Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.8, No.3, 2017

Effects of Practical Activities and Manual on Science Students' Academic Performance on Solubility in Uruan Local Education Authority of Akwa Ibom State

Rebecca, Ufonabasi Etiubon Nsimeneabasi Michael Udoh*
Department of Science Education, University of Uyo, Uyo, Akwa Ibom State, Nigeria

Abstract
This study investigated the effects of practical activities and manual on science students' academic performance on solubility in Uruan Local Education Authority of Akwa Ibom State. The study adopted pretest, posttest non randomized quasi experimental design. Three research questions and three hypotheses were formulated to guide the study. One hundred and four (104) science students from the population of two thousand, nine hundred and fifty (2, 950) senior secondary two in 2015/2016 academic session formed the sample size using simple random sampling technique. Instrument for data collection was a 20- multiple-choice-test item on the concept of solubility. The instrument was validated by three experienced secondary school science teachers of over 10 years teaching experience and by three lecturers from the department of science education and test and measurement unit of the University of Uyo, Uyo. Kuder Richardson formular 21was used in determining the reliability of the instrument was which .80. The research questions were answered using mean and standard deviation while the hypotheses were tested using Analysis of Covariance (ANCOVA). The findings of the study showed that students taught solubility with practical activities performed equally with their counterparts taught the same concept with practical manual. Results also showed that gender had no significant influence on the students' mean performance scores when taught solubility with practical activities and practical manual. Recommendations among others were that science teachers should make effective use of practical activities and manual in teaching abstract concepts like solubility.
Keywords: Practical activities, Science manual, Solubility, Experimentation, Students' performance

Introduction

1.1 Objectives of Science Learning

Science learning is practical-oriented and requires practical activities in the laboratory. It requires broad-based experiences to widen students' knowledge in a world of abundance of choices and opportunities to give meaning to learning. Science learning employs experiments using enriching learning materials to equip learners with appropriate knowledge, skills, attitudes and behaviours. Achimugu (2014) stated that science learning involves experimentation that uses hands-on and minds-on activities for better understanding. This is because experimental methods enable students to verify theories, laws and principles surrounding science phenomena. These parameters help the students to build their capacity and interest to attain the goals of learning science.

The objectives of studying science in secondary school as a life science in Nigeria contained in the West African Examinations Council (WAEC, 2014) syllabus include among others; understanding basic science concepts, acquisition of laboratory skills, awareness of linkage between science and industry/environment and everyday life in terms of benefits and hazards and acquiring skills of critical and logical thinking. These objectives require that science be learnt through experimentation by doing practices and making thorough observations that give meaning and relevance to understanding science. Based on these objectives, learners thinking capacity must be developed to widen interest and curiosity to think creatively. Having known some of these objectives, it is obvious that no concept in science should be learned in abstraction but practically by subjecting such concepts to experiments, testing, observing and verifying problems experimentally. It is important therefore, to give effective interpretation of existing phenomena and to gain useful insight into science as life using appropriate practical activities (Njelita, 2008).

According to Okoye (2013), learning science practically develop students' scientific knowledge and are most effective when the learning objectives are clear and relatively few in number for any given task. The task design highlights the main objectives and keeps students busy to minimize noise. These strategies are used to stimulate the students' thinking beforehand, so that the practical task is answering a question the student is already thinking about. It is therefore needful, for science students to actively participate in practical activities that further enhance their understanding of the concepts taught or in learning a new skill.

1.2 Practical Activities in Science Learning

Practical activities may be defined as an act of science students engaging and equipping themselves on hand-on-skills. Lazarowita and Tamir (2006) opined that practical work is important because it provides opportunities for students to perform various hand- on- activities. These practical works also give students many opportunities to

use their minds to discover general laws and principles of science. to Practical activities promote conceptual change, motivation and excitement for enriching science learning. Furthermore, practical activities develop students' manipulative skills, attitude and interest that simplify science concepts. It make difficult and abstract concepts real, remove misconceptions, ignite, increase and sustain students' interest in science through various activities using sourced science materials to enrich science learning experiences. This is aimed at preparing students to become productive individuals at the job place and has opened access to creativity and knowledge.
Kulshretta (2013) noted some advantages of practical activities in science to include; skills development, planning, manipulation of equipment, observation, analyzing, evaluating, experiential learning, testing out own ideas, testing out theories, developing of problem solving strategies and team work. Other advantages according to Achimugu (2014), include- taking responsibility, developing students as self learners for independent learning, students work at their own pace, at their own level, supporting differentiation by outcome, task and questioning. This enables them to build self- confidence, learning in different ways, working as individuals, manipulating materials and objects, observing the use of all the senses and having informal dialogue with peers and teachers to develop personal, learning and thinking skills (PLTs). These therefore require that science students should be adequately taught through practical activities to acquire useful practical skills in science concepts.

1.3 Practical Manual in Science Learning

Science laboratory manual is a practical guide for systematically directing students on how laboratory procedures are to be carried out. It gives the guideline for clear explanation and instructions regarding rules and regulation, material, time and space management and students' commitment to responsibilities. It provides general and specific guidelines for activities frequently performed in science laboratories. According to Nurzatulshima (2008), laboratory manual provides an authoritative collection of core experimental procedures that engage students' psychomotor activities for wider application of knowledge.

The use of practical manual as 'hands on' activity in science learning supports the development of practical skills, help to shape students' understanding of scientific concepts and phenomena. A good- quality practical manual can engage students, help them to develop important skills, help them to understand the process of scientific investigation, and develop their understanding of concepts. Practical manual provides a range of information on how to carry out investigations in various situations such as a step-by-step explanation of producing alcohol (local gin) from fresh palm wine used as methylated spirit and for anesthetic purposes. It is built on the acquired expertise, knowledge and judgment of users in their respective areas of work that practical manuals are sometimes designed to be used alongside with the primary reference.

Enderle and Leeanne (2016) opined that physical science students' laboratory manual is a hands-on, interactive laboratory experience. This laboratory interactive experience provides demonstrable activities found in each text manual. The laboratory manual covers laboratory safety guide which include how to read and use science material safety data sheets (SSDS). Students are guided through the laboratory practices in science courses as well as the techniques involved. Practical manual support science effectiveness as well as learning experiences that enable students to get the best out of it. A good practical manual stimulate and engage students' learning at different levels, challenging them mentally to concretize science concepts. Based on these, adequate facilities and materials with supportive science practical manuals are needed to reduce the burden of the teacher and to promote sensory receptors of the learner on abstract concepts such as solubility (Etim, 2006).

1.4 Concept of Solubility

Solubility refers to the amount of a substance that will dissolve in a given amount of a solvent to give a saturated solution under specified conditions. Solubility compares the extent to which different solutes can dissolve in a particular solvent at different temperatures. The solubility of a solute in a solvent at a particular temperature is the maximum amount of the solute in moles or grammes that will saturate $1dm^3$ or $1000cm^3$ of the solvent at that temperature. The solubility of a substance is expressed in moles per dm^3 ($moldm^3$) (Donald, 2009). For example, when sugar is put in water, it dissolves and a solution is formed. Addition of more sugar to the solution will cause the sugar to dissolve in the water until a point of saturation is reached. Consequently, as more sugar crystals dissolves and go into solution, some molecules of sugar move about by diffusion. Some of them collide with the dissolving crystals of sugar and take up positions in the crystal lattice. A solution that contains only a small amount of solute in comparison with the amount of solvent is said to be dilute; the addition of more solute makes the solution to be concentrated. These phenomena are influenced by three main factors namely, temperature, nature of solute, solvent and pressure. It is important therefore, for science students to have understanding on the concept of solubility and find opportunities that strengthen their knowledge to choose career-paths effectively.

The concept of solubility is studied by biology, Physics and chemistry students as a science concept and the use of practical activities and manual to learn the concept help to reduce abstraction and the rate of poor performance among science students. Learning solubility requires effective transfer of practical skills that facilitate knowledge acquisition on the concept. This requires the sourcing and use of suitable instructional materials that can adequately improve students' performance. The concept of solubility forms some of the West African Examinations Council (WAEC), National Examinations Council (NECO) and the Joint Admission and Matriculation Board (JAMB) questions set yearly, yet many students do not perform well. This may probably be due to the fact that many students may not have been using appropriate instructional materials in the learning of the concept.

1.5 Gender Differences

There are still varied viewpoints as well as different conclusions on gender and academic performance. Indication on gender differences on students' academic performances differ among gender in the science subjects. Okoye (2013) saw gender as a range of physical, mental and behavioural characteristics pertaining to and differentiating the masculinity and feminity of an individual. In the process of learning science-based subjects, some researches show superiority of male over female students and others show superiority of females over males. Udoh (2015) argued that in a classroom setting where male and female students are actively involved in an interactive lesson with the teacher, there will be no difference in their academic performance. Raimi (2010) also opined that gender is not a significant factor to be associated with students' performance. If given equal opportunity with the right teaching and learning process, male and female students will achieve equally**.** The observations agree with Udoh (2015) which showed no significant difference in gender on students' academic performance and retention in biology when taught nervous coordination using computer simulation and charts. Olasheinde and Olatoye (2014) also found that there was no significant effect on gender with regards to students' achievement in science. Okoye (2013) posited that when students are given practical tasks to carry out in science, the sex of the students was a non-significant contributor to their academic performance. On the contrary, Etiubon (2011) observed that female students performed significantly better when exposed to the use of different technological tools in electrolysis than their male counterparts in chemistry and Ekeh (2004) observed that male students performed significantly better than their female counterparts in mathematics when taught using iconic models. Since the study on gender is inconclusive this study included gender as one of its intervening variables.

2.0 Statement of the Problem

Many science students view solubility as a difficult concept and do not put in their best to adequately master the contents of solubility. Some students do not know simple experiments involving solubility in science and do not possess the pre-requisite knowledge that could help them carry out experiments. These students do not pay adequate attention to practical activities and detailed instructions to science manual that specify details on how experiments involving solubility is done because, they are deficient on the effective use of instructional materials during laboratory activities on such detailed methods on how to prepare solutions, solving mathematical calculations involving solubility and they miss out on important steps that lead to genuine results. This leads to poor performance of students in the content area of solubility. In this regard, the West African Examinations Council (WAEC, 2015) Chief Examiner's report, observed that students' poor performance in science can be attributed to their lack of familiarity with common laboratory equipment/apparatuses and poor knowledge in the fundamental principles, process and procedures. This poor performance on the part of the students is from inability to effectively use instructional materials and apply the principles and procedures necessary for practical work on solubility. It is on this basis therefore, that the question arises: what effects will practical activities and manual have on science students' academic performance on the concept of solubility?

2.1 Objectives of the study

The purpose of this study was to find out the effects of practical activities and practical manual on science students' academic performance on solubility in Uruan Local Education Authority. Specifically, the objectives of the study are to determine;

1. the academic performances of science students taught solubility using practical activities and those taught using practical manual.
2. the academic performances of male and female science students taught solubility with practical activities.
3. the academic performances of male and female science students taught solubility with practical manual.

2.2 Research Questions

The following research questions guided the study.

1. What difference exists between the academic performances of science students taught solubility using practical activities and those taught using practical manual?
2. What difference exists between the academic performances of male and female science students taught solubility using practical activities?

3. What difference exists between the academic performances of male and female science students taught solubility using practical manual?

2.3 Research Hypotheses

The following null hypotheses were raised and tested at .05 level of significance

1. There is no significant difference between the academic performances of science students taught solubility using practical activities and those taught using practical manual.
2. There is no significant difference between the academic performances of male and female science students taught solubility using practical activities.
3. There is no significant difference between the academic performances of male and female science students taught solubility using practical manual.

2.4 Design of the Study

The design adopted for this study was non- randomized pretest – posttest experimental design in two intact classes involving two (2) experimental groups. Experimental group 1 was taught solubility with practical activities and experimental group 2 was taught the same concept using practical manual.

2.5 Population of the study

The population of the study comprised all the two thousand, nine hundred and fifty (2, 950) senior secondary two science students in all the 13 public secondary schools in Uruan Local Education Authority Area of Akwa Ibom State.

2.6 Sample and sampling technique

The sample of the study was one hundred and four (104) Senior Secondary two (SS2) science students in their intact classes in two (2) selected public schools in the study area using criterion sampling technique.

3.0 Instrumentation

Science Performance Test (SPT) on solubility was the instrument used for data collection developed by the researchers. The SPT had two sections, section A and B. Section A obtained personal information from the students, while section B contained twenty- multiple- choice question items on solubility. The SPT had twenty multiple choice questions. Each correct answer had 5 points and zero (0) for an incorrect answer. Hundred (100) was the maximum score and zero (0) was the minimum score.

Instrument validation was done by three experienced secondary school science teachers of over 10 years teaching experience, three lecturers from the department of science education and then test and measurement unit of the University of Uyo, Uyo. The reliability of the instrument was .80 determined by Kuder-Richardson Formulae-21.

3.1 Research Procedure

In order to control teacher quality, the science teachers in each school were used as research assistants in carrying out solubility experiments with practical activities and the one with practical manual. The research assistants were trained for one week with lesson packages and experimental guide. This was to ensure that the research assistants acquired requisite knowledge and competence to teach and carry out practical activities on solubility. At the end of one week, the research assistants demonstrated their understanding of the procedure during mock teaching sessions using well-prepared lesson packages. Following the training of the research assistants, Science Performance Test (SPT) was administered as pretest to the experimental groups to test the entry behaviour of the students and was also used as covariate in assessing the performance of students on solubility after treatment. Pretest administration was followed by the teaching of solubility to the two (2) groups using the prepared lesson packages with practical activities and experimental manual for students to practice by themselves. At the end of the treatment which lasted for three weeks, a reshuffled version of SPT was administered as posttest to the experimental groups. All activities were strictly supervised by the researchers. Data from pretest and posttest from the experimental groups were analyzed using descriptive statistics (mean and standard deviation) and Analysis of Covariance (ANCOVA). Hypotheses were tested at .05 alpha level of significance.

3.2 Results: The results are presented in tables as follows:

Research Question 1: What difference exists between the academic performances of science students taught solubility using practical activities and those taught using practical manual?

Table 1: Mean and Standard Deviation Scores of Students' Pre-test and Post-test Performance taught Solubility Classified by Instructional Material

Instructional Material	Pre-test			Post-test		
	N	$\overline{X}$	SD	$\overline{X}$	SD	Mean Gain
Practical Activities	53	30.02	5.62	68.70	6.52	38.68
Practical Manual	51	30.20	5.37	68.10	4.69	37.90

In Table 1, the mean gain score for practical activities is 38.68 and those taught using practical manual is 37.90. These results indicated that students taught with practical activities performed equally with those taught using practical manual.

Research Question 2: What difference exists between the academic performances of male and female science students taught solubility using practical activities?

Table 2: Mean and Standard Deviation Scores of Male and Female Science Students' Pre-test and Post-test Performance Taught Solubility using Practical Activities.

Gender		Pre-test		Post-test		
	N	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	Mean Gain
Male	19	28.58	5.50	68.68	4.19	40.10
Female	34	30.82	5.60	68.71	7.58	37.89

In Table 2, the results showed that male students taught solubility using practical activities had a mean gain of 40.10 and their female counterparts had a mean gain of 37.89. The result indicated that male students performed better than their female counterparts when both groups were taught solubility using practical activities.

Research Question 3: What difference exists between the academic performances of male and female science students taught solubility using practical manual?

Table3: Mean and Standard Deviation Scores of Male and Female Science Students' Pre-test and Post-test Performance Taught Solubility using Practical Manual.

Gender		Pre-test		Post-test		
	N	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	Mean Gain
Male	20	30.25	6.65	68.05	5.35	37.80
Female	31	30.16	4.47	68.13	4.30	37.97

In Table 3, the results showed that male students taught solubility using practical manual had a mean gain of 37.80 and their female counterparts had a mean gain of 37.97. The result indicated that female students performed better than their male counterparts when both groups were taught solubility using practical manual.

3.3 Testing the Research Hypotheses

Hypothesis 1: There is no significant difference between the academic performances of science students taught solubility using practical activities and those taught using practical manual.

Table 4: Summary of Analysis of Covariance (ANCOVA) of Students' Post-test Performance Classified by Instructional Materials with Pre-test as Covariate

Source	Sum of Squares	Df	Mean Square	F	Sign at P < .05	Decision
Pre-test (Covarate)	17.723	1	17.723	.544	.463	NS
Instructional Materials	8.942	1	8.942	.274	.602	NS
Error	3291.956	101	32.594			
Total	489944.000	104				

* = significant at .05 level of significance

NS = Not significant at .05 level of significance

In Table 4, the calculated Probability value (P-value) .602 of the main effect of instructional materials is greater than the declared Probability value (alpha level) .05. Therefore, the null hypothesis one is accepted. This implied that there exists no significant difference between the academic performances of science students taught solubility using practical activities and those taught using practical manual.

Hypothesis 2: There is no significant difference between the academic performances of male and female science students taught solubility using practical activities.

Table 5: Summary of Analysis of Covariance (ANCOVA) of Science Students' Academic Performance Scores using Practical Activities Classified by Gender with Pre-test as Covariate

Source	Sum of Squares	Df	Mean Square	F	Sign at p < .05	Decision
Pre-test (covarate)	61.742	1	61.742	1.436	.236	NS
Gender	2.542	1	2.542	.059	.809	NS
Error	2149.422	50	42.988			
Total	252341.000	53				

* = Significant at .05 level of significance
NS = Not significant at .05 level of significance

As shown in Table 5, the calculated P-value .809 of gender is greater than alpha level .05. Therefore, null hypothesis two is retained. This implied that there is no significant gender difference in the academic performances of science students taught solubility using practical activities.

Hypothesis 3: There is no significant difference between the academic performances of male and female science students taught solubility using practical manual.

Table 6: Summary of Analysis of Covariance (ANCOVA) of Science Students' Academic Performance Scores using Practical Manuals Classified by Gender with Pre-test as Covariate

Source	Sum of Squares	Df	Mean Square	F	Sign at p < .05	Decision
Pre-test (covarate)	4.237	1	4.237	.186	.668	NS
Gender	.085	1	.085	.004	.951	NS
Error	1094.197	48	22.796			
Total	237603.000	51				

* = Significant at .05 level of significance
NS = Not significant at .05 level of significance

As shown in Table 6, the calculated P-value .951 of gender is greater than alpha level .05. Therefore, null hypothesis three is retained. This implied that there is no significant gender difference in the academic performances of science students taught solubility using practical manual.

4.0 Discussion of Findings

The result of findings in tables 1 and 4 which answered the research question 1 and hypothesis 1 respectively revealed that students taught solubility with practical activities and practical manual achieved higher mean scores of 68.70 and 68.10 respectively, and the calculated Probability value (P-value) .602 of the main effect of instructional materials is greater than the declared Probability value (alpha level) .05. This implied that the use of practical activities to teach solubility in science is effective as the use of practical manual in teaching the same concepts in science. This is in line with Njokwu (2010) and Obinna (2012) who observed that students' proper utilization of instructional materials during practical activities and the use of practical manual significantly influence students' academic performance in sciences. This may be due to the fact that, science students who utilized instructional materials involving practical activities and practical manual made the lesson real and so they were able to assimilate and internalize the concept effectively.

Results of findings in tables 2, 3, 5 and 6 which answered research questions 2 and 3 and hypotheses 2 and 3 respectively revealed that there are no significant differences between the academic performances of male and female students in science when taught solubility with practical activities and those taught with practical manual since both groups made use of instructional materials. These comparable performances of males and females students observed agreed with Udoh (2015) which showed no significant difference in gender on students' academic performance and retention in biology when taught nervous coordination using computer simulation and charts. The findings also are in line with Okoye (2013), Olasheinde and Olatoye (2014), Enderle and Leeanne (2016) who found that there were no significant effects on gender with regards to students' achievement in science. This implied that when male and female students are exposed to the same learning environment with appropriate instructional materials irrespective of gender, they will assimilate faster and perform equally since knowledge has to do with intellectual ability and not gender. However, the findings disagreed with Etiubon (2011) that female students performed significantly better than their male counterparts in chemistry using technological resources in electrolysis and Ekeh (2004) who observed that male students performed significantly better than their female counterparts in mathematics using science iconic models and these make the study on gender inconclusive.

4.1 Conclusion

The use of practical activities to teach solubility in science is as effective as the use of practical manual in teaching the concept of solubility in science. This is due to the fact that students had direct access and adequate instructional materials to work with. The study also showed that students performed significantly better and achieved equally when both gender were taught the concept of solubility with practical activities and with practical manual. This facilitated students' academic performance on the concept of solubility taught. It therefore means that, effective and quality instructional delivery in the classroom and beyond depends to a large extent on the utilization of instructional materials for practical activities to enhance students' academic performance.

4.2 Recommendations

Recommendations based on the findings of the study were that:
Science students should be exposed to the concept of solubility with practical activities and practical manual to enhance their academic performance.
Science students should also be exposed and be trained on the use and proper handling of instructional materials to facilitate the process of transmitting knowledge, ideas and skills on solubility.
Science students should develop self-determination, willingness and competence at studying relevant and well edited journals on solubility.
School administrators should equip and enrich science laboratories with appropriate facilities to enhance students' utilization of instructional materials to concretize the learning of solubility and other science concepts.

References

Achimugu, L. (2014). Strategies for Effective Conduct of Practical Chemistry works in Senior Secondary Schools in Nigeria. *Journal of Science Teachers Association of Nigeria, 47 (1), 126-136*

Chief Examiner's Report. West African Examination Council (WAEC, 2015). Results of Candidates at the Senior Secondary Certificate Examination, May/ June in Biology, Chemistry and Physics, 2015.

Donald, B. S. (2009). *Science-based Teaching Competencies for Science Teachers*. Ibadan: Heinemann Books.

Ekeh, P. U. (2004). Gender Bias and Achievement in Science and Mathematics among Primary School Pupils: Implications for Human Resource Development. *Journal of Curriculum Organization of Nigeria,* 11(2): 30-33.

Etiubon, R. U. (2011). Employing Technological Resources to Enhance Students' Performance in Chemisty. *Journal of Education*, 4(1): 230-239.

Etim, P. J. (2006). *Issues in Educational Technology*. Designed and Printed by Abaam Publishing Company, Uyo, Nigeria.

Enderle, P. J. and Leeanne, R. B. (2016). Students Lab Manual for Argument-Driven Inquiry in Chemistry. Retrieved September 2016 from http://chronicle.com/article/The- Fight-for-Classroom/19431

Federal Republic of Nigeria (FRN, 2014). *National Policy on Education*. Yaba: NERDC Press.

Kulshretta, A. K. (2013). *Teachers' Training and Professional Competencies*. Dayalbagh Educational Press, India.

Lazarowita, R. & Tamir, P. (2006). Research on using laboratory instruction in Science. In: Gabel D. (Ed.) Handbook of research on Science Teaching and Learning (pp 94-128), Macmillan, New York.

Nurzatulshima, D. (2008). Management of Students' Involvement in Practical Science. Malaysia Education Journal, 34(1), 201-207.

Njelita, C. B. (2008). Enhancing Science Process Skills Acquisition in Volumetric Analysis using Cooperative Learning Strategy. Paper presented at the workshop organized by science teachers Association of Nigeria.

Njokwu, Z. C. (2010). Level of Chemistry Practical Science Skills Acquired by Senior Secondary School Students*. Nigeria Journal of Professional Teachers, 2(2), 114-116.*

Nwagbo, C. (2008). Science, Technology and Mathematics Curriculum Development. Focus on Problems and Prospects of Biology Curriculum. In Nzewi (Ed.), Proceedings of the 49th Annual Conference of Science Teachers Conference of Nigeria. Pp. 99-104, Nigeria: Heinemann Educational Books.

Obinna, J. B. (2012). Analysis of Poor Performance of Senior Secondary School Students in Chemistry in Nigeria. African Research Review : *International Multidisciplinary Journal, Ethiopia, 6(4), 319-330.*

Okoye, P. O. (2013). Teachers' knowledge of the Content and Activities of Basic Science Curriculum: Implications for MDGs. Proceeding of 54^{th} STAN Annual Conference.

Olasheinde, K. J., & Olatoye, R. A. (2014). Comparison of Male and Female Students' Learning outcomes in Science in Katsina State , Nigeria*. Mediterranean Journal of Social Sciences, 5(2), 518-523.*

Raimi, A. (2010). Gender Differences among College Students as Determinants of Performance. *Journal of Science Research, 5(9), 710-718.*

Udoh, N. M. (2015). Effects of Computer Simulation and Charts on Biology Students Academic Performance and Retention on the concept of Nervous Coordination. Unpublished M.Sc. Dissertation, Department of Science Education, University of Uyo, Uyo.

West African Examination Council (WAEC, 2014). Latest WAEC Syllabus for all Subjects (SSCE, GCE, 2015). Retrieved on December 23, 2015 from *http://www. myschoolgist.com/ng/waec-syllabus.*
WAEC (2015). West African Examinations Council Chief Examiners' Reports for 2012 May/June Senior School Certificate Examinations. Biology O- Level paper, Lagos: WAEC press