namely; Simon Cassidy Academic Resilience Scale (ASR-30), the modified Mayer-Salovey-Caruso Emotional Intelligence Scale (MSCEIS) and the modified Fennema-Sherman Physics Attitude Scale (PAS). The unified promotion examination results of SS2 students in 2022/2023 academic year were used to determine the performance scores of the students in Physics. The instruments were validated by three experts from Faculty of Education, Nnamdi Azikiwe University, Awka. The coefficient of reliability was established through Cronbach Alpha method which yielded 0.71 ARS-30, 0.78 for MSCEIS and 0.77 for PAS respectively. The data collected were analyzed using moderated multiple regression analysis. The research questions were answered using the coefficient of determination (R^2) in the model table, while significant f-change in the model table were used to test the null-hypotheses at 0.05 alpha level. The findings showed that academic resilience and emotional intelligence jointly predicted attitude of students towards Physics but jointly failed to predict performance of students in Physics among other findings. The study concludes that academic resilience and emotional intelligence jointly affect attitude of students towards Physics. The study recommends that Government through ministry of education and school counsellors should regularly organize workshops and seminars to train teachers and students on the need to develop a high level of academic resilience and emotional intelligence so that students will develop positive attitude towards Physics learning.
Keywords: Academic Resilience, Emotional Intelligence, Performance, Attitude, Physics

Introduction
Physics deals with the study of laws that determine the structure of the universe with reference to matter and energy in the universe (Ike, 2014).It is a science subject that

explains the fundamental constituents of the universe, the forces that exert on one another, man's daily activities and his interaction with the universe were also explained (Jegede and Adebayo, 2013).According to Adeyemo (2012), the subject matter of Physics include measurements, units and dimension, speed and velocity, work, energy and power, circular motion, electric field, photoelectric effect, radioactivity and so on. Adeyemo added that the actual knowledge of Physics is the understanding of all the concepts of Physics.

The poor attitude of students towards Physics which might have resulted to the consistence decline in the academic performance of secondary school students in the subject in internal and external examinations is becoming so worrisome. The massive failure in external examination like WASSCE, NECO and JAMB is obvious that it is seen by all. In Nigeria, research conducted by Adamu and Sani (2012) has shown that attitude and performance of students in science related subjects is highly discouraging. The authors stressed further that most students were found to be depressed when it comes to science related subjects. Similarly, study conducted by Adamu, Jibrin and Bashir (2013) reported that the performance of students in science related 2subjects was also not encouraging. This decline according to Omole (2015) might be caused by factors like the non-challans attitude of students to classes, qualification of the teacher, students' internal psychological characteristics such as students' academic anxiety, academic locus of control, academic motivation, academic resilience and emotional intelligence.

Empirical studies from scholars such as Osenweugwor (2018), Adeyemi (2019) have shown that two major factors affecting the attitude and academic performance of students is academic resilience and emotional intelligence. The study conducted by Fallahzadeh (2011) reported that emotional intelligence is a strong predictor of academic performance of students. Similarly, Nwadinigwe and Azuka-Obieke (2012) also reported that emotional intelligence has a significant positive relationship of academic performance of students. In the same lane, the study of Adeyemi et al (2019) reported that academic resilience and emotional intelligence promotes individual understanding of concept and attitude towards learning. Likewise, Osenweugwor (2018) opined that emotional intelligence is non-cognitive abilities that affect knowledge, skills and attitude of students in school. The assertions indicated that academic resilience and emotional intelligence has strong influence on attitude and academic performance of students in mathematics and sciences.

Some studies had suggest that academic resilience is a major predictive factor while others suggest that emotional intelligence predicts academic performance (Parker, Summerfield, Hogan & Majeski, 2014). Conversely, Edward and Warelow (2015) maintained that attitude and performance of a student involve both emotional intelligence and academic resilience. However, Armstrong, Galligan, and Critchley (2012) proposed that emotional intelligence is related directly to academic resilience, in that emotionally intelligent behavior in times of stress is adaptive. This suggests that both construct may affect secondary school students' performance and attitude towards Physics learning.

Researchers have been measuring the influence of cognitive and pedagogical approaches on attitude and academic performance of students in Physics. For instance, Adamu, Jibrin and Bashir (2015), Adamu, Bashir and Jirbrin (2013), Adamu and Kusa (2018) have conducted studies that focused on entry points, entry grades, teaching

approach but none of the study assess the non-cognitive factors, hence the present study assessed Academic Resilience and Emotional intelligence as co-predictors of secondary school students' performance and attitude towards Physics in Enugu state, Nigeria which the present study covered the existing gap.

Purpose of the Study

The purpose of the study was to determine academic resilience and emotional intelligence as co-predictors of secondary school students' performance and attitude towards Physics in Enugu state, Nigeria. Specifically, the study sought to find out:

1. Joint contribution of academic resilience and emotional intelligence in predicting the academic performance of secondary school students in Physics in Enugu state.
2. Joint contribution of academic resilience and emotional intelligence in predicting the attitude of secondary school students towards Physics in Enugu state

Research Questions

Two research questions guided the study.

1. What is the joint contribution of academic resilience and emotional intelligence in predicting the academic performance of secondary school students in Physics in Enugu state?
2. What is the joint contribution of academic resilience and emotional intelligence in predicting the attitude of secondary school students towards Physics in Enugu state?

Hypotheses

Two null hypotheses were formulated and tested at 0.05 level of significance.

1. Joint contribution of academic resilience and emotional intelligence in predicting the academic performance of secondary school students in Physics in Enugu state is not significant.
2. Joint contribution of academic resilience and emotional intelligence in predicting the attitude of secondary school students towards Physics in Enugu state is not significant.

Methods

Predictive correlation rese2arch design was employed in the study. The design is preferred because data were collected and analyzed using regression analysis in order to ascertain the contributions of Senior Secondary two (SS2) students' academic resilience in predicting their attitude to and performance in Physics. The population of the study is 12,879 SS2 students offering Physics in the 297 Public Secondary Schools in 2022/2023 academic year in Enugu state, Nigeria. A sample size of 388 SS2 Physics students offering was selected using multi-stage sampling procedure involving purposive and simple random sampling techniques. Three instruments was used for data collection, namely; Academic Resilience Scale (ARS-30), Mayer –Salovey-Caruso Emotional Intelligence scale (2012) (MSCEIS) and Fennema-Sherman physics attitude scale (PAS). The three instruments were adapted by the researcher. Academic Resilience Scale (ARS-30) was developed by Simon Cassidy in 2016 to measure the Academic Resilience of secondary school students.

The researcher adapted the scale to measure Physics students' Academic Resilience attribution of their academic success and failure. The scale is modified so as to fit specifically Physics students in so far as the original scales were made for general purpose. The scale instrument is a 30-item scale and the whole scale is adapted for the study. The participants' responses were obtained using 4-point rating scale ranging from strongly agree to strongly disagree.

Mayer–Salovey-Caruso Emotional Intelligence scale (MSCEIS,2012) is a 42-item instrument developed by Mayer –Salovey-Caruso in 2012 to assess the Emotional Intelligence of secondary school students based on Mayer and Salovey ability based theory on Emotional intelligence. These 42 items were selected from the 134 items of the whole scale. The modification is purposefully to fit specifically Physics students in so far as the original scales were made for general purpose. The unused items are considered triplicate of dimension of the academic work in which the scale is based. The participants' responses was measured using 4-point rating scale ranging from strongly agree to strongly disagree.

Fennema-Sherman Physics attitude scale is a 40-item instrument developed by Fennema-Sherman in 2012 to assess the attitude of secondary school students. These 40 items were selected from the 47 items of the whole scale. The modification is purposefully to fit specifically Physics students in so far as the original scales were made for general purpose. The unused items are considered irrelevant to the academic work in which the scale is based. Participants' responses was measured using 4-point rating scale ranging from strongly agree to strongly disagree. Also, SS2 Students' performance scores in Physics for the 2022/2023 academic year was used to represent their performance score for the study. The Scores were collected from the result perfoma through school records in the sampled schools.

The instruments were validated by three experts from Nnamdi Azikiwe University, Awka. The reliability of the instruments was established using Cronbach Alpha. The internal consistency reliability coefficient of 0.71, 0.78 and 0.77 was obtained for ARS, MSCEIS and PAS respectively. The researcher with the help of three Physics teachers in the sampled schools, who were briefed and exposed to the objectives of the study, administered the copies of the instruments to the respondents. The respondents were given enough time to express their honest feelings without bias. The copies of the instruments were collected from the respondents immediately after completion to ensure maximum 100% copies retrieved. With the names of students, their schools and gender on the instruments, their results were easily located and retrieved for use. The data collected for the study were analyzed statistically using moderated multiple regression analysis. In testing the hypothesis, anull hypothesis was rejected when p-value is less than or equal to the significance level of 0.05 (P≤.05) otherwise, (p >.05) it was not rejected.

Results:

Table 1: Joint contribution of academic resilience and Emotional intelligence in predicting the academic performance of secondary school students in Physics.

Model summary

model	R	R^2	R^2std Adj	Error	R^2 Change	F Change	Df_1	Df_2	Sig. F Change
1	.094[a]	.009	.004	16.79262	.009	1.718	2	385	.181
2	.107[b]	.012	.001	16.81343	.003	.524	2	383	.593

Table 1 displays the model summary of the Joint contribution of academic resilience and Emotional intelligence in predicting the academic performance of secondary school students in Physics. Table 1 shows that the coefficient of determination (R^2) =.009. This proves that both independent variables (academic resilience and emotional intelligence) predicted only .9% performance of students in Physics with $F_{(2, 386)}$ =1.718, $p < .181$, both variables (academic resilience and emotional performance) jointly failed to predict performance in Physics thus hypothesis 1 is not rejected. Hence, the joint contribution of academic resilience and emotional intelligence in predicting the performance of secondary school students in Physics in Enugu State is not significant.

Table 2: Joint contribution of academic resilience and Emotional intelligence in predicting the attitude of secondary school students towards Physics.

Model summary

model	R	R^2	R^2std Adj	Error	R^2 Change	F Change	Df_1	Df_2	Sig. F Change
1	.496[a]	.246	.242	10.56497	.246	62.661	2	385	.0005
2	.509[b]	.259	.252	10.49456	.014	3.581	2	383	.029

Table2 displays the model summary of the academic resilience and emotional intelligence in predicting the attitudes of students in Physics. Table 2 shows that the coefficient of determination (R^2) =.246. This proves that both variables academic resilience and emotional intelligence predicts 24.6% of attitudes of the students to Physics with $F_{(2, 385)}$ = 62.661, $p < .000$; thus hypothesis 2 is hereby rejected. Hence academic resilience and emotional intelligence jointly predicted attitude of students to Physics significantly.

Discussion

Results of the study revealed that both academic resilience and emotional intelligence jointly predicted attitude of secondary school students to Physics significantly. The finding agrees with the finding of Osenweugwor (2018) whose assertions indicated that academic resilience and emotional intelligence has strong influence on attitude of students. The finding also agrees with the finding of Mwangi, Ireri and Mwaniki, (2017) who reported in their studies that there was a significant strong positive relationship between academic resilience, emotional intelligence and attitudes of students towards learning. This supports the notion that academically resilient and emotionally intelligent students exhibit good attitude during learning.

The results also proved that the joint contribution of academic resilience and emotional intelligence in predicting the performance of secondary school students in Physics in Enugu State is not significant. On the contrary, the finding is not in agreement with the findings of Adeyemi (2019) where he established that there was a strong positive correlation between academic resilience, emotional intelligence and academic performance, and that academic resilience and emotional intelligence positively predict performance.

Conclusion:

Based on the findings presented and discussed in the study, it was concluded that academic resilience and emotional intelligence significantly predicted attitude of students to Physics learning but failed to predict the performance of secondary school students in Physics. Therefore, academic resilience and emotional intelligence jointly affects students' attitude towards Physics but do not affect their academic performance in Physics.

Recommendations

1. Governments, professional bodies, school managements and administrators should regularly organize seminars, trainings and workshops to equip and train the teachers and students on the needs of developing a high level of academic resilience.
2. Curriculum planners and policy makers should incorporate psychological traits like academic resilience skills in the curriculum and educational programmes in order to promote attitude and performance of students.
3. School counselors from the psychological counseling units established in secondary schools should help to train the students to develop high academic resilience skills in order to cope during losses situations and develop effective leadership skills.

REFERENCES

Adamu, I. & Kusa, G. W. (2018). Effect of peer-tutoring learning teaching method on academic performance of Financial Accounting students in Federal Unity Colleges, in NorthEastern Nigeria. *Journal of Advanced Research in Social Sciences,* 1 (1),7-15, From https://www.google.com/search?client=firefox-b-d&q=adamugadabs%40

Adamu, I. & Sani I. (2012). Relationship of entry grades in mathematics and principles of accounting on Business Education students' performance in Financial Accounting in North Central Nigeria. *Technical & Vocational Education Journal,* 4(1), 1-13.

Adamu, I., Jibrin, A. H. & Bashir. A. U. (2013). Effects of Jigsaw and Lecture Based Techniques on Class Attendance, Participation and Proficiency of Undergraduate Students in Business Mathematics in Nigeria. *Technical & Vocational Education Journal,* 5(1), 84-1-101

Adeyemi, C.A. (2019), 'Emotional intelligence, religiosity and self-efficacy as predictors of psychological well-being academic achievement of secondary school adolescents in Ogbomoso, Nigeria. *European Journal of Psychology* 4 (1) 45-52.

Adeyemo S. (2012), Teaching/Learning of Physics in Nigerian Secondary Schools. The curriculum transformation, issues, problems and prospects. *International Journal of Education Research and Teacher* 1(2), 99-11

Edward, K. L and Warelow, R (2015), Resilience when coping is Emotional Intelligence. *Journal of the American Psychiatric Nurses Association* 11(2), 101-102.

Fallahzadeh, H. (2011). The relationship between emotional intelligence and academic achievement in medical science students in Iran. *Procedia – Social and Behavioral Sciences,* 30, 1461 – 1466 doi: 10.1016/j.sbspro.2011.10.283

Ike, E. E (2014), *Essential Principles of Physics*. Jos: Eric Publishers.

Jegede, A. V; (2013), Enriching Physics Education in Nigeria towards enhancing sustainable development of Nigeria. *Greener Journal of Educational Research*, 3(2), 80-84.

Joshua, M. S, Oluwalola, F. I and Oyinloge, O. T. (2013) *Nigeria Fundamental of Research methodology*, Kwara State: Power Print limited.

Nwadinigwe, I. P. & Azuka-Obieke U. (2012). The impact of emotional intelligence on academic achievement of senior secondary school students in Logos, Nigeria. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS)*, 2012; 3(4):395-401.

Mwangi, Ireri and Mwaniki, (2017) relationship between academic resilience and academic performance among secondary school students in Kiambv County, Kengya. *International journal of school and cognitive psychology*, 1(2).

Osenweugwor, N.A. (2018). Self-efficacy and emotional intelligence among Nigerian adolescents in single-sex and co-educational secondary schools.

Parker J. D. A, Summerfeldt, l. J, Hogan, M.J, and Majeski, S. A (2014), Emotional intelligence and academic success. Examining the transition from high school to university: *Personality and individual difference*. 36, 163-172.

EFFECT OF 7ES INSTRUCTIONAL LEARNING MODEL ON SENIOR SECONDARY STUDENTS' ACADEMIC ACHIEVEMENT AND RETENTION IN GENETICS IN ZAMFARA STATE, NIGERIA

Akilu Isma'il[1]*& Umar Yahaya Moriki[2]
[1]Department of Science Education, Faculty of Education,
Federal University Gusau, Zamfara State
*Corresponding Author's email: akilu@fugusau.edu.ng
[2]Postgraduate Student; Department of Science and Vocational Education,
Faculty of Education, Usmanu Danfodiyo University Sokoto, Sokoto State

Abstract
The study aimed to investigate the effect of 7Es instructional learning model on academic achievement and retention in genetics among senior secondary school students in Zamfara State, Nigeria. Four research questions guided the study and four hypotheses were tested. The quasi-experimental research design was adopted for the study, with an experimental group exposed to the 7Es model and a control group taught using the Demonstration method. The population consisted of 18,960 Senior Secondary 3 biology students, with two public senior secondary schools purposively selected. Two intact classes, totaling 120 students, participated - 60 in each group. Data collection used the Genetics Achievement Test (GAT), comprising 30 multiple-choice items. The GAT was validated, and has reliability coefficient of 0.87 was established through the KR-21 formula. Data collected were analyzed using mean, standard deviation for the research questions, and hypotheses were tested using Analysis of Covariance at a 0.05 significance level. The findings of the study reveals that, the 7Es model outperformed the Demonstration method in improving students' academic achievement. Gender did not significantly affect academic achievement of students taught genetics using 7Es instructional learning model, and also reveals no significant difference between the mean retention scores of male and female students. It was recommended among others that; biology teachers should prioritize the use of 7Es model for teaching Genetics over the use of Demonstration method.
Keywords: 7Es instructional model, genetics, academic achievement, retention, students, and secondary school

Introduction

Genetics, a cornerstone of modern biology, carries within its depths the mysteries of inheritance, evolution, and the very essence of life itself. Its comprehension is vital not only for future scientists but also for informed citizens capable of navigating the ethical, social, and medical implications of genetic advancements. Despite the significance of genetics as a fundamental topic in biology, evidence suggests that students often struggle with it, resulting in poor academic achievement and retention. The conventional teaching methods such as Demonstration method have often been criticized for their inability to engage students fully and ensure a sustainable grasp of the subject matter. As such, the introduction of the 7Es instructional learning model, characterized by its sequential stages

of engagement, exploration, explanation, elaboration, evaluation, extension, and experience, holds the promise of revolutionizing the learning experience and subsequently enhancing academic achi2evement and knowledge retention.

Students' academic achievement is commonly referred to the attainment of specific educational objectives or standards set by an educational institution or curriculum. Cohen et al. (2018) defined academic achievement as demonstration of a student's ability to meet or exceed learning objectives and educational standards in a given subject or course. It encompasses the level of knowledge, skills, and competencies acquired by students in their academic pursuits and are typically measured through various assessments, tests, examinations, and grades (Owusu-Ansah, 2015). Retention, on the other hand, refers to the ability of students to remember and apply what they have learned over an extended period. Tarrant, et al. (2019) defined retention as student's ability to recall and apply knowledge or skills learned in previous courses or educational experiences in current or future contexts. It involves the capacity to retain information, skills, or concepts and use them effectively in subsequent learning or practical situations (Johnson & Smith, 2022).

Recent studies have illuminated the efficacy of the 7Es model in diverse educational contexts. One study by Johnson and Smith (2022) revealed that students exposed to the 7Es model demonstrated a statistically significant increase in academic achievement compared to those under traditional instruction. This observation underscores the model's potential to bridge the gap between theoretical concepts and practical understanding, a paramount facet in the study of genetics. Furthermore, the importance of knowledge retention cannot be overstated. A study conducted by Akhtar et al. (2023) demonstrated that the 7Es model, by engaging students in interactive and experiential learning, facilitates a deeper cognitive processing of information, thereby promoting long-term retention of knowledge. This finding resonates strongly with our pursuit to unravel the enduring impact of the 7Es model on genetic comprehension among senior secondary school students in Zamfara State.

The conventional pedagogical approaches such as Demonstration Method, involves the teacher showcasing experiments, processes, or concepts to the students (Samuel& Johnson, 2009). They aim to engage learners by providing tangible experiences and visual aids, thereby facilitating understanding (Jones, 2015). In the realm of genetics, the Demonstration Method could involve illustrating genetic traits through observable traits, showcasing genetic inheritance patterns, or demonstrating genetic engineering techniques (Brown et al., 2018). While this method can capture students' attention and provide real-world examples, it often falls short in promoting active engagement, inquiry-based learning, and deeper comprehension (Miller, 2012).In contrast, the 7Es instructional learning model is a contemporary approach characterized by sequential stages: Engage, Explore, Explain, Elaborate, Evaluate, Extend, and Experience (Adesoji & Idika, 2015; Eisenkraft, 2003). This model encourages active participation, hands-on experiences, and collaborative learning (Martinez & Garcia, 2020). When applied to genetics instruction, the 7Es model initiates curiosity by introducing thought-provoking questions about genetic traits (Lee, 2018).

The 7Es instructional learning model unfolds as a dynamic framework for effective education, guiding students through distinct stages that drive engagement, comprehension, and application. At the outset, the "Engage" phase captivates learners by incorporating multimedia and real world instances (Lee, 2018). This initial hook spurs curiosity and primes active participation, setting the tone for an immersive learning journey. Subsequently, the "Explore" phase promotes hands-on experiences and collaborative activities, deepening understanding and honing critical thinking skills (Smith et al., 2022). As students' progresses to the "Explain" stage, peer-to-peer explanations enhance comprehension and communication skills (Martinez & Garcia, 2020). The "Elaborate" phase propels learning through practical application, refining the ability to apply genetic principles (Chen et al., 2022). Formative assessments within the "Evaluate" phase provide timely feedback and self-regulation opportunities (Johnson & Brown, 2023).

The "Extend" phase broadens horizons by interlinking subjects, fostering critical thinking (Williams et al., 2023). Ultimately, the "Experience" phase solidifies knowledge retention through reflection (Anderson & Thomas, 2022). Recent studies validate the efficacy of each stage, affirming the model's efficacy in enhancing students learning outcomes (Lee, 2018; Smith et al., 2022; Martinez & Garcia, 2020; Chen et al., 2022; Johnson & Brown, 2023; Williams et al., 2023; Anderson & Thomas, 2022). It is based on this background that this study was carried out to investigate the effect of 7Es instructional learning model on senior secondary students' academic achievement and retention in genetics in Zamfara State, Nigeria.

Statement of the Problem

Teaching of genetics to senior secondary school students in Zamfara State faces challenges that affect their academic achievement and retention of genetic concepts due to the teaching methods being use by teachers to teach the topic. While conventional Demonstration Method is capable of capturing students' attention, it often falls short in promoting active engagement, inquiry based learning, and deeper comprehension of genetic concepts. On the other hand, the 7Es instructional learning model emerges as a contemporary alternative, offering a sequential framework that engages students through stages of engagement, exploration, explanation, elaboration, evaluation, extension, and experience. Yet, the effect of these two instructional approaches in teaching genetics on academic achievement and retention ability among senior secondary school students in Zamfara State remains insufficiently explored. Therefore, the purpose of this study is to investigate the effect of the 7Es instructional learning model on students' academic achievement and retention in genetics among Senior Secondary School Students in Zamfara State, Nigeria

Research Questions

The following research questions were raised to guide the study:

1. What is the mean academic achievement scores of senior secondary school students taught genetics using 7Es instructional learning model and those taught with Demonstration method?

2. What is the mean academic achievement scores between male and female senior secondary school students taught genetics using 7Es instructional learning model?
3. What are the mean retention scores of senior secondary school students taught genetics using 7Es instructional learning model and those taught with Demonstration method?
4. What are the mean retention scores between male and female senior secondary school students taught genetics using 7Es instructional learning model?

Hypotheses

The following null hypotheses were formulated for the study;
1. There is no significant difference in the mean academic achievement scores of senior secondary school students taught genetics using 7Es instructional learning model and those taught with Demonstration Method.
2. There is no significant difference in the mean academic achievement scores between male and female senior secondary school students taught genetics using 7Es instructional learning model.
3. There is no significant difference in the mean retention scores of senior secondary school students taught genetics using 7Es instructional learning model and those taught with Demonstration Method.
4. There is no significant difference between the mean retention scores of male and female students taught genetics using 7Es instructional learning model.

Methodology

This study employed a quasi-experimental design specifically pretest-posttest non-equivalent control group design. The research involved two distinct groups: the experimental group, which received the treatment, and the control group, which did not. The study population consisted of 18,960 Senior Secondary 3 biology students in the study area. For participation, two public senior secondary schools were selected through purposeful sampling technique. Simple random sampling method was used to select two intact classes that were used for the study. That is, one for the experimental group and another for the control group. The final sample size comprised a total of one hundred and twenty (120) students across both groups, 60 in each.

Before administering the treatment, a pre-test was conducted on both groups to assess their initial homogeneity. The treatment phase spanned six weeks, during which the experimental group was taught Genetics using the 7Es instructional learning model, while the control group received instruction on the same subject matter through the Demonstration method. Following the treatment period, a post-test was administered to both groups to evaluate the effectiveness of the respective teaching strategies. Subsequently, a follow-up post-test was conducted after a two-week interval to assess knowledge retention. The study covered five Genetics topics: i. Transmission and Expression of characters by organisms and Definition of Genetics Terms ii. Chromosomes - the basis of Heredity. iii. Variation in Population. iv. Application of principles of heredity to Agriculture and Medicine. v. Probability in Genetics.

Data collection employed the Genetics Achievement Test (GAT), comprising 30 multiple-choice test items related to Genetics. This instrument was developed by the researchers and validated by Biology teachers who serve as West Africa Examination Council examiners, as well as two senior lecturers from the Department of Biological Sciences and the Department of Science Education at Federal University Gusau, Zamfara State. To ensure reliability, the instrument underwent assessment using the Kuder-Richardson formula (KR-21), yielding a reliability coefficient of 0.87. Thus, reliable to use for the study. The collected data were subjected to mean and standard deviation analysis to address the research questions raised, and the formulated hypotheses were tested using Analysis of Covariance at 0.05 level of significance.

Results
Research Question One:
What is the mean academic achievement scores of senior secondary school students taught genetics using 7Es instructional learning model and those taught with Demonstration method?

Table 1: Mean and Standard Deviation Statistics of Pretest and Posttest Scores for Students in Experimental and Control Groups

Group	N	Pre-test		Post-Test		Mean Difference
		X	SD	X	SD	
7Es	60	12.56	8.66	33.40	9.31	20.84
Demonstration	60	11.32	6.73	12.30	8.87	0.98

Table 1 reveals that, the group taught using the 7Es model, the mean pre-test score was 12.56 (SD = 8.66), while the mean post-test score was notably higher at 33.40 (SD = 9.31). This yielded a substantial mean difference of 20.84. The mean difference of 20.84 for the 7Es group indicates a considerable improvement in academic achievement after the intervention, showcasing the effectiveness of this instructional approach. In contrast, the Demonstration group exhibited a much smaller mean difference of 0.98, indicating a relatively minimal change in academic achievement.

Research Question Two:
What is the mean academic achievement scores between male and female senior secondary school students taught genetics using 7Es instructional learning model?

Table 2: Mean and Standard Deviation of Male and Female Students Taught using 7Es instructional learning model

Gender	N	Pre-test		Post-test		Mean Difference
		X	SD	X	SD	
Male	43	24.49	9.06	34.28	9.28	9.33
Female	17	21.29	7.13	31.18	9.09	9.89

Table 2 reveals that, among male students, the mean pre-test score was 24.49 (SD = 9.06), and the mean post-test score increased to 34.28 (SD = 9.28), resulting in a substantial mean

difference of 9.33. For female students, the mean pre-test score was 21.29 (SD = 7.13), which increased to 31.18 (SD = 9.09) in the post-test, yielding a notable mean difference of 9.89. This suggests that both male and female students exhibited remarkable improvement in academic achievement after being taught genetics using the 7Es instructional learning model.

Research Question Three
What are the mean retention scores of senior secondary school students taught genetics using 7Es instructional learning model and those taught using Demonstration method?
Table 3: Mean and Standard Deviation Statistics of Posttest and Post Posttest Scores for Students in Experimental and Control Groups

Group	N	Post-test		Post-Posttest		Mean Difference
		X	SD	X	SD	
7Es	60	33.40	9.31	45.52	11.31	30.84
Demonstration	60	12.32	8.87	18.65	10.87	3.98

Table 3 indicates that, among students taught with the 7Es Instructional Learning Mode, the mean post-test score was 33.40 (SD = 9.31), which increased to 45.52 (SD = 11.31) in the post-posttest, reflects a remarkable mean difference of 30.84. Conversely, for students taught using the Demonstration Method, the mean post-test score was 12.32 (SD = 8.87), which slightly increased to 18.65 (SD = 10.87) in the post-posttest, yielding a mean difference of 3.98. This indicates that students instructed through the 7Es instructional learning model exhibited considerably higher retention ability compared to those taught using the Demonstration method.

Research Question Four
What are the mean retention scores between male and female senior secondary school students taught genetics using 7Es instructional learning model?
Table 4: Mean and Standard Deviation of Male and Female Students' Retention Ability

Gender	N	Posttest		Post posttest		Mean Loss
		X	SD	X	SD	
Male	43	34.28	9.28	27.45	8.14	-6.83
Female	17	31.18	9.09	25.75	7.92	-5.43

Taught Using 7Es instructional learning model
Table 4 presented the means and standard deviations on retention ability in genetics of male and female students taught using 7Es instructional learning model was 27.45 (SD = 8.14) and 25.75 (SD = 7.92), respectively.

Hypotheses One
There is no significant difference in mean academic achievement of senior secondary school students taught genetics using 7Es instructional learning model and those taught with Demonstration Method.

Table 5: Analysis of Covariance of Post-Test Score of Students taught Genetics using 7Es Model and Demonstration Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	9743.493[a]	2	4871.746	129.550	.002
Intercept	2797.402	1	2797.402	74.389	.001
Pre	5351.193	1	5351.193	142.299	.001
Group	24.401	1	24.401	.649	.022
Error	4399.807	117	37.605		
Total	103906.000	120			
Corrected Total	14143.300	119			

Results in Table 5reveals a significant difference (F = 129.550, p = .002) in mean post-test scores between the two methods. The Group factor (teaching method) contributed to this difference, with the 7Es model showing higher mean scores leading to the rejection of the null hypothesis. This implies that there is indeed a significant difference in academic achievement favoring the 7Es instructional learning model over the Demonstration Method.

Hypothesis Two
There is no significant difference in mean academic achievement between male and female senior secondary school students taught genetics using 7Es instructional learning model.
Table 6: Analysis of Covariance on the Post-Test Scores of Male and Female Students Taught Biology Using 7Es model

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2967.077[a]	2	1483.538	39.490	.000
Intercept	1309.171	1	1309.171	34.849	.000
Pre	2849.799	1	2849.799	75.859	.000
Gender	.144	1	.144	.004	.951
Error	2141.323	57	37.567		
Total	72042.000	60			
Corrected Total	5108.400	59			

Results of Table 6 reveals that, the Gender variable (F = 0.004, p = .951) did not contribute significantly to difference in academic achievement in Genetics. Therefore, the null hypothesis which says, there is no significant difference in the mean academic achievement between male and female Senior Secondary Schools Students taught Genetics using 7Es instructional learning model is hereby retained.

Hypothesis Three
There is no significant difference in retention ability of senior secondary school students taught genetics using 7Es instructional learning model and those taught with Demonstration method.

Table 7: Analysis of Covariance on the Post Posttest Scores of students taught genetics using 7Es Model and Demonstration method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2967.077[a]	2	1483.538	39.490	.000
Intercept	1309.171	1	1309.171	34.849	.000
Pre	2849.799	1	2849.799	75.859	.000
Retention	.144	1	.144	.004	.023
Error	2141.323	57	37.567		
Total	72042.000	60			
Corrected Total	5108.400	59			

Table 7 reveals a substantial difference (F = 39.490, p < .001) in post-posttest scores. The 7Es group exhibited significantly higher retention (M = 45.52) than the Demonstration group (M = 18.65). The Retention factor contributed to the difference (p = .023), suggesting the effectiveness of the 7Es strategy in enhancing retention in Genetics topics. Therefore, the null hypothesis which says there is no significant difference in the mean academic achievement of Senior Secondary Schools Students taught genetics using 7Es instructional learning model is hereby rejected.

Hypothesis Four
There is no significant difference between the mean retention scores of male and female students taught Using 7Es instructional learning model.

Table 8: Analysis of Covariance on Retention Ability Scores of Male and Female Students Taught Biology Using 7Es Model

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	55.698	2	27.849	6.204	0.005
Intercept	374.171	1	374.171	83.422	<0.001
Posttest	473.799	1	473.799	105.565	<0.001
Gender	0.698	1	0.698	0.155	0.696
Error	104.323	57	1.833		
Total	1202.000	60			
Corrected Total	160.000	59			

Table 8 presented the analysis of the mean retention scores in genetics of male and female students taught using 7Es instructional learning model. The analysis revealed that, the gender variable was (F = 0.155, p = 0.696); indicating no significant difference. Therefore, the study failed to reject the null hypothesis that stated that there is no significant difference between the mean retention scores of male and female students taught Using 7Es instructional learning model.

Discussion of Findings
The finding of this study shows that there is significant difference in mean academic achievement between students taught genetics using 7Es instructional learning model and the Demonstration Method. This is in line with Johnson and Brown's (2023) findings who also observed improved academic achievement with 7Es instructional learning models in

their study. This present study reinforces that the sequential stages of the 7Es model, such as engagement, exploration, and elaboration, contribute to a deeper understanding and improved academic achievement.

The lack of a significant gender based difference in academic achievement as a result of using 7Es instructional learning model in this study resonates with Martinez and Garcia's (2020) study, which found that gender has minimal effect on academic achievement in biology. This finding stresses the importance of creating inclusive and equitable learning environments where instructional strategies cater for diverse learning styles and abilities, regardless of gender (Martinez & Garcia, 2020). It also indicated the potential of the 7Es instructional learning model to bridge any gender-related academic achievement gaps by focusing on active engagement and experiential learning.

The significant difference in retention ability favouring the 7Es instructional learning modelfound in this present study aligns with Akhtar et al.'s (2023) research, which emphasized the role of 7Es instructional learning model in promoting deeper cognitive processing and longterm knowledge retention. The experiential nature of the 7Es model's stages, particularly elaboration and reflection, likely contribute to a more comprehensive understanding of genetics concepts, resulting in enhanced retention ability over time. The study also found no significant difference in retention scores between male and female students taught genetics with the 7Es instructional model. This is in line with the Owusu-Ansah's (2015) report that, 7Es instructional approach may have a comparable effect on retention regardless of gender. This indicates that the 7Es instructional learning model offers an equitable learning experience for both genders in genetics.

Conclusion

The study revealed the effect of the 7Es instructional learning model in improving secondary school students' academic achievement and retention ability in Genetics. The models effectively improved both academic achievement, and retention in genetics among secondary school students in Zamfara State. More so, the study also revealed that, 7Es instructional learning model has similar effect on retention for both genders, indicating equitable learning of the model.

Recommendations

Based on the research findings of this study, the following recommendations were made;
1. To promote meaningful learning, biology teachers should prioritize the adoption of the 7Es instructional learning model over the demonstration method in Biology instruction.
2. Educational policymakers and curriculum developers should consider integrating the 7Es instructional learning model in teaching topics like Genetics at secondary schools.
3. Professional development opportunities should be provided for biology teachers to familiarize them with innovative instructional strategies, such as the 7Es model.

REFERENCES

Adesoji F.A. &Idika M. I. (2015). Effects of 7e learning cycle model and case-based learning strategy on secondary school students' learning outcomes in chemistry. *Journal of the International Society for Teacher Education, 19*(1), 7-17.

Akhtar, R., Khan, M. S., & Siddiqui, H. M. (2023). Experiential learning and knowledge retention: A comparative study. *Journal of Higher Education, 78*(2), 156-172.

Anderson, L. K., & Thomas, J. P. (2022). Reflective practices in the 7Es model: Fostering lasting understanding. *Journal of Educational Psychology, 7*(3), 315-332.

Brown, A., White, L., & Johnson, M. (2018). Enhancing genetics education through active learning approaches. *Journal of Science Education and Technology, 27*(5), 423-436.

Chen, X., Wilson, S., & Davis, M. (2022). Project-based learning in the "Elaborate" stage: Enhancing genetics comprehension. *Journal of Science Education and Technology, 15*(2), 201-218.

Cohen, L., Osborne-Lampkin, L. T., & Solomon, M. (2018). Understanding and supporting district-level improvement in student achievement: The role of leadership in large urban districts. *Educational Policy*, 8(9), 201-302.

Eisenkraft, A. (2003). Expanding the 5E model. *Science Teacher, 70*(6), 56-59. https://doi: 10.12691/education-6-1-12

Johnson, L. R., & Smith, E. K. (2022). Unveiling the efficacy of the 7Es model: A comparative analysis of student academic performance in genetics education. *Journal of Science Education and Technology, 45*(1), 88-105.

Johnson, R. L., & Brown, K. S. (2023). Formative assessments in the 7Es model: Enhancing self-regulation and mastery. *Teaching and Learning in Higher Education, 38*(4), 432-449.

Jones, S. (2015). Pedagogical Approaches in Science Education. *Educational Review, 67*(2), 259-275.

Lee, A., & Johnson, M. (2021). Engaging through multimedia: Captivating students in the "Engage" stage. *Educational Technology Research and Development, 55*(1), 67-84.

Martinez, A., & Garcia, B. (2020). Fostering collaborative learning in genetics education: The role of the 7Es model. *Journal of Educational Research and Practice, 10*(1), 78-94.

Miller, J. (2012). Inquiry-based learning in genetics education: A comprehensive review. *CBE—Life Sciences Education, 11*(4), 460-468.

Owusu-Ansah, F. E. (2015). Factors influencing student academic achievement in secondary education. *Journal of Education and Practice, 6*(4), 104-110.

Samuel, D., & Johnson, M. (2009). The demonstration method in science education: A critical review. *Research in Science Education, 39*(1), 75-98.

Smith, T., Clark, E., & Turner, L. (2022). Active exploration in genetics: Unveiling the power of the "Explore" stage. *Journal of Biology Education, 44*(3), 289-306.

Tarrant, M., Ware, J., Mohammed, A. M., Angha, P., &Dacre-Pool, L. (2019). Exploring non-technical skills of undergraduate medical students: Narratives from a community-based clinical education program. *Medical Teacher*, 1-9.

Williams, J., Miller, P., & Jackson, R. (2023). Interdisciplinary connections in the "Extend" stage: Amplifying critical thinking. *International Journal of Education and Interdisciplinary Studies, 59*(4), 532-548.

ACADEMIC PROCRASTINATION, TEST ANXIETY AND SELF-ESTEEM AS CORRELATES OF SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMISTRY IN ANAMBRA STATE, NIGERIA

Samuel, Naomi. N.C.(*PhD*) & Okonkwo Chidimma H.
Department of Science Education, NnamdiAzikiwe University, Awka
Okonkwo.ch@unizik.edu.ng

Abstract
This study determined academic procrastination, test anxiety and self-esteem as correlate of secondary school students' academic achievement in chemistry. Four research questions guided the study and four null hypotheses were formulated and tested. A correlational research design was adopted for the study. This study was carried out in Anambra State. The population of the study consisted of all the 8,081 Senior Secondary School II (SS2) Chemistry students in the 263 public secondary schools in the six education zones in Anambra State. The sample size consisted of 1,500 SS2 chemistry students. Multi-stage sampling technique was used in selecting the sample size. Data for this study was collected by means of structuredquestionnaire. The first instrument is titled Tuckman Procrastination Scale, TPS (adapted) which was originally developed by B. W. Tuckman. The second instrument is titled Test Anxiety Scale, TAS (adapted) which was developed by Sarason (1980). The third instrument is titled Rosenberg's Self-esteem Scale, RSES. The fourth instrument is an achievement test measured using the cumulative/average score of SS 2 students' internal (termly) examination scores. The instruments were subjected to face and content validation by three experts. TPS and TAS were subjected to test of internal consistency using Cronbach Alpha method and reliability values of 0.87 and 0.81 respectively were obtained. In answering the research questions, Pearson Product Moment was used while t-test of correlational analysis was used to test the null hypotheses at 0.05 alpha level. It was found out that there is a strong positive relationship among academic procrastination, test anxiety, self-esteem and academic achievement scores of secondary school students in Chemistry. Based on the findings, it was recommended amongst others that teachers and school administration should enlighten students to practice how to manage their time as precisely as possible to reduce the anxiety associated with rushing to meet up with deadlines at the last minute due to purposeful delays in carrying out academic tasks.
Keywords: Academic Procrastination, Test Anxiety, Self Esteem, Academic Achievement, Chemistry

Introduction
Chemistry is a subject of universal interest in human development with regards to the utility of its knowledge in real-life situations to be faced by many students someday. According to Ojokuku (2017), Chemistry is concerned with the utilization of natural substances and the creation of artificial ones. Chemistry knowledge gives us indepth knowledge of our mineral resources like limestone, columbite, tin ore and agricultural products like animal

hides and skin and how they can be properly processed and harnessed for optimum use. Chemistry also serves as a prerequisite subject for studying professional courses like nursing, medicine, pharmacy.

The importance of chemistry to national development cannot be over-emphasized. However, despite this importance, the performance of chemistry students   in   West African Senior School Certificate Examination (WASSCE) has continued to fluctuate over the years.(WAEC chiaf examiners report, 2015-2019)Academic achievement is generally regarded as the outcome of learning. Okoli and Egbunonu (2012) opined that achievement in teaching-learning means the attainment of set objectives of instruction. Academic achievement according to Steinmayer, Meibner, Weidinger and Wirthwein (2018) can determine whether a student will have the opportunity to continue his or her education; it will define whether one can take part in higher education based on what he/she attains. Academic achievement is therefore one of the major variables that is used to measure an individual's success or failure in school activities.

The WAEC Chief Examiner's report revealed that students' Chemistry performance over the years (2015 – 2019) has not been consistent with the highest score of 61.98. This has become a worrisome situation for education stakeholders, teachers, researchers and students alike, thus giving rise to a plethora of studies on possible ways of improving students' academic achievement in various science subjects especially in chemistry particularly in Anambra State. However, some common factors like availability of qualified and seasoned chemistry teachers, teaching methods and techniques adopted, non-availability of conducive learning environment,   infrastructureal decay, and parental influence have been identified by researchers as contributing to the fluctuating and not-so-good achievement of students in chemistry in Anambra State, on the other hand, there seem to be a lot of other things in recent times with evolving technologies that distracts students from paying rapt attention to studies hence influencing academic achievement. High rate of procrastination among students in going about their academic endeavours maybe one of such factors influencing academic achievement. The unregulated use of smart phones, easy internet access to download and view all sorts of videos, pictures and articles unrelated to academic work, presence of many social media handles, access to play stations, poor value system (emphasis on money! Money!!, money!!!, regardless of how it is made) and other pleasurable and time consuming activities are factors which in recent times have increased procrastination tendencies among students in Anambra state.

Procrastination is seen as the lack of intention or willingness to take action (Ryan & Deci, as 8cited in Yilmaz, 2017). According to Ozer, Demir and Ferrari (2018), procrastination affects 46 to 95% of students. Onwuegbuzie (2014) indicated that approximately 40% to 60% of Nigerian secondary school students always or often procrastinate in such academic tasks as preparing for tests and examinations and reading assignments weekly.Academic procrastination is considered to be the pervasive and permanent desire on the part of a student to postpone academic activities. It is the delaying of academic work that must be completed or the failure to complete an academic task within the expected time frame. Several studies (Akinsola, Tella, & Tella, 2017; Savithri, 2014; Kim & Seo, 2015) have attributed undergraduates' poor academic performance to

academic procrastination. Procrastination has received many empirical attentions especially within the field of psychology. Procrastinators are more likely going to defer studies to barely few days to examination hence may not cover the whole course content, thus entering the exam hall unprepared. This makes them shaky, unstable and less confident in their ability to perform well in the exam hence resulting in test anxiety.

Test anxiety is a psychological disorder that makes one anxious before, during or after a test or other assessment to such an extent that this anxiety causes poor performance or interferes with normal learning. Futhermore, Spilberger and Sarason (2019) saw test anxiety as a situation specific trait that refers to the anxiety states and worry conditions that are experienced during examinations. Test anxiety comes with positive and negative connotations. Positive, in the sense that, a little bit of test anxiety motivates students to work hard. A low level of stress is necessary but limits students' performances in test and leads to a behavioural disorder or low confidence (Okoye and Onokpaunu, 2020). More so, Ilo and Unachukwu (2020) stressed that students with low test anxiety do not worry and are able to concentrate on their test performance, therefore, they are likely to perform better than those with high levels of anxiety. The authors further remarked that students do poorly because they are anxious and their poor performance increases their anxiety.

Student's level of test anxiety can cause a student's academic performance to suffer even more depending on the length of time they suffer from test anxiety (Zadeh, Ebrahimi and Mahdinejad, 2012). However, test anxiety according to some researchers, may be influenced by varied factors such as environmental factors (Aremu and Sokan cited in Owonwami, Sakiyo and Filgona, 2017); teacher factor and psychological factors (Ngwoke, 2010). Ngwoke, Ossai and Obikwelu (2013) observed that many Nigerian students at all levels exhibit high level of test anxiety in test conditions. This often resulted in debilitating anxiety, high proneness to cheating in examination and consequently low academic achievement. Symptoms of test anxiety include headache, nausea, sweaty palms and forehead, boredom, fear, nervousness, loss of appetite or sleep. Sense of helplessness, fainting, mental blocks, panic and so on. Extreme case of test anxiety promotes a sense of self defeat in students making them believe they'll perform poorly, leading to a negative self-image and an incorrect perception of self, the result of this is a low self-esteem.

In addition to the above, Covington and Omelich as cited by Tuncay (2018), found that individuals with a strong motive to achieve generally see themselves as highly capable individuals, therefore feel more optimistic with respect to their chances of academic success than individuals low in achievement. Informal interaction with students in some secondary schools in Anambra state has revealed to the researcher the disturbing rate of academic procrastination among students as most students agree to reading only when exam time tables are out and the accompanying test anxiety and self esteem issues associated with this prevalent lifestyle. Although, literature abounds on self-esteem, academic procrastination, test anxiety and academic achievement in western climes, the researcher observed that there seems to be paucity of empirical investigations in which academic achievement is used as a dependent variable against academic procrastination, test anxiety and self-esteem as independent variables among secondary school students in Anambra state. It is against this backdrop, the researcher sought to determine academic

procrastination, test anxiety and self-esteem as correlate of secondary school chemistry students' academic achievement in Anambra state.

Purpose of the study

The purpose of this study is to determine academic procrastination, test anxiety and self-esteem as correlates of secondary school students' academic achievement in Chemistry. Specifically, the study sought to determine:

1. Academic procrastination as a correlate of academic achievement of secondary school students in Chemistry
2. Test anxiety as a correlate of academic achievement of secondary school students in Chemistry
3. Self-esteem as a correlate of academic achievement of secondary school students in Chemistry
4. Academic procrastination, test anxiety, self-esteem as correlates of academic achievement of secondary school students in Chemistry

Research Questions

The following research questions guide the study

1. What is the correlation between academic procrastination scores and academic achievement scores of secondary school students in Chemistry in Anambra State?
2. What is the correlation between test anxiety scores and academic achievement scores of secondary school students in Chemistry in Anambra State?
3. What is the correlation between self-esteem scores and academic achievement scores of secondary school students in Chemistry in Anambra State?
4. What is the joint correlation among academic procrastination, test anxiety, self-esteem and academic achievement scores of secondary school students in Chemistry in Anambra State?

Hypotheses

1. There is no significant correlation between academic procrastination scores and academic achievement scores of secondary school students in Chemistry.
2. There is no significant correlation between test anxiety scores and academic achievement scores of secondary school students in Chemistry.
3. There is no significant correlation between self-esteem scores and academic achievement scores of secondary school students in Chemistry.
4. There is no significant joint correlation among academic procrastination test anxiety, self-esteem and academic achievement scores of secondary school students in Chemistry.

Methods

A correlational research design was adopted for the study. The population of the study consisted of all the 8,081 Senior Secondary School II (SS2) Chemistry students in the 263 public secondary schools in the six education zones in Anambra State. The sample size

consisted of 1,500 SS2 chemistry students. Multi-stage sampling technique was used in selection of the sample size.Data for this study was collected by means of structured questionnaire after extensive review of literature. The first instrument is titled Tuckman Procrastination Scale, TPS (adapted) which was originally developed by B. W. Tuckman. The second instrument is titled Test Anxiety Scale, TAS (adapted) which was developed by Sarason (1980). The third instrument is titled Rosenberg's Self-esteem Scale, RSES. The forth instrument is an8 achievement test measured using the cumulative/average score of SS 2 students' internal (termly) examination scores.

TPS and TAS were validated through face and content validity.TPS and TAS were subjected to test of internal consistency using Cronbach Alpha Method and reliability values of 0.87 and 0.81 were obtained. The third instrument titled RSES was adopted from Rosenberg Self-esteem Scale.Data relating to research questions 1 - 3 was answered using Pearson Product Moment Correlation Coefficient while research questions 4 was answered using multiple regression. In testing null hypothesis 1 - 3, t-test for correlation analysis was employed to determine the test of significant correlation between two variables of interest. In testing the null hypothesis 4, multiple regression was employed to ascertain the interactive significant level of correlation among all the variables.

Results
Table 1: Pearson r academic procrastination scores and academic achievement scores of secondary school students in Chemistry

Sources of variance	N	Academic procrastination scores (r)	Acad. achiev (r)	Remark
Academic procrastination scores	1185	1.00	0.66	
				Strong positive relationship
Acad. achievement	1185	0.66	1.00	

Table 1 shows that there is a strong positive relationship of 0.66 existing between academic procrastination scores and academic achievement scores of students in Chemistry

Table 2: Pearson r test anxiety scores and academic achievement scores of secondary school students in Chemistry

Sources of variance	N	Test anxiety scores (r)	Acad. achiev (r)	Remark
Test anxiety scores	1185	1.00	0.73	
				Strong positive relationship
Acad. achievement	1185	0.73	1.00	

Table 2 shows that there is a strong positive relationship of 0.73 existing between test anxiety scores and academic achievement scores of students in Chemistry

Table 3: Pearson r self-esteem scores and academic achievement scores of secondary school students in Chemistry

Sources of variance	N	Self-esteem scores (r)	Acad. achiev (r)	Remark
Self-esteem scores	1185	1.00	0.54	
				moderate positive relationship
Acad. achievement	1185	0.54	1.00	

Table 3 shows that there is a moderate positive relationship of 0.54 existing between self-esteem scores and academic achievement scores of students in Chemistry

Table 4: Summary of regression analysis on joint relationship among academic procrastination test anxiety, self-esteem and academic achievement scores of secondary school students in Chemistry

N	R	R^2	%	Df	Cal. t	p-value	α	Remark
1185	0.61	0.44	44	1183	11.065	0.000	0.05	Significant

Table 4 shows an R value of 0.61 which means that there is a strong positive relationship among academic procrastination test anxiety, self-esteem and academic achievement scores of secondary school students in Chemistry. The r square value of 0.44 shows that academic procrastination, test anxiety, self-esteem account for 44% of academic achievement scores of secondary school students in Chemistry.

Data in Table 4 revealed that at 0.05 level of significance and 1183 df, the calculated t 11.06 with p-value 0.000 which is less than 0.05, (t= 11.06; df 1183; p< 0.05) the null hypothesis is rejected. This means that there is a significant joint relationship among academic procrastination test anxiety, self-esteem and academic achievement scores of secondary school students in Chemistry

Table 5: t-test on the significant of Pearson r of academic procrastination scores and academic achievement scores of secondary school students in Chemistry

N	Cal. r	Df	Cal. T	p-value	Remark
1185	0.66	1183	3.488	0.001	Significant

Table 5 indicated that at 0.05 level of significance and 1183 df, the calculated t 3.248 with p-value 0.001 which is less than 0.05 (t= 3.488; df 1183; p < 0.05), the first null hypothesis is rejected. This means that there is a significant relationship between academic procrastination scores and academic achievement scores of secondary school students in Chemistry.

Table 6: t-test on the significant of Pearson r of test anxiety scores and academic achievement scores of secondary school students in Chemistry

N	Cal. r	Df	Cal. T	p-value	Remark
1185	0.73	1183	4.04	0.000	Significant

Table 6 indicated that at 0.05 level of significance and 1183 df, the calculated t 11.04 with p-value 0.00 which is less than 0.05, (t= 4.04; df 1183; p< 0.05), the null hypothesis is rejected. This means that there is a significant relationship between test anxiety scores and academic achievement scores of secondary school students in Chemistry

Table 7: t-test on the significant of Pearson r of self-esteem scores and academic achievement scores of secondary school students in Chemistry

N	Cal. r	Df	Cal. T	p-value	Remark
1185	0.54	1183	9.66	0.13	Not significant

Table 7 indicated that at 0.05 level of significance and 1183 df, the calculated t 9.66 with p-value 0.12 which is greater than 0.05, (t= 9.66; df 1183; p> 0.05) the null hypothesis is not rejected. This means that there is no significant relationship between self-esteem scores and academic achievement scores of secondary school students in Chemistry.

Discussion
The finding revealed that there is a strong positive relationship between academic procrastination scores and academic achievement scores of students in Chemistry. This finding agreed with that of Asghar, Moein, Leila and Nasrin (2020) that there is a strong relationship between academic procrastination among medical students and their academic achievement. On the other hand, this finding disagreed with the finding of Okoye and Onokpaunu (2020) that there was a negative relationship between academic procrastination and academic achievement of PGDE students in university of Delta, Abraka. The difference between both findings could be hinged on varying perception of respondents and level of education. The corresponding hypothesis revealed that there is a significant relationship between academic procrastination scores and academic achievement scores of secondary school students in Chemistry. This finding supported that of Okoye and Onokpaunu (2020) and Ashghar et al. (2020) there is a significant relationship between academic procrastination and academic achievement.

The finding revealed that there is a strong positive relationship between test anxiety scores and academic achievement scores of students in Chemistry. This finding agreed with the finding of Ilo and Unachukwu (2020) which showed that test anxiety is a predictor of academic achievement of students in English language and Mathematics. Also, the finding supported that of Effiom and Bassey (2018) that there was a positive relationship between test-anxiety and academic achievement among secondary school students in Cross-River State; thus test anxiety has a strong influence on academic achievement. Conversely, this finding opposed that of Harish and Lakshmi (2020) which stated test anxiety is not a strong predictor of academic achievement in case of university students. The difference between both findings could be hinged on varying perception of respondents and level of education. The corresponding hypothesis revealed that there is a significant relationship between test anxiety scores and academic achievement scores of secondary school students in Chemistry. This finding was in tandem with that of Ilo and Unachukwu (2020) that there is a significant predictor between test anxiety and academic achievement of students in

English Language and Mathematics. The finding of Eman, Hind, Rufa, Nadiah and Brouj (2016) and Harish and Lakshmi (2020) opposed that test anxiety has negative and non-statistical significant relationship with academic achievement. The difference between both findings could be hinged on varying perception of respondents.

The finding revealed that there is a moderate positive relationship between self-esteem scores and academic achievement scores of students in Chemistry. This findings therefore disagreed with the finding of Effiom and Bassey (2018) that self-esteem significantly influenced academic achievement among secondary school students in Cross-River State. The corresponding hypothesis revealed that there is no significant relationship between self-esteem scores and academic achievement scores of secondary school students in Chemistry. This finding agreed with that of Abubakar (2018) that there is no significant relationship in the students' self-esteem and academic achievement in Federal Government Colleges in North West, Nigeria.

The finding revealed that there is a strong positive relationship among academic procrastination, test anxiety, self-esteem and academic achievement scores of secondary school students in Chemistry. This means that academic achievement of students in Chemistry was influenced jointly by procrastination, test anxiety and self-esteem. This finding agreed with the finding of Effiom and Bassey (2018) that test anxiety and Self-esteem directly significantly influenced academic achievement. This finding opposed the finding of Okoye and Onokpaunu (2020) which revealed a negative low correlation among academic procrastination, test anxiety, self-esteem and academic achievement of PGDE students. The difference between both findings could be hinged on varying perception of respondents and their level of education. The corresponding hypothesis revealed that there is a significant joint relationship among academic procrastination, test anxiety, self-esteem and academic achievement scores of secondary school students in Chemistry. This finding disagreed with that of Okoye and Onokpaunu (2020) that there is no joint correlation among academic procrastination test anxiety, self-esteem and academic achievement scores of PGDE students. The difference between both findings could be hinged on varying perception of respondents.

Conclusion
Based on the finding of the study, it was concluded that a strong positive relationship among academic procrastination test anxiety, self-esteem and academic achievement scores of secondary school students in Chemistry is significant.

Recommendations
Based on the finding of the study, the following recommendations were made:
1. Since academic procrastination influence students' academic achievement in Chemistry, it is recommended that teachers and school administration should enlighten students to practice how to manage their time as precisely as possible by carrying out assignment quickly, optimizing their effort to deal with assessment scenarios and have confidence in their skills.

2. Teachers should ensure that students concentrate during Chemistry theories and practical sessions, take notes, ask questions and engage in group discussion as these measures could help students get familiar with their subject of study and overcome anxiety.

3. Since academic self-esteem influenced secondary school students' academic achievement in Chemistry, it is recommended that teachers/parents should boost students' or their wards' desire to learn so as to achieve higher academically. Even at that, teachers may help the learners develop their high self-belief to perform in Chemistry by employing creative teaching and learning strategies that will make the learners more interested to learn Chemistry concepts and practical.

REFERENCES

Akinsola E. F., and Nwajei A. D. (2013). Test anxiety, depression and academic performance assessment and management using relaxation and cognitive restructuringtechnique. *Psychology*, *4*, 18–24. https://doi.org/10.4236/psych.2013.46A1003.

Akinsola , M. K., Tella, A. and Tella, A. (2017). Correlates of academic procrastination and mathematics achievement of University undergraduate students in Eurasia. *Journal of Mathematics, Science & Technology Education,* **3**(4), 363-370 [Retrieved on February 11, 2022, from http://www.ejmste.com

Demeter, V.D. and Davis, E.S (2013). Procrastination as a tool: Exploring unconventional components of academic success. *Creative Education Journal* 4(7), 144-149. Retrieved from http://dx.doi.org/10.4236/ce.2013.47A2018.

Effiom, B. A., and Bassey, A. B. (2018). Test anxiety, self-esteem and academic performance among secondary school students in Cross River State. *International Journal of Education and Evaluation*, 2(9), 18-27.

Eman, D., Hind, A.G., Rufa, M., Nadiah, A. and Brouj, A. (2016). Relationship between test anxiety and academic achievement among undergraduate nursing students. *Journal of Education and Practical*, 7(2), 57-65.

Federal Ministry of Education (2012). *Nigeria education sector diagnosis: A framework for re-engineering the education sector.* Retrieved from http://planipolis.iiep.unesco.org/upload/Nigeria/Nigeria%20Education%20Sector%20Diagnosis.pdf.

Federal Republic of Nigeria. (2013). *National policy on education.* Lagos: NERDC Press

Ferrari, J. R., and Emmons, R. A. (2015). Methods of procrastination and their relation to self-control and self-reinforcement: An exploratory study. *Journal of Social Behaviour and Personality, 10,* 135-142.

Ilo, D. C., and Unachukwu, G. C. (2020). Test anxiety as predictor of senior secondary school students' achievement in English and Mathematics in Anambra State. *Socialscientia Journal of the Social Sciences and Humanities, 5*(1), 72 – 90

Kim, R. K. and Seo, E. H. (2015). The relationship between procrastination and academic performance: Ameta-analysis, Personality and Individual Differences, 82, 26-33.

Ngwoke, D. U. (2010). Creating enabling environment for equity in gender participation in global economic system.*International Journal of Educational Research*, 10(2), 18-29.

Ngwoke, D. U., Ossai, O.V., and Obikwelu, C.L. (2013). Influence of study skills on test anxiety of secondary school students in Nsukka Urban, Enugu state, Nigeria. *Journal of Educational Practice*, *4*(17), 162-165.

Ojokuku, G.O. (2017). *Understanding chemistry for senior secondary school.* Zaria: MacChin Multimedia Designers.

Ojukwu, M.O. (2016). Perception of students on poor performance in Chemistry in external examinations in Umuahia North Local Government of Abia State. *International Journal of Education and Literacy Studies*, 4(1), 67-73.

Okoli, J. N., and Egbunonu, R. N. (2012). Effect of blended learning approach on Nigerian senior secondary school students' achievement in biology.*IJERD International Journal of Education Research and Development, 4*(1), 92.

Okoye, K. R. E., and Onokpaunu, M. O. (2020). Relationship between self-esteem, academic procrastination and test anxiety with academic achievement of postgraduate diploma in education (PGDE) students in Delta State University, Abraka. *ISJASSR, 3*(1), 37 – 48.

Olaniyi, B. (2019). Causes of academic procrastination among high school pupils with learning disabilities in Ilorin State, Nigeria.*International Journal of Technology and Inclusive Education, 8*(1), 1 – 6.

Onwuegbuzie, A. J. (2014). Academic procrastination and statistics anxiety. Assessment Evaluation of Higher Education, 29(1), 3-19.

Owonwami, I.T., Sakiyo, J., and Filgona, J. (2017). Effect of test anxiety on secondary school students academic performance in mathematics in Dala education zone, Kano State, Nigeria. *Gombe Journal of Education (GOMJE) December, 2017. 1(2), 256-267.*

Ozer, B. U., Demir, A., and Ferrari, J. R. (2018). Exploringacademic procrastination among Turkish students: Possibegender differences in prevalence and reasons.*JournalofSocial Psychology, 149*(2), 241-257.

Samuel, N. N. C. (2008). *Effect of teaching relevant mathematical topics before and during the teaching of selected topics in Chemistry.* Unpublished MSc Thesis. Department of Science Education, Nnamdi Azikiwe University, Awka

Spielberger, C. D., and Sarason, I. G. (2019).*Stress and anxiety.* Washington. Hemisphere Publishing Cooperation.

Steinmayer, R., Meibner, A., Weidinger, A. F., and Wirthwein, L. (2018). Academic achievement. *Psychological Bulletin, 7*(2), 908 – 918.

Tuncay, E. (2018). The relationships among test anxiety, study habits, achievement, motivation, and academic performance among Turkish High School Students*: Journal of Education and Science. 3*(2), 90 – 99.

Yilmaz, M.B. (2017). The relation between academic procrastination of university students and their assignment and exam performances: the situation in distance and face-to-face learning environments. *Journal of Education and Training Studies* 5(9), 146-157. Retrieved from DOI:11114/jets.v5i9.2545b

Zadeh, R. Ebrahimi, S., and Mahdinejad, G. (2012). Studying test anxiety and its relationship with self-efficacy, metacognitive beliefs and some effective predictable variables. *European Journal of Social Services*, 30(4), 511-522

EFFECTIVENESS OF MULTIMEDIA INSTRUCTIONAL PACKAGE ON SECONDARY SCHOOL STUDENTS' ACADEMIC PERFORMANCE IN CHEMISTY

Onuigwe, Blessing Ukamaka & EGOLUM, Evelyn O. (*PhD*)
Department of Science Education, Nnamdi Azikiwe University, Awka

Abstract
The study investigated the effect of multimedia instructional package on secondary school students' academic performance in Chemistry. Three research questions guided the study and three null hypotheses were tested at .05 level of significance. The design adopted for this study was quasi-experimental design. Specifically the design is a pretest-post test non-equivalent control group design. The population of the study consisted of 2,109 SS1 students made up of 1,027 males and 1,082 females in 2020/2021 academic session in public secondary schools in Enugu Education Zone of Enugu State. The sample for this study comprised 415SS1 students drawn using multistage sampling procedure. The instruments for data collection were titled ''Chemistry Performance Test (CPT) which was duly validated by three experts from Faculty of Education, Nnamdi Azikiwe University, Awka. The reliability of CPT was determined using Kuder-Richardson formular 20 (k-R20) which yielded 0.84. Mean and standard deviation were used to answer the research questions and Analysis of Covariance (ANCOVA) to test the hypothe2ses. The findings of the study revealed among others that students taught Chemistry using multimedia instructional package effectively performed more than those taught using conventional teaching method. It is also revealed there was a significant difference between Chemistry students taught with multimedia instructional package and those taught with 8conventional teaching method in favour of those taught with multimedia instructional package.. Based on the findings, recommended and conclusions were made.
Keywords: Education, Chemistry, Multimedia Instructional Package and Performance.

Introduction

Education is critical for the advancement of science and technology, which contributes to the advancement of humanity. Science and technology play critical roles in the growth of nations around the world. As a result, education in the sciences and scientific education become critical for emerging countries to compete with developed countries. Science education is essential tool for achieving a society's technological growth and it also can assist a person in developing and realizing of their full potential.

According to Ogunode and Jegede (2019) science programs in Nigerian schools are given maximum attention due to their significant contribution to technological development of the country. It is extremely difficult for any nation to advance technologically if science education is not prioritized.

Obikezie et al (2020) defined science as a body of knowledge, a way of investigation and thinking in pursuit of an understanding of nature. The authors further stated that science is studied in school because it plays a vital role in the lives of individuals and the

development of a nation. Sciences in senior secondary schools are done in three major subject areas namely Biology, Chemistry and Physics. For the purpose of this study, Chemistry was considered.

Chemistry is one of the science subjects that occupy a central place in secondary schools curriculum, offering insights into the structure of matter, chemical reactions and real- world application. Itikpo, John and Ozoji (2021) defined Chemistry as branch of science that deals with changes in matter. Chemistry is a subject that deals with the study of matter and its behaviour when exposed to varying temperatures and pressure conditions. According to Samuel and Ukpoh (2021),Chemistry is the scientific study of the interaction of chemical substances that are constituted of atoms or subatomic particles: protons, electrons and neutrons. In the context of this study, Chemistry is the science that is concerned with composition, structure and properties of matter and the way that they react with other matters.

Oginni, Awobodu, Alanka, and Saibu (2013)Chemistry is commonly viewed "central science" as mastery of its concepts regarding the structure of matter serves as a foundation to further study in all sciences, the author further stated that chemistry performs the function of gate keeper for the future study of both pure and applied science, medicine, pharmacy, Engineering, Agricultural and all other professions at the secondary school level.

Proficien2cyin chemistry is not only crucial for academic success but also for understanding and addressing contemporary global challenges such as environmental sustainability, health and technology The teaching of Chemistry to students enables them to acquire knowledge and skills to understand and solve environmental issues such as various forms of pollution and global warming. Idika (2021) noted that chemistry students have a better chance of understanding global problems such as water and air pollution, poverty and global warming . Chemistry is a subject of universal interest in human development with regards to the utility of its knowledge in real life situations which is likely to be faced by many students Ahmad(2012).. Despite the important of Chemistry to humanity it is observed that students' performance in the subject is unsatisfactory.

According to WACE Chief Examiners' Report(2016 to 2021), showed that there is Chemistry student's poor academic achievement in Chemistry paper 2 (theory) over the years. This arises from students' having difficulties in tackling questions that required explanation and plotting of graphs. According to some researchers, one of the contributing factors to students' difficulty in learning Chemistry arises as a result of use conventional method in teaching the subject (Obikezie et al, 2020; Ibe et al 2021). The conventional method is the instructional strategy in which the teachers use the chalk- and- talk approach in teaching the student. Achufusi-Aka and Okpanachi (2021)observed that it is a common practice in Nigerian secondary for the teacher to stand by chalk and deliver lesson without students active participation. Oghomwen, Abdullahi, Kolo and Karickson(2021) noted that he conventional method can no longer meet the needs of our instructional delivery method and hence they gradually being replaced with multimedia technology which has the ability of making information and objects available in learning environment with speed and practical approach. Other researchers also asserted that these weaknesses in Chemistry

subject may be overcome by use of innovative teaching methods like cooperative teaching method, computer assisted instructions, multimedia instructional package e.t.c, (Egolum & Igboanugo (2017), Obikezie et al. 2021). For the purpose of this study, multimedia instructional package was considered.

In recent years, there has been a growing recognition of the potential of multimedia instructional packages to enhance the teaching and learning of science subjects, including chemistry. Harlliru and Muhyideen (2018) defined multimedia instructional package as a platform designed to solve problems of teaching and learning through the use of audio, audio visual, graphics, and animations to facilitate learning. Murali and Jaise (2016) asserted that multimedia allows teachers to address various levels of students in a classroom due to the fact that it enables students to see, hear, and imagine what is being taught thereby help increase students' academic performance in any subject. Multimedia tools encompass a range of technologies, from video lectures and animations, to interactive stimulations and digital textbooks. These tools have the capacity to present complex concepts in a more accessible and interactive manner, catering to the diverse learning preferences of students in the digital age. Akinbobola (2015) averted that since all students have different learning styles, it is the function of the teacher to identify these learning styles and find appropriate instructional strategies that will match the preferred styles in order to enhance effective teaching and learning process for improvement on academic performance

Academic performance is the assessment of a student's ability in a variety of academic areas; Class room performance, graduation rate and standardized test that are commonly used by teachers' and education administrators to evaluate the students accomplishment. Shahjahan, et al (2021).Performance is assessment and examination is the criteria for analyzing ones level of academic performance. Through a comprehensive review of existing literature and an empirical investigation involving a diverse group of students, so many findings have been made to give insight into the use of multimedia as a pedagogical approach. Akinbadewa and Sofowora (2020) reported that multimedia instructional packages used in teaching and learning Biology in secondary schools prove effective to students' performance than the use of conventional teaching method. The authors further revealed that there was no significant difference in academic performance between male and female students taught Biology using multimedia instructional packages. Similarly, Alamina and Otuturu (2019) revealed that female students had a greater academic performance than their male counterpart in the use of multimedia instructional package because the package significantly enhanced academic performance of female students in Biology than their male counterpart but there was no significant difference between male and female students taught with multimedia instruct. Ayodeji (2021) revealed among others that the performance of students taught mathematics using multimedia instructional strategy was significantly better than the performance of students taught mathematics using conventional method thereby making multimedia instructional package more effective to conventional method. The author further revealed that there was no significant difference in the academic performance of male and female students taught mathematics using multimedia instructional strategy. Eze et al (2020) revealed that

teaching with multimedia was more effective in enhancing student's performance in mechanical trade.

From the look of things, it seems that most of the studies done as cited above on multimedia instructional packages where done in other areas like Mathematics, Mechanical trade and Biology. From the researchers best of knowledge, no work has been done on effectiveness of multimedia instructional strategy on secondary school students academic performance in Chemistry. Secondly, base on WAEC individual Chief examiners' report 2016-2021, students weaknesses in Chemistry paper 2 (theory) are noticed in plotting of graph especially in separation methods, atomic structure, chemical industry related questions, Boyle's law and Charles law. According to the report, this has contributed to low performance of students in senior secondary school certificate examination in those years. Base on this, the researchers wish to investigate whether multimedia instructional packages can effectively enhance secondary school Chemistry students' academic performance in Enugu state.

Purpose of the Study
The purpose of this study was to investigate the effectiveness of multimedia instructional package on secondary school students' academic performance in Chemistry in Enugu state. Specifically, the study sought to investigate the:
5. The mean performance scores of Chemistry students taught with multimedia instructional package and that of those taught using conventional teaching method
6. The mean performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method
7. The interaction effectiveness of gender and multimedia instructional package on students' academic performance scores in Chemistry.

Research Questions
The following research questions guided the study:
1. What are the mean performance scores of Chemistry students taught with multimedia instructional package and that of those taught using conventional teaching method?
2. What are the mean performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method?
3. What is the interaction effect of gender and multimedia instructional package on students' academic performance scores in Chemistry?

Hypotheses
The following hypotheses were tested at 0.05 level of significance.
1. There is no significant difference in the mean performance scores of students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method.

2. There is no significant difference in the mean performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method.
3. There is no significant interaction effectiveness of gender and multimedia instructional package on students' academic performance scores in Chemistry.

Methods

The design of the study was a quasi-experimental design. Quasi-experimental design is an experiment where a random assignment of subjects to experimental or control group is not possible (Nworgu, 2015). The population of the study was 2,109 SS1 Chemistry students in Enugu Education Zone. The sample for the study comprised of 415 SS 1 Chemistry students from four schools used for the study in Enugu Education Zone of Enugu State using multistage sampling procedure. Purposive sampling technique was used to draw four schools from the Enugu education zone on the basis that most schools selected have double streams of Chemistry classes, most of whom have presented candidates in secondary school senior certificate examination for at least five years and have qualified Chemistry teachers of not less than six years of experience. Simple random sampling technique was used to draw four intact classes from the six science classes from the two schools used for the study which were assigned to both experimental and control groups. The two schools (treatment group) that were exposed to multimedia instructional package consisted of 198 students (95 males and 103 females) and the two schools (control group) who were exposed to conventional teaching method constituted of 217 students (99 male and 118 female). The study covered a period of four weeks. First week was for familiarizing visit with the Chemistry teachers in the selected schools who act as research assistants. First day of the second week was used to administer a pretest achievement test to all the Chemistry students involved in the study. Second day of the second week was used to teach the Chemistry concepts of separation methods, chemical industry, atomic structure and Boyle's law and Charles's law in the experimental group schools using multimedia instructional package of computer animation in treatment group and conventional teaching method in control group for three weeks. The Chemistry teachers were given detailed information and instructions concerning the study. The teachers in the two groups used lesson plan prepared by the researchers for multimedia instructional package of computer animation and convention teaching method. At the end of the fourth week, both experimental groups and control group was post tested based on what they are taught. Marks were awarded to each question prepared for both experiment test groups and control group performance test which constituted twenty (20) multiple choice questions. If all the questions were answered correctly by the student, his/she is entitled to twenty (20) marks that is one mark per questions. The pre test scores were recorded as performance of the students in the two groups. Post test scores were recorded also as performance of the students when taught with multimedia instructional package and conventional teaching method. The reliability of the instrument was established using Cronbach alpha at 0.84. The instruments for data collection were Chemistry Performance Test (CPT) which was designed by the researchers. The CPT consisted of 20 items taken

from West African Senior School Certificate Examination (WASSCE) Chemistry past questions but modified by the researchers based on the focused topics of separation methods, chemical industry, atomic structure and Boyle's law and Charles's law. To ensure the reliability of the instrument, the twenty five (20) objective questions were administered on a group of forty students outside the place of this study after face and content validation of three expect, two from Department of Science Education Nnamdi Azikiwe University Awka, and one from Department of Educational Foundation Nnamdi Azikiwe University Awka. The results were subjected to Kuder 20 Richardson test to determine the reliability coefficient. A mean coefficient of 0.84 was obtained Mean and standard deviation was used for answering research questions and Analysis of Covariance (ANCOVA) used to test the hypotheses.

Results
Research Questions 1
What are the mean performance scores of Chemistry students taught with multimedia instructional package and that of those taught using conventional teaching method?

Table 1: Mean Pre-test and Posttest Performance Scores of Students taught Chemistry using MIP and those taught using CTM

Method	N	Pretest Mean	Posttest Mean	Mean Gain	Pretest SD	Posttest SD
MIP	198	38.05	86.31	48.26	6.64	4.35
CTM	217	32.49	60.04	27.55	5.01	3.99

Data presented on Table 1 showed that students taught Chemistry with multimedia instructional package had pre-test mean performance score of 38.05 with standard deviation of 6.64, their posttest mean performance score was 86.31 with 4.35 value of standard deviation and mean gain of 48.26. Those students that were taught Chemistry with conventional teaching method had pre-test mean performance score of 32.49 with standard deviation of 5.01, their posttest mean performance score was 60.04 with 3.99 values of standard deviation and 27.05 mean gains.

The mean performance gain difference between students taught Chemistry using multimedia instructional package and those taught using the conventional teaching method was 20.71 in favour of the experimental group. The result indicated that students taught Chemistry using multimedia instructional package had higher performance score than those taught using conventional teaching method.

Research Questions Two
What are the mean performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method?

Table 2: Mean Pre-test and Post-test Performance Scores of Male and Female Students taught Chemistry using Multimedia Instructional Package and that of those taught using Conventional Teaching Method

	Gender	N	Pretest Mean	Posttest Mean	Mean Gain	Pretest SD	Posttest SD
MIP	Male	95	30.01	87.08	57.07	5.01	4.47
	Female	103	27.43	76.11	48.68	5.08	4.03
CTM	Male	99	21.05	79.67	58.62	5.76	5.15
	Female	118	19.99	71.81	51.82	5.99	5.38

Table 2 shows that the male students taught Chemistry using multimedia instructional package had mean gain performance score of 57.07, while the females had mean gain performance score of 48.68. The mean performance gain difference between male and female students taught Chemistry using multimedia instructional package was 8.39 in favour of male students. The results show that the male students Chemistry using multimedia instructional package yielded greater mean gain performance score than female students. The male students taught Chemistry using conventional method had mean gain performance score of 58.62, while the females has mean gain performance score of 51.82. The mean performance gain difference between male and female students taught Chemistry using conventional teaching method was 6.8 in favour of male students. The results show that the male students taught Chemistry using conventional teaching method yielded greater performance mean gain score than female students. The findings indicated that male students taught Chemistry using multimedia instructional package and conventional teaching method yielded greater mean performance score than female students.

Research Questions 3
What is the interaction effect of gender and multimedia instructional package on students' academic performance scores in Chemistry?

Table 3: Mean and standard deviation of interaction effect of gender and multimedia instructional package on students' academic performance in chemistry

	Gender	N	Mean	Standard Deviation
Experimental Group	Male	95	39.44	3.57
	Female	103	35.03	3.40
Control Group	Male	99	31.02	3.27
	Female	118	29.40	3.21

Result of the analysis in Table 3 revealed that male students exposed to experimental group (multimedia instructional package) had a higher mean performance score of 39.44 and standard deviation of 3.57 as against their male counterpart exposed to conventional method that had mean performance score of 31.02 with standard deviation of 3.27. On the other hand, female students exposed to experimental group (multimedia instructional package) had a higher mean performance score of 35.03 and standard deviation of 3.40 as against their female cou2nterpart exposed to conventional method that had mean

performance score of 29.40 with standard deviation of 3.21. The results do not suggest ordinal interaction effect between gender and multimedia instructional package on students' performance in Chemistry. This was because at all the levels of gender, the mean performance scores were higher for students in the experimental group than those in the conventional method.

Hypothesis One
There is no significant difference in the mean performance scores of students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method.

Table 4: ANCOVA on Difference between the Mean Performance Scores of Students taught Chemistry using Multimedia Instructional Package and that of those taught using Conventional Teaching Method

Source of variation	SS	Df	MS	F	P-value	Decision
Corrected Model	31301.622[a]	2	15650.811	433.220	.001	
Intercept	27654.117	1	27654.177	3082.087	.000	
Pretest	.496	1	.496	.089	.765	
Method	20087.111	1	20087.11	568.102	.001	Sig.
Error	24779.119	76	326.041			
2Total	11232.901	79				
Corrected Total	16543.407	78				

Table 4 shows that at 0.05 level of significance, 1df numerator and 91 df denominator, the calculated F is 568.102 with p-value of .001 which is less than 0.05. Thus, the null hypothesis was rejected. Therefore, there is significant difference in the mean performance scores of students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method in favour of those taught with multimedia instructional package.

Hypothesis Two
There is no significant difference in the mean performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method.

Table 5: ANCOVA for Testing Significance Difference in the Mean Performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method

Source	SS	Df	Mean Square	F	Sig.	Decision
Corrected Model	46754.366[a]	4	11688.592	454.117	.000	
Intercept	33478.654	1	33478.654	3160.120	.000	
Pretest	.076	1	.076	.020	.854	
Gender	38876.235	1	38876.235	917.110	.074	

Method	287.453	1	287.453	8.117	.081	
Method * Gender	8.866	1	8.866	.831	.310	Not Sig.
Error	4090.777	92	44.465			
Total	3981.144	95				
Corrected Total	3753.108	94				

Table 14 shows that at 0.05 level of significance, 1df numerator and 91 df denominator, the calculated F is 0.831 with p-value of 0.310 which is greater than .05. Thus, the null hypothesis was not rejected. Therefore, there is no significant difference in the mean performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method.

Hypothesis Three
There is no significant interaction effect of gender and multimedia instructional package on students' academic performance scores in Chemistry.

Table 6: ANCOVA for testing significance of interaction effect of gender and multimedia instructional package on students' performance in chemistry

Source	SS	Df	Mean Square	F	Sig.	Decision
Corrected Model	37113.113[a]	4	9278.278	100.113	.000	
Intercept	45655.515	1	45655.515	2454.141	.000	
Pretest	.245	1	.245	.007	.611	
Gender	34324.113	1	34324.113	710.113	.002	
Method	161.186	1	161.186	5.1690	.010	
Method * Gender	7.008	1	7.008	.443	.167	NS
Error	1767.909	81	19.864			
Total	32146.154	86				
Corrected Total	223433.511	85				

Table 6 shows that at 0.05 level of significance, 1df numerator and 91 df denominator, the calculated F is 0.443 with P value of 0.167 which is greater than 0.05. Thus, the null hypothesis was not rejected. Therefore, there is no significant interaction effect of gender and multimedia instructional package on students' performance in Chemistry.

Discussion
The finding of the study revealed that students taught Chemistry using multimedia instructional package had higher performance score than those taught using conventional teaching method and there was a significant difference between Chemistry students taught with multimedia instructional package and those taught with conventional teaching method in favour of those taught with multimedia instructional package. This is in line with the finding of Ayodeji (2021) who revealed that the performance of students taught mathematics using multimedia instructional strategy was significantly better than the performance of students taught mathematics using conventional method. The findings is also in line with that of the study of Akinbadewa and Sofowora (2020), who reported that multimedia instructional packages used in teaching and learning Biology in secondary

schools proved better to students' performance than the use of conventional teaching method. The result is also inconsonance with the findings of Ayodeji (2021) and Eze et al (2020) who revealed that there was no significant difference in the performance of male and female students taught mathematics and mechanical trade respectively using multimedia instructional strategy. The result of this study is probably due to the fact that visual feature of multimedia instructional package provides opportunity for teachers to present and explain instruction as they appear in real life. The study revealed that male Chemistry students taught with multimedia instructional package and conventional teaching method had a better performance than their female counterpart but there were no significant difference among them. The result was in line with the findings of Akinbadewa and Sofowora (2020) who revealed that there was no significant difference between male and female students taught Biology using multimedia instructional packages. The findings of this study was in contrast to that of Alamina and Otuturu (2019) who revealed that female students had a greater performance than their male counterpart in use of multimedia instructional package because the package significantly enhanced academic achievement of female students in Biology than their male counterpart. The no significant difference as revealed in this study could be as a result that multimedia instructional package take equal care of both genders in instruction.

Conclusions

Based on the result obtained from this study, it was concluded that the multimedia instructional package had proved to be an effective method of teaching Chemistry. Also, multimedia instructional package was found to be superior to conventional method of teaching Chemistry to senior secondary school students.

Recommendations

The researchers formulated the following recommendations based on the findings and conclusions made from the study:

1. Curriculum experts and planners should add or modify some contents in Chemistry curriculum to incorporate the use of multimedia instructional package in teaching of Chemistry to improve students' academic performance.
2. Chemistry teachers should use multimedia instructional package in teaching the subject in senior secondary schools.
3. Secondary Education Management Board should organize annual training programme for Chemistry teachers on the use of multimedia instructional package in teaching the subject.

REFERENCES

Achufsi-Aka, N.N. &Okpanachi, E.E. (2021). Effect of collaborative learning strategy on students' academic achievement in chemistry in Onitsha Education Zone, Anambra State. *International Scholars Journal of Arts and Social Sciences Research,* 3(3), 182-189.

Akinbadewa, B.O. &Sofowora, O.A. (2020). Effectiveness of multimedia instructional learning packages in enhancing secondary school students' attitudes toward biology. *International   Journal on Studies in Education, 2*(2), 119-133.

Alamina, J.I. &Otuturu, F.G. (2019). Effects of multimedia instructional package on students' academic performance in biology in senior secondary schools in Rivers State. *Rivers   State University Journal of Education (1), 74-83.*

Ayodeji, J.E. (2021). Effects of multimedia instructional strategy on senior school students' performance and retention in mathematics. *Anatolian Journal of Education, 6*(2), 193-206.

Cyril, M.U. (2016). Effects of multimedia instruction on retention and achievement of basic machining skills in mechanical craft practice. *International Journal of Education and Information Technology, 2*(1), 1-7.

Egolum, E.O. &Igboanugo, B.I. Effects of computer assisted instruction and power point presentation on academic achievement of secondary school chemistry students. *Journal of Science Education*, 13(1), 129-135.

Eya, N.M. &Ezeh, D.N. (2020).Meta-analysis of influence of gender on students' academic achievement in chemistry in Nigeria. *Journal of Chemistry Society of Nigeria, 45*(4), 615 -619.

Eze, T.I., Olumoko, B.O. & Obi, M. N. (2020).Effect of multimedia instructional strategy on students' academic achievement in mechanical trades in Technical Colleges. *Journal of   Education and Development, 4*(2), 38-43.

Ibe, F.N., Obikezie, M.C., Chikendu, R.E. (2021). <u>Effect of improvised instructional materials on Chemistry students' academic retention in secondary schools</u>. *Journal DOI: www. doi. org*

Idika, M.I. (2021). Effect of visualized case-based learning strategy on students' academic performance in Chemistry in Ibadan Metropolis, Nigeria. *African Journal of Teacher Education, 10*(1), 106-126.

Tikpo, G., John, F. &Delmang, T.K. (2021).The use of model-lead test strategy in enhancing achievement of senior secondary two students in organic chemistry in Benue State, Nigeria. *British Journal of Education, 9*(4), 81-92.

Margaret Oginni, A., Yetunde Awobodu, V., Olusegun Alaka, M., &Olajide Saibu, S. (2013). School Factors as Correlates of Students' Achievement in Chemistry. *International Journal for Cross-Disciplinary Subjects in Education*, 3(Special 3), 1516–1523. https://doi.org/10.20533/ijcdse.2042.6364.2013.0213.

Murali, V. &Jaise, J. (2016).Teacher-assisted multimedia instructional package-an assured modus to enhance basic process skills in physics of secondary school students. *International Journal of Innovative Research in Science, Engineering and Technology,   5*(10), 18646-18654.

Nworgu, B.G. (2015). *Education research: Basic issues and methodology (3ʳᵈed.)*. Enugu: University Trust Publishers.

Obikezie, C. M., Abumchukwu, A. A & Eke, J. A. The challenges of e- learning faced by secondary school students in chemistry during COVID-19 lockdown in Awka South Local Government Area of Anambra State. *BSU Journal of Science, Mathematics & Computer Education, 1 (2), 21-30.*

Oghomwen, J.S., Abdullahi, A.N., Kolo, J. &Karickson, P.K. (2021).Effects of multimedia technology on instructional delivery in commerce in selected secondary schools in Bida Metropolis. *International Journal of Management, Social Sciences, Peace and Conflict Studies, 4*(1), 347-354.

Ojo, G.A. (2019). Effects of multimedia instructional materials on Ekiti state secondary school students' academic performance in social studies. *Social Science Education Journal,2*(1), 143-149.

Orodho, D.S. (2021). Efficacy of differentiated instruction and conventional methods on low achievers' interest in learning and gender. *ABC Research Alert, 8*(3), 115-128.

Samuel, I.R., &Ukpoh, A. (2021). Influence of teachers' attitude towards practical chemistry on senior secondary schools students' interest and achievement in Nasarawa state, Nigeria. *International Journal of Innovative Psychology & Social Development,* 9(3), 139-149.

WAEC, (2016-2021). Chief Examiners Report. Lagos: West African Examinations Council.

SOCIAL INTELLIGENCE AND SELF EFFICACY AS CORRELATES OF ACADEMIC ACHIEVEMENT IN MATHEMATICS AMONG SECONDARY SCHOOL STUDENTS IN ABIA STATE, NIGERIA

Ahukanna Henry Ndubuisi
Department of Psychological Foundations, Faculty of Education ABSU
ahukanna.henry@abiastateuniversity.edu.ng
08033167548

Abstract
The study investigated social intelligence and self-efficacy as correlates of academic achievement in Mathematics among secondary school students in Abia State, Nigeria. The study adopted a correlational research design. Three research questions were raised and three 2hypotheses were formulated at 0.05 level of significance to guide the study. The population of the study comprised 3,287 SS1 students drawn from 248 public senior secondary schools in the seventeen (17) Local Government Areas (L.G.As) encompassing the three education zones that make up Abia State. A sample size of 357 students was selected from the population using accidental sampling technique. One researcher developed instrument titled "Social Intelligence and Self -Efficacy Scale" (SISES) was used together with the continuous assessment "Mathematics Test Scores" (MTS) of the students to carry out this study. The instruments were validated by experts in Measurement and Evaluation and Mathematics. The instrument had reliability coefficient of 0.87 determined using test re-test method. The collected data was analyzed using Pearson's product moment correlation. The result of the study revealed that: self-regulation, self-awareness and mastery of experience all had high positive relationship with academic achievement in Mathematics. The researcher made some recommendations among which were that; Self regulation techniques such as self punishment, self instruction, self monitoring, thought stopping technique and turtle technique should be by students improve their self regulation as it has far reaching positive relationship with their academic achievement in Mathematics.
Keyword: Social Intelligence, Self –Efficacy, Academic Achievement, Mathematics

INTRODUCTION
Mathematics is an aspect of science that deals with structure, order and relations. Mathematics as a subject of instruction is essential and existential in our contemporary society. It holds the potency of making individuals to apply mathematical knowledge, skills and values to daily 2problems and hence develop the individuals to a level that they are intellectually and economically stable (Anyakoha, 2016). Recently, there has been a frequent report on the decline on students' academic achievement in Mathematics in Nigeria. This has become an issue of worry to many due to the great role Mathematics education plays in technological and national development (Popola, 2012). The study seeks to unravel how social intelligence and self-efficacy are correlates of academic achievement in Mathematics among secondary school students in Abia State, Nigeria. The components

of social intelligence and self-efficacy that were studied include; self-regulation, self awareness and mastery of experience.

Self-regulation is the ability to control oneself, it borders on exercising restraints over impulses. S2ahranavard, Miri, & Salehiniya (2018) investigated the relationship between self-regulation and educational overall performance in students and found that there is a significant correlation between self-regulation and academic overall performance among students of Payame Noor University, whereas it is not enormous for public college students. Self-awareness is the knowledge an individual has about his strength and limitations in relation to his environment. Oba-adenuga, Ezeribe, Oba-adenuga (2022) investigated the relationship between self-awareness and task performance in selected private universities in Ogun State, Nigeria and found among other things that self-awareness had huge relationship with project overall performance (r (296) = 0.833, p < 0.05). Based on the result of the study, it was consequently endorsed that the control of private universities have to train their instructional body of workers to gather the talents associated with self-awareness as a radical understanding of oneself is a critical determinant of self-efficacy for improving non-public overall performance.

Mastery of experience is the degree to which an individual has mastered his/her learning experiences. Toheed and Ali (2019) examined effects of mastery learning model on academic achievement of secondary school students in Mathematics. The result revealed that the overall performance of the scholars' experimental group was better than the ones of the control groups. It was concluded that mastery of learning experience improved educational achievements of students in city and rural regions of district Mardan. Until now, only few studies have been conducted on this regard. It is against this background that the researcher conducted the study.

Statement of the Problem

Mathematics is considered as a necessary part of general education all over the world. It features prominently in the school system from primary to secondary levels. In Nigeria, Mathematics is a core subject for students going through the formal education process. Unfortunately, the subject seems to be disliked by most students at the secondary school level; there has been public outcry and complaints over students' poor achievement in Mathematics in external examinations such as general certificate examination and senior school certificate examinations (GCE/SSCE). Researchers have identified; lack of adequate instructional materials, learners' negative attitudes towards Mathematics, Mathematics teacher's nonchalant attitudes and their boring teaching methodology and lack of Mathematics -English-Concepts comprehension among the students and the teachers. There is a need to address the under achievement in Mathematics as it affects students' academic prospects in internal and external examinations, impedes their sense of reasoning, handicaps their numerical abilities, promotes examination malpractice and culminates into the production of educated illiterates in our society. The likely correlates of poor academic achievement in Mathematics may be understood better from the points of view of students' social intelligence and self-efficacy given that the students in question are unique configuration of forces operating within environments which are uniquely

configured as well. Therefore, the researcher deemed it necessary to conduct a study on social intelligence and self-efficacy as correlates of academic achievement in Mathematics among secondary school students in Abia State.

Purpose of the Study

The aim of the study was to investigate social intelligence and self-efficacy as correlates of academic achievement in Mathematics among secondary school students in Abia State, Nigeria.

Specifically, the study sought to:
5. Determine the extent to which self regulation relate to academic achievement in Mathematics among secondary school students in Abia State;
6. Investigate the extent to which self-awareness relate to academic achievement in Mathematics among secondary school students in Abia State;
7. Examine the extent to which mastery of experiences relate to academic achievement in Mathematics among secondary school students in Abia State;

Research Questions

The following questions guided the conduct of the study:
1. To what extent does self-regulation relate to academic achievement in Mathematics among secondary school students in Abia State?
2. 2To what extent does self-awareness relate to academic achievement in Mathematics among secondary school students in Abia State?
3. To what extent do mastery of experiences relate to academic achievement in Mathematics among secondary school students in Abia State?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:
1. There is no significant relationship between self- regulation and academic achievement in Mathematics among secondary school students in Abia State.
2. There is no significant relationship between self-awareness and academic achievement in
    Mathematics among secondary school students in Abia State.
3. There is no significant relationship between mastery of experience and academic performance in Mathematics among secondary school students in Abia State.

Methods

The study adopted a correlational design. The study was conducted in Abia State. The population of the study was 3,287 public senior secondary school (SS1) students' drawn from 248 senior secondary schools in the seventeen (17) Local Government Areas (L.G.As) encompassing the three education zones that make up Abia State (Ministry of Education, Abia State, 2023). The sample of the study consisted of 357 (11%) of public senior secondary school (SS1) students in Abia State. Abia State has three education zones among which are: Umuahia, Ohafia and Aba education zones. A total of 119 (SS1) students

were selected from three schools in each education zone, making it a total of 357 secondary school students. The SS1 students were used for the study owing to the fact that they are in an adjustme8nt class that serves as the foundation senior secondary school. The accidental sampling technique was used to select the sample for the study. The instrument for data collection was one researcher developed instrument titled: "Social Intelligence and Self-Efficacy Scale" (SISES). The instrument: "Social Intelligence and Self-Efficacy Scale" (SISES) was validated based on face and content validity by experts in Measurement and Evaluation and Mathematics. The reliability coefficient of the instrume2nt was determined to be .87 using test re-test method. The Continuous Assessment Mathematics test scores of the students was deemed reliable enough for the study as it was a summation of the students assignment scores, midterm test scores and third term test scores in Mathematics. The research questions and hypotheses were answered and tested using Pearson's product moment correlation statistics while the r coefficients was subjected to critical probability value at 0.05 alpha level of significance with regard to the null hypotheses. All data was subjected to analysis using statistical package for social science.

Results

Research Question One: To what extent does self-regulation relate to academic achievement in Mathematics among secondary school students in Abia State?

Hypothesis One: There is no significant relationship between self-regulation and academic achievement in Mathematics among secondary school students in Abia State.

Table 1: Pearson's Product Moment Analysis of the extent to which Self-regulation Relate to Academic Achievement in Mathematics among Secondary School Students in Abia State

Correlations		self-regulation	academic achievement in Mathematics
self-regulation	Pearson Correlation	1	.858[*]
	Sig. (2-tailed)		.013
	N	357	357
academic achievement in Mathematics	Pearson Correlation	.858[*]	1
	Sig. (2-tailed)	.013	
	N	357	357
*. Correlation is significant at the 0.05 level (2-tailed).			

Table 1 above shows the extent to which self-regulation relate to academic achievement in Mathematics among secondary school students in Abia State. An overview of the table revealed that there exists a correlation coefficient of .858 between the two variables. This

evince that self-regulation has a high positive relationship with the academic achievement of the students in Mathematics. The table further revealed that the existent relationship between the two variables has a p- value of .013 which is below the critical p- value of 0.05. The null hypothesis therefore is not accepted. The implication is that the extent to which self-regulation relate to the academic achievement of the students in Mathematics is statistically significant.

Research Question Two
To what extent does self-awareness relate to academic achievement in Mathematics among secondary school students in Abia State?
Hypothesis Two: There is no significant relationship between self-awareness and academic achievementin Mathematics among secondary school students in Abia State.
Table 2: Pearson Product Moment Analysis of the extent to which Self-awareness Relate to Academic Achievement in Mathematics among Secondary School Students in Abia State

Correlations		self-awareness	academic achievement in Mathematics
self-awareness	Pearson Correlation	1	.944[**]
	Sig. (2-tailed)		.001
	N	357	357
academic achievement in Mathematics	Pearson Correlation	.944[**]	1
	Sig. (2-tailed)	.001	
	N	357	357
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 2 above shows the extent to which self-awareness relate to academic achievement in Mathematics among secondary school students in Abia State. An overview of the table revealed that there exists a correlation coefficient of .944 between the two variables. This evince that self-awareness has a high positive relationship with the academic achievement of the students in Mathematics. The table further revealed that the existent relationship between the two variables has a p- value of .001 which is below the critical p- value of 0.05. The null hypothesis therefore is not accepted. The implication is that the extent to which self-awareness relate to the academic achievement of the students in Mathematics is statistically significant.

Research Question Three: To what extent do mastery of experiences relate to academic achievement in Mathematics among secondary school students in Abia State?

Ho3: There is no significant relationship between mastery of experiences and academic achievement in Mathematics among secondary school students in Abia State.

Table 3: Pearson Product Moment Analysis of the extent to which Mastery of Experiences Relate to Academic Achievement in Mathematics among secondary school students in Abia State

Correlations			
		Mastery of experiences	**Academic achievement in Mathematics**
Mastery of experiences	Pearson Correlation	1	.940[**]
	Sig. (2-tailed)		.002
	N	357	357
Academic achievement in Mathematics	Pearson Correlation	.940[**]	1
	Sig. (2-tailed)	.002	
	N	357	357
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 3 above shows the extent to which mastery of experiences relate to academic achievement of students' in secondary school Mathematics in Abia State. An overview of the table revealed that there is exists of correlation coefficient of .940 between the two variables. This evince that mastery of experiences has a high positive relationship with the academic achievement of the students in Mathematics. The table further revealed that the existent relationship between the two variables has a p- value of .002 which is below the critical p- value of 0.05. The null hypothesis therefore is not accepted. The implication is that the extent to which mastery of experiences relate to the academic achievement of the students in Mathematics is statistically significant.

Discussion

The result of the finding revealed that self-regulation has a high positive relationship with academic achievement in Mathematics among secondary school students in Abia State. This is explicable because self-regulation is characterized by being reserved, calculative, having high self-control, meticulous and serious. The result of the study consolidates that of Sahranavard et al. (2018) which revealed that there is a significant correlation between self-regulation and academic overall performance among students of Payame Noor University. The finding of hypothesis one revealed that that the extent to which self-regulation is related to the academic achievement of the students in Mathematics is statistically significant.

The finding of the result also revealed that self awareness has a high positive relationship with the academic achievement of the students in Mathematics. Self-awareness creates an enabling environment needed for high academic achievement to flourish. This result of this study improves the frontiers of knowledge pertaining to the

findings of Oba-adenuga et al. (2022) which revealed that self-awareness has huge relationship with project overall performance (r (296) = 0.833, p < 0.05). The finding of hypothesis two revealed that the extent to which self awareness is related to the academic achievement of the students in Mathematics is statistically significant.

The findings of the result further revealed that mastery of experiences has a high positive relationship with the academic achievement of the students in Mathematics. What this means is that the more students master learning experiences, the higher their academic achievement in Mathematics. This consolidates the findings of Toheed and Ali (2019) which revealed that mastery of learning experience improved educational achievements of students in city and rural regions of district Mardan. The finding of hypothesis three revealed that the extent to which mastery of experiences is related to the academic achievement of the students in Mathematics is statistically significant. The mastery of experience in Mathematics is decisive therefore and should be prioritized. The students need to upgrade their psychomotive development in Mathematics from guided response to mechanism and complex overt response.

Conclusion

Based on the findings of the study, the researcher concluded that self- regulation endears students to excel in Mathematics. Self-awareness enhances the academic achievement of the students' in Mathematics while mastery of experiences is akin to high academic achievement in Mathematics among the students.

Recommendations

The researcher recommended as follows:

1. Self regulation techniques such as self punishment, self instruction, self monitoring, thought stopping technique and turtle technique should be by students improve their self regulation as it has far reaching positive relationship with their academic achievement in Mathematics.
2. Aptitude tests, Socratic dialogue and orientation toward meaning should be used by teachers to enhance the self-awareness of the students in relation to their academic performance in Mathematics.
3. Teachers should organize extramural classes for the students to enable them master their Mathematical studies.

REFERENCES

Anyakoha, C. I. (2016). Single parenting as correlate of academic performance of students in unity secondary school in south east geo-political zone in Nigeria. *Journal of Contemporary Research on Parenting, 5*(2), 7-15.

Anyakoha, C. I., & Anyanwu, G. A. (2016). The relationship between academic goal orientation and the academic achievement of school-aged children. *Journal of Home Economics Research, 7*(5), 242-247.

Oba-adenuga, O. A., Ezeribe, S. N., & Oba-adenuga, M. A. (2022). Relationship between self-awareness and task performance in selected private universities in Ogun State, Nigeria. *KIU Journal of Social Sciences, 8*(3), 123-130.

Popoola, A. D. (2012). On the density-profile slope of scholastics. *Journal of Scholastic Development, 5*(9),1-7.

Sahranavard, S., Miri, M. R., &Salehiniya, H. (2018). The relationship between self-regulation and educational performance of students. *Educational Health Promotion, 7*(5), 154-170.

Toheed, L., & Ali, A. (2019). Effects of mastery learning model on academic achievement of secondary school students in mathematics. *European Journal of Educational Research, 4*(4), 232-238.
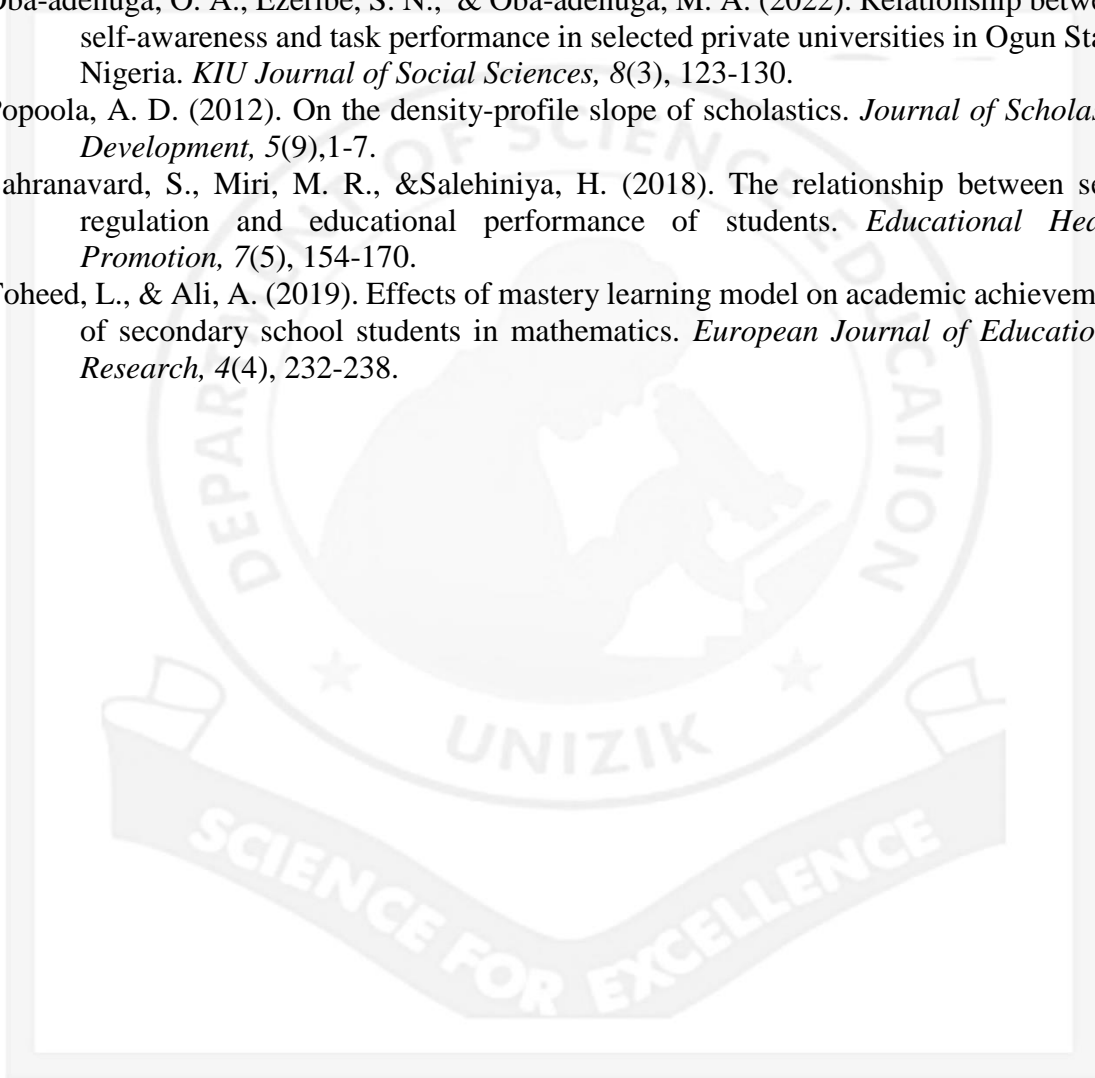
EFFECT OF VIDEO - ANALYSIS ON TEACHING PRACTICE PERFORMANCE AMONG COLLEGES OF EDUCATION STUDENTS IN NORTH -WEST ZONE, NIGERIA

H. Muhammad-Lawal[a], J.S. Mari[b], I.A. Usman[c], &A. U. Abubakar[c]
[a]Department of Chemistry, Federal College of Education, Zaria [b]Department of Science Education, Faculty of Education, Ahmadu Bello University, Zaria [c] Institute of Education, Ahmadu Bello University, Zaria.
e-mail: hadizamuhammad03@gmail.com
08060101203

Abstract
This study investigated the impact of video analysis on teaching practice performance among Colleges of education in North -West Zone Nigeria. The research design adopts for the study was pure experimental design specifically, Post-test only Control Group design. The population consists of 1,770 NCE II Chemistry Students from eight(8) Colleges of Education, a sample of 105 N.C.E II were drawn from the population using simple random sampling technique and were categorized into Experimental and Control groups. Teaching Practice Performance Assessment Sheet (TPASS) with a reliability coefficient of 0.79 determined using Pearson Product Moment Correlation (PPMC) was the instrument used for data collection. One research question and one research hypothesis were raised to guide the study and analysed using Mean and independent t- test. Findings from the study revealed that Pre-service Chemistry teachers exposed to Video- self, and peer - analysis performed better in their teaching practice exercise than their counterparts in the Control group who were not exposed to video self and peer analysis. Based on the findings of the study, it was concluded that video -self, and peer-analysis of assessment enabled pre-service chemistry teachers perform better in their teaching practice exercise. Based on the findings of the study it was recommended that video should be used as a tool for observation and feedback during teaching exercise in teacher education programmes.
Keywords: Teacher Education, Teaching Practice, Video Analysis

Introduction

Quality teachers are very important to the success of any educational system and to a greater extent of the success of any nation. Aina (2014) opines that the quality of any educational system depends on the quality of teacher qualifications and competency. Teacher quality is said to be an 2important factor in determining students' achievement even after considering their prior knowledge, peer group influence and family background and character. Riley(2009) differentiates between teacher quality, which he describes as what teachers "do" and teaching quality which he considered as what students "learn". Churchill, Ferguson, Godinho, Johnson, Keddie, Lett (2011) were of the view that teachers' quality incorporates teachers' identity together with knowledge and skills in pedagogy, content and theory. They were of the view that teaching quality depends upon the ability to personalize learning, nurture a supportive classroom and implement a relevant

curriculum and constant monitoring and evaluating the performance of their students and this could be achieved through Teacher Education Programme.

For any Educational system to be considered as been effective the attainment of the teachers needs to be considered because it is said that no system of education can be qualitatively higher than the quality and commitment of its teachers. Teaching and learning depend greatly on the quality of teachers for there can be no meaningful socio-economic and political development in any country without teachers, the educational planners may have the best educational policies and designs, the government may budget the largest sum of its revenue to education, but the ultimate realization of any set of aims for education depends on the teachers (Aina, 2014). It is the teacher who will ultimately be responsible for translating policy into action and principles into practice in their interactions with their students.

Unfortunately, result from teacher trainers such as Sunusi(2009) Akinmusuru (2009) and Okebukola(2007) shows that student teachers go to the classroom with minimum or zero Teaching Skills. Also, Okebukola (2007) was of the view that most graduates from Colleges of Education in Nigeria are incompetent in knowledge of subject matter (content knowledge), in teaching methods and teaching skill. He was of the view that the subjects offered at teacher training institutes are more of theories rather than practical. The teaching of skills acquisition towards micro teaching are generally poorly handled there by making Teaching Practice ineffective. The findings of Okebukola (2007) outlined the following weakness in colleges of education graduates as follows; Shallow subject matter knowledge, Inadequate teaching skills, inability to acquire practical skills, lack of commitment to teaching as a profession.

Therefore, there is a need for professional development of teachers which can be done through Teaching Practice (Ogunyinka, Okeke & Adedoyin, 2015).

According to (Odia &Omofonmwan, 2012) Teacher Education refers to professional Education of Teachers towards attainment of attitudes, skills and knowledge considered desirable so as to make them efficient and effective in their work, in accordance with the need of a given society at any point in time. It includes training and or Education acquired before commencement of service (pre-service) and during service (in-service or on-the-job). Adewuyi and Ogunwuyi (2002) opines that Teacher Education is the provision of Professional Education and specialized tr2aining within a specified period for the preparation of individuals who intends to develop and nurture the young ones into responsible and productive citizens. Teacher Education is the teaching and training experiences provided not only within teacher institutions but also outside them with the basic aim of preparing and grooming potential teachers for teaching activities.

Anho (2011) was of the view that Teacher Education is the process which nurtures prospective teachers and updates qualified teacher knowledge and skills in the form of continuous professional development. Teacher Education involve policies and procedures designed to equip prospective teachers with the knowledge, attitude, behaviour and skills required to perform their duties affectively in the classrooms, and in other social gatherings including religion institutions.

The National Teacher Education Policy, (2009) states that the goals and objectives of Teacher Education in Nigeria is to produce quality, highly skilled, knowledgeable and creative teachers based on explicit performance standards through pre-service and in-service programs who are able to raise a generation of students who can compete globally through teaching. Day (2004) and Pollard (2005) view teaching as a complex cognitive skill acquired to conduct and construct a lesson. Teacher Education is a vital tool towards educational development. This is the reason why there is a clear objective for it in National Policy on Education (FRN, 2014) which is:to produce highly motivated, conscientious and efficient classroom te2achers for all levels of our education system, to encourage further the spirit of enquiry and creativity in teachers, to help teachers to fit into the social life of the community and society at large and to enhance their commitment to national objectives.

Teacher Education refers to professional training given to teachers to enable them develop positive attitudes, acquire skills and knowledge essential to make them effective practicing teachers to meet up with the need of the society. It involves the TrainingEducation teachers undergo before practicing as teachers (pre-service) and Education/Training teachers undergo when practicing as teachers (in-service or on-the-job) (Osuji, 2009). According to United Nation Education, Scientific and Cultural Organisation(UNESCO) (2005) Teacher Education looks into environmental, social, political, cultural and economic contexts of the society to create locally relevant appropriate Teacher Education Programme for both pre-service and in-service Teachers. Ogunyinka, Kayode and Adedoyin (2015) view Teacher Education as a process whereby individuals are provided with professional and standardized skills within a specific period of time in other to prepare them to develop and nurture the young ones into responsible and productive citizens. It can be seen as professional Education, training and lifelong development of teachers which usually comprises of pre-service courses, work combined with supervised Teaching Practice, formal in-service courses and career long self-developme2nt of practicing tea2chers.

Teaching Practice is a form of work-integrated learning that is described as a period of time when students are working in the relevant industry to receive specific in-service training in order to apply theory in practice. According to NCCE (2020) Teaching Practice exercises serve as an avenue where student teacher showcases and develop the acquired experience upon the use of teaching skills. It is a crucial aspect of Teacher Education where pre-service teachers are faced with real classroom situation. It provides pre-service teachers with an opportunity for the acquisition of necessary professional skills through practical experience to prepare them for an effective professional practice after graduation and regarded as an integral part of Teacher Education Programme in Colleges of Education which is aimed at providing student teachers with the opportunities of putting theories acquired during classroom interaction in to practice in a real-life school situation.

Teaching Practice is recognised as a vital instrument towards preparing pre-service teachers to face the challenges attached to teaching profession. It is a major component of a Teacher Education Programme (Adeleke, 2011) which main purpose is to produce effective practicing teachers (Kalande, 2006). The NCE Minimum Standard (2020) states that to ensure effective Teaching Practice exercise, all the NCE awarding institutions

should ensure that teachers design and coordinate a comprehensive Teaching Practice preparation programme for student teachers. Such a preparation programme should present pre-service teachers with a gradual building up of Teaching Practice preparation assignment which should require pre-service teachers to develop lesson plans, learning materials, and assessment tasks that could be use when they are in a school during Teaching Practice. In this way, pre-service teachers are prepared through their various courses in consistent and effective manner for a Teaching Practice experience that adds value and allows pre-service teacher to develop and apply professional teaching skills.

The objective of Teaching Practice in Teacher Education Program according to National Commission for Colleges of Education, (2020) are:

i.   to enable student teachers, develop positive attitude towards teaching profession,
ii.   expose student teachers to real life classroom experiences under the supervision of professional teacher,
iii. provide a forum for student teacher to translate educational theories and principles in to practice,
iv.   familiarize student teachers with school environment as their future work place,
v.   to provide student teachers with an opportunity to acquire professional skills competence,
vi.   personal characteristics and experiences for full time teaching after graduation,
vii. to serve as a means of assessing the professional competence of student teachers,
viii. to enable student teachers to\ discover their strengths and weakness in teaching and 2look to consolidate the former and overcome the latter.

The central goal of student teaching programmes is to provide aspiring teachers challenging, relevant and rewarding field experiences to inculcate essential teaching skills and professional growth. Muset (2012) was of the opinion that Teaching Practice is an opportunity for aspiring teachers to understand the role and operation of how the business of schooling is done. This field of experience provides a challenging yet rewarding experience of working with students in actual classrooms and acquiring professional competence. It is believed that these experiences have the potential to enhance the teacher acquisition of professional competence. However, Muijs & Reyolds(2002) were of the view that acquired experiences will include among other things, their ability to assume the various responsibilities of the classroom teacher, plan and deliver instruction that meets the learning needs of all students regardless of their individual learning styles, developmental and cognitive levels, Organize and manage the classroom environment for maximum academic performance, manage classroom interactions and student's behaviour to create safe, conducive learning atmosphere for student academic success.

Video Analysis is described as a situation whereby students are video-taped in a teaching situation and then prompted to constructively analyse their performance (Sherin& Van ES, 2005). During Teacher Education Programme, teacher educators can prompt the students to watch for specific elements when viewing their video which compels the students to look more deeply than they might otherwise have done. Cornish and Jenkins (2012) argue that teachers who engage in regular critical reflection shape their own

development and that this self-assessment is a key element in continual self-improvement and consequently, teacher quality.

Teacher Education students need to translate the relationships between the various events that occur in the classroom and this can be done using video. Kane and Picci, Calvani and Bonaiuti (2012) were of the view that the use of video provides effective solutions to problems pre-service teachers encounter during Teaching Practice by providing real and authentic situations of their learning process. Using video to analyse learning within complex class room settings encourages deep analysis and higher order thinking on the part of pre-service teachers Teaching Practice. It allows teachers to peer into real classrooms which are the actual place where teaching takes place. Student - Teachers has been reported to develop previous habits as well as apply new habits as a result of video enabled reflection, and this process enables them to draw attention to aspects that they would not have noted from their memory (Harlin, 2014). The video medium enables teachers to customize all learning experiences by providing images of classrooms practices that are most relevant (Beck, King& Marshall, 2012).

Reflection practice is a key component to improving teacher quality, regardless of differences in approach. Korthagen and Wubbels (2001) are of the view that the use of Video Analysis can be seen as a means of reflection. It has the potential to provide a means by which all the process in teaching can2 be captured to enable pre-service teachers identify not only areas of improvement but also in helping them find ways to address their deficiencies. The video analysis will enable student see their personal features and behaviours that may have impact on their teaching. It is against this background that this study aims at investigating the impact of video analysis on Teaching Practice Performance among Colleges of Education Students.

Purpose of the Study
The purpose of the study is to assess the impact of video analysis on teaching practice performance among colleges of education students in North -West Zone Nigeria.
Specifically, the study sought to examine:
1. the difference between the teaching practice performance of students exposed to video self and peer analysis of teaching procedure and those not exposed to video self and peer analysis of teaching procedure.

Research Question
The study was guided by one research question
1. What is the difference between the teaching practice performance of students exposed to video self and peer Analysis of teaching procedure and those not exposed to video self and peer analysis of teaching procedure?

Hypothesis
One null hypothesis guided the study and was tested at 0.05 level of significance
1. There is no significant difference between the teaching practice performance of students exposed to video self and peer analysis of teaching procedure and those not exposed video self and peer analysis of teaching procedure?

Methods
The Research Design for this study was pure experimental design specifically, Post-test only control group design. Both Experimental and Control Groups were pretested (O_1) to determine their similarities in Teaching Practice Performance. Pre-service Teachers in the Experimental Group (EG) were treated using multiple interactive video activities (X_1) on their Practical skills when teaching a particular concept in Chemistry. Here the video was set up during each lesson, all lesson procedures were captured and recorded through digitized video. Teaching process were analysed by observation, analysis was discussed and presented to the students. Questions were asked and strategies for improvement were discussed. Pre-service Teachers in the Control Group (CG) were analysed using peer and self-analysis (X_0) without Video. Posttest O_2 was administered to the two groups to determine the effect of Video analysis on students' Teaching Practice Performance. The population of the study comprises all NCE II 2018/2019 Chemistry students in 8- Federal Colleges of Education in North-west Zone Nigeria.1770, N.C.E II Chemistry Students are enrolled in the 8 Federal Colleges of Education. The sample of the study covered a total number of 105 NCE students from two Colleges of Education in North-West Nigeria. 80 students from Federal College of Education Zaria, Kaduna State and 25 students from Federal College of Education Kano State. This was done according to their population size. The choice of 105 students as a sample size is in line with central limit theorem which recommended that 30 as minimum sample size for an experimental research, Andy (2009), Usman (2010), Fraenkel, Wallen&Khun (2012) who suggest sample size of less than 30 in an experimental research and the sample size in this research is greater than 30 therefore viable for the study as an experimental research with the distribution as follows:

Sample for the Study

Institution	Group	No. of Students
FCE, Zaria	Experimental	80
FCE, Kano	Control	25
Total		105

Teaching Practice Performance Assessment Sheet (TPPAS) with reliability coefficient of 0.79 determined using Pearson Moment Coefficient of Correlation (PPMC). The form is of two sections (Section A and B). Section A contains information about the students' teacher and Cooperating Teaching Practice School, Section B contains teaching skills to be observed and their scores.

Results
Research Question One
What is the difference between the teaching practice performance of students exposed to video self and peer Analysis of teaching procedure and those not exposed to video self and peer analysis of teaching procedure?

Table 1: Mean and Standard Deviation Scores of Pre-service Chemistry Teachers in the Experimental and Control Groups

Variable	Study groups	N	Mean	STD	Mean Difference	Remark
Performance	Experimental Group	80	68.50	3.91		
					33.03	Difference exists
	Control Group	25	35.46	9.24		

Result in Table 1 shows that Pre-service Chemistry Teachers in Experimental Group had a Mean Score of 68.50 and Standard Deviation of 3.91 While those in the Control Group had a mean score of 35.46 and standard deviation of 9.24. This shows that Pre-service Chemistry Teachers in the Experimental Group who were exposed to Video self and peer analysis had higher Mean scores when compared to their counterparts in the Control Group who were not exposed.

Hypothesis
Hypothesis One
There is no significant difference between the teaching practice performance of students exposed to video self and peer analysis of teaching procedure and those not exposed to video self and peer analysis of teaching procedure.

Table 2 Independent t test Statistic Result on Performance of Pre-service Chemistry Teachers in the Experimental and Control Groups

V\ariable	Study Groups	N	Mean	STD	df	p value	Remark
Performance	Experimental	80	68.50	3.91			
					103	0.00	Sig.
	Control	25	35.46	9.24			

p value < 0.05.

In Table 2 the Independent t test statistics shows that significant difference exists between Performance of Pre-Service Chemistry Teachers in Colleges of Education exposed to Video self and peer- analysis of teaching procedure and those who are not exposed. This is because the p value of 0.00 is lower than the 0.05 alpha level of significance set for the study. Pre-service Chemistry Teachers in the Experimental Group had a Mean value of 68.50 and those in the Control Group had a mean value of 35.46 with a mean difference of 33.03 in favour of those exposed to video self and peer- analysis of teaching procedure. This showed that the video self and peer- analysis of teaching procedure has positive effect on the pre-service teachers Performance in Teaching Practice. Therefore, the null Hypothesis which state that there is no significant difference between the performance of Pre-service Chemistry Teachers in Colleges of Education exposed to Video self and peer-analysis of teaching procedure and those that are not exposed, is not accepted.

Discussion
Result in Table 2 shows that a significant difference exists between the performance in Teaching Practice of Pre-service Chemistry Teachers exposed to video self and peer analysis and those who were not exposed in favour of Pre-service Chemistry Teachers who were exposed to Video Self and peer analysis of Teaching. This shows that the use of Video self and peer analysis in observing Pre-service Chemistry teaches' Teaching Procedures enabled pre-service teachers to perform better in their Teaching Practice. This result is supported by Harlin (2014) who opines that the use of Video Analysis allows teachers to peer into real classrooms which are the actual place where teaching takes place. Student teachers have been reported to develop previous habits as well as apply new habits as a result of video enabled reflection, and this process enables them to draw attention to aspects that they would not have noted from their memory. Cornish and Jenkins (2012) argue that teachers who engage in regular critical reflection shape their own development and that this self-assessment is a key element in continual self-improvement and consequently, teacher quality. Kane and Picci, Calvani and Bonaiuti (2012) were of the view that the use of video provides effective solutions to problems pre-service teachers encounter during Teaching Practice by providing real and authentic situations of their learning process. Using video to analyse learning within complex class room settings encourages deep analysis and higher order thinking on the part of pre-service teachers Teaching Practice. It allows teachers to peer into real classrooms which are the actual\ place where teaching takes place. Harlin (2014) was of the opinion that Student teachers develop previous habits as well as apply new habits as a result of video enabled reflection, and this process enables them to draw attention to aspects that they would not have noted from their memory. The video medium enables teachers to customize all learning experiences by providing images of classrooms practices that are most relevant (Beck, King and Marshall, 2012).

Conclusion
The findings of this study revealed that Pre-service Chemistry Teachers who were exposed to Video self and Peer analysis of their teaching procedure were able to translate educational theories and principles and apply them into their teaching and this enabled them to perform better during Teaching Practice when compared to their counterparts who were not exposed to Video self and peer analysis.
Recommendations

Based on the findings from the study, the following recommendations are made:
Video should be used as a tool for observation and feedback during Teaching Practice exercise in Teacher Education programmes.
Colleges of Education Tutors should adopt the use of Video analysis during Teaching Practice to enable pre-service teachers draw attention to aspects that they would not have noted from their memory.

REFERENCES

Adeleke, I.A (2011) "Sustainable Roles of ICT in Transforming the Nigerian Educational Sector in the 21st Century: In New Trends in Linguistics & Literacy Studies, Lagos. Adewuyi, J.O & Ogunwuyi, A.O (2012). Basic text on teacher education. Oyo: Odummat `press and publishers.

Aina, J.K (2014). Pre-service science teacher's training: The case of colleges of education in Nigeria. Open Access Library Journal, 2(3), 10-70. http:1/doc.doi.org/10-4236/0alib.1101070.

Akinmusuru J.O (2009) The curriculum as a living document for achieving educational for sustainable development. The Proceeding of the 12th general conference on Sustainable Development in Africa: The Role of Higher Education, Abuja, Nigeria 4-9 May

Anho, R.O (2001). The role of educational administration in Nigeria secondary schools. African journal of education and technology, 1(1), 39-44.

Beck, R. J., King, A., & Marshall, S. K. (2012). Effects of video case construction on pre-service teachers' observations of teaching. The Journal of Experimental Education, 70(4), 345-361.

Churchill, R., Ferguson, P., Godinho, S., Johnson, N.F., Keddie, A., Lett, W. et al. (2011). Teaching: making a difference. John Wiley & Sons: Milton, Qld.

Day, C. &Polard, A. (2004). A Passion for Teaching. London: Routledge Falmer

Federal Republic of Nigeria (2020). National Commission for Colleges of Education. Abuja: NERDC press.

Fraenkel, J., Wallen, N., & Hyun, (2012). How to design and evaluate research in education. New York, NY: McGraw-Hill.

Harlin, E.M. (2014). Watching oneself teaching – long-term effect of teachers' reflections on their video recorded teaching. Technology pedagogy and education, 23(4), 507-521.

Mtika, P. D. G. (2008). Teaching Practice as a component of teacher education in Malawi: An activity theory perspective. PhD thesis, University of Nottingham, United Kingdom.

Muijs, D. & Reynolds, D. (2002) 'School effectiveness and teacher effectiveness in mathematics: some preliminary findings from the evaluation of the Mathematics Enhancement Programme (Primary)'. School effectiveness and school improvement, 11(3), 273-303.

Muijs, D. & Reynolds, D. (2004). Effective teaching: e2vidence and practice (2nd edn). London: Sage.

Odia, L.O. & Omofonmwan, S.I. (2007) Educational System in Nigeria Problems and Prospects. Journal of Social Science, 14, 81-86.

Ogunyinka, E.K., Okeke, T.T. & Adedoyin, R.C (2015). Teacher Education and development in Nigeria: An analysis of reform, Challenges and prospects. Education Journal, 4(3),111-122.

Okanlawon, A.E. (2014). Nigerian pre-service science teacher self-perceptions of acquired pedagogical knowledge and skills after teaching practice exposure. Bulgarian Journal of Science and Education Policy, 8(1),110-128.

Okebukola F. A (2007). Quality assurance in your education. Perspectives from sub-sahara African in Guni et al (Ed). State of the World Report on Quality Assurance in your education. Bacelona 46-59.

Osunji, S.N (2009). Teacher Education curriculum in Nigeria in the perspective of life long education. Journal of International Social Research, 2(8)295-301.

Riley, C. (2009). Teacher Quality Vs Teaching Quality What's the Difference? Teachers Innovations, 8, 6:9.

Tuckman, B.W. (1975). Measuring Education Outcomes. Handout, Bace Hovawick, New York

UNESCO.(2005). Guidelines and Recommendations for Reorienting teacher education to Address Sustainability. Retrieved from unesdoc.unesco.org/images.

SELF-EFFICACY AND LEARNING STYLES AS PREDICTORS OF ACADEMIC PERFORMANCE AMONG SECONDARY SCHOOL CHEMISTRY STUDENTS IN ANAMBRA STATE, NIGERIA

OKONKWO, Ifeoma Georgina (PhD)[1], EGOLUM, Evelyn O. (PhD)[2], & SAMUEL, Naomi Nkiru C. (PhD)[3]
Department of Science Education, Nnamdi Azikiwe University, Awka
&
OKONKWO, Onyekachi Osmond
Department of Psychology, Nnamdi Azikiwe University[4]

Abstract
The study examined self-efficacy and learning styles as predictors of academic performance among secondary school Chemistry students in Ogbaru Local Government Area. The study was guided by three research questions, and three hypotheses (tested at 0.05 level of significance). The study is a cross-sectional survey research which adopted a predictive design. The study population comprised of 647 Senior Secondary two (SS2) Chemistry Students from 11 public school selected in Ogbaru local government area. Using a purposive sampling technique, a total sample size of 99 was drawn from the population. Two research instruments were given out to respondents, they include, the General Self-Efficacy questionnaire (GSE) developed by Schwarzer et al., (1995) and Visual Auditory Read-write Kinesthetic (VARK) learning style questionnaire to asses learning styles, developed by Flemming (2012). Academic performance was measured using Chemistry test score of students provided by the teachers. Research instruments were validated by experts from the Department of Science Education, Nnamdi Azikiwe University Awka, and internal consistency was established using Cronbach's alpha coefficient. Data collected from respondents were analyzed using the multiple regression statistical method. Findings show that self-efficacy and learning styles significantly predict academic performance among secondary school Chemistry students in Ogbaru L.G.A. Based on research findings, it was recommended that Chemistry teacher should be trained on how best to involve students' learning styles by using a variety of instructional styles and paces so as to facilitate students' performance in Chemistry. This could be achieved through seminars and workshops for teachers in secondary school. Also, Teachers should be responsible to their students to enhance students' self-efficacy.
Keywords: Self-efficacy, Learning Style, Academic Performance

Introduction
One of the most crucial methods for fostering socialization and preparing kids to contribute to society responsibly is through education. Many skills are inculcated in children through education, and they include, decision-making, problem-solving, critical and creative thinking, communication, and interpersonal relationship skills, as well as self-awareness, empathy, stress management, and emotional intelligence, among others (World Health Organization [WHO], 2020). Science education is education that studies the inter-

relationship between science as a discipline and the application of educational to its understanding, teaching and learning (Okonkwo & Samuel, 2020).

Science education is the key to socio- economic and technological development/advancement because it can be effectively used to develop skills for productivity, entrepreneurship and employability, values, attitudes and modes of thinking of the people. According to Robertson (2018), remarkable educational improvements in recent time have been linked to the exploration of teaching and learning styles in science education. Science education comprises majorly of four subjects namely Biology, Chemistry, Mathematics and Physics. Over the years, researchers (Okonkwo et al., 2020; Titilayo et al.,2016 and Nwagbo & Okonkwo, 2014), reported there has been low enrolment and poor achievement in these subjects in our institutions, and this has been attributed to a lot of factors among which is, poor teaching and learning methodology in science education (Aina, 2013).

Chemistry is a branch of science that deals with the study of matter, its structure, composition, properties, and the changes it undergoes. Chemistry occupies a fundamental position in science and technology and is needed in every aspect of human endeavor (Abubakar & Eze, 2010; Olayemi, 2009). Chemistry is a fascinating subject which plays a vital role in shaping the world around us. However, the understanding of this concept is reflected on students' performance which has been reported to have been unimpressive over the years. The academic performance of students is one criterion for judging educational programs and outcomes.

Academic performance is the measure of how well a student, teacher, or institution has met its educational objectives. It is determined by marks that are assigned by teachers and refers to the knowledge obtained (Narad & Abdullah, 2016). Academic performance has an impact on students' lives as well as teachers' lives by enhancing their self-confidence and instilling a sense of accomplishment and belief in them based on the premise that they have tutored and mentored such successful individuals (Oredein et al., 2019). Academic success and obtaining good grades are among the main goals in all levels of education; resultantly, the factors influencing the students' academic success has ever remained one of the most important concerns of researchers, teachers and other stake holders in education. Bandura (1997) opined that academic performance of students is greatly influenced by their level of self-efficacy.

Self-efficacy is a belief in one's abilities to accomplish a task, not a measure of those abilities. Pajares (2018) added that self-efficacy affects behavior by regulating an individual's choices, the extent of his or her expended effort, and his or her emotional responses. He showed some features of self-efficacy in the classroom thus; students with higher self-efficacy are more likely to persevere in difficult situation, be engaged, see failure as indication that more effort is needed, choose specific strategies to enhance learning and attribute success to ability. On the other hand, students with lower self-efficacy are less likely to do those things, and more likely to equate failure to bad luck and poor ability and presume that a problem is more complex than it is. Development of self-efficacy beliefs hinges on information derived from four types of resources namely; Mastery(inactive) experiences, Vicarious experiences, Verbal persuasion and

Physiological states. Mastery experiences are derived from what one has experienced; it is said by (Asfaw,2022) to be the most forceful reference of self-efficacy beliefs. To have a resilient sense of self -efficacy requires experience in overcoming obstacles through effort and perseverance. Vicarious experiences are gained by observing a model's performance and comparing it with the observer. Seeing people similar to ourselves succeed by their sustained efforts raises our beliefs that we too possess the capabilities to master the activities and skills needed for success in that area. The third resource, Persuasion, comes from influential people in our lives, such as, parents, teachers, counsellors, managers, and couches among others, who can strengthen our belief that we have what it takes to succeed, with words like…'I have faith in you'…thereby making us more likely to put in the effort and sustain it when problems arise. The last source of students' self-efficacy is physiological reactions or state, such as stress, anxiety, depression and such other feelings can dampen confidence and capabilities, and, therefore, can be interpreted as signs of vulnerability to poor performance; however, positive emotions can boost confidence in an individual's ability and skills. Self-efficacy in knowledge adoption in sciences, cannot be complete without the students' adherence to a learning style.

Learning styles have been described from different perspectives by researchers. Lorenzo &Lorenzo (2013) viewed Learning styles in terms of how the learner process, absorb and retain information. Perry (1994) cited in Lorenzo et al., (2013) defined it as a pattern that perceive, interact with and respond to knowledge consistently, noting that learning styles are more stable and general than learning strategies. According to Allison and Hayes (1996), cited in Lorenzo et al., (2013), a learning style is a preferential mode, through which a student like to master learning, solve problems, think or simply reach a pedagogical situation. Similarly, Asfaw (2022) defined learning style as the range of instructional strategies through which students typically pursue the act of learning and this study adopted this definition. The preferred learning style of a student refers to their typical method of information acquisition and use as well as how they react to stimuli in a learning situation. These learning styles acknowledge that different people learn in different ways and that students in every course will interpret their lessons in a number of ways (Bailey & Garratt, 2002; Lorenzo & Lorenzo, 2013; Zhang et al.,2017; Ha, 2021). The four types of learning styles are visual learning, auditory learning, read/write learning and kinesthetic learning. According to Felder(1993)as cited in Lorenzo et al., (2013), when students' learning styles and an instructor's teaching style are in harmony (Meshing Hypothesis), achievement could be optimized as it improves retention and understanding as well as post-course attitudes. Dalmolin et al., (2018) stated that a positive correlation exists between the learning styles of students and their academic performance.

Government officials at all levels and curriculum planners should be generally concerned. The degree of subpar performance in the most recent Chemistry external examinations is high profile when compared to other countries. For the sake of enhancing students' academic performance, teachers must thoroughly examine their teaching strategies with a view to addressing the individual differences in the students. Therefore, the purpose of this study is to investigate how students' self-efficacy and learning preferences relate to their academic performance in Chemistry in Anambra state.

Purpose of the study

The purpose of this study was to examine self-efficacy and learning styles as predictors of academic performance in Chemistry among secondary school students in Anambra state.

Specifically, the study determined:

1. The predictive effect of self-efficacy on academic performance among Chemistry students.
2. The predictive effect of learning styles on academic performance among Chemistry students.
3. The joint predictive effect of self-efficacy and learning styles on academic performance among Chemistry students.

Research Questions

1. Will self-efficacy predict academic performance among Chemistry students?
2. Will learning styles predict academic performance among Chemistry students?
3. Will self-efficacy and learning styles jointly predict academic performance among Chemistry students?

Hypothesis

1. Self-efficacy will not significantly predict academic performance among Chemistry students.
2. Learning styles will not significantly predict academic performance among Chemistry students.
3. Self-efficacy and learning styles will not have a significant joint prediction on academic performance among Chemistry students.

Methods

The present study is a cross-sectional survey research, which adopts a predictive design. Multiple regression statistical analysis was used as the appropriate statistics to analyze the data collected. The justification for this design and statistics is based on the fact that the researcher examined self-efficacy and learning style of Chemistry students to understand its predictive role on academic performance. The population of the study comprised of 647 Senior Secondary two (SS2) Chemistry Students from 11 public school selected in Ogbaru local government area. The sample of this study consisted of ninety-nine (100) SS2 chemistry students drawn from five (5) schools out of 11 public secondary school in Ogbura L.G.A, using a purposive sampling technique. Purposive sampling involves the selection of a sample that possesses particular characteristic relevant to achieving the purpose of the following: mixed gender schools, schools that have well equipped and functioning chemistry laboratory, schools that are currently presenting candidate for senior secondary school certificate examination (SSCE) and schools that have SS2 Chemistry students' enrolment not less than 20 students. Two research instruments were given out to respondents, they include, the General Self-Efficacy questionnaire (GSE) developed by Schwarzer et al., (1995) and Visual Auditory Read-Write Kinesthetic (VARK)

questionnaire to asses learning styles, developed by Flemming (2012). Academic performance was assessed using the chemistry test scores of students, provided by the teachers. The instruments were validated by three experts, two from the Department of Science Education and one from the Department of Education Foundation, Nnamdi Azikiwe University Awka. Internal consistency was established using Cronbach's alpha, where an alpha value of .82 and .70 was obtained respectively for both research instruments. On collection of data from respondent, the researchers experience a mortality of 1, making the total number of respondents ninety nine (99)

RESULTS
Table 1: Summary table of the mean and standard deviation: A descriptive Statistics.

VARIABLES	Mean	SD	N
Academic performance	55.29	9.312	99
Self-Efficacy	29.83	5.200	99
Visual	7.92	2.538	99
Auditory	7.04	2.222	99
Read/write	7.85	3.072	99
Kinaesthetic	7.71	2.327	99

Table 2: Standardised Multiple Regression Analysis, showing the independent prediction of Self-efficacy and learning styles on academic performance among secondary school chemistry students.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta (β)		
(Constant)	29.963	10.054		2.980	.004
Self-Efficacy	.412	.175	.230	2.353	.021
Visual	.679	.402	.185	1.690	.094
Auditory	-.318	.471	-.076	-.675	.501
Read/write	.438	.304	.145	1.441	.153
Kinaesthetic	.838	.411	.209	2.038	.044

Dependent Variable: Academic Performance.

Research Question 1: Will Self-efficacy significantly predict Academic performance among secondary school chemistry students?

In Table 2, research findings indicate that self-efficacy significantly predicts academic performance among secondary school chemistry students with an observed beta value of β = .230 and point of significance below .05 (sig = .021).

Research Question 2: Will Learning styles significantly predict Academic performance among secondary school chemistry students?

In Table 2 above, findings show that visual learning style did not significantly predict academic performance among secondary school chemistry students with an observed beta value of $\beta = .185$ and point of significance above .05 (sig. = .094).

Similarly, findings indicate that Auditory learning style did not significantly predict academic performance among secondary school chemistry students with an observed beta value of $\beta = -.076$ and point of significance above .05 (sig. = .501).

Findings indicate that Read/Write learning style also did not significantly predict academic performance among secondary school chemistry students with an observed beta value of $\beta = .145$ and point of significance above .05 (sig. = .153).

However, findings show that Kinesthetic learning style significantly predicts academic performance among secondary school chemistry students with an observed beta value of $\beta = .209$ and point of significance below .05 (sig. = .044).

Finding from table 2 above indicate that kinesthetic learning style significantly predicted academic performance, while visual, auditory and read/write learning style did not significantly predict academic performance among secondary school chemistry students.

Research question 3: Will Self-efficacy and Learning styles jointly and significantly predict Academic performance among Secondary school chemistry students?

Table 3: (Model summary); Standardized Multiple Regression Analysis, showing the joint prediction of Self-efficacy and learning styles on academic performance among secondary school Chemistry students.

Model	R	R Square	Adjusted R^2	Std. Error of the Estimate	F	Sig
	.406[a]	.165	.120	8.734	3.697	.004

Predictors: (constant), Self-Efficacy, Visual, Auditory, Read/write and Kinesthetic

From the findings in Table 3, using a standardized multiple regression analysis (Enter Method), results indicate that Self-efficacy and learning styles jointly and significantly predicted Academic performance with an Adjusted $R^2 = .120$; F = 3.697; point of significance at below .05 level (sig = .004) as it can account for 12% of the variance observed in Academic performance in chemistry.

Hypothesis 1: Self Efficacy will not significantly predict Academic Performance among Chemistry students. Based on research finding, the hypothesis is rejected

Hypothesis 2: Learning styles will not significantly predict Academic Performance among Chemistry students. Although Visual learning style, Auditory learning style and Reading/Writing did not significantly predict academic performance among secondary school students, Kinesthetic learning style significantly predicts academic performance

among secondary school students with an observed beta value of β = .209 and point of significance below .05 (sig. = .044). based on findings, this hypothesis is rejected.

Hypothesis 3: Self efficacy and Learning Styles will not have a significant joint prediction on Academic Performance among Chemistry students. Based on research finding, the hypothesis is rejected.

Discussion

The general purpose of the study was to investigate the predicting role of self-efficacy and learning styles on the academic performance of secondary school Chemistry students in Ogbaru LG.A. Based on research findings, Self-efficacy significantly predicted academic performance of secondary school Chemistry students in Ogbaru L.G.A. This discovery supported the work of Bandura (1997) and Domenech et al., (2017) who stated that students possessing moderate or higher self-efficacy will be more successful in academic performance, whereas those who lack the belief and abilities for success become inefficient and may avoid higher academic performance altogether. Similarly, Kiran and Sungur (2011) also reported that students with high self-efficacy also produced a corresponding high level of academic performance in Chemistry. Relative to this finding, it is imperative that students be encourage to have a more positive self-efficacy towards curricular activities in school.

Findings also reveal that learning styles significantly predicts academic performance among secondary school Chemistry students in Ogbaru L.G.A. Kinesthetic style of learning was shown to have a significant role on academic performance; however, visual, auditory and read/writing learning styles did not significantly predict academic performance among secondary school Chemistry students. It is important to note that this finding does not in anyway place Kinesthetic learning style above other learning styles. It simply implies that among secondary school chemistry students in Ogbaru LGA, kinesthetic learning, also known as hands-on learning appears to have a more significant impact on their academic performance. This finding is in tandem with the works of Dalmolin et al., (2018) who found a positive correlation between learning styles and academic performance of students.

Additionally, self-efficacy and learning styles jointly predicts academic performance among secondary school Chemistry students in Ogbaru L.G.A. This study corroborated the assertion of Ha (2021), that learning may not take place if the teaching as a counseling guide is not structured to facilitate learning even when the teaching mode is appropriate. Learning factors (principles) that will affect the learning of students and the success of teaching efforts are setting the stage to provide clear instructions and modeling appropriate behavior when emphasizing particularly skills or competencies, increasing learning during teaching, providing active participation, increasing self-efficacy, matching teaching techniques to students' self-efficacy, ensuring specific, timely, diagnostic, and practical feedback, providing opportunities for students to practice new behaviors and maintaining basic knowledge in particular areas- developing learning points to assist in knowledge retention, setting specific goals, identifying appropriate reinforcement, teaching students

how to reinforce their learning and teaching students how to take responsibility of their own learning. Hence the challenge to the counselor is the attempt to bridge this gap in academic performance.

Conclusion

In conclusion, self-efficacy, and learning styles are crucial aspects of teaching and learning to foster an overall academic performance. It is imperative that students should have a high self-efficacy and teachers should be able to structure their curriculum in a way that helps them to deliver effective teaching using a combination of different learning styles to enable students excel academically.

Recommendations

Based on the finding of the study, the following recommendations were made:
1. Chemistry teacher should be trained on how best to involve students learning style so as to facilitate students' achievement and attitude in the lesson. This could be achieved through seminars and workshops for teachers in secondary school.
2. Curriculum planners should integrate learning style approach in chemistry curriculum, as it will promote an overall academic performance.
3. Teachers should be responsible to their students to enhance students' self-efficacy.
4. Such factors like provision of adequate laboratory materials, recruitment of qualified teachers, provision of conducive classroom environment etc. should be taken much more seriously so that these can be complemented with the high self-efficacy of the students to produce a better performance of students in chemistry.

REFERENCES

Abubakar, R. B., & Eze, F. B. (2010). Female students' academic performance in Mathematics at federal college of education (technical,, Omoku, Rivers State. *International Journal of Social and Policy Issues* 6(1&2), 48 – 53.

Aina, J. K., (2013). Security challenges in Nigeria; Causes and effects on science education. Retrieved from http://www.basearticles.com/Art/932483/39

Allinson, C. W. & Hayes, J. (1996) `The Cognitive Style Index: A Measure of Intuition-Analysis for Organizational Research', Journal of Management Studies 33(1): 119-135

Bailey, P.D. & Garratt, J. (2002) Chemical Education: Theory and Practice. University Chemistry Education, 6, 39-57

Bandura A., (1997). Self-efficacy: The exercise of control. New York: W. H. Freeman and Company.

Bandura A., (1997). Self-efficacy: towards a unifying theory of behaviour change. Psychol Rev. 84: 191 – 215. Doi:10.1037/0033-295X.84.2.191.

Dalmolin, A., Mackeivicz, G., Pochapski, M., Pilatti, G., & Santos, F., (2018). Learming styles preferences and e-learning experience of undergraduate dental students. Rev Odontol UNESP, 47(3), 175-182. https://doi.org/10.1590/1807-2577.05118

Domenech, B. F., Abellan, R. L. & Gomez, A. A. (2017). Self-efficacy, Satisfaction and Academic Achievement: The Mediator Role of Students' Expectancy Value Beliefs. *Front.Psycho*.8:1193.doi,10-3389/fpsy.2017.01193

Flemming, N. (2012). VARK: A guide to learning styles.

Ha, N.T.T. (2021). Effect of learning style on students achievement: Experimental research. Linguistics and Culture Review 5(53), 329 – 339. https://doi.org/10.37028/lingcure.v5ns3.1515

Kiran, D. & Sungur, S. (2011). Middle school students' science self-efficacy and its sources: Examination of gender Differences. Journal of Science Education Technology, 23(3) 51-59.

Lorenzo, A. R. & Lorenzo B. U. (2013). Learning styles of teacher education students: Basis in improving the teaching – learning process. Procedia – Social and Behavioural Sciences, 103, 595 – 605

Narad, A. & Abdullah, B. (2016). Academic performance of senior secondary school students: influence of parental encouragement and school environment. Rupkatha Journal on Interdisciplinary Studies in Humanities. 2016. Doi: 10.21659/rupkatha (8) 2.02.

Okonkwo, I. G. & Samuel N. C., (2020). Influence of Chemistry teachers' self-efficacy on inclusive education in secondary school chemistry teaching, Anambra state, Nigeria. International Journal of Innovative Research and Development. Doi.org/10.24940/ijird/2020/v9/i12/Dec20016 pp 61 – 66

Olayemi, O. O. (2009). Students' correlates and achievement as predictors of performance in physical chemistry. ABACUS: *The Journal of Mathematics Association of Nigeria* 34(1), 99 – 105.

Oredein, A.O & Killian, O.T.P (2019). Essence of academic performance: counseling for effective mentioning. Current Research in Education and Social Studies 1. Doi :10.9734/bpi/cress/vi/c4

Pajares, F. (2018). Self-efficacy beliefs in academic settings. Review of Educational Research, 66(4), 543 – 578.

Robertson, A. (2018). www.schoolsweek.co.uk Learning and skills Events Consultancy and Training Limited.

Samuel, N. N. C. & Okonkwo I. G. (2020). Effect of computer assisted instruction on senior secondary school students' academic self-concept in Chemistry. Journal of International Academic Research for Multidisciplinary. Vol 8, issue 8.

Schwarzer, R., & Jerusalem, M. (1995). Generalized Self-Efficacy scale. In J. Weinman, S. Wright, & M. Johnston, Measures in health psychology: A user's portfolio. Causal and control beliefs (pp. 35-37). Windsor, UK: NFER-NELSON.

Titilayo, F. B., Olayede, S. O., & Adekunle, S.O. (2016) Self-Efficacy and Chemistry Students' Academic Achievement in Senior Secondary Schools in North-Central, Nigeria. The Malaysian Online Journal of Educational Science vol 4, issue 1, 43 – 52 www.moj-es.net

World health organization (2020. Life skills education. School handbook: prevention of non-communicable disease 17-18. Introduction : ISBN :978-92-4-000484-9. Retrieved from https://apps.who.int/iris/rest/bitstreams/1276896.retrieve.

Zhang, M. Quan, Y. Huang, L. & Kuo, Y. (2017). The impact of learning styles on Academic achievement. International Journal of Intelligent Technologies and Applied Statistics. Vol.10, No 3, pp 173 – 185. Doi:10.6148/IJITAS.

EXTENT OF UTILIZATION OF TEACHERS AS HUMAN RESOURCE IN SECONDARY SCHOOL ADMINISTRATION IN ENUGU STATE, NIGERIA

Ekwe, Gabriel Michael (Ph.D)
Department of Educational Foundations, Enugu State College of Education Technical
Email: Ekwemic@Gmail.Com, Phone No: 08030409137

Onyia Bernadette Nwakaego
Department of Educational Psychology, Enugu State College of Education Technical
Email: Onyiabernadette@Gmail.Com, Phone No: 08064949592
&
Ugwu, Festus A.
Department of Educational Psychology
Enugu State College of Education (Technical) Enugu
Phone No:08065820721

Abstract
The study centered on the extent of utilization of teachers as human resource in secondary school administration in Enugu state. Two research questions guided the study while two null hypotheses were tested at 0.05 level of significance. Descriptive survey research design was adopted for the study. The population of this study comprise of all the teachers in the 314 public secondary schools in Enugu State. Available data show that there are 2282 male and 6601 female secondary school teachers in Enugu state. The sample size of this study2 was 889 made up of 229 male teachers and 660 female teachers. Questionnaire was designed to elicit appropriate information from the respondents. The reliability co-efficient of the instrument was calculated using Cronbach Alpha method. Alpha value was found to be 0.93 indicating high reliability of the instrument. Mean score and standard deviation were used to answer the research questions, and t-test statistic was used to test the hypotheses at 0.05 level of significance. Some of the findings of the study indicated that there is great extent to which teachers are utilized in instructional planning. The findings also showed that there is great extent to which teachers are utilized in students' personnel administration in secondary schools in Enugu state. Based on this, it was recommended among others that curricular planners should always involve teachers in planning and also integrate them to any curricular innovation.
Key words: Utilization, Human Resource, School Administration

Introduction
Organizations world over, be they industry or education depend on the use of resources available to them for their operations. Infact, management involves the arrangement and utilization of human and material resources for the achievement of the objectives of any organization. Resource, be it human or material, involves the combination of those things that make up the resource in the right proportion to achieve the pre-determined output

which is the goals of the organization. In other words, no organization can thrive above its available resource. This is to say that the extent of management in an organization is determined by the available resources it has. A large organization implies that the organization has a lot of resource (material and human) at its disposal. Resources of any organization go a long way to determine the progress of the organization, that is, whether the organization will continue to exist or not. Derel and Heather (2017) defined resource thus "a material or an abstract quality that a person or an organization uses to perform some work, for example tools, stock, time and employees." This definition implies that resource could be in form of material, money, time and human which could be utilized for performance of any activity. Human resource is an indispensable factor in any organization. The human resource is the bedrock upon which other resource rest. The quantity and quality of human resource of an organization determines the quantity and quality of service or goods the organization will give. It is the human resource that plan and implement the activities and policies of the organization. Human resource plan, source, and manipulate other resources of the organization. Nwangwu (2015) remarked that; human resource constitutes the ultimate basis for the wealth of nations. Human resource is the active agents who accumulate capital, exploit natural resource, build social, economic and political organizations and carry forward national development.

Human resource is the human agent in any organization. It is through the human agent in the organization that other non-human resources are harnessed for the realization of the organizational goals and objectives. This means that other resources of the organization remain dormant until the human agent acts upon them. Kelly (2011) stated that human resource within an organization refer to human beings that are in charge of the day-to-day activities of the organization. Such activities include operating the office machines, computers, training and other personnel issues in order to achieve the organizational objectives. It is the responsibility of the human resource to conduct these activities in an effective, legal, fair and consistent manner. The implication is that human resource controls the activities and any other resource within the organization. The emphasis is that human resources are the creative and social beings in predictive activities. The human resource in schools by implication of the above definition means principals and teachers who are in charge of the day to day activities of the school. Apart from the principals and teachers, human resource also involves non-tutorial staff and students who are involved in manipulating the office machines, computers, training and other personnel issues in order to achieve the organizational objectives.

From the above, it could be seen that human resource determines the fate of other resources in an organization. In other words, it is human resource that determines the availability and the extent of utilization of other non-human resources of the organization. Human resource is vital to all human parastatals. Therefore, the ability of an organization to achieve its goals depends to a large extent on the extent of motivation of its human resource. Nwankwo (2020) stated that, 'all the activities of any enterprise, education industry inclusive are initiated and determined by the human resources, who make up that institution'. Plants, offices, computers and all that a modern firm uses are unproductive except for human effects and directions. This implies that it is through the combined and

concerted efforts of human resource that monetary or material resources are harnessed to achieve the organizational goals. According to Ezeani and Nwankwo (2012) human resource is defined as "men and women, young and old who engage in the production of goods and services and who are the greatest assets of an organization". They further stated that, people are the human resource for the supply of physical labour, technical and professional skills which are germane for effective and efficient planning and implementation of development policies, programmes, projects and daily activities. In other words, the human resource is the people at the centre of all activities of an organization.

However, in this study, human resource refers to the teachers who are the bedrock upon which other school resources rest. The quantity and quality of teachers in any school determine the quantity and quality of services the school will give. It is the teachers who implement the activities and policies of the school. Teachers utilized other resources of the school. They constitute the ultimate basis for the activities of the school. School buildings and other equipment of the school are passive resources of the school. Teachers are the active agents that exploit other resources, and carry out school programmes. Teachers are vital to any educational institutions. Therefore, the ability of any educational institution to achieve its goals depends, to a large extent, on the institution and motivation of its teachers. This is buttressed by Nwankwo (2020) when he observed that all the activities of any enterprise, educational industry inclusive, are initiated and determined by the human resource who make up that institution. In other words, all the activities of the school are initiated and determined by the teachers who make up that institution. It is through the combined and concerted efforts of the teachers that monetary or 2material resources of the school are harnessed to achieve the educational goals.

Similarly, Yusuf (2013) noted that the level of productivity in an industry or enterprise depends on the quality and efficient administration of the employed labour. Thus, no industry can function effectively without human resource. This is to say that the level of productivity in the education industry depends on the quality and efficient administration of the employed teachers. Thus, no educational industry can function effectively without the teachers.

The extent to which educational institutions succeed in the delivery of their services with an efficient use of scarce human and material resources will depend, to a large extent, upon the quality of human resource engaged in the education process and the effectiveness with which the individuals discharge their responsibilities. It is against this background that Peretomode (2011) defined utilization of human resource as "effective and efficient use of human input in the system". This implies that the knowledge, skills, interests, and whatever potentials the teacher may have should be channeled to the attainment of the school objectives.

In the view of Nwankwo (2020), utilization of human resource was defined as, "decisions and actions taken to effectively harness human resource of an organization to achieve its goals and objectives". In other words, utilization of human resource in an organization is a desperate decision and actions to see that human resource of the organization are effectively tapped to achieve the organizational goals. Utilization of

human resource in secondary school setting involves all the decisions and actions taken to make sure that teachers are up and doing in the discharge of their responsibilities, as the school may deem necessary. Such responsibilities may include; involving teachers in instructional planning, decision making, students' personnel administration and school business administration.

Utilization of teachers in secondary school administration is very important in order to achieve the broad and specific goals of secondary education as outlined in National Policy in education (2013). According to this policy, the broad goals of secondary education shall be to prepare the individual for:
a. Useful living within the society; and
b. Higher education

In specific term, secondary education shall:-
(a) Provided all primary leavers with the opportunity for education of a higher level, irrespective of sex, social status, religious or ethnic background;
(b) Offer diversified curriculum to cater for the differences in talents, opportunities and future roles;
(c) Provide trained manpower in the applied science, technology and commerce at sub-professional grades;
(d) Develop and promote Nigerian language, art and culture in the context of world's cultural heritage;
(e) Inspire students with a desire for self improvement and achievement of excellence;
(f) Foster National Unity with an emphasis on the common ties that unites us in our diversity;
(g) Raise a generation of people who can think for themselves, respect the views and feelings of others, respect the dignity of labour, appreciate those values specified under our broad national goals and live as good citizens;
(h) Provide technical knowledge and vocational skills necessary for agricultural, industrial, commercial and economic development.

The above broad and specific goals of secondary education cannot be fully carried out f teachers are not properly utilized. To ensure uniformity, government formulated some policies and guidelines to be used and followed by the principals to ensure that teachers are involved in school administration. School administration is a specialized activity which requires the smooth running of the whole educational enterprise composed of human and material resources in an organized manner to constructive and fruitful direction. Erwee (2013) described it as the process that involves comprehensive effort to achieve some specific educational objectives and it deals with policies and practice. The principal is at the head of the school. He uses teachers to achieve the school objectives. It is the extent to which he uses teachers who constitute the human resource that will determine the extent of success in education delivery. Nwangwu (2015) defined school administration as the process of mobilizing the human and material resources within a school for effective teaching and learning so that the goals of establishing the school may be efficiently

realized. School administration involves prudent management of scarce and available resources as well as high degree of accountability on all organizational members. The handbook on School Administration (2005:32) observed that:

> *Teachers should be involved in the running of the school, it is important that teachers know what is happening in the school, teachers should be able to identify with the policy and programmes of the school. When policies and plans are made, teachers should be involved because they are the people that implement those policies and plans.*

Thus, this study was motivated by one of the above statements which stated that: when policies and plan are made, teachers should be involved because they are the people that implement those policies and plans. This implies that teachers should be involved in major school administration such as instructional planning, students' personnel administration, school business administration and decision-making which this study is interested. Instructional planning, which some authors refer to an curriculum planning can be seen as outlined learning activities for a particular group of students within specified period of time (Nwankwo, 2020). Oboegbulem (2011) viewed curriculum as a vehicle through which the school strives towards the achievement of educational ends; be they those of the nation, state, local governments or even the community. Oboegbulem went further to note that Curriculum planning is a plan for the education of learners.

The essence of teaching and learning is founded on proper curriculum planning and development. An adequate and carefully planned curriculum is very important in every educative process. This should focus on the needs of learners and on that of the society. Every relevant curriculum must properly articulate and take into account of problems, aspirations and challenges of both the learner and society. Educational planners should encapsulate all these factors and carefully tailor them into the programme of the school. This is necessary because the school exists to serve the society that sets it up for the education of her young ones. This can be properly achieved through dynamic leadership of the school administrator who is also referred to as the principal.

Students personnel administration as defined by Oboegbulem (2011) involves all the activities and services, apart from the normal classroom instruction rendered to the students by the principal, headmaster, staff (tutorial and non-tutorial), the students themselves and even the community that are geared towards making an individual in the school an all-round educated, law abiding citizen of the community. This involves service rendered to the learner that compliments regular classroom instruction. Such services include taking pupils inventory, organizing and placing the students in classes, provision of guidance and counseling services to help students career choice and maladjustment problems. The school administration should inculcate in the students the need for co-curricular activities. Students should be encouraged to participate in recreational and sporting activities. For socialization processes, students should be encouraged to join school clubs like Boys Scout, Girls Guide, Debating Society, jets club among others.

However, it is the intention of this study to examine the extent to which Teachers as human resource are utilized in the administration of secondary schools in Enugu State. The gap that this study intends to fill is to identify the extent to which teachers as human resource is efficiently utilized in education delivery with the aim of strengthening the areas of deficiency for effective utilization of human resource. This will enhance efficiency in school system.

Purpose of the Study
The purpose of this study is to examine the extent of utilization of teachers as human resource in secondary school administration in Enugu state. Specifically, the study sought to determine:
1. the extent to which teachers are utilized in instructional planning in the administration of secondary schools in Enugu State.
2. the extent to which teachers are utilized in the students personnel administration in secondary schools in Enugu State.

Research Questions
The following research questions will guide the study:
1. To what extent are teachers utilized in instructional planning in secondary school administration in Enugu State?
2. To what extent are teachers utilized in students' personnel administration in secondary schools administration in Enugu state?

Hypotheses
The following null hypotheses were tested at 0.05 level of significance
1. There is no significant difference between the mean rating scores of male and female teachers on the extent to which teachers are utilized in instructional planning in secondary school administration in Enugu State.
3. There is no significant difference between the mean rating scores of male and female teachers on the extent to which teachers are utilized in students' personnel administration in secondary schools in Enugu state.

Methods
The research design of this study was descriptive survey design. The study was carried out in Enugu State, Nigeria. The study covers the six educational zones in the state. The population of this study comprised of all the teachers in the 314 public secondary schools in Enugu State. Available data showed that there are 2282 male and 6601 female secondary school teachers in Enugu state. This gives a total population of 8883 secondary school teachers from the six educational zones in the state. To obtain the sample for the study, a proportionate stratified random sampling technique was used to sample 10% of male and female teachers from each zone of the six education zones in Enugu State. The sample size of this study was 889 made up of 229 male teachers and 660 female teachers. While the instrument for data collection was a structured questionnaire titled "Utilization of Teachers

as Human Resource (UTHR). The instrument was developed by the researcher and it has two sections, A and B. Section A deals with the bio-data of the respondents while section B deals with information on utilization of human resource, a four point scale was used to assign values to the items to be rated by the respondents as follows: Very Great Extent (VGE) 4 points, Great Extent (GE) 3 Points, Low Extent (LE) 2 Points and Very Low Extent (VLE) 1 point. The instrument was faced validated while the reliability co-efficient of the instrument was calculated using Cronbach Alpha method. Alpha value was found to be 0.93, indicating high reliability of the entire instrument. Mean score and standard deviation were used to answer the research questions, and t-test statistic was used to test the hypotheses at 0.05 level of significance. In rating the computed mean scores, items whose mean range from 2.50 and above were regarded as being great extent while items that fall below 2.50 were regarded as low extent. The criterion mean of 2.5 were got by summing up the weighted options (4+3+2+1 = 10) and dividing it by total number of response options (4) as follows; 10/4 = 2.50 The t-test statistics was used to test the null hypotheses at 0.05 level of significance. The decision rule for the hypotheses is that, the null hypotheses was accepted when the t-calculated value is less than the critical table value, but rejected when the t-calculated value is greater than the critical table value.

Results

The results are presented in tables according to research questions.

Research Question One

To what extent are teachers utilized in instructional planning in secondary school administration in Enugu state?

Table 1:- Mean rating score of male and female teachers on the extent to which teachers are utilized in instructional planning in secondary school administration in Enugu state.

S/N	Extent of teachers involvement in:	Male Teachers			Female Teachers		
		$\overline{X}$	SD	Decision	$\overline{X}$	SD	Decision
1.	Planning the scheme of work from the curriculum for your class	2.56	0.98	G.E	2.62	0.97	GE
2.	Selecting instructional text books that address curriculum content	2.87	0.92	GE	2.93	0.87	GE
3.	Planning school timetable that accommodates every aspect of the curriculum.	2.49	1.05	LE	2.43	1.03	LE
4.	Planning instructional materials for teaching to address curriculum content	2.99	0.87	GE	3.02	0.69	GE
5.	Teaching the students to accommodate every aspect of the curriculum	3.05	0.66	GE	2.83	0.86	GE
6.	Supervising student's class activities which address curriculum content	2.67	0.90	GE	2.77	0.94	GE

7.	Evaluating learning outcomes which form part of curriculum.	3.21	0.65	GE	3.14	0.65	GE
8.	Teachers participating fully in the planning of instruction.	3.08	0.66	GE	2.73	0.94	GE
	Cluster Mean	**2.87**	**0.84**	**GE**	**2.81**	**0.96**	**GE**

G.E =GREAT EXTENT, L.E =LOW EXTENT

The data on table 1 above show that while the mean for male teachers range from 2.49 to 3.08, that of female teachers range from 2.43 to 3.14. In exception of item 3 with a mean of 2.49 for male teachers and 2.43 for female teaches, other items have a mean above the acceptable benchmark of 2.50. In other words, they share the view that teachers are utilized in instructional planning in secondary school administration in Enugu state. The cluster mean are 2.87, for male teachers and 2.81, for female teachers in a four point rating scale with corresponding standard deviation of 0.84 and 0.96 for male and female teachers respectively.

Research Question Two
To what extent are teachers utilized in student's personnel administration in secondary schools administration in Enugu state?

Table 2:- Mean rating score of male and female teachers on the extent to which teachers are utilized in students' personnel administration in secondary schools in Enugu state.

S/N	Extent of teachers involvement in:	Male Teachers			Female Teachers		
		$\overline{X}$	SD	Decision	$\overline{X}$	SD	Decision
9.	Admission of students.	2.65	0.99	G.E	2.70	0.97	GE
10.	Registration of students.	2.53	1.02	GE	2.51	1.02	GE
11.	Selection of students' functionaries.	3.07	0.65	GE	2.98	0.85	GE
12.	Providing guidance counseling services for the students.	3.12	0.64	GE	3.17	0.63	GE
13.	Enforcing the school rules and regulations.	3.10	0.65	GE	3.02	0.69	GE
14.	Planning mid day meals for students.	2.64	0.89	GE	2.79	0.86	GE
15.	Selecting uniform for students.	2.83	0.86	GE	2.79	0.86	GE
16.	Placing students in new classes.	2.94	0.80	GE	2.85	0.82	GE
17.	Helping students select subjects for NECO/WASSCE.	2.66	0.99	GE	2.91	0.77	GE
18.	Supervision of student's meal.	3.15	0.64	GE	3.22	0.63	GE
19.	Supervision of boarding houses.	2.35	1.12	LE	2.48	1.14	LE
20.	Buying of students food stuffs.	3.00	0.67	GE	2.93	0.85	GE
21.	Disciplining of students.	2.48	1.10	LE	2.44	1.07	LE
22.	Monitoring of students extra curricular activities	3.13	0.64	GE	3.04	0.65	GE
23.	Selecting house masters/matrons.	2.57	0.98	GE	2.65	0.99	GE
	Cluster Means	**2.81**	**0.84**	**GE**	**2.83**	**0.85**	**GE**

G.E =GREAT EXTENT, L.E =LOW EXTENT

The data on Table 2 above show that while the means for male teachers range from 2.35 to 3.15, that of female teachers range from 2.44 to 3.22. In exception of item 19 and 21 with a mean of 2.35, 2.48 for male teachers and 2.48, 2.44 for female teachers, other items have a mean above the acceptable benchmark of 2.50. In other words they share the view that teachers are utilized in students' personnel administration in secondary school administration in Enugu state. The cluster means are 2.81 for male teachers and 2.83 for female teachers in a four point rating scale with corresponding standard deviation of 0.84 and 0.85 for male and female teachers respectively.

Hypotheses
Hypothesis One
There is no significant difference between the mean rating scores of male and female teachers on the extent to which teachers are utilized in instructional planning in secondary school administration in Enugu state.

Table 3: t-test of male and female teachers on the extent to which teachers are utilized in instructional planning in secondary school administration in Enugu state.

Group	N	$\overline{X}$	SD	DF	t-cal	t-critical	Decision
Male teachers	229	2.87	0.84	887	0.18	1.96	Not Significant
Female Teachers	660	2.81	0.96				

Table 3 shows the independent t-test analysis of the mean difference in the response opinions of male and female teachers on the extent to which teachers are utilized in instructional planning in secondary school administration. The result on Table 3 shows that the calculated t-value (0.18) was less than the critical value (0.54). The null hypothesis was not rejected. Therefore, there is no significant difference in the mean ratings of male and female teachers on the extent to which teachers are utilized in instructional planning in secondary school administration in Enugu state. The hypothesis is, therefore not rejected.

Hypotheses Two
There is no significant difference between the mean rating scores of male and female teachers on the extent to which teachers are utilized in student's personnel administration in secondary schools in Enugu state.

Table 4: t-test of significant difference between the mean score of male and female teachers on the extent to which teachers are utilized in students' personnel administration in secondary schools in Enugu state.

Group	N	$\overline{X}$	SD	DF	t-cal	t-critical	Decision
Male teachers	229	2.81	0.84	887	0.33	0.90	Not Significant
Female Teachers	660	2.83	0.85				

Table 4 shows the independent t-test analysis of the mean difference in the response opinions of male and female teachers on the extent to which teachers are utilized in students' personnel administration in secondary school administration. The results on Table 4 show that the calculated t-value (0.33) was less than the critical value (0.90). The null hypothesis was not rejected. Therefore, there is no significant difference in the mean rating scores of male and female teachers on the extent to which teachers are utilized in students' personnel administration in secondary school administration in Enugu state.

Discussion

The findings of this study have shown that teachers are utilized to a great extent in instructional planning in secondary school administration in Enugu state. In other words, respondents greatly shared the view that teachers are utilized in instructional planning in secondary school administration in Enugu state. The findings showed that teachers participate fully in instructional planning, scheme of work and construction of instructional materials.

The findings agree with Erwee (2013) who maintains that teachers as curriculum implementer need to be involved in instructional planning. The findings are also in consonance with the opinion of Anwukah (2011) who noted that implementation of curricular innovations have been encountered with some problems as a result of lack of involvement of teachers in the planning. He maintained that for curricular innovation to be successfully implemented, curricular planners' needs to involve teachers and make them part of the curricular. The findings also revealed that there was no significant difference between the mean rating scores of male and female teachers on the extent to which teachers are utilized in instructional planning in secondary school administration in Enugu state.

Evidence from the study revealed that the respondents shared the view that teachers are utilized to a great extent in students' personnel administration in secondary school administration in Enugu state. In other words, the findings show that teachers are involved in students' personnel administration in secondary schools in Enugu state. The findings agree with Oboegbulum (2014) who noted that teachers have enormous role to play in students' personnel administration, therefore, for the aims and objectives of students' personnel administration in school to be achieved teachers need to be greatly involved and utilized in students' personnel administration. The finding also agree with Ibrahim (2003) who opined that for guidance and counseling services as part of students' personnel administration to be fully realized, teachers need to be involved. The findings also revealed that there was no significant difference between the mean rating scores of male and female teachers on the extent to which teachers are utilized in students' personnel administration in secondary schools in Enugu state.

Conclusion

The study concludes that teachers are utilized to a great extent in instructional planning. The finding also showed that teachers are utilized to a great extent in students' personnel administration in secondary schools in Enugu state.

Recommendations

 Based on the findings, the following recommendations were proffered.
1. Curricular planners should always involve teachers in planning and always integrate them to any curricular innovation.
2. School management should encourage students' to participate in extra curricular activities such as debate, football, and cultural group. All these will help to increase students' personnel administration in the school

REFERENCES

Anwukah, T.G. (2011), *curriculum development for responsive education in third world Countries.* Owerri: Cape Publishers International Ltd.

Derel, N. and Heather, L. (2017). *The Management of Organizational Resources,* London: Prentice hall, Inc. Englewood Cliffs.

Erwee, R. (2013), *Integrating Diversity Management Initiatives   with Strategic human Resource Management,* in Wiesner, R. and Millett, R. (2003) Op. Cit, p.59.

Ezeani, E.O. and Nwankwo B.C. (2012). *Human Resources Management in the Local Government System in Nigeria Nsukka:* Apex Press Pub. Company.

Ibrahim, A.I. (2003), *Principles of Curriculum: Planning and Implementation,* Iboron: Tajudeun Press.

Kelly, D. (2011) Dual Perception of HRD: Issues for policy, SMES, other constituencies and the contested definitions of human resources development.

Nwangwu, I.O (2015) *Personnel Management in Education,* human resources administration and development. Onitsha: Noble graphic press.

Nwankwo B.C. (2020). *Human Resources Management in the Local Government System in Nigeria Nsukka:* Apex Press Pub. Company.

Nworgu, B.C. (2016). Educational Research: Basic Issues and Methodology. Ibadan: Wisdom.

Oboegbulem, A.I. (2014) *Stress Management and School Effectiveness.* Enugu: Magnet Press.

Peretomode, V.F. (2011) *Educational Administration: Applied concepts and theoretical perspectives. Nigeria*: Jopa Press Ltd.

Yusuf J. (2013), *Effective manpower utilization:* The Nigerian economy, Centre for Management Development.

PARENTING STYLES AS CORRELATE OF ACADEMIC ACHIEVEMENT OF SENIOR SECONDARY SCHOOL STUDENTS IN ANAMBRA STATE, NIGERIA

[1]Susan Ebele Obadike & [2]Gabriel Chidi Unachukwu (*Prof.*)
[1 & 2]Department of Educational Foundations, Faculty of Education, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria,
[1]*07032205841, se.ofora@unizik.edu.ng, [2]08033361004, gc.unachukwu@unizik.edu.ng*

Abstract
The study investigated parenting styles as correlates of academic achievement of senior secondary school students in Anambra State. Four research questions and four null hypotheses guided the study. The correlational research design was adopted for the study. The sample of the study consisted of 952 SS2 students. The instrument used for data collection was the Parenting Style Questionnaire (PSQ) adapted from Kimble (2009) and Shyny (2017). The instrument was validated by three experts in the Faculty of Education, Nnamdi Azikiwe, Awka. The reliability of the instrument was ascertained using Cronbach Alpha which yielded an alpha coefficient of 0.81. Data were collected by administering the instruments with the aid of five research assistants. Pearson Product Moment Correlation Coefficient was used to answer the research questions while the t-test at 0.05 level of significance was used for testing the research hypotheses. The findings revealed a positive relationship between authoritative parenting style and student's academic achievement. It also revealed a negative relationship between authoritarian, permissive and uninvolved parenting styles and student's academic achievement respectively. The researcher recommended among others that seminars and other awareness creation activities to be organized for parents, teachers, counsellors and other stakeholders should focus among other things topics on the different parenting styles to highlight their importance for student's academic achievement.
Keywords: Parenting Styles, Authoritative, Authoritarian, Permissive, Uninvolved, Academic Achievement,

Introduction

Education is considered critical for the sustainable development of individuals, nations and the world. The quality of educated individuals available in any society determines its pace of development. Therefore, attainment of academic success is paramount. In educational institutions at all levels: primary, post primary and post-secondary, academic success is measured by academic achievement. Academic achievement is the scholastic standing of a child at a given point in time; it is the knowledge obtained or skills developed in the school subjects usually designed by test scores or marks assigned by the teacher (Okwuduba, Nwosu, Okigbo, Samuel and Achugbu, 2021). This is supported by Unachukwu, Anierobi, Nwosu and Okeke (2021). The authors asserted that teachers usually determine academic achievement through continuous assessment by administering tests and also by examination grades achieved by students at the end of every examination. According to Amponsah, Milledzi, Ampoto and Gymbra (2018), academic achievement

can be either high or low. Having higher academic achievement has been associated with positive characteristics, including self-esteem, self-efficacy and motivation (Theresya, Latifah and Hernawati, 2018). On the other hand, low academic achievement according to Kiama, Aloka and Gumbi (2018), may create many negative consequences for students such as stress, hopelessness, delinquency, psychopathology and substance abuse. The critical role education plays in development has led to stakeholders raising concerns on possible factors that affect academic achievement and how these factors work.

Studies such as Okwuduba and Okigbo, (2018); Imran, Kakar and Yousaf (2020) have provided insights into factors that possibly contribute to poor academic achievement. These studies have traced poor achievement to several possible factors and have identified several causative phenomena that could affect individual scholastic achievement. A student's academic achievement depends on the student's personal characteristics, home, school, society and psychosocial factors (Nwosu, Nwasor, Onyebuchi and Nwanguma, (2020). The extent to which a student can learn and develop is to a large degree affected by these factors. There is no gainsaying that the home environment particularly especially parents, parental factors play a significant role in the social and academic life of their children that would impact on their academic achievement. Researchers have shown that parents, through their parenting practices, values and behaviours build critical foundations for various aspects of their children's development and achievement (Sahithya, Manohari and Vijaya, 2019). Studies have shown that parents influence their children's academic development and achievement through various processes, including parents' values and beliefs, educational aspirations, parental involvement, parenting styles and practices. Generally, parenting styles have a significant relationship with students' academic achievement (Kiama *et al.*, 2018; Ugwuanyi, Okeke and Njeze, 2020). This is so because parents are the first educators of their children and they do this using various approaches and styles. This view is supported by Imran, Kakar and Yousaf (2020) who asserted that parents are key persons who play very important role in the development and upbringing of their children. According to Family and Human Life Unit, Abuja (FHLU, 2021), parenting styles are behaviours, values and standards that are transmitted toward children, and these behaviours, values and standards are expected to be adopted by children. They serve multiple purposes which include the moral and psychological training of a child, the identification, 2growth and development of a child's talents amongst other things. Imran *et al.* (2020) opined that well cared students who are reared under best parenting styles would be resilient, socially competent and emotionally strong and such students have the capability to discover novel opportunities. Parenting styles have been conceptualized into four types based on the dimensions of levels of demandingness and responsiveness, Baumrind (1971). Responsiveness represents warm supportiveness while demandingness means the behavioural control. The parenting styles are: authoritarian (high demandingness and low responsiveness), authoritative (high demandingness and responsiveness), permissive (low demandingness and high responsiveness) and uninvolved parenting styles (low in demandingness and responsiveness), (FHLU, 2021). Authoritarian parents are restricted to one dimension, demandingness. They are found to be unresponsive (Ironsi,

2020). According to Alyssa (2020), authoritarian parents restrict their children by rules and structured environment and are not flexible in nature.

A balance between these two dimensions is maintained by authoritative parenting style. Authoritative parents are supportive in nature, demonstrate involvement and warmth. On the other hand, permissive parents are responsive but not demanding in nature; give children opportunity to plan their activities as per their interest. They exert minimum control over children and do not restrict them in their social activity nor to achieve realistic goals (FHLU, 2021). In contrast, uninvolved parents are neither responsive nor demanding. They rarely show any interest in their children's affairs such as school and friends. Uninvolved parents are described as not being warm, supportive and involved. Ibukunolu, (2013) asserted that the parenting style adopted by a parent can be either to the development or to detriment of the child's academic career.

Findings from studies found out that authoritative parenting style have positive outcomes on children's academic achievement more than any other style. It was found out to connect to positive children's outcomes including high academic achievement, academic identity, intrinsic motivation, self-resilience, mental health and wellbeing (Imran *et al.* 2020; Stuck 2023). On the other hand, authoritarian, permissive and uninvolved parenting styles were found to have negative outcomes on children's academic achievement (Nwune and Anidi 2021; Obiunu 2018). Despite the role that parenting styles play in children's academic achievement, it appears that few studies have been carried out to determine the relationship between dimensions of parenting styles and academic achievement of senior secondary school students in Anambra State, hence the choice of the researchers to conduct this study.

Purpose of the Study

The purpose of this study is to find out the relationship between students' parenting styles and their academic achievement in senior secondary schools in Anambra State. Specifically, the study determined:

a) The relationship between authoritarian parenting style and academic achievement of senior secondary school students in Anambra State.
b) The relationship between authoritative parenting style and academic achievement of senior secondary school students in Anambra State.
c) The relationship between permissive parenting style and academic achievement of senior secondary school students in Anambra State.
d) The relationship between uninvolved parenting style and academic achievement of senior secondary school students in Anambra State.

Research Questions

The following research questions guided the study:

1. What is the relationship between authoritarian parenting style and academic achievement scores of senior secondary school students?
2. What is the relationship between authoritative parenting style and academic achievement scores of senior secondary school students?

3. What is the relationship between permissive parenting style and academic achievement scores of senior secondary school students?
4. What is the relationship between uninvolved parenting styles and academic achievement scores of senior secondary school students?

Hypotheses

The following null hypotheses guided the study:

1. There is no significant relationship between authoritarian parenting style and academic achievement of senior secondary school students.
2. There is no significant relationship between authoritative parenting style and academic achievement of senior secondary school students.
3. There is no significant relationship between permissive parenting style and academic achievement of senior secondary school students.
4. There is no significant relationship between uninvolved parenting style and academic achievement of senior secondary school students.

Methods

The correlation research design was used for the study. According to Nworgu (2015), correlation research is a type of research design that seeks to establish a statistically corresponding relationship between two or more variables by observing these variables. The design was adopted because this study is interested in establishing whether there is a relationship between each of the dimensions of parenting styles and academic achievement of senior secondary school students in Anambra State. This study was delimited to senior secondary two students in three education zones in Anambra state. The population of the study comprised 19,042 senior secondary class two (SS2) students' drawn from the 262 public secondary schools in Anambra State (Source: Post Primary Schools Commission (PPSC) Anambra State). The SS 2 students were chosen because they are not in external examination class. The sample used for the study consisted of 952 SS2 students drawn from 14 schools. A multistage sampling procedure was employed in the selection of the sample. Simple random sampling was used at the first stage to select three out of the six education zones in Anambra State. Secondly, purposive sampling was used to select the sample LGAs and schools respectively. The sample was finally randomly selected from the SS 2 students present at the time of the study from each of the schools. The instrument data collection in the study was Parenting Styles Questionnaire (PSQ). The PSQ is a 32-item questionnaire adapted from Kimble (2009) and Shyny (2017). The researchers adapted items from both scales to form a scale that was used in this study. The PSQ consists of items that elicited information on the four subscales of authoritarian, authoritative, permissive and uninvolved parenting styles. In adapting the instrument, some of the items were reworded to be specific on parenting styles and academic matters. Each of these subscales contains 8 items with five-point rating scales of Never 1, Rarely 2, Some of the time 3, Most of the time 4 to All the time 5. The PSQ was subjected to content and face validity by three experts in the Faculty of Education, Nnamdi Azikiwe University, Awka.

The reliability of the instrument was ascertained using Cronbach alpha which yielded an alpha coefficient of 0.81. The data collected for the study was analysed using SPSS version 25. The students' annual cumulative scores in English Language and Mathematics were collected from each of the sampled schools and used for analysis. Statistical analysis of inferences was carried out using Pearson Product Moment Correlation Coefficient for the research questions and the t-test which was tested at 0.05 level of significance for the hypotheses.

Results
Research Question One
What is the relationship between authoritarian parenting style and students' academic achievement?

Table 1: Correlation between Authoritarian parenting style and students' Academic Achievement

Variables	*N*	Academic Achievement (*r*)	Decision
Authoritarian Parenting style	949	-.257	Low negative relationship

Table 1 reveals that authoritarian parenting style has low negative relationship with students' academic achievement. This is evident from the Pearson Correlation Coefficient (r) value = -.257.

Table 2: Test of Significant Relationship between Authoritarian parenting style and Academic Achievement of students.

Variable	N	Academic Achievement	α-level	t(r)-cal	p-val	Decision
Authoritarian parenting style	949	-.257	0.05	-3.232	.001	Significant

Table 2 shows that there is statistically significant negative relationship between authoritarian parenting style and students' academic achievement. This is so because the p-value = .001 is less than the level of significance = 0.05.

Therefore, the statement of null hypothesis that there is no significant relationship between authoritarian parenting style and students' academic achievement is rejected. This implies that there is significant relationship authoritarian parenting style and student's academic achievement.

Research Question One
What is the relationship between authoritative parenting style and students' academic achievement?

Table 3: Correlation between Authoritative parenting style and students' Academic Achievement

Variables	*N*	Academic Achievement (*r*)	Decision

Authoritative Parenting	949	.059	Low positive relationship

Table 3 shows that authoritative parenting style related positively but weakly with students' academic achievement. This is evident in the Pearson Correlation Coefficient *(r)* value = *.059*.

Table 4: Test of Significant Relationship between Authoritative parenting style and Academic Achievement of students.

Variable	N	Academic Achievement	α-level	t(r)-cal	p-val	Decision
Authoritative parenting style		.059		1.410	.159	Not Significant

Table 4 shows that there is no statistically significant relationship between authoritative parenting style and student's academic achievement. This is so because the p-value = .159, is greater than the level of significance = 0.05. Therefore, the researchers did not reject the null hypothesis. This finding shows that although there is a relationship between authoritative parenting style and academic achievement but the relationship was not significant.

Research Question Three

What is the relationship between permissive parenting style and students' academic achievement?

Table 5: Correlation between Permissive parenting style and students' Academic Achievement

Variables	N	Academic Achievement *(r)*	Decision
Permissive Parenting	949	-.377	Low negative relationship

Table 5 reveals that there is a low negative relationship between permissive parenting style and academic achievement of students. This is evident in the Coefficient (r) value = - 0.377.

Table 6: Test of Significant Relationship between Permissive parenting style and Academic Achievement of students.

Variable	N	Academic Achievement	α-level	t(r)-Cal	p-val	Decision
Permissive parenting style	949	-.377	0.05	-6.483	.000	Significant

Table 6 shows that there is statistically significant negative relationship between permissive parenting style and students' academic achievement. This is so because the p-value = .000, is less than the level of significance = 0.05. Therefore, the statement of null hypothesis that there is no significant relationship between the permissive parenting style

and students' academic achievement is rejected. This implies that there is significant relationship between permissive parenting style and student's academic achievement.

Research Question Four
What is the relationship between uninvolved parenting style and students' academic achievement?
Table 7: Correlation between Uninvolved parenting style and students' Academic Achievement

Variables	*N*	Academic Achievement (*r*)	Decision
Uninvolved Parenting style	949	-.324	Low negative relationship

Table 7 also reveals that there is a low negative relationship between uninvolved parenting style and student's academic achievement. This is evident in the Coefficient (r) value = -0.324.

Table 8: Test of Significant Relationship between Uninvolved parenting style and Academic Achievement of students.

Variable	N	Academic Achievement	α-level	t(r)-cal	p-val	Decision
Uninvolved parenting style	949	-.324	0.05	-2.901	.004	Significant
Overall		.413				

Table 8 shows that there is statistically significant negative relationship between uninvolved parenting style and students' academic achievement. This is so because the p-value = .004 is less than the level of significance = 0.05. Therefore, the statement of null hypothesis that there is no significant relationship between uninvolved parenting style and students' academic achievement is rejected. This implies that there is significant relationship uninvolved parenting style and student's academic achievement.

Table 9: Test of Significant Relationship between Parenting styles and Academic Achievement of students

Variable	N	Academic Achievement joint (*r*)	α-level	p-val	Decision
8Parenting styles	949	.413	0.05	0.000	Significant

Table 9 shows the summary. Overall, the joint *r* is significant at 0.05 level of significance, p = 0.000. Therefore, the null hypothesis that there is no significant relationship between the dimensions of parenting styles and students' academic achievement is rejected.

Discussion
The findings of the study revealed that there is negative relationship between three dimensions of parenting styles and students' academic achievement. These are

authoritarian, permissive and uninvolved parenting styles. On further testing it was found out that the negative relationship was not significant. It also revealed that there is low positive relationship between authoritative parenting style and students' academic achievement. The results show that authoritative parenting had the most positive influence on academic achievement compared to all the other styles. On further testing it was found out that the positive relationship was significant. Therefore, the statement of null hypothesis that there is no significant relationship between the dimensions of parenting styles and students' academic achievement is rejected. This implies that there is significant relationship between parenting styles and student's academic achievement. The findings of this study support the findings of Nwune and Anidi, (2021) and Imran, Kakar and Yousaf (2020). Nwune and Anidi found out that there is a negative relationship between authoritarian, permissive and uninvolved parenting styles and academic achievement. It also agrees with their findings that there is a positive relationship between authoritative parenting and styles and academic achievement. Similarly, Imran, Kakar and Yousaf found out that other dimensions of parenting styles other than authoritative parenting style relate negatively with academic achievement of students.

The findings are also in line with the findings of Stuck (2023) and Hayek *et al*, (2022). Stuck found out that high academic achievement is one of the effects of authoritative parenting style. Students of authoritarian, permissive and uninvolved parents were significantly less likely to have high academic achievement. Hayek *et al*, (2022) documented a positive effect of authoritative parenting style on school outcomes among younger children. Hence, even though there may be other social influences such as peer relations, social media, school environment, parents continue to largely impact their children's outcomes. The findings of this study are consistent with these studies that found out beneficial effect of authoritative parenting on academic achievement.

Conclusion

Based on the findings of the study, the researchers concluded that there is a positive relationship between authoritative parenting style and academic achievement and negative relationship between authoritarian, permissive and uninvolved parenting styles and academic achievement. Based on these findings, it was concluded that parenting styles are central factors in student's academic achievement.

Recommendations

Based on the findings of this study, the following recommendations are made:
1. Parenting programs and interventions aimed at fostering positive parenting should be organized in schools during PTA meetings for parents.
3. Guidance Counsellors should organize orientation programmes for students to include topics on various parenting styles and how to cope with the style adopted by their parents at home to enable them improve their academic achievement in school.
4. Trainings and seminars, should be organized for teachers to equip them with relevant knowledge and skills to help students adapt to the home environment.

REFERENCES

Alyssa, M. (2020): Studies at the High School Experiences. Retrieved on 7/6/2021 from htpps:// www.quora.com/- what makes for a good educational experience?

Amponsah, M. O, Milledzi, E. Y, Ampoto, E. T and Gymbra, M. (2018): Relationship between parental involvement and academic performance of senior high school students: The case of Ashanti Manpong Municipality of Ghana. *American Journal of Educational Research 6* (1), 1-8.

Baumrind, D. (1971). Current patterns of parental authority. Developmental psychology, 4(1p2), Family a/lnd Human Life Unit (2021): The impact of good parenting on children and the society Catholic Secretariat of Nigeria, Abuja pp 1- 13**.**

Ibukunolu, A. G.A. (2013): Parenting Style and Students Academic Achievement in Junior Secondary Schools in Ogun State, *Nigeria Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS) 5(1):* 20-24(ISSN: 2141-6990). Electronic version Retrieved 4/08/2021

Imran, M. J, Kakar, K and Yousaf. M (2020): Effect of parenting styles on academic performance of disable students in Quetta, Pakistan: Research Article *World Journal of Advanced Research and Reviews, 2020, 07(03), 062–069* Article DOI: https://doi.org/10.30574/wjarr.2020.7.3.0324 Retrieved 20/06/2021

Kiama, R.W, Aloka, P. J. O and Gumbi. E (2018): Influence of Parenting Styles on Academic Performance among Girls in Public Secondary Schools in Kenya International Journal of Advanced and Multidisciplinary Social Science 2018, 4(2): 39-44. Electronic version Retrieved 21/07/2021.

Kimble, A. B. (2014): The Parenting Styles and Dimension Questionnaire: A Reconceptualization and Validation. Retrieved 17/5/2021 from

https://shareok.org/bitstream/handle/11244/14936/Kimble_okstate_0664M_13607.pdf? sequence=1

Nwosu, K.C, Nwasor, V.C, Onyebuchi, G.C. and Nwanguma, V.C. (2020): Understanding Adolescents' Moral Stance on Examination Malpractice through the Lenses of Parenting Styles, Test Anxiety and their Academic Self-efficacy. *Journal of Research in Educational Psychology, 18 (2),* 225-254Electronic Version. ISSN:1696-2095. 2020. no. 51 - 177 Retrieved 13/09/2021**.**

Nwune E.C and Anidi A. C (2021): Parenting styles as a correlate of academic achievement of primary school pupils in Awka south. *Journal Plus Education*, Vol xxviii, No. 1, pp. 30-38 Electronic version ISSN: 1842 077X, E-ISSN (online) 2068 – 1151, Retrieved on 4/08/2021**.**

Obiunu, J. J. (2018): Influence of Parenting Styles on the Academic Performance of Secondary School Students in Ethiope East Local Government Area Delta State *International Journal of Educational Technology and Learning*, *2*(2), 54-58. https://doi.org/https://doi.org/10.20448/2003.22.54.58. Electronic version Retrieved 30/7/2021**.**

Okwuduba, E. N., Nwosu, K. C., Okigbo, E. C., Samuel, N. N. Achugbu, C. (2021): Impact of intrapersonal and interpersonal emotional intelligence and self-directed learning

on   academic performance among pre-university science students. Heliyon, 7(3), e06611

Okwuduba, E. N. and Okigbo, E. C. (2018). Effect of teaching methods on students' academic performance in chemistry in Nigeria: meta-analytic review. Bulgarian Journal of Science and Education Policy, 12(2), 418-434

Sahithya, B., Manohari, S and Vijaya. R. (2019): Parenting styles and its impact on children—A cross cultural review with a focus on India. *Mental Health Relig. Cult.*, 22, 357–383. Retrieved 1/9/2021.

Shyny, A. M. (2017). Construction and Validation of PS_FFQ (Parenting Style Four Factor Questionnaire IJEDR Volume 5, Issue 3 ISSN: 2321 – 9939. Retrieved 17/5/2021

Stuck, A. M. (2023): The 4 Types of Parenting Styles.

https://www.choosingtherapy.com/parenting-styles/ Retrieved 19/7/2023

Theresya, J. Latifah, M. and Hernawati, N. (2018): Effect of parenting style, self-efficacy and self-regulated learning on adolescents' academic achievement. *Journal of Child Development Studies*, Vol. 03, No. 01 page 28-43 DOI: 10.29244/jcds.3.1.28-43 Retrieved on 7/8/2021.

Ugwuanyi, C.S., Okeke, C.I.O and Njeze, K.C, (2020): Parenting style and parental support on learner's academic achievement, *Journal of Sociology Soc Anth*, 11(3-4): 198-205. DOI: 10.31901/24566764.2020/11.3-4.352 Retrieved 20/06/2021.

Unachukwu, G. C. Anierobi, E.I., Nwosu, K. C and Okeke. N.U (2021): TRDF Influence of Academic Self-Efficacy and Resilience on Academic Achievement among Secondary School Students in Aguata L.G.A., Anambra State, Nigeria. Electronic version https://www.researchgate.net/publication/354177596 Retrieved 1/9/2021.

EFFECT OF PEER GROUP ACTIVITY-BASED LEARNING STRATEGY ON STUDENTS' ACADEMIC ACHIEVEMENT IN INTEGRATED SCIENCE IN LAGOS STATE, NIGERIA

**Delphonso Bamidele Tokunbo (*Ph.D), Osunloye Olawale Adejumo,*
Sunday Ernest Frank &Ajose Okunola Oluwagbotemi**
Department of Natural Science, College of Science Education,
Lagos State University of Education, Oto/Ijanikin, Lagos State, Nigeria.
Delphonsobt@lasued.edu.ng,08023878870Osunloyeolawale@gmail.com,
Sundayfrank2019@gmail.com,08023878870.Ajoseoluwagbotemi8@gmail.com,
08057420740, 08132181437

Abstract
This paper examined the effect of peer group activity-based learning on Junior Secondary 8Schools students' academic achievement in integrated science. The study adopted quasi experimental research design. Two hypotheses were generated for the study. The study consists of 100 purposively sampled students in education district V, Lagos State. Students were taught in their intact classes. A test re-test reliability of 0.75 was obtained in respect of the instruments. The Pre-test and Post-test scores of the experimental and control group served as data for this study. Data analysis was done using ANCOVA. The analysis revealed that students taught using Peer group activity-based teaching strategy performed better academically in integrated science than those taught with traditional method. The findings also revealed significant effect in achievement scores of female students than the male students taught with peer group activity-based method. Furthermore, there was significant interaction effect of gender and peer group assisted based method on students' achievement in integrated science. It was recommended that curriculum planner should include peer group activity-based learning into the integrated science curriculum.; there is a need to organize in-service training for all integrated science teachers in the area of the use of activity-based method of teaching; and Government should provide functional laboratory for effective teaching and learning of integrated science and include more science kits to the schools at all levels, be local, state and federal level.
Keywords: Activity-Based Learning Integrated Science, Peer group, Academic achievement.

Introduction

The use of peer group activity-based method in a conducive learning environment is a golden teaching approach (Ajewole, 2016). It is the corner stone of intellectual development and it leads students to critical thinking. This method lay emphasis on the direct participation of students in th8e learning process. It helps the students to get the right concept while engaging themselves in different activities. Peer activity-based teaching is an approach adopted by the teachers whereby activities are used to bring about effective learning experience. It is a method that motivate the child to become actively involved both mental and physical learning by focusing on the right method. The more students are actively involved in the learning process, the longer they learn. A8ctivity-based method is students centered learning that is taught through many activities. Integrated science due to

its nature of being an activity-oriented course, has the potential of equipping learners with such processed and skills through activities.

The development of science, process skills such as observation, measurement, experimentation, manipulation and problem solving skills among others as well as scientific attitudes such as honesty, objectivity, open-mindedness and willingness to cooperate and accept criticism among others through integrated science can best be realized when the learners are taught practically using the activity-based approach as demanded by the course curriculum and at the same time as recommended by the National Commission for Colleges of Education (NCCE, 2008). Those teaching/learning techniques must have necessary provision for students active engagement with explanatory ideas and evidence so as to enable them make connection of scientific theories and concept to real purpose and practice in the world they live (Tyler 2016). The most recommended strategies for teaching science are problem-solving, inquiry-based teaching, laboratory-based activity and project based teaching/learning. But unfortunately teachers teach classes the same way they were taught, typically using lecture method (Mazur, 2008) and this situation is in continuation since. This stereotype results in learners depending upon role learning without having deep understanding of scientific phenomenon, concepts and theories. Aladejana (2008), Delphonso (2015) & Delphonso (2018) explains that teaching still retains the old conservative approach of teachers acting as repertoire of knowledge and students the dormant recipients. Delphonso (2018) further states that the traditional teacher-centered teaching approach which favours passive reception of knowledge is still in vogue in most of our secondary schools all over the country and such an approach has been criticized for its neglect of students' learning from a variety of sources.

A positive attempt to improve students' learning of scientific concepts will therefore involve the use of strategies that are tailored towards constructivism that will help to modify students' misconceptions. The process of modifying misconceptions with scientifically acceptable concepts is called conceptual change. Constructivism is one of the pedagogical tools used to 2promote conceptual change among learners. The unique features of conceptual change instruction are (1) students exhibit their conceptions explicitly so that they become conscious of their own ideas and thinking including groups and (2) that students are constantly engaged in evaluating and revising their conceptions. Since learners engage in activities that aid the processing of information and mental activities that will assist them to acquire, organize, s8tructure instill and retrieve incoming knowledge efficiently (Park, 1995), learning therefore, depends on the use of appropriate thinking strategies that will promote meaningful learning where teachers go about teaching for conceptual change by making use of teaching methods that emphasize constructivist philosophies.

Theoretical Framework
The theoretical framework of this study is based on constructivist theory. A basic assumption in teaching for conceptual change is the key constructivist idea that construction of new conceptions (learning) is possible only on the basis of already existing conceptions. Piaget's Genetic Epistemology is fundamentally constructivist. It emphasizes that assimilation, accommodation, disequilibrium and equilibrium are important components in the conceptual change process. Von Glaserfeld (1988) described constructivism as a theory of knowledge which is rooted in philosophy, psychology and cybernetics. Yager (1991) claims that constructivist theory of knowing and ability to cope

depends on equilibrium state while the equilibrium is like a balance beam. According to Slavin (1987), there are two major theoretical perspectives related to cooperative learning -- motivational and cognitive. The motivational theories of cooperative learning emphasize the students' incentives to do academic work, while the cognitive components emphasize the effects of working together.

Social Constructivism is a variety of cognitive constructivism that emphasizes the collaborative nature of learning. Social Constructivism was developed by post-revolutionary Soviet psychologist; Vygotsky. Vygotsky was a cognitivist, but rejected the assumption made by cognitivists such as Piaget and Perry that it was possible to separate learning from its social context. He argued that all cognitive functions originate in, and must therefore be explained as products of, social interactions and learning is not simply the assimilation and accommodation of new knowledge by learners; it is the process by which learners were integrated into a knowledge community.

Teaching strategies based upon cognitive dissonance and its resolution has been used as the basis for developing teaching strategies designed to teach for conceptual change. These teaching strategies are derived from a Piagetian constructivist view of learning; they involve creating situations where learners' existing conceptions about particular phenomena or topic are made explicit and then directly challenged in order to create a state of cognitive conflict. Cooperative Learning and Conceptual change Strategies related and rooted in both social and radical constructivism as they create and encourage social and pattern of interactions among students. Therefore it is against this premise that Cooperative Learning Approach is one of the appropriate and effective teaching strategies that guide the learners to attain goals that cannot be obtained working alone or competitively.

The use of active learning strategies, such as peer group, cooperative learning and Conceptual Change Strategy is growing at a remarkable speed. These learning strategies employ a variety of learning activities to improve students' understanding of a subject by using a structured approach which involves a series of steps, requiring students to create, analyze and apply concepts (Kagan, 1990). Based on the foregoing, the theoretical thrust of this study is derived from previous works of Dewey 1938; Piaget 1930, 1973, and Vygosky 1978. The relevance of this investigation to such previous works is in the areas of cognition, logic reasoning, schema, problem-solving, group work, collaboration, memory inference and concept formation.

Integrated science is a practical subject which equips students with concepts and skills that are useful in solving the day-to-day problems of life. The study of integrated science aims at providing the learner with necessary knowledge with which to control or change the environment for the benefit of an individual, family or community. But lack of good science achievements in the part of students is linked to the poor performance to poor quality of science teachers, large and overcrowded classrooms and lack of suitable and adequate science equipment, students' misconceptions derived from religious, cultural and societal related sources (Salami, 2012). Both activity-based learning/teaching and Peer instructions are embedded in Constructivist theories of learning and both are being used in science classrooms with positive outcome.

Storh (2016) conducted a researcher to find relationship between students' achievement and hands on experience in a science classroom. A significant difference was found across the hands-on frequency variable with respect to science achievement of the students. The student who had been engaged in hand-on activities every day or once a week scored significantly higher on a standardized test of science achievement than students

engaged in hands-on activities once a month or never. Thus the integrating of peer instruction and activity-based instructing may be analogous to laboratory class supported by group discussion that form the core pedagogical practices as discerns by Planner (2013), where hands-on activities challenge learner personal theories and prior conceptions while group discussion allow them to reconstruct and reshape their knowledge, all this provides for deep understanding and conceptual linkage of various scientific representations unfortunately, research reports showed that the teaching of science in Nigeria secondary schools fall short of the standard expected of it. It has been observed that the present methods used in the teaching students in secondary school do not augur well for the acquisition of able process skills by students (Vandor, 2012, Ibe 2014, Madu 2015). These methods are demonstration of lecture, direct observation, fielding group work laboratory activities, reading, reciting, seminar and programmed instruction. Ali (2017) asserted that the most effective method of teaching should be laboratory centered activity oriented rather than textbook or lecture centered which characterized the Nigerian schools. It is against this background that the effects of Peer group activity-based learning on students' academic achievement in integrated science would be investigated.

Purpose of the study
The purpose of this study is to investigate the effect of peer group activity-based learning on students' academic achievement in integrated science in Ojo Local Government Area. Therefore, the specific objectives of this research are to:
1. determine the effect of Peer group activity-based learning strategy and Traditional methods on academic achievement of students in integrated science
2. examine the effect of gender and peer group activities-based learning method on the achievement of means scores of students taught integrated science.

Research Questions
The following research questions for the study are as follows:
1. What is the effect of Peer group activity-based learning strategy and Traditional methods on academic achievement of students in integrated Science?
2. What is the effect of gender on the achievement of means scores of students taught integrated science using peer group activities-based learning method and traditional method?

Hypotheses
The following null hypotheses were tested at 0.05level of significance
1. There is no significant effect of Peer group activity-based and traditional methods of teaching on academic achievement of the students in integrated science.
2. There is no significance effect of Peer group activity-based and traditional methods in the achievement of means scores of students based on gender
3. There is no significance interaction effect of gender, Peer group activity-based and traditional methods in the achievement of means scores of students based on gender.

Methods
The study adopted a quasi-experimental research design on carrying out investigation. The population of the study comprised of one hundred (100) students from randomly selected junior secondary schools in Ojo Local Educational District of Lagos State. The instrument used for this study was the Achievement Test (AT), which was used for pretest, post- test.

The scores on two administrations of the AT (i.e. test re-test method) were subjected to correlation analysis using Pearson Product Moment Correlation Analysis (PPMCA). The reliability coefficient was 0.75 which was considered high enough as being reliable for the study. The procedure for collection of data was in three main phases and it lasted for three weeks. The phases were: pre- test for the first one week, treatment within second week and post-test within the third week. The data collected were analysed using ANCOVA statistical tool at $p < 0.05$ level of significance.

Results
Research Question One
What is the effect of Peer group activity-based learning strategy and Traditional methods on academic achievement of students in integrated Science?
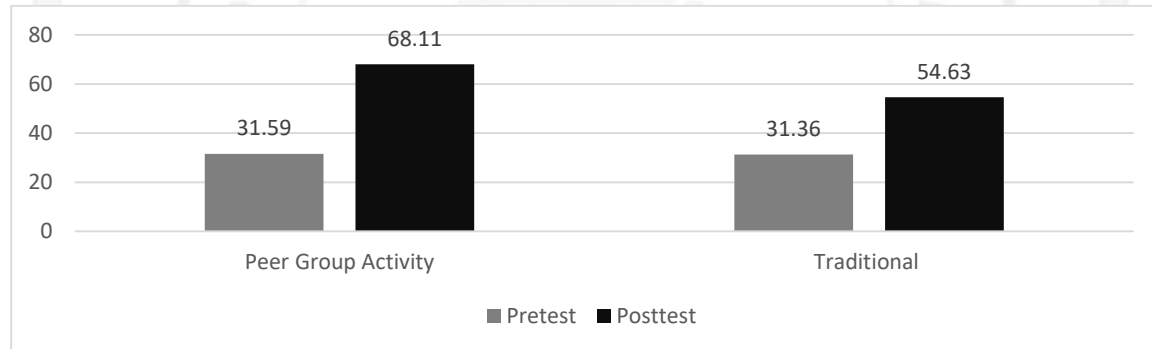

Figure 1. Students' achievement in integrated Science before and after being taught using Peer group activity-based learning strategy and Traditional methods

The result in Figure 1 showed that the students in peer group activity scored 31.59% before the treatment and 68.11% thereafter. Those in traditional classroom scored 31.36% and 54.63% respectively. It implies that peer group activity is more helpful in enhancing their achievement in integrated science.

Research Question Two
What is the effect of gender on the achievement of means scores of students taught integrated science using peer group activities-based learning method and traditional method?
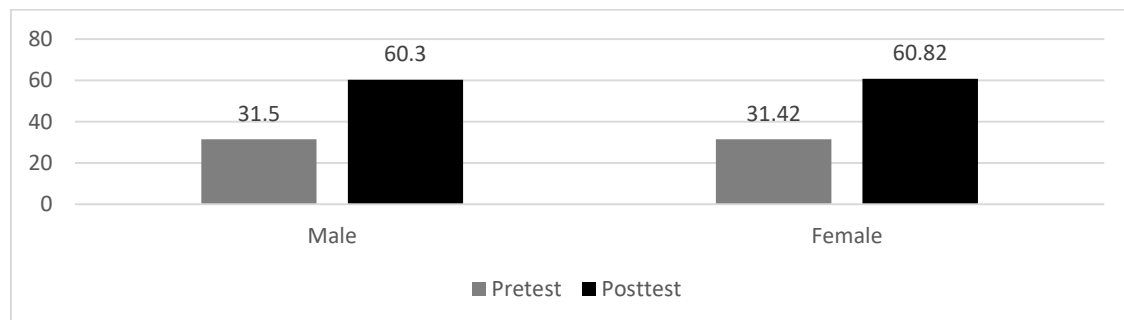

Figure 2. Students' achievement in integrated Science before and after being taught using Peer group activity-based learning strategy and Traditional methods based on gender

From Figure 2, it can be deduced that male students scored 31.5% and 60.3% before and after treatment, while the females scored 31.42% and 60.82% respectively. This means that both male and female students are the same in achievement in integrated science.

Hypothesis One
There is no significant effect of Peer group activity-based method and those taught by traditional method of teaching on academic achievement of students in integrated science.

Table I: Effect of Peer group activity-based and Traditional Method on Academic achievements

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4677.690[a]	4	1169.423	88.526	.000	.788
Intercept	305.109	1	305.109	23.097	.000	.196
Pretest	20.845	1	20.845	1.578	.212	.016
Group	4473.397	1	4473.397	338.637	.000	.781
Error	1254.950	95	13.210			
Total	372684.000	100				
Corrected Total	5932.640	99				

a. R Squared = .788 (Adjusted R Squared = .780)

The result $F(1, 95)=338.64$; $p=0.00$ in Table 1 showed that there is significant effect of Peer group activity-based method and those taught by traditional method of teaching on academic achievement of students in integrated science. The null hypothesis which states that there is no significant effect of Peer group activity-based method and those taught by traditional method of teaching on academic achievement of students in integrated science was rejected. This implies that students exposed to peer group activity-based method performs better in integrated science than those taught with traditional method.

Hypothesis Two
There is no significance difference in the achievement of means scores of male and female students taught integrated science using peer group activities-based learning method and traditional method.

Table II: Effect of Peer group activity-based and Traditional Method on Academic achievements based on gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4677.690[a]	4	1169.423	88.526	.000	.788
Intercept	305.109	1	305.109	23.097	.000	.196
Pretest	20.845	1	20.845	1.578	.212	.016

Gender	86.429	1	86.429	6.543	.012	.064
Error	1254.950	95	13.210			
Total	372684.000	100				
Corrected Total	5932.640	99				

a. R Squared = .788 (Adjusted R Squared = .780)

The outcome F(1, 95)=6.54; p=0.01 in Table 2 showed that there is no significant effect of peer group activity-based method on students' achievement in integrated science. Hence, the null hypothesis which states that there is no significant difference in the mean scores of male and female students taught integrated science using peer group activity-based and traditional methods was rejected. This result indicated that the female students had higher mean scores than the male students. That is to say the female students performed better than the male students taught integrated science using peer group activity-based method as shown in Figure 2.

Hypothesis Three
There is no significance interaction effect of gender, Peer group activity-based and traditional methods in students' means scores in integrated science.

Table III. Interaction effect of gender, peer group activity-based and traditional Method on Academic achievements

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4677.690[a]	4	1169.423	88.526	.000	.788
Intercept	305.109	1	305.109	23.097	.000	.196
Pretest	20.845	1	20.845	1.578	.212	.016
Gender * Group	107.899	1	107.899	8.168	.005	.079
Error	1254.950	95	13.210			
Total	372684.000	100				
Corrected Total	5932.640	99				

a. R Squared = .788 (Adjusted R Squared = .780)

The outcome F(1, 95)=8.17; p=0.01 in Table 3 showed that there is significant interaction effect of gender and peer group activity based method on students' achievement in integrated science. So the third null hypothesis which states that there is no significance interaction effect of gender, Peer group activity-based and traditional methods in students' means scores in integrated science was also rejected. This significant interaction effect could be due to either gender or treatment.

Discussion
The study revealed that peer group activity-based method is an effective method of teaching. This shows that students that were exposed to peer group activity-based method performed better in grades than those taught with traditional method. This is in agreement with Harfield (2018) which asserted that students performed better in integrated science when taught with peer group activity-based method than traditional lecture method. This

implies that students exposed to peer group activity-based method perform well academically in integrated science due to the acquisition of more scientific skills than those exposed to traditional lecture method. Also, Jegede (2013) revealed that peer group activity-based method enhances effective science teaching as a result of acquisition of knowledge of process and product of science by the students through learning science by doing.

It was also discovered from this study that female students performed better in integrated science than male students using activity-based method because of constant interaction with scientific materials. This also implies that peer group activity-based method enhances the performance of female students more than the male students in integrated science. This in line with Stakery (2011) which revealed that peer group activity-based method stimulates the cognitive domain of female more than the (knowledge, understanding, application, synthesis and evaluation) of their male counterparts. The significant interaction effect of gender and the peer-group-activity based method was due to either of the two variables. Based on these findings, it is hereby concluded that using peer group activity-based method during integrated science lesson enhances academic achievement of the students in the subject. This implies that learning by doing enhances retention memory of the learner because it will be absolutely difficult to remember what they were taught without practical experience to demonstrate their ideas among themselves and in things they did by themselves.

Conclusion

Based on the finding made from the study, it was concluded that the use of peer group learning strategy is an effective method of teaching integrated science in secondary schools because it encourages students to learn from each other as they actively and innovatively participate and take responsibility for their own learning.

Recommendations

Based on the findings and discussions of this study, it was recommended that:
(i)   The curriculum planner should include peer group activity-based learning into the integrated science curriculum.
(ii)   There is a need to organize in-service training for all integrated science teachers in the area of the use of activity-based method of teaching.
(iii)   The Government should provide functional laboratory for effective teaching and learning of integrated science.
(iv)   The government should include more science kits to the schools at all levels, be local, state and federal level.
(v)   There is a need for government to provide an enabling environment such as physical infrastructural facilities for effective teaching and learning.
(vi)   In service teachers in integrated science should provide a platform for interaction with learners/students on the use of activity based method of teaching.

REFERENCES

Ajewole G.A (2016).*History and Philosophy of Science Teaching*: Lagos Published and printed by Print City.

Aladejana, F.O, (2008). Blended Learning and Improved Biology Teaching in the Nigerian Secondary Schools. Proceedings of the World Congress on Engineering and Computer Science WCECS   October 22 - 24, San Francisco, USA.

Ali B.O. (2017). Achievement Variations of Basic Science Students taught with teachers centered, teacher/student oriented instructors. *Kaduna State Journal of Educational and Social Research*   2 (8) 34-38.

Delphonso,B.T. (2018). Effectiveness of Cooperative Learning and Conceptual Change Strategies in Improving Learning Outcomes of Prospective Teachers with Different Religious Inclination. *People: International Journal of Social Sciences,* 4(2), 315-329.

Delphonso, B.T.(2015).Effectiveness of Cooperative learning and Conceptual Change Strategies in improving learning outcomes of College of Education Biology students in south-western Nigeria,   Unpublished Doctoral Thesis, Obafemi Awolowo University, Ile-Ife, Osun State,   Nigeria.

Dewey, J. (1938). Experience and Education. Toronto: Collier-MacMillan Canada Ltd.

Ibe, B. F (2014). Activity based teaching strategic in the mathematics classroom. *Journal of Educational Practice* 4 (13), 8-14

Kagan, S. (1990).Educational   Leadership.   Retrieved   September   2,   2023,   from: http://home.capecod.net/~tpanitz/tedsarticles/coopdefinition.htm.

Jegede, C.O. (2013): Effective Science Teaching through the use of local resources: A way out. Paper present at the International Symposium on implication of science education, Abu Zaria.

Mazur, M. O. (2008). Teacher and School Factors as predictors of Students in Integrated Science: *African Journal of Educational Research.*

National Commission for College of Education (2008). Minimum Standard for Nigerian Certificate in   Education (NCE) 4 Edition.

Olarewaju, A. O. (1999). Evaluation of the teaching of integrated science in Lagos and Ondo State   Junior Secondary Schools. 4th STAN Conference Proceedings.

Oludipe, B. & Oludipe, D. (2010). Effect of Constructivist approach in Curriculum development: *University Education Faculty Journal,* 23, 81-84.

Piaget, J. (1930). The Child's Conception of Physical Causality. New York: Harcourt Brace.

Plamer, F.U. (2013). Variable affecting Integrated Science Achievement: *Journal of Research in Science   Teaching* 46(9) 961-976.

Slavin, R.E. (1995). Research on Cooperative Learning: Consensus and Controversy: *Educational   Leadership*, 47 (4), 52 - 54.

Storch, C. H. (2016). A Conceptual frame work for considering Learning with Multiple Representations: *Learning and Instruction*. 16 (3) 183-198.

Tydrer, B.N. (2016). The Effects of an Integrated Activity-Based Science Curriculum on Student   achievement, Science Process skills and Science attitudes: *Electronic Journal of Scientific   Research Journal* (SCIRS) VII (I) 9.

Von-Glaserasfeld, E. (1988). Cognition, Construction of Knowledge and Teaching. Washington, D.C.: National Science Foundation.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Cambridge: MIT Press.

Yarger, G. E. (1991). The Constructivist Learning modal: Toward Reform in Science Education: *The science Teacher*, 4, 52-57.