

EFFECTIVENESS OF THE DEMONSTRATION, COMPUTER ASSISTED INSTRUCTIONS AND INQUIRY METHOD USED FOR TEACHING CARBON HYDRATES IN SENIOR SECONDARY SCHOOLS BIOLOGY IN IKOT EKPENE LOCAL GOVERNMENT AREA

BY

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ABSTRACT

The study investigated the “Effectiveness of the Demonstration, Computer Assisted Instructions and Inquiry Method used for teaching carbon hydrates in senior secondary schools biology in Ikot Ekpene Local Government Area” Two research questions and two null hypotheses were formulated to give direction to the study. The study used a quasi-experimental research using intact classes as non-randomized pretest-posttest group design. The study was conducted in Ikot Ekpene Local Government Area of Akwa Ibom State. The population of the 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 as 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. Instrument such as “Cognitive ability test, Biology Achievement and Retention Test were used for the instrumentation. Data obtained form pre-test and retention test instruments were analysis of covariance (ANCOVA), with pre-test as covariates. All the hypotheses were tested at .05 alpha. From the result of the findings, it was observed that there is no significant difference in the performances of students on the concept of carbohydrate nutrients when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching methods and there is no significant difference in student’s retention of the concept of carbohydrate nutrients when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches. It was concluded that that computer Assisted instructional Approaches followed by Demonstration have better enhancing effect on both the student’s performance and retention in the concept of carbohydrate nutrients and one of the recommendations was that all teachers of biology should make effective use of computer-assisted instruction and demonstration method in teaching the concept of carbohydrate.

Keywords: Demonstration, Computer Assisted Instructions, Inquiry Method, Senior Secondary Schools, Biology, Ikot Ekpene L.G.A.

INTRODUCTION

Science teaching and indeed, the teaching of biology was introduced into Nigerian Secondary Schools between 1859 and 1929 (Akpan, 1999), Biology is a natural science that studies that vital process of life (Stones, 1999). Biology is a popular science subject taught at the senior secondary school level. It deals with the natural environment and the organisms living with them. It also deals with the interactions existing between different organisms and non-living components (temperature, rainfall, pressure among others) of the environment (Chinwe, 2008). It is a subject offered by both science and non-science students in the Senior Secondary School level, hence, it is offered by a large number of students in Senior School Certificate Examinations. It is basically concerned with answering questions about natural phenomena and generating information on how the universe works (Smith and Good, 1984).

The gateway to socio-economic and technological advancement of any Nation is determined by the level of educational development of its citizens (Udeme-Obong, 2013) therefore biology programme must be geared towards inculcating in students, a clear understanding of biological concepts and the capability to use them to solve the problems in the environment (Akpan, 1996). 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.

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 (Erinosho, 2005). This is a process in which students are taught science using scientific process such as experimenting, measuring, calculating, describing, manipulating, among others. According to Erinosho, this process is expected to make use of effective teaching approaches capable of encouraging active participation of students. This will enhance understanding of biological concepts by students who will show improved academic achievement and retention of the concepts (Kempa, 1990). Shaibu and Mari (2000) opined that teachers continue to teach biology as a body of abstract knowledge with limit or no student’s involvement in the teaching process. This has resulted in persistent poor performance in international and external examinations.

Akpan (1996) observed that the teaching of biology was in the hands of teachers who adopted inappropriate teaching methods. This has a tremendous effect on the understanding of biology concepts. Success in the biology teaching depends on the efficiency of the teacher and the degree of success of the teacher in performing instructional duties in his profession. According to Dagogo-Jack (1999), inadequate mastery of subject matter by secondary school teachers is a limiting factor to the effectiveness of the teacher and consequently, the improvement of the quality of biological education. The biology teacher therefore need the biological knowledge as well as instructional skills to impart the knowledge and skills to the students (Chinwe, 2008). Teaching is viewed by Nwosu and Nzewi (1908) as the task of stimulating, guiding and generally facilitating the students’ learning so as to assure his attainment of meaningful goals. According to Gbamaja (1991), biology teaching involves the

students to several opportunities to understand different types of concepts and expose them in direct physical materials that will make meaningful cognitive framework.

Biology has to be communicated to learners in an active, interactive and an effective way since it is the study of living organisms which are best studied in the natural habitats (Nwosu and Nzewi, 1998). Therefore, there is a need for effective teaching approaches that can enable learners to learn biology actively, acquire functional and relevant knowledge, skills, attitudes and capability to problem solving needed for effective and responsible citizens as well as adaptation in a changing environment such as ours.

For some times now, Nigerian biology educators have been expressing concern over the perennial poor performances of students in secondary schools (Nwosu, 2002). Nwosu (2002) and Onioduokik (2013) attributed the low performance of students in biology to insufficient supply of qualified biology teachers, inadequate supply of teaching equipment and inappropriate teaching methods among others. Most student fails to show evidence of mastery of the content in biology curriculum because of continuous use of stereotyped and obsolete teaching methods among others. Most students fail to show evidence of mastery of the content of biology curriculum because of continuous use of stereotyped and absolute teaching methods, especially by the unprofessional teachers. This is because in most of our schools, biology is taught as a passive subject where students are expected to learn through memorization of facts and concepts without any unconscious attempt to relate biology instruments to solve contemporary human problems. Soyibo, quoted in Bajuliaje (1999) said that “practical science” dates back to the earliest pioneering scientist who had to originate both their ideas and materials needed to practically demonstrate and authenticate their claims. According to Akale (2002), biology could be taught successfully if necessary facilitates such as electricity, water, charts, models, microscopes, preserved specimens, among others are provided in the school.

The present trend in biology teaching therefore is geared towards discovery and development of intellectual ability and skills. It therefore behoves on the teachers of biology in our Senior Secondary Schools to address how the subject can be taught practically to develop in the students the appropriate skills to learn and solve biological problems.

It is important to note that despite all efforts invested in the teaching of biology at the Senior Secondary School level, the performance of students has been quite unsatisfactory over the years (Onwioduokit, 2013). It is observed that students continue to perform poorly at the Senior School Certificate Examinations (WAEC, 1995 & STAN Position Paper 4, 1992). Okebukola (1997) attributed the dismal poor performance to the use of inappropriate teaching methods and approaches teachers can use to present biological information and impact skills to students. According to Okebukola, such methods and approaches include demonstration, discovery (guided and unguided), discussion, project, laboratory, field trip, inquiry, Computer-Assisted Instruction approaches among others. Okebukola also observed that most biology teachers prefer the lecture method and neglect the other teaching methods. While many teaching methods abound for teaching carbohydrates in biology, their effectiveness vary. Ajeyalemi (1990) indicated that biology and indeed the concept of carbohydrates is theoretically taught and suggested that other teaching strategies ought to be tired out in order to find whether the performance in biology can be improved.

Students' performance in an examination depends on their ability to remember the facts they have been taught in a concept (Sem and Ellis, 2004). Ability to remember information which has also be referred to as retention, means recalling or remembering pieces of knowledge or skills that were learned earlier in time. According to Derille (2006), retention depends much on the way the students have been taught. Poor performance in biology and its effects on the economy of the country has been the major concern of various science educators, educationalists and institutions directly concerned in the educational system (Ndiaho, 2007).

Statement of the Problem

The study of biology has contributed immensely to the growth and development of the nation. Such growth and development are seen in the aspects of better health care, family planning,, medicine, pharmacy, agriculture among others. In the senior secondary school biology curriculum, there are some aspect that are central to the existence of life on the earth. One of such concepts is carbohydrate in animal nutrition. It is worth mentioning here that certain concepts in the senior secondary biology curriculum require more effective teaching approaches such as Demonstration, Computer-Assisted Instruction and Guided-Inquiry approaches (Okafor 1990; Adesoji, 1992; WASSCE Chief Examination Report, 2006), 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, through 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 Demonstration, Computer-Assisted Instrument and Guided-Inquiry teaching approaches would enhance students' achievement and retention in the concept of carbohydrates in biology. Therefore, this study is an attempt to find out answers to these questions

The purpose of the study

The purpose of the study is to determine the effectiveness of the demonstration, computer assisted instructions and inquiry method used for teaching carbon hydrates in senior secondary schools biology in Ikot Ekpene Local Government Area. Specifically, the study is design to achieve the following objectives:

1. To determine the effect of demonstration, computer Assisted instruction and inquiry approaches on student's performance on the concept of carbohydrates in secondary school biology.
2. To determine the effect of demonstration, computer Assisted Instructions and inquiry approaches on student's retention on the concept of carbohydrate in secondary school biology.

Research Questions

1. How do student differ in their performance on the concept of carbohydrates when taught with demonstration, computer Assisted Instruction and inquiry approaches?

2. How do student differ in their retention of the concept of carbohydrate when taught with Demonstration, computer Assisted Instruction and inquiry approaches?

Research Hypothesis

The following null hypothesis were formulated to guide the study

1. There is no significant difference in the performance of student on the concept of carbohydrates when taught with Demonstration, computer-Assisted instruction and Guided-Inquiry teaching methods.
2. There is no significant difference in the student's retention of the concept of carbohydrates when taught with demonstration, computer-Assisted instruction and Guided-Inquiry teaching approaches.

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

Data Analysis and Results

Research Question One

How do student differ in their performance on the concept of carbohydrate when taught with Demonstration, computer-Assisted instruction and Guided-Inquiry teaching approaches?

Table 1: Mean and standard deviation of student’s pre-test and post-test scores classified by treatment groups.

Treatment Groups	Sample size (n)	Pre test		Post test		Mean Difference
		X	SD	X	SD	
Demonstration	86	25.16	5.41	59.42	8.09	34.26
Computer-Assisted Instruction	87	25.03	6.74	59.08	8.84	34.05

Guided-inquiry	91	25.93	5.85	55.21	7.35	29.28
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In table 1, the result shows that the student taught carbohydrate nutrients using Demonstration method had a post-test, pretest mean different of 34.26; those taught using computer assisted instructions had mean difference of 34.05 while those taught using Guided-Inquiry approach had 29.28. this observation shows that the student taught by Demonstration method had the best performance while the least performance was recorded by those taught with the Guided-inquiry approach.

Research Question Two

How do student differ in their retention of the concept of carbohydrate when taught with Demonstration, computer Assisted Instruction and inquiry approaches?

Table 2: Mean and standard deviation of student’s pre-test and retention scores classified by treatment groups

Treatment Groups	Sample size (n)	Pre test		Retention		Mean Difference
		X	SD	X	SD	
Demonstration	86	25.16	5.41	50.86	6.12	25.70
Computer-Assisted Instruction	87	25.03	6.74	53.59	8.43	28.56
Guided-inquiry	91	25.93	5.85	48.62	6.98	22.69

In table 2, the result shows that the student taught carbohydrate nutrients using demonstration method had retention pre-test mean difference of 25.70; those taught using computer Assisted Instructions had a mean difference of 28.56 while those taught using Guided-inquiry approach had 22.69. This observation shows that the student taught by computer assisted Instruction approach had the best retention followed by those taught Demonstration Method while the least retention was recorded by those taught with the Guided-inquiry approach.

Hypothesis Testing

The two research hypotheses formulated are tested in the subsection

Hypothesis One (H₀₁): There is no significant difference in the performances of students on the concept of carbohydrate when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching methods.

Table 3: Summary of Analysis of Covariance (ANCOVA) of student’s post-test scores classified by treatment groups with pre-test as covariate

Source of Variation	Sum of Squares	df	Mean Square	F-cal	Sig.	Decision at p<.05
Covariate: <i>Pre-test</i>	995.57	1	995.57	16.583	.00	s
Main Effects: <i>Instructional Methods</i>	849.66	2	424.83	7.08	.00	s
Error	15608.83	260	60.03			
Total	17582.53	263				

R. Squared = .112 (Adjusted R. Squared = .102)

In Table 3, the calculated F. Ratio for the main effect of Instructional methods at df 2,260 is 7.08, while its corresponding calculated level of significance is .00 alpha. This significance is less than .05, indicating the Instructional method used has statistically significant effect on the effect on the performance of students in carbohydrate nutrients. Hence, Hypothesis 1 which assumed that “There is no significant difference in the performances of students on the concept of carbohydrate nutrients when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching methods” – was rejected.

Hypothesis Two (Ho2): There is no significant difference in students’ retention of the concept of carbohydrate when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches

Table 4: Summary of Analysis of Convenience (ANCOVA) of students’ retention scores classified by treatment groups with pre-test as covariate.

Source of Variation	Sum of Squares	Df	Mean Square	F-Cal	Sig.	Decision at p<.05
Covariate: <i>Pre-test</i>	422.49	1	422.49	8.29	.00	S
Main Effects: <i>Instructional Methods</i>	10106.73	2	508.36	9.98	.00	S
	13244.48	260	50.94			
	14767.94	263				

R Squared = .103 (Adjusted R Square = .093)

In table 4, the calculated F-Ratio for the main effect of instructional methods on students’ retention at df 2, 260 is 9.98, while the corresponding calculated level of significance is .00 alpha. The level of significant is less than .05, indicating that the instructional method used has statistically significant effect on the students’ retention of carbohydrate nutrients. Hence, Hypothesis 2, which assumed that “There is no significant difference in student’s retention of the concept of carbohydrate nutrients when taught with Demonstration, Computer-Assisted Instruction and Guided-Inquiry teaching approaches” was rejected.

Conclusion

Based on the observations made in this study it is concluded that computer Assisted instructional Approaches followed by Demonstration have better enhancing effect on both the student’s performance and retention in the concept of carbohydrate nutrients.

Recommendations

Based on the following and the conclusion reached, the following recommendations were made:

1. All teachers of biology should make effective use of computer-assisted instruction and demonstration method in teaching the concept of carbohydrate

2. Seminars, workshop and conference should be organized for biology teachers to update their knowledge on effective use of computer Assisted Instructional approaches and Demonstration Method to allow for their effective implementation in classroom situation.
3. Effective use of computer Assisted Instructional approach and Demonstration method require availability of relevant facilities. It is therefore recommended that school proprietors should ensure that schools are adequately equipped with functional computers and computer software, as well as laboratory facilities for effective implementation of the method in classroom situation.

REFERENCES

- Adesoji, F. A. (2002). The Need for Humanistic Approach to the Teaching of Science. *Nigerian Journal of Education Philosophy*, 9(1): 25-28.
- Ajeyalemi, D. (1990). *Science and Technology Education in Africa: A comparable Analysis and Future Prospects of Science and Technology Education in Africa: Focus on Seven Saharan Countries*. Lagos: University of Lagos, pp. 14-16.
- Akale, D. P. (2002). *Educational Psychology: A Cognitive View*. 2nd ed., New York: Halt Rinehart and Wiston, pp. 15-15.
- Akpan, A. A. (1996). Teacher Effective as a Determinant of students' performance in Mathematics. *Journal of Nigerian Educational Research Reporters' Association*, 1 (11): 89-99.
- Akpan, B. B. (1999). *Perspectives on Education and Science Teaching: From the eyes of Iwowl*: Abuja: Foremost Educational Services Ltd, pp. 398-400.

- Ali, A. (2006). *Conducting Research in Education and the Social Science*. Eungu: Tashiq Networks Ltd, pp. 9-18.
- Bajuliaje, A. F. (1999). The Constructivist Approach to Teaching Relationship Between Volume and Capacity in School Mathematics. *Journal of Science Teachers Association of Nigeria (STAN)*, 40(1&2): 21-27.
- Chinwe, N. (2008). Science, Technology and Mathematics (STM) Curriculum Development. 49th STAN Annual Conference Proceedings, pp. 77-81.
- Dagogo, J. (1999). Evaluation of Teacher Effectiveness Achievement Among Secondary School Students. Annual Conference of Education, University of Uyo, July, 1999, pp.20-23.
- Derille, M. (2006). *The Use of Psychology in Teaching*. London: Longman Group Ltd, p. 85
- Erinosho, T. Y. (2005). *A Review of School Science Curricula for Developmental Needs of Nigeria*. Yaba: NERDC Press.
- Gbamaja, S. P. T. (1991). *Modern Methods in Science Education in Africa*. Owerri: Totan publishers, p. 89
- Igwue, P. O. (1990). Science Teachers' Qualification and Students' Performance in Secondary Schools in Kano State. *Journal of Science Teachers Association of Nigeria*, 26(2): 47-51 (Igwue in the text book)
- Ikot Ekpene LEC Report, 2014)
- Iliyasu, A. Y., Hamidu, B. M. & Anwal, A., (2006). Agriculture Education: A panacea to food Security and poverty Eradication. *Nigerian Journal of Professional Teachers*, 1(14): 49-59
- Kempa, R. (1990). *Assessment of Science*, New York: Cambridge University Press p. 69
- Ndiaho, O. F. (2007). Effective of Constructivist –Based instructional Model on Senior Secondary School students' Achievement in Biology. 50th STAN Anniversary Conference Proceedings, 98-101.
- Nwosu, A. A. & Nzewi, U. M. (1998). Using the Constructivist Model to Communicate Science. 39th STAN Annual conference proceeding, 349-353.
- Nwosu, A. A. (2002) Level of Acquaiition of Science Process Skill among Year one Senior Secondary School Student. *Journal of Science Teachers Association of Nigeria*, 29 (1&2): 147-153
- Okafor, P. N. (1990). Laboratory resource and Correlates of Chemistry Students' Learning Outcomes. 41st STAN Annual Conference Proceedings, pp. 169-173
- Okebukola, P. A. O. (1997). The Barriers to the meaningful Learning of Science came Tumbling down. *Seventh Inaugural Lecture of Lagos State University, December 21, 2009*.

- Onioduokik, F. A. (2013). The Ordeal of Science Teaching in the Contemporary Society: A Need for Paradigm Shift for the New Generation. *36th Inaugural Lecture Series, University of Uyo, Uyo*. (Onwioduokit this what is found on the text book)
- Sem, G. B. & Ellis, J. A. (2004). Knowledge Taught in School: What is Remembered? *Review of Education Research, 64*:253-286.
- Shaibu, A. A. & Mari, J. S. (2000). *Encyclopaedia of Informal Education*. Biringham: Methuen & co. Ltd.
- Smith, M. U. & Good, R. (1984). Problem-solving and Classical Genetics. *Successful Journal of Research in Science Teaching, 21* (2): 895-912.
- Stones, R. H. (1999). *A New Biology foe West African Schools*. London: Longman Group Ltd.
- Udeme-Obong, A. (2013). Selected Approaches to Effective Teaching of Excretion in Living Thing in Senior Secondary School. STAN Biology Panel Series 2013. Awka: Fab Anieh Nig. Ltd., pp. 134-136.
- West African Examination council (WAEC), (1995). Chief Examiner's Report in Biology. May/June, 1985-1995.