

**GENDER AND TEACHING METHODS AS DETERMINANTS OF  
SECONDARY SCHOOL STUDENTS' PERFORMANCE AND RETENTION  
IN BIOLOGY IN IKOT EKPENE LOCAL GOVERNMENT AREA**

BY

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***ABSTRACT***

*The study investigated gender and teaching methods as determinants of secondary school students' performance and retention in biology in Ikot Ekpene Local Government Area. The population of this study consisted of six hundred and fifty-six (656) Senior Secondary Two (SS2) Biology Students in all the seven (7) Senior Secondary Schools in the Local Government Area during 2013/2014 school year. The study adopted a quasi-experimental, employing the pre-test, post-test non-equivalent control group design. The data obtained from pre-test and retention test instruments tagged "Cognitive Ability Test and Biology Achievement Test on Carbohydrate" were analysis of covariance (ANCOVA), with pre-test as covariates while all the hypotheses were tested at .05 alpha. The instrument was vetted by expert in biology and test and measurement before the reliability test was conducted with 30 respondents. The test produced the reliability coefficient of 0.89 and this proved the instrument to be reliable for the study. From the results of the data analysis, it was observed that there is no significant influence of gender on the performances of students on the concept of carbohydrate nutrients when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches". It was also observed that there is no significant influence of gender on the retention of students on the concept of carbohydrate nutrients when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches". It was concluded that gender does not affect students' performances and retention on the concept of carbohydrate nutrients when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches. One of the recommendations was that there should be provision of equal access to educational opportunities for all citizens of the country at all levels of education irrespective of sex or tribe as it will enhance teaching and learning effectively.*

**KEYWORDS: Gender, Performance, Retention, Carbohydrates, Teaching Approaches  
Demonstration, Computer-Assisted Instruction and Guided-Inquiry,**

## **Introduction**

Science teachers, educators and curriculum designers have over the years engaged in the reviewing of secondary school science curriculum in an attempt to make students learn science through "hands-on" experience. The importance of biology in our society is no longer in doubt. Nigeria has become one of the greatest importers of food in tropical Africa (Iliyasu,

Hamidu and Anwal, 2006), consequently, poverty and hungers are still experienced in most homes. They added that many people are too poor to feed themselves or to satisfy their most basic and elementary requirement for human survival. Biological knowledge has contributed immensely to various aspects of life such that the conservation of natural resources, food production, better health care and proper family life.

One of the objectives of junior and senior secondary school Education in Nigeria is to inculcate in children permanent literacy and numeracy and the ability to communicate effectively. The objectives according to Onwu (1993) include the need to prepare students to observe and explore the environment to explain simple natural phenomena and to develop scientific attitudes such as curiosity, critical reflection and objectivity. Also, to enable students apply the skills and knowledge gained through science to solve everyday problems in the environment, and to develop self-confidence and self-reliance through problem solving activities in science. On students' performance and gender in West African Senior School Certificate Examination (WASSCE), for the years under review by Onwioduokit (2013), male students performed consistently better than their female counterparts (Appendix 1).

Achievement is an important academic factor that has been identified to be influenced by teaching methods. According to Opara (2011), teaching methods influences students' achievement in Biology. However, some biology teachers do not discriminate in the method they use in teaching. They teach all aspects of biology by lecture method (Okafor, 2002), this may be one reason for poor performance of students in this subject (Biology). It is time teachers of science begin to vary in the methods/strategies they use to teach the different aspects for effective measures, so that students would be able to learn more, retain more, and apply what is learnt by engaging in significant activities. It is on the basis of improving students learning in biology, that the study focuses the influence of gender on students' performances and students' retention of the concept of carbohydrates in biology when taught with Demonstration, Computer Assisted Instruction and Inquiry approaches.

### **Statement of the Problem**

The decline in academic performance of students in biology over the years has been a source of concern to teachers, parents, educators and the general public. There have also been debates among researchers over which variables influence student's academic performance. In spite of the efforts made in teaching to enhance student's academic performance in Biology, it appears that this condition gets deteriorating as their academic performance continues to dwindle.

The way students learn is as important as the way they are learning. The use of appropriate teaching methods would enhance effective retention of the concepts of carbohydrates for subsequent recall and use in examinations. Strategies used in the teaching of biology do seem to have helped in improving students' academic achievement and retention. It is therefore inevitable to try out other teaching approaches that could enhance effective teaching and learning of biology, though Igwue (1990) indicated that there is no one best method. Studies, however, show that some methods are more effective than others (Nwosu & Nzewi, 1998). It is therefore pertinent to find out the extent to which gender influence students' performances and students' retention of the concept of carbohydrates in biology when taught with Demonstration, Computer Assisted Instruction and Inquiry approaches.

### **Purpose of the study**

The purpose of this study is to determine the influence of gender on students' performances and students' retention of the concept of carbohydrates in biology when taught with

Demonstration, Computer Assisted Instruction and Inquiry approaches. Specifically, the study is designed to achieve the following objectives:

1. To ascertain the influence of gender on students' performance on the concept of carbohydrates in biology when taught with Demonstration, Computer Assisted Instruction and Inquiry approaches.
2. To ascertain the influence of gender on students' retention on the concept of carbohydrates in biology when taught with Demonstration, Computer Assisted Instruction and Inquiry approaches.

### **Research Questions**

In order to achieve the above stated objectives, this study will attempt to provide answers to the following research questions:

1. How does gender influence the performance of students on the concept of carbohydrates when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches?
2. How does gender differentiate the retention of students on the concept of carbohydrates when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches?

### **Research Hypotheses**

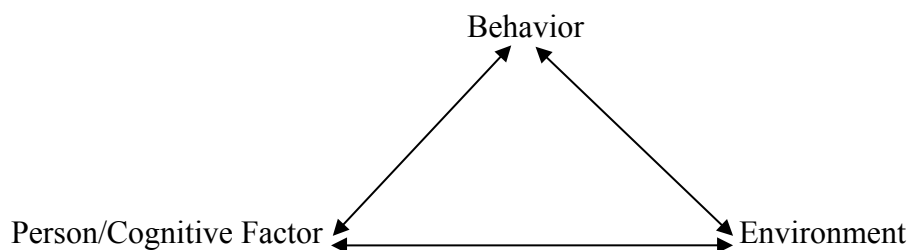
The following null hypotheses were formulated to guide the study:

1. There is no significant influence of gender on the performance of students on the concept of carbohydrates when taught with Demonstration, Computer Assisted Instruction and Guided-Inquiry teaching approaches.
2. There is no significant influence of gender on the retentions on the concept of carbohydrates when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches.

## Review of Related Literature

### Bandura – Learning Theory (1977)

Albert Bandura was a Social psychologist of Canadian descent who worked in America. Albert Bandura – Social Learning Theory (1977), states that behavior is learned from the environment through the process of observation. Albert Bandura – Social Learning theory commonly referred to as observational or imitation theory is primarily based on what a child learns in his environment, interaction and observation of others (Okoli, 2002). Children observed the people around them behaving in various ways. Individuals that are observed are called models. In the society, children are surrounded by many influential models such as parents within the family, members of the peer group and teachers at school. These models provide examples of behavior to be observed and imitated. This theory has a wide application in students' theories of learning in order to provide a comprehensive model that could account for the wide range of learning experiences that occur in the real world. This theory is concerned with personality development (Sprint Hall and Print Hall, 1981). Social theorists believe that personality is simply something that is learned. It is the sum total of all the ways we have learned to act, think and feel (Sprint Hall and Print Hall, 1981). This theory is described as such because it concerns itself with learning from other people in the society. According to Okoli (2002) an inadequate environment will result in inadequate personality development. This is described as Reciprocal Determinism. This model consists of three main factors: behavior, person (cognitive) and environment. These factors interact to influence learning.



**Figure 1: Bandura Model**

**Source: Bandura, 1977**

Social learning theory rest heavily on the concept of modeling or learning by observing behavior. Bandura (1977) outlines three types of modeling stimuli to include:

- **Live Model:** This involves an actual person demonstrating the desired behavior. This is applicable in demonstration teaching techniques.
- **Verbal Instruction Model:** This involves an individual describing the desired behavior in detail who instructs the participants on how to engage in the behavior. This is an application in the enquiry teaching approach.
- **Symbolic Model:** This involves modeling occurring by means of the media which include movies, television, internet, radio and literature. This modeling has a wide application in the computer-assisted instruction approach. According to Bandura (1977) whatever information is gleaned from observation, is influence by the type of model as well as a series of the following cognitive and behavioral processes:
- **Attention:** In order to learn or observe behavior, the observer must pay attention. Any damper on attention decreases learning. For example, if an observer is sleepy, groggy,

drugged, sick, nervous or hyper, learning is decreased. Accordingly, the characteristics of a model influences attention. For example, if a model is colorful and dramatic, attractive or prestigious, appears to be particularly competent. Computer-assisted instructional approach adapts these variables. The use of televisions has a high enhancing influence on students' performance and retention.

- **Retention:** In order to reproduce (remember) an observed behavior, the observer must remember features of the behavior (imagery and language). The observer (learner) features what the model is doing in the form of mental images or verbal descriptions. When these features are stored, they can later be "brought up" for the purpose of reproduction in the learner's behavior. This process is consequently, influenced by observers' characteristics (cognitive capabilities, cognitive rehearsal) and event characteristics (complexity).
- **Reproduction:** This involves translation of the images or description into actual behavior. Observer's characteristics that affect reproduction include cognitive capabilities and previous performance.
- **Motivation:** The decision of an observer (learner) to reproduce or refrain from reproducing an observed behavior is dependent on the motivations and expectations of the observer along with the anticipated consequences and internal standards. Smith (2011), opines that social learning is a powerful principal of operation of demonstration method. In this method, the student observes another person (teacher) who serves as a model and then proceed to imitate what the model does. According to Feldman (1996), Social Learning is facilitated by a number of factors which includes attention, memory, motor skills, reinforcement, and identification.

### Gender and Academic Achievement

Keller (1991) defines gender as a cultural construct that distinguishes the role, behavior, mental and emotional characteristics between female and males developed by a society. Gender can be looked at in terms of a psychological term used to describe the basis of being born of either female or male (Basow, 1991). Basow sees genders' role as not being born of either male or female (Boscow, 2002), gender is defined as the social differences and relations between men and women which are learned and varied widely among societies and culture, and change over time. Okeke noted that gender deals with roles, responsibilities, constraints and opportunities the society grant for man or woman.

Ukwungwu (2002) observed no gender superiority in academic performance Popoola (2010) maintained that if both groups learn the same thing, they are likely to achieve the habit the same way. Adigwe (1992) also saw girls as having a predominantly low interest in science and technology while boys are seen to be more practically, more scientifically and more technologically oriented. Such reports together with cultural expectations and stereotype held about sex roles have caused tremendous damage to women's education. In many developing countries, women education has only been taken seriously within the last decade. In Nigeria, the campaign for women education has only recently received government approval. Nigerian cultural expectations and stereotypes held about sex roles have significant effects on female performance. Such feminine roles include the fact that a woman's place is in the kitchen.

Ogunleye (1999), observed that male and female students' performance equally on acquisition of science process skill tests. Onwioduokit (1996) on effects of gender difference among undergraduate students' academic achievement in science concluded that women's

performance in science was not significantly different from that of their male counterparts. Shaibu and Mari (1997), revealed that female students performed significantly better than male students in their understanding of science process skill, while males perform better than females in the ability to solve problems in science.

Erinosho (1994) and Nsofor (2001) seem to concur that both males and females could do well in science if exposed to similar learning conditions. Archibong (1997), reported no significant difference in the achievement of female and male students exposed to certain chemical concepts. Anagbogu (2003) compared the performance of boys and girls using scientific training manual. The study showed that a new approach to teaching of science will improve scientific performance of girls in the study of science. In the result, girls performed better than boys using strategies that were human oriented.

Isyaku and Kago (1996) examined the effect of sex in the academic performance of field-independent junior secondary school 11 children in Sokoto State. The analysis of the data obtained showed that there was difference in their academic achievement with female independents and female dependents showing superiority over their male counterparts. This reason adduced was that the female students came from schools with best teachers and learning materials.

Sonumesi (1994) reported that there was no significant difference in the academic attainments of female field-independent and male field-independent Senior Secondary 2 students in biology on the contrary Tobin and Garnet (1986) observed that the female field-dependent students scored significantly high in the biology achievement test than their male counterparts (Tobin and Garnete, 1987).

The provision of equal access to educational opportunities for all citizens of the country at all levels of education irrespective of sex or tribe has become very vital for achievement of the MDGs. Okeke (2007), indicates that females are grossly under-achievers in STEM disciplines. Oloyede (2011), noted that female under-achievement in STEM disciplines. Oloyede (2011), noted that female under-achievement in STEM is historical and has been brought about by several interrelated socio-cultural and interacting school factors which act jointly and singly to suppress female interest, enrolment, participation and achievement in STEM education at various levels of the Nigerian education system. These factors include sex-stereotyping, gender bias in curriculum materials, science teaching strategies used by STEM teachers, low expectation of female students and sexual harassment of females.

Many reports have shown that women are still disadvantaged in Nigeria. For example, John and Davou (2008) reported that percentage of educated females in Nigeria as 33% and Males 67%. Improvement in girl-child access to education has been reported by Dantata (2004). Perhaps with many recent reforms surging up in education, increased awareness of the MDGs, many conferences and seminars addressing the issue of gender equality, the situation may or may not have improved. There is evidence that gender stereotyping in science and female under-achievement as reported by Okeke (2007) and Oloyede (2011) still manifest in schools. Perhaps most female students still consider science subjects as more suitable for males. If this tried is not urgently curbed, the realization of the gender equality of the MDGs may still remain farfetched.

Research findings by Oloyede (2011) showed that female students perform better than males in both Physics and Chemistry. This is quite encouraging, contrary to the popular

notion of under achievement of girls in science and reported by Nwaiwu and Audu (2005) and Okeke (2007). Research findings indicate great hope that gender equality, as one of the MDGs, could be attained if urgent attention is given to sensitization of female students to choose science subjects in Senior Secondary, especially those who consistently did well in Basic Science at the JSS level.

## **METHODS**

### **Research Design**

The study was quasi-experimental, employing the pre-test, post-test non-equivalent control group design. There was no randomization of subjects in the study. Intact classes were assigned to the three experimental groups, demonstration, computer-assisted instruction and guided-inquiry approaches.

### **Area of the Study**

The research area for this study was Ikot Ekpene Local Government of Akwa Ibom State. Ikot Ekpene Local Government is made up of 31 local government areas with head quarters at Ikot Ekpene town.

### **Population of the Study**

The population of this study comprised all the six hundred and fifty-six (656) Senior Secondary Two (SS2) Biology Students in all the seven (7) Senior Secondary Schools in the Local Government Area during 2013/2014 school year (Ikot Ekpene LEC Report, 2014).

### **Sample and Sampling Techniques**

The sample for this study was two hundred and sixty-four (264) Senior Secondary Two (SS2) Biology Students representing 40.24% of the target population in six intact Biology classes of the six (6) co-educational Senior Secondary schools in Ikot Ekpene Government Area. Stratified random sampling technique was used in selecting the sampled schools. Simple random sampling method (paper balloting) was used to assign each of the three school to each of the experimental groups (Demonstration, Computer-Assisted Instruction and Guided-Inquiry). This assignment of schools took place in both urban and rural areas of the Local Government Area.

### **Instrumentation**

The following researcher developed instruments were used to collect data for the study

1. Cognitive Ability (CAT)
2. Biology Achievement Test on Carbohydrate, BATC

**Cognitive Ability Test (CAT):** The cognitive Ability Test (CAT) was designed to measure the respondents understanding of basic biological concepts studied in their earlier lessons. It consisted of twenty-five (25) multiple choice objective test items.

**Biology Achievement Test on Carbohydrate:** The biology Achievement Test on Carbohydrate (BATC) was a twenty-five (25) items, 4 options multiple choice objective test was developed to measure the students understanding of the concept investigated.

## **Validation of the Instruments**

The two research instruments (cognitive Ability Test (CAT) and Biology Achievement Test (BAT) were subjected to both content and face validity. Validation copies of the instrument were sent to experts in educational measurement and evaluation, specialists in science education and experienced biology teachers.

## **Reliability of the Instrument**

Field Trial: Biology-Achievement Test on carbohydrate (BATC) was used for the field-trial. The Biology Achievement Test on carbohydrate (BATC) was administered to thirty (30 boys and 15 girls) senior secondary biology two (SS2) students from one senior secondary school in Essien Udim Local Government Area that did not form part of the sample for the study. Their responses to the package and indeed their scores were determined. The test score was used to establish the reliability, difficulty and discrimination indices of the research instrument. Such responses were subjected to an internal consistency reliability test using Kuder Richardson Kr-21 formula (Ali, 2006).

## **Method of Data Analysis**

The data obtained from pre-test and retention test instruments were analysis of covariance (ANCOVA), with pre-test as covariates. All the hypotheses were tested at .05 alpha.

## **RESULTS AND DISCUSSIONS**

### **Results**

#### **Answering the Research Questions**

#### **Research Questions**

##### **Research Question One**

How does gender influence the performance of students on the concept of carbohydrate when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches?



**Table 1:** Mean and Standard Deviation of students' pre-test and post-test scores classified by treatment groups or Gender

Treatment Groups	Gender	Sample Size (n)	Pre test		Post-test		Mean Difference
			$\bar{X}$	SD	$\bar{X}$	SD	
Demonstration	Male	42	22.57	3.93	65.52	4.32	42.95
	Female	44	27.64	5.96	53.59	6.35	25.95
Computer-Assisted Instruction	Male	47	25.94	6.99	64.13	6.69	38.19
	Female	40	22.80	5.76	64.90	6.44	42.10
Guided-Inquiry	Male	41	29.56	5.13	55.02	7.93	25.46
	Female	50	22.96	4.63	55.36	6.92	32.40

In table 1, the post-test, pre-test means differences displayed are 42.95 and 25.95 respectively, for the male and female students taught using Demonstration method, for that for the male and female students in Computer Assisted Instruction group are 38.19 and 42.10 respectively, while the scores of their counterparts taught with Guided Inquiry approach are 25.46 and 32.40 respectively. A comparison of these results shows that Demonstration method had the best enhancing effect on the performance of the male and females while the female students benefitted most from the Computer Assisted Instruction.

**Research Question Two:** How does gender differentiate the retention of students on the concept of carbohydrate when taught with demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches?

**Table 3:** Mean and Standard Deviation of students' pre-test and retention scores classified by treatment groups and Gender

Treatment Groups	Gender	Sample Size (n)	Pre test		Post-test		Mean Difference
			$\bar{X}$	SD	$\bar{X}$	SD	
Demonstration	Male	42	22.57	3.93	53.95	4.56	31.38
	Female	44	27.64	5.96	47.91	5.99	20.27
Computer-Assisted Instruction	Male	47	25.94	6.99	49.06	6.59	23.11
	Female	40	22.80	5.76	58.90	7.19	36.10
Guided-Inquiry	Male	41	29.56	5.13	48.39	6.68	18.83
	Female	50	22.96	4.63	48.80	7.27	25.84

In table 2, the retention pre-test mean differences displayed are 31.38 and 20.27 respectively, for the male and female students taught using Demonstration method; that for the male and female students in Computer Assisted Instruction group are 23.11 and 36.10 respectively, while the scores of their counterparts taught with Guided Inquiry approach are 18.83 and 25.84 respectively. A comparison of these results shows that Demonstration method had the best enhancing effect on the retention of the male students while the female students benefitted most from the Computer Assisted Instruction.

## Hypotheses Testing

### Hypothesis One

There is no significant influence of gender on the performance of students on the concept of carbohydrate when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches.

**Table 3:** Summary of Analysis of Covariance (ANCOVA) of students' post-test scores classified by treatment groups and gender with pre-test as covariate.

Source of Variation	Sum of Square	df	Mean Square	F-cal	Sig.	Decision at $p < .05$
Covariate: <i>Pre-test</i>	76.32	1	76.32	1.79	.18	ns
Main Effects:						
<i>Instructional Methods</i>	1038.62	2	519.31	12.18	.00	s
<i>gender</i>	13.74	1	13.74	.32	.57	ns
Interaction Effects:						
<i>Instructional Methods* Gender</i>	4598.09	2	2299.05	5.92	.00	s
Error	10958.12	257	42.64			
Total	17582.53	263				

R Squared = .377 (Adjusted R Squared = .362)

In Table 3, the Calculated F-Value for the main effect of gender on the students' performances, given instructional methods, at df 1, 257 is .32, while its corresponding significant level is .00 alpha. This significant influence on the performances of the students in carbohydrate nutrients when taught with Demonstration method, Computer Assisted Instruction and Guided-Inquiry approach. Hence, Hypothesis one which assumed that "There is significant influence of gender on the performances of students on the concept of carbohydrate nutrients when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches" – was upheld. The finding was therefore in agreement with the findings of Onwihhiren (2002) who asserted that no significant interaction exists between teaching strategies and gender of students' academic performance and retention of scientific concepts.

**Hypothesis Two:** There is no significant influence of gender on the retention of students on the concept of carbohydrate nutrients when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches.

**Table 4:** Summary of Analysis of Covariance (ANCOVA) of students' retention scores classified by treatment groups and gender with pre-test as covariate

Source of Variation	Sum of Square	df	Mean Square	F-cal	Sig.	Decision at $p < .05$
Covariate: <i>Pre-test</i>	21.47	1	21.47	.51	.48	Ns
Main Effects:						
<i>Instructional Methods</i>	1238.25	2	619.13	14.78	.00	S
<i>gender</i>	107.57	1	107.57	2.57	.11	Ns
Interaction Effects:						
<i>Instructional Methods* Gender</i>	2412.83	2	1206.41	28.80	.00	S
Error	10766.24	257	41.89			
Total	14767.94	263				

R Squared = .271 (Adjusted R Squared = .254)

Table 4.14 showed a calculated F-ratio for the main effect of gender on the students' retention, given instructional methods, at df 1, 257 as 2.57, while its corresponding significant level is .00 alpha. This significant level is greater than .05, indicating that gender had significant influence on the retention of the students in carbohydrate nutrients when taught with Demonstration method, Computer Assisted Instruction and Guided-Inquiry approach. Hence, the hypothesis which assumed that "There is significant influence of gender on the retention of students on the concept of carbohydrate nutrients when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches" – was upheld. The result therefore disagrees with the report of Popoola (2010) who highlighted that there is no significant interaction effect among teaching approaches (demonstration, computer-assisted instruction and guided-inquiry), gender and retention of biology concepts.

## Conclusion

Based on the observations made in this study it is concluded that: there is no significant influence of gender on the performances of students on the concept of carbohydrate nutrients when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches and that there is no significant influence of gender on the retention of students on the concept of carbohydrate nutrients when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches.

## Recommendations

1. There should be provision of equal access to educational opportunities for all citizens of the country at all levels of education irrespective of sex or tribe as it will enhance teaching and learning effectively.
2. Textbook authors should adopt computer-assisted instruction and demonstration teaching approaches in presenting materials and activities in their books.

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