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Effect of Computer-Aided Instruction on Chemistry Students' Achievement in Organic Chemical Nomenclature in Enugu Education Zone of Enugu State, Nigeria

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ABSTRACT: *This study investigated the effect of Computer-Aided Instruction on chemistry students' achievement in organic chemical nomenclature in Enugu Education zone of Enugu State, Nigeria. One research question and one hypothesis guided the study. The design of the study adopted was quasi experimental, pretest-post test, non equivalent control design. The sample for the study comprised of 308 chemistry students (122 male and 186 female) purposively sampled from a population of 2,734 SS1chemistry students in Enugu Education zone of Enugu state. The instrument used for data collection was Teacher Made Organic Nomenclature Achievement Test (TMONAT) with 20 items multiple choice test. The instrument was constructed by the researchers and validated by two experts, one from the department of science education and one from the department of mathematics computer education (measurement and evaluation unit, Enugu State University of Science and Technology, (ESUT). TMONAT achieved a reliability of 0.87 calculated using kuder Richardson 20 (KR-20). Treatment lasted for six weeks. Mean and standard deviation were used to answer research questions while hypothesis was tested at 0.05 significance using Analysis of Covariance (ANCOVA). Males and Females were taught using computer-aided instruction (CAI). The findings of the study revealed that male and female chemistry students taught organic chemical nomenclature (OCN) with Computer-Aided Instruction (CAI) were almost at par in their achievement in OCN. Gender has no significance influence on students' achievement in OCN with CAI. Based on the findings, it was recommended among others that Curriculum planners should include CAI as a model of instruction that promotes gender-equity.*

KEYWORDS: computer-aided, achievement, nomenclature, organic, chemistry.

INTRODUCTION

Education is necessary for the overall development of the citizens of any nation. Every nation cannot develop socially, politically, economically and technologically without sound basic education put in place. Proficiency in basic science is essential for everyday functioning of our technological world (Ogwu 2021). Onyishi (2004) stated that science education provides opportunities for students to acquire relevant functional knowledge.

Science subjects are learnt in the senior secondary schools. Science subjects are chemistry, Biology, Physics, Agriculture, Introductory Technology, Mathematics and Basic Science. Chemistry part of science is taught by chemistry teachers. It has three main branches. They are Physical, Inorganic and Organic Chemistry. For students to achieve well in organic chemistry, they must know some fundamentals of chemistry known as organic chemical nomenclature (OCN) very well (Mogho, 1993).

Organic chemical nomenclature is defined as the system of naming a hydrocarbon (Odesina, 2008). Chemistry teachers use Expository method of Instruction (EMI) to impart this knowledge (Gbamanja, 1991). This method of instruction is only chalk, chalkboard and talk which makes learning abstract. As a result, boys and girls develop a most regrettable phobia for the study. It has been identified by (Buseri, 1987; Maduabum, 1995; Ezeugwu, 2007) that Expository method of Instruction (EMI) is grossly ineffective for teaching chemistry concept. Asim, Bassey and Essien (2005) stated that as a result of using this ineffective method of instruction, students' achievements in chemistry at secondary school level in Nigeria, has been abysmally poor, with little or no appreciable achievement over the years. Achievement as defined by Encarta (2005) is synonymous with male and female students level of success. Gender as a factor in science learning and students' achievement has for some time now generated a lot of issue for chemistry educators. This issue arose from emerging data on differential gender achievement in science with the 2nd largest effect size being found in chemistry Soyre (2001).

There is statistical significant difference in the mean achievement scores of male/female students in their level of comprehending chemistry concept. Gender difference in chemistry often results in hostile environment for females in chemistry classes. Additionally, another area that has significant impact on the image of chemistry is male superiority in the area of the brain-based sex differences. Fauto-sterling (2006) asserted that male and female brains function differently and thus give rise to varying levels of achievement for males and females in a variety of academic pursuits. The author further stated that males were more intelligent than females due to their greater brain size. Eventually, the theories revolving around the physical size of the brain died out; none are considered valid in the modern brain research (Restak, 2008). Recently replaced by theories revolving around the genetic differences between males and females; Genes are the cellular material known to determine a number of traits and characteristics passed from parents to offspring via chromosomes. Barnhart (2006) mention that males and females have different chromosomal make ups. He further identified a genetic rationale for male superiority linked to male superiority in chemistry.

Although these differences in the study reviewed, their magnitude was small, followed by dominance of male teachers' attitude in chemistry class. Teachers of chemistry often hold lower expectations for girls in their classes. Chemistry teachers are more likely to (a) ask girls lower order questions; (b) ask boys higher order question (c) call on boys to answer specific questions (d) respond to boys with precise praise; and (e) respond to girls with

simple acceptance such as "okay" (Hyde, 2011). Given these rationales, the second question is: what can we do as educators to have gender balance in chemistry class participation and achievement? This leads in identifying strategies for encouraging gender equity in chemistry.

A wealth of strategies is needed for keeping females in pipeline (McMurdy, 1992; Ormerod,2007; Vedelsby, 1987) some researchers suggested on what parents, schools and teachers should do. Of the later, some address the organization, environment, structure of class room, coursework, content and presentation of the material taught in the classroom.

To ensure gender-equity, actions must be taken by parents, administrators and teachers especially chemistry teachers. The most important action parents can take for their daughters are to encourage them to be independent, explore and experiment. Schools must not initiate or reinforce gender stereotypes. Teachers in chemistry should follow strategies design to appeal to girls' talent, achievement and needs. They are (i) Teachers at all-girls preparatory school/ use non-sexist language. (ii) uses and application of chemical principles by linking chemistry to human body, esthetically appealing exhibitions and imaginative writing as an aid to assimilating scientic principles and ideas. (iii) Schools creating single-sex sections for chemistry lesson. (iv) Chemistry teachers creating single –sex laboratory groups (Gierl, 1994; Stowe, 1991).

Furthermore, (Kearsly, 2002) stated that under representation of girls in chemistry laboratory is not due to gender base brain difference. Nor does it appear that the under representation is as a result of compelling or obstinate gender- base psychological differences. Rather, it appears that the under representation is as a result of gender role socialization, creation and maintenance of hostile environment in chemistry laboratory and classes. These things result to girls achieving low in chemistry. While it is a daunting task, these things can be changed. But it will require changes in the model of instruction, of which Computer Aided Instruction (CAI) is one.

One good way of affecting a change of method in teaching a particular subject is to demonstrate empirical evidence that such method can yield positive instructional outcomes. Without empirical evidence to support its effectiveness in enhancing students' achievement in OCN it may be ignored. It is based on this that this study intends to find out the effect of Computer- Aided Instruction on male and female chemistry students achievement in Organic Chemical Nomenclature (OCN).

Statement of the Problem

For over some years now students' achievements in chemistry have not been encouraging. The reason is as a result of lack of fundamental knowledge in chemistry known as organic chemical nomenclature. One of the major factors responsible for the poor achievement is use of ineffective method in teaching. It is therefore necessary to

device a new method to improve students' achievement in chemistry, especially inorganic Chemical Nomenclature (OCN).

Educators and researchers in chemistry identified Computer –Aided Instruction as instructional method that serves as a remedy to students' poor achievement in chemistry. Computer- Aided Instruction is an interactive instructional technique that has elicited its efficacy in boosting students' achievement in chemistry. Therefore there is need to further investigate the effect of Computer- Aided Instruction on male and female students' achievement in Organic Chemical Nomenclature (OCN).

Purpose of the Study

This study was design to determine the effect of Computer-Aided Instruction (CAI) on chemistry students' achievement in Organic Chemical Nomenclature (OCN) in Enugu Education Zone of Enugu State, Nigeria. Specifically, the study sought to;

1. Examine the achievement score of senior secondary school one male and female chemistry students on organic chemical nomenclature using computer-aided instruction.

Research question

The following research question guided the study

1. What is the mean achievement score of SS1 male and female chemistry students taught Organic Chemical Nomenclature (OCN) using Computer-Aided Instruction (CAI)?

Hypothesis

The following null hypothesis guided the study and was tested at 0.05 level of significance.

HO_1There is no significant difference in the mean achievement scores of SS1 male and female chemistry students taught Organic Chemical Nomenclature (OCN) using Computer- Aided Instruction (CAI).

METHODOLOGY

The design for the study was quasi- experimental, thus, a pretest- posttest, non equivalent groups were used. The study was conducted in Enugu Educational Zone in Enugu state. The population for the study consists of 2,734 SS1 chemistry students in Enugu Educational zone. Purposive sampling was used in sampling mixed sex and single- sex schools that have Computer, also due to the variable gender. Computer was used as one of the teaching material and students that are computer literate were involved in the study. The sample for the study consists of 308 SS1chemistry students in the eight intact classes, which were from four schools random sampled by balloting without replacement

from 24 government schools in Enugu Educational zone in Enugu state. The four schools were further purposively sampled into male (122) and female (186) SS1chemistry students. Instrument used for data collection was TEMOCNAT. This instrument was developed by the researcher. It is made up of twenty (20) multiple choice questions. The items were drawn using table blue print to ensure adequate coverage of the content area as well as to evenly spread across the different levels of the cognitive domain.

Teacher made organic nomenclature and achievement test (TMONAT) was validated by two experts, one from the department of science education and one from mathematics and computer education (measurement and evaluation unit) of Faculty of Education, Enugu State University of Science and Technology with a trial test and the scores obtained was calculated using kuder-Richardsons' formula 20 (KR-20). The reliability co-efficient obtained was 0.87.

Experimental Procedures

Research assistants in the four sampled schools were trained by the researcher for a period of one week on the use of Teachers made Organic Nomenclature Achievement Test (TMONAT). Before the study started Teachers made Organic Nomenclature Achievement Test (TMONAT) was administered to all the subjects of the study as Pretest. The treatment was administered for a period of six weeks. The males in each school were taught OCN using Teachers made Organic Nomenclature Achievement Test (TMONAT) in a separate classroom while the females in each school were taught OCN using Teachers made Organic Nomenclature Achievement Test (TMONAT) in a separate classroom. Post-test was administered to the two groups after the treatment. The two scores (Pretest & Posttest) were collected for data analysis. Mean and Standard deviation were used to answer the research question while Analysis of Covariance (ANCOVA) was to test the hypothesis at 0.05 level of significance.

RESULTS

Research question

1. What is the mean achievement score of SS1 male and female chemistry students taught organic chemical nomenclature (OCN) using Computer-aided instruction (CAI).

Table 1: Mean and Standard deviation of SS1 male and female chemistry students' achievements in organic chemical nomenclature (OCN).

Method CAI	N	**Pre- test**		**Post- test**		**Mean gain score**	**Mean gain difference**
Male		**Mean**	**SD**	**Mean**	**SD**		
	122	27. 42	14. 09	56. 19	29. 44	28. 77	2.27
Female	186	28.82	15.03	55.32	29.94	26.50	

Table 1 indicates that the male students had a Pre- test mean achievement score of 27.42 with 14.09 as the standard deviation. They also obtain a Post- test mean achievement score of 56.19 with 29.44 as the standard deviation. However, the female students had a Pre-test mean achievement score of 28.82 with 15.03 as the standard deviation and a Post- test mean achievement score of 55.32 with 29.94 as the standard deviation. The table also shows that the male and female students had mean gain scores of 28.77 and 26.50 respectively. Thus males achieved almost the same with the females in Organic Chemical Nomenclature (OCN).

Hypothesis

HO_1 There is no significant difference in the mean achievement scores of SS1 male and female chemistry students taught Organic Chemical Nomenclature (OCN) using Computer- Aided Instruction(CAI).

Table 2: Summary of Analysis of Covariance (ANCOVA) of SS1 male and female chemistry students mean achievement score in Organic Chemical Nomenclature (OCN) using Computer- Aided Instruction (CAI).

Source	Type III Sum of Squares	DF	Mean Square	F	Sign.	Partial Eta Squared
Corrected model	213698.735[a]	4	53424.684	283.548	.000	
Intercept	168981.615	1	168981.615	896.857	.000	
Pre-test Ach	360.656	1	360.656	1.914	.168	
Method	177659.312	1	177659.312	942.914	.000	.757
Gender	70.013	1	1.713	.370	.543	.001
Method *gender	1.722	1	1.722	.009	.924	
Error	57089.820	303	188.415			
Total	1225175.000	308				
Corrected total	270788.555	307				

The result presented on table 2 showed that the calculated F value of 0.37 with respect to gender is significant at 0.54. This indicates that at 0.05 level, the F value of 0.37 is not significant. This means that the difference in the mean achievement scores of males and females in Organic Chemical Nomenclature is not statistically significant. Thus, the null hypothesis that gender has no significant effect on the mean achievement scores of SS1 chemistry students taught Organic Chemical Nomenclature (OCN) is upheld. Therefore gender has no significant influence on students' achievement in organic chemical nomenclature (OCN) with Computer Aided Instruction (CAI).

DISCUSSION OF FINDINGS

The evidence obtained in table 1with regard to gender and students' achievement in OCN shows that male students had a mean score of 56.19 in the post test, but the female students had a mean score of 55.32 in the post test. This shows that the males achieved slightly higher than the females,, but this was not found to be statistically significant in the test of hypothesis. In other words, both males and females were almost at par in their achievement in OCN.

The result of this study is in accordance with the finding of (Seymour, 2001) which shows that gender balance should be promoted by teachers implementing gender-inclusive chemistry instructional stategy CAI that is not gender-biased, addresses boys short comings and girls short comings and eliminates boys harassment in the chemistry laboratory that inhibits girls learning. Sayre (2001) suggested that computer-animation has the ability of representing materials using pictorial form and verbal form such as

spoken and printed text. Through it, instructions are analyzed through motion, voice, text graphics and still images. This increases females thinking ability, analytical skill and understanding; helps register and retain information (Mayer, 1996; Kearsley, 20020, stimulates more than one sense at a time, be more attention getting and attention gaining (Reeves, 1998). With this teaching method Kenway and Gough, 1998 opined that females are motivated, not demoralized and relegated from studying chemistry.

Furthermore, they suggested that girls should study chemistry since it is highly profitable in our society in terms of money (e.g job), status and influence (decision-making) capability. They also mentioned that when females are fully involved in learning science especially chemistry, there will be no more gender disparities in science.

CONCLUSION

The outcome of this study revealed that gender has no significant influence on students' achievement in organic chemical nomenclature (OCN) with computer-aided instructions (CAI). Therefore, there is no significant difference between the male and the female chemistry students.

Recommendation

Based on the finding of this study, the following recommendation is made;

Curriculum planners should include CAI as a model of instruction that promotes gender-equity and wipe away gender disparities in science especially chemistry (OCN).

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