AFRICAN JOURNAL OF EDUCATIONAL FOUNDATIONS
University of Uyo, January/March, 2024. online:2672-5660, print: 2672-5649

Improving Science Students' Academic Retention on Energy Using Scaffolding and Project Strategies in Uyo Local Government Area, Nigeria

Rebecca U. Etiubon & Christiana A. Udo
Department of Science Education
University of Uyo, Uyo
Akwa Ibom State, Nigeria
Email: etiubon@yahoo.com and udochristiana1@gmail.**com**

Abstract
Energy is the driving force of nature. Appropriate teaching strategies evolve interest in the knowledge of the concept of energy. The study employed scaffolding and project teaching strategies to investigate senior secondary school science students' academic retention on energy in Uyo Local Government Area, Nigeria. The population comprised all senior secondary one science students. Sample of 142 senior secondary one science students (fifty nine male and eighty three female) in their intact class settings were used for the study. The study adopted quasi-experimental design of non-randomized pretest, posttest, control group. Purposive sampling technique was used. Science Retention Test (SRT) was the instrument used to collect data. The reliability coefficient of SRT was 0.78. Descriptive statistics of mean and standard deviation was used to answer the research questions while the hypotheses were tested using Analysis of Covariance (ANCOVA) at .05 level of significance. The result showed that students taught the concept of energy using scaffolding strategy retained better, followed by project strategy and expository strategy had the least facilitative effect. The result also indicated no differences in the retention of male and female science students taught energy using scaffolding, project and expository strategies. It is recommended that scaffolding strategy should be adopted to teach the concept of energy and various difficult concepts in science.

Keywords: Scaffolding and project strategies, retention, energy, posttest

Introduction

Energy is a basic conceptual element of all natural phenomena and is extremely important in all natural sciences. Energy is the ability to do work. The sun is the ultimate energy source for any ecosystem. Its radiation is used by plants to synthesize biological molecules by photosynthesis (Michael, 2021). There are many forms of energy, broadly categorized into: kinetic and potential energy. Kinetic energy is the energy associated with the objects' motion. Objects in motion are capable of doing work. Example is the energy associated with the constant random bouncing of atoms or molecules which causes thermal energy. The average

thermal energy of a group of molecules is referred to as temperature, and when thermal energy is transferred between two objects, it is known as heat. Potential energy is the energy stored in an object or system of objects that can transform into a more obvious form of energy like gravitational potential energy which is stored in an object due to its vertical position or height (Opitz *et al.*2017). Energy can be transferred mechanically by the action of force, through radiation by light or sound waves, electrically and by heating through conduction, convection, or radiation (Beals *et al.* 2021). Strategies that are learner-friendly like scaffolding and project strategies can enhance and motivate students' interest towards learning and understanding energy.

Scaffolding is the support given during a learning process tailored towards the needs of the students with the intention to help them achieve learning goals (Oluwasegun and Niedderer, 2020). Scaffolding is the assistance, parameters, rules, or suggestions a teacher give to the students during instructional process to achieve learning. Adamu (2017) added that scaffolding instruction is the duty of teachers and others in supporting the learners' development and providing structures to get to the next stage. It is a learning process designed to promote deeper level of understanding. Scaffolding is a teaching strategy the teacher models to suit the desired learning and task, then gradually shifts responsibility to the students (Firestone, 2018). In using scaffolding, the teacher's job is to help bridge the gap between what a student already knows and what he will learn next. Teachers provide successive levels of temporary support that helps students reach higher levels of comprehension and skill acquisition that they would not be able to achieve without assistance. Three major levels of scaffolding are: the content, task and materials needed for learning with scaffolding. At the content level, the teacher breaks instructional plans to lead the students from what they already know to a deeper understanding of what they do not know (Ibritam, *et al.* 2021). The second level of instructional scaffolding is task scaffolding. The instructor provides support to the learners at every step of the learning process (Pandhu, 2018). At the beginning of the process, the instructor models the task in its entirety. With observations, the students begin guided practice by performing parts of the task independently. The instructor assists the learners with their early practice and continuously assesses their learning. As the students gains experience with an understanding of new information of task, the instructor increases the complexity of guided practice activities and gradually reduces his or her support. The third level is material scaffolding which involves the use of manipulative, verbal or physical prompt and cues to help the learner perform a task (Olatubosun, 2020).Another important strategy under study that requires students active participation is project strategy.

Project strategy is student-centered strategy with the teacher taking the role of facilitating students' development on self-guided activities that occur after a period of time. Project teaching strategy encourages students' ownership of scientific knowledge and skills

through real life inquiry activity. Project strategy is a pedagogical strategy where students work in groups to collaborate, ask questions, make predictions, collect data, analyse data and draw conclusion (Dole *et al*. 2017). Project strategy uses 21st century skills to make students cultivate skills of communication, negotiation, collaboration and creativity (Lenz, *et al.* 2020). Project strategy entails giving unfamiliar or new topics to students to research independently outside the classroom setting. In most cases, students are given certain problems to solve and it will be expected of them to submit result of their findings for discussion and correction. Many studies show that when project strategy is implemented consistently and with fidelity, it impacts students with both content and science process skills (Branch, 2021). Other studies show that students that undergo project teaching strategy perform better when tested for science process skills requiring application of knowledge and are able to solve problems (Lenz, *et al.* 2020). The principle of project-based learning include: constructing knowledge through trial and error, learning by doing and applying new knowledge to new circumstances (Miller, 2018). Dole *et al.* (2017), posited that project-based learning applied to science concepts improve students' acquisition and retention of knowledge. For students to retain knowledge, they may be taught using expository strategy.

Expository strategy is an instructional strategy where the teachers' role is to present information that is to be learned to direct the learning process to students. The teacher identifies the lessons' objectives and takes the primary responsibility for guiding the instruction using models and explanations. Classes are usually dominated by lectures and direct instruction. The idea is that there is a fixed body of knowledge that the students must come to know (Miller, 2020). The teacher seeks to transfer thoughts and meanings to passive listener, leaving little room for students initiated questions, independent thoughts or instruction between students. The expository strategy pays more attention to teachers which in turn helps to decrease students' retention to a greater extent.

Retention is the ability of learners to remember tasks and material learnt. It is the ability to store facts and remember things easily. Adonu, *et al.* (2021), define retention as the act of remembering and the ability to recall and recognize experience learnt Adamu (2017), observed that instructional strategy serves as a pre-requisite to students' retention because students retain knowledge when appropriate pedagological strategies are employed to teach the concept of energy irrespective of their gender.

Gender relates to male and female attributes on cultural basis (Akpochafo, 2019). It is a psychological experience of being a male or female. In the process of learning science, some researches show superiority of male over female students on science subjects while others observe otherwise. Betiku (2022), found that male students performed better than their female counterparts in tasks involving mathematical skills in science. While others show superiority

of female over male (Udo *et al.* 2019). Udo (2020), 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 achievements. Edet (2021), posit that academic performance of male and female students have no significant difference in science. The students can achieve better when taught with motivating teaching strategies like scaffolding and project.

Statement of the Problem

Continuous high failure rate among science students calls for serious concern. Exposure to internal and external examinations like West African Examination Council, National Examination Council and Joint Admission and Matriculation Board show students do not perform well. This poses a threat to knowledge input among students for future performances either at the tertiary institution or in obtaining job. This needs to be tackled and the gap filed. In doing so, effective strategies could be used alongside with other instructional materials to improve students' retention in science. It is unfortunate to note that many teachers do not use student-centered approach capable of arousing students' interest and to stimulate curiosity towards the lesson to enhance retention. Energy is an important and interesting concept that cut across all the sciences. Despite its importance, students find the concept abstract and difficult. This could be because of the way it is taught. Teachers have difficulty making the concept real to students' understanding. It is on this basis, that the study investigates the effect that scaffolding and project teaching strategies will have on students' retention in energy.

Purpose of the Study

The purpose of the study was to examine the effects of scaffolding and project teaching strategies on science students' academic retention on energy in Uyo Local Government Area, Nigeria. The specific objectives of the study are to:

1. Examine the difference in the retention mean scores of science students taught energy using scaffolding, project and expository strategies.
2. Compare the retention mean scores of male and female science students taught energy using scaffolding, project and expository strategies.

Research Questions

The following research questions guided the study:

1. What difference exists among the retention scores of science students taught energy using scaffolding, project and expository teaching strategies?
2. What difference exists among the retention scores of male and female science students taught energy using scaffolding, project and expository strategies?

Research Hypotheses

1. There is no significant difference in the retention mean scores of science students taught energy using scaffolding, project and expository strategies.
2. There is no significant difference in the retention mean scores of male and female science students taught energy using scaffolding, project and expository strategies.

Methodology

The design for the study was quasi-experimental of non-randomized pretest, posttest, control group. Intact classes were assigned to experimental and control groups. The population used for the study was all senior secondary one (SS1) students in Uyo Local Government Area. The size of the population was eight thousand senior secondary one science students. The sample comprised 142 senior secondary one (SS 1) students. Out of one hundred and forty two sample drawn, eighty-three were female and fifty-nine were male. Intact classes were randomly assigned to the experimental and control groups. Experimental group one (E_1) were taught using scaffolding teaching strategy and the experimental group two (E_2) using project teaching strategy then the control group using expository teaching strategy. The instrument used to gather data for the study was Science Retention Test (SRT). The instrument gathered relevant information from the students on the use of scaffolding and project teaching strategies on energy. The SRT has 25 multiple choice test questions drawn from the concept of energy with four possible options lettered A-D, one correct answer and three distractors. Each correct answer carries 1 mark and wrong answer 0.

The instrument was validated by one secondary school science teacher and two lecturers from the department of test and measurement. To ascertain the reliability of the instrument, twenty-five (25) multiple-choice test items were administered to 30 students in another school in Uyo Local Government Area not selected for the study. The results obtained from the administration of the test were subjected to Kuder-Richardsons' formula-21. The instrument was deemed suitable for measuring the students' academic retention with consistency on the basis of the high reliability index of 0.78.

Research Procedure

The tests were administered with the help of research assistants, scripts were collected, marked and scored by the researcher. The students in the experimental group one and two were taught using scaffolding and project strategies respectively. Students in the control group were taught using expository strategy in their intact class. Data collected were analysed using descriptive statistics of mean and standard deviation and Analysis of Covariance (ANCOVA) at .05 level of significance.

Results of Data Analysis

Research Question one: What difference exists among the retention scores of students taught energy using scaffolding, project and expository teaching strategies?

Table 1: Mean and standard deviation of students' posttest and retention mean scores taught energy using scaffolding, project and expository teaching strategies

Posttest				**Retention**		
Strategies	N	Mean	SD	Mean	SD	Mean Diff/Loss
Scaffolding	46	19.17	3.07	19.80	2.44	0.63
Project	47	19.55	2.73	18.96	3.51	-0.95
Expository	49	12.83	3.20	11.51	3.21	-1.32

Data in Table 1 show the mean difference (retention - posttest mean scores) for the treatment groups scaffolding, project and expository teaching strategies to be 0.63, -0.95 and -1.32 respectively. This result indicates that students taught energy using scaffolding teaching strategy have the best retention followed by their counterparts taught using Project and Expository teaching strategies in decreasing order. This implies that scaffolding teaching strategy facilitate retention better than Project and Expository teaching strategies.

Research Question two: What difference exists among the retention mean scores of male and female students taught energy using scaffolding, project and expository teaching strategies?

Table 2: Mean and standard deviation of male and female students Posttest and Retention mean scores taught energy using scaffolding, project and expository teaching strategies

Posttest				**Retention**		
Groups	N	Mean	SD	Mean	SD	Mean
Scaffolding						
Male	18	18.61	3.30	19.33	2.66	0.72
Female	28	19.54	2.92	20.11	2.28	0.57
Project						
Male	20	19.45	2.52	18.80	3.85	-0.74
Female	27	19.63	2.92	19.07	3.32	-0.56
Expository						
Male	21	12.48	3.52	11.95	3.22	-0.53
Female	28	13.11	2.97	11.19	3.22	-1.92

Data in Table 2, shows the mean difference (retention-posttest mean scores) for male students taught energy using scaffolding, project and expository teaching strategies to be 0.72, -0.74 and -0.53 respectively, while those of the female counterparts are 0.57, -0.56 and -1.92 respectively. The result indicates that Male students taught energy using scaffolding teaching strategy had the best retention. For those taught using Project teaching strategy, female students had a better retention compared to the male students while male students retained better than the female students when taught using Expository teaching strategy. This implies that scaffolding teaching strategy facilitate retention better than project and expository teaching strategies. Based on gender, male students retained better than female students, although on the whole retention was poor across treatment groups.

Research Hypotheses

Null Hypothesis 1: There is no significant difference in the retention mean scores of students taught energy using scaffolding, project and expository strategies

Table 3: Analysis of Covariance (ANCOVA) of students' retention classified by treatment groups (scaffolding, project and expository strategies) with posttest scores as covariate

Source of Variance	Sum of Squares	Df	Mean Square	F_{cal}	F_{crit}	Decision at .05 alpha
Corrected model	2372.66	3	790.88	113.79	2.60	Significant*
Posttest (Covariate)	370.28	1	370.28	53.28	3.84	Significant*
Main effect: Treatment	320.25	2	160.13	23.04	3.00	Significant*
Error	959.12	138	6.95			
Corrected total	3331.78	141				

*significant at p<.05

In Table 3, the calculated F-value, F-cal, for the difference in the retention mean scores of students taught energy using scaffolding, project and expository strategies is 23.04 while its corresponding Table value, F-crit, at df 2, 138 and 0.05 alpha is 3.00. The F-cal is greater than the F-crit. This implies that there is a significant difference in the retention means scores of students taught energy using scaffolding, project and expository strategies. Hence, null hypothesis one is rejected.

Null Hypothesis 2: There is no significant difference among the retention mean scores of male and female students taught energy using scaffolding, project and expository teaching strategies.

Table 4: Analysis of Covariance (ANCOVA) of students' retention mean scores classified by treatment groups (scaffolding, project and expository teaching strategies) and gender with posttest scores as covariate

Source of Variance	Sum of Squares	Df	Mean	F_{cal}	F_{crit}	Decision at .05 alpha
Corrected model	2388.80	6	398.13	56.99	2.60	Significant*
Posttest (Covariate)	371.81	1	371.83	53.23	3.84	Significant*
Main effect:						
Treatment	297.27	2	148.64	21.28	3.00	Significant*
Gender	1.72	1	1.72	.25	3.84	Not Significant
2-way Interaction:						
Treatment*Gender	14.08	2	7.04	1.01	3.00	Not Significant
Error	942.98	135	6.99			
Corrected total	3331.78	141				

*significant at p<.05

As shown in Table 4, the calculated F-value, F-cal for the difference in the retention mean scores of male and female students considering the treatment and control groups (scaffolding, project and expository) is 1.01, while its corresponding critical value, Fcrit, at df 2, 135 and .05 alpha is 3.00. The F-cal is less than Fcrit. This implies that the difference in the retention mean scores of male and female students is not statistically significant. That is, there is no significant difference in the retention mean scores of male and female students taught the concept of energy using scaffolding, project and expository teaching strategies. Based on this observation, the null hypothesis 2 is retained.

Discussion of Findings

Findings on the effect of scaffolding, project and expository teaching strategies on students' retention when taught the concept of energy indicated that students taught using scaffolding performed better than those taught using project teaching strategy followed by those taught using expository teaching strategy. This can be attributed to the fact that scaffolding enable learners to focus attention on important information and they prompt the learner to organize and record what they see. This finding is supported by Adamu (2017), that scaffolding teaching strategy supported the learners' development and provided structures to get to the next stage or level and gains control of the new learning to become increasingly able

to complete the task alone thus leading to improved academic achievement of students. This finding is also in agreement with Joda (2019); Akani (2020); Uduafemhe (2021) and Adamu (2017) asserted that instructional scaffolding strategy has a better effect on academic retention.The findings on the retention scores of students taught energy using scaffolding, project and expository teaching strategies indicates that students taught energy using scaffolding teaching strategy have the best retention followed by their counterparts taught using Project and Expository teaching strategies. This can be attributed to the fact that scaffolding moves students progressively toward greater understanding and ultimately, greater independence in the learning process. This is in contrast with studies by Dole *et al.* (2017), that project-based learning applied to science topics improve students' acquisition and retention of knowledge.

Findings show that there is no significant difference in the retention mean scores of male and female students taught energy using scaffolding, project and expository strategy. This is in contrasts with the observation by Udo, Udo and Anidu (2019), which showed superiority of male over female students and others show superiority of female over male. The finding of this study is in contrast with that of Edet (2021),that the academic performance of male and female students has no significant difference in science teaching and learning: that students can achieve better when taught with motivating teaching strategies like scaffolding and project. Gender played no significant role on the students' academic achievement when taught energy using scaffolding, project and expository strategies.

Findings on the retention scores of male and female students taught energy using scaffolding, project and expository teaching strategies showed that male students taught energy using scaffolding teaching strategy had the best retention. For those taught using Project teaching strategy, female students had a better retention compared to the male students while male students retained better than the female students when taught using Expository teaching strategy. This implies that scaffolding teaching strategy facilitate retention better than project and expository teaching strategies. Based on gender, male students retained better than female students. This is in line with Agrenor (2022), that male students have higher knowledge retention in science subjects than their female counterparts.

Findings show that there is no significant difference in the retention mean scores of male and female students taught the concept of energy using scaffolding, project and expository teaching strategies. This is in line with Nzewi (2017) who opine that there is no significant influence of gender on students' knowledge retention in science subjects. These are contradictory findings on gender influence on students' knowledge retention in science. However, Swarat *et al.* (2017) maintained that knowledge retention is a function of students'

interest in a subject matter, mostly derived from the effectiveness of the instructional strategies utilized in the lesson delivery.

Conclusion

Based on the observations made in the study, it was concluded that students taught energy using scaffolding teaching strategy retained better than those taught using project and expository teaching strategies. Based on gender, it was observed that male students retained better than female students.

Recommendations

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

1. Students should be taught using scaffolding teaching strategy to enhance and facilitate their retention in the concept.
2. Teachers should endeavor to use scaffolding teaching strategy to prompt and increase students' interest on science concept in order to improve students' academic retention in the subject.
3. School Administrators should encourage teachers to engage students in the course of the lesson, using scaffolding teaching strategy to enhance their retention in science.
4. The State Secondary Education board and relevant education stakeholders should provide instructional scaffolding materials to encourage the use of scaffolding teaching strategy in the teaching and learning of science subjects.

References

Adamu, I. (2017). *Effects of analogy and scaffolding instructional strategies on senior secondary school physics students' academic achievement in Adamawa State, Nigeria*. Unpublished M. Tech. Thesis Modibbo Adama University of Technology Yola, Adamawa State.

Adejoh, M. J. (2017). Modern Approaches to the Teaching and Learning of Science Innovation in Teaching and Learning. Adeka Printing and Publishing Company Ltd. High level Makurdi.

Agrenor, T. (2022). *Effects of Study Questions as advance organizers on Students Achievement and Roles in Basic Science in Markudi Local Government Area of Benue State*. Unpublished M. Ed. Thesis, University of Makurdi,Benue State.

Akani, O. (2020). Impact of instructional scaffolding on students' achievement in chemistry in secondary school in Ebonyi State, Nigeria. *International Journal of Education, Learning and Development*, 3(7): 74-83.

Akpochafo, W. P. (2019). *Social Studies and Feminist Issues for teacher Education.* Benin City: Justice Jeco Press and Publishing Ltd.

Alebiosu, K. A. and Michael, E. (2018). Towards optimal enhancement of practical work and activities in school science. *Journal of Research in Science Education,* 2(3): 1-10.

Aslam N., Khanam A., Fatima G., Akbar A., Muhammad N., (2017). A study of the impact of Scaffold Instructions on the Learning Achievements of Post- Graduate Students *Journal of Arts and social Sciences*, 4(1):53-68.

Avulata, B., and Onyama, E. (2019). Cultural prejudice and women education in a Nigerian rural community: Implications for counseling. *The Counselors*, 14 (2): 124-130.

Beals, A. M., McNall Krall, R. and Wymer, C. L. (2021). Energy flow through an ecosystem: Conceptions of in-service elementary and middle school teachers. *International Journal of Biology Education,* 2(4): 1-18.

Betiku, O. F. (2022). Gender equity in science, technology and mathematics: Paper Presented at the 3rd Biennial Conference of WCCI Nigeria Chapter, Abuja 26th - 29th April 2022.

Branch, L. J. (2021). *The impact of project based learning and technology on students' achievement in Mathematics.* New Media, knowledge practices and multi-literacies, pp. 259-268. Singapore, Springer Singapore.

Casem, R. Q. (2013). Scaffolding Instructional Strategy in teaching Mathematics: Its effects on students' performance and attitude. *Comprehensive Journal of Education Research,* 1(1), 9-19

Dole, S., Bloom, L. and Doss, K. K. (2017). Engaged Learning: Impact of PBL and P, BL with elementary and middle grade students. *Interdisciplinary Journal of Problem-based Learning*, 11(2): 80-95

Edet, N. O. (2021). *A comparative Analysis of Mathematics and Economics Students Achievement*. Unpublished B. Sc. Project, University of Uyo, Uyo.

Fariha, Gul and Shumalia Shehzad, (2015). Effects of Cooperative Learning on Students Academic Achievement. *Journal of Education and Learning (EduLearn)* 9(3):246-255.

Firestone, M. (2018). Scaffolding in Education. *www study.com/academy/lesson*.

Hacisalihoglu, G., Stephens, D., Johnson, L. and Elington, M. (2018). The use of active learning approach in a scale – up learning space improves academic performance in undergraduate General Biology. 13(5) eO197916 doi 1o: 1371/Journal.Pone.0197916.

Hastie, P. A., Chen, S., Guarino, A. J. (2017). Health-related fitness knowledge development through project-based learning. *Journal of Teaching in Physical Education,* 36(1): 119-125.

Ibritam, K. S., Udofia, N. Onweh, V. Z. (2021). Assessing the Potency of Scaffolding and Demonstration Instructional Methods on Students Achievement in Technical Colleges in Akwa Ibom State. *Advance in Research,* 3(1): 92-101.

Ihejiamaiziu, C. C. Ochui, I. O. (2016). Utilization of Biology laboratory equipment and students academic performance in Cross River State, Nigeria. *British Journal of Education,* 4(9): 55-13.

Lahey, H. (2018). *Discipline for self- control.* Upper Sadle River, NJ: Prentice hall.

Lenz, B., Wells, J., & Kingston, S. (2020). Transforming Schools using project-based learning, performance assessment, and common core standards. San Francisco CA: Jossey-Bass.

Liu, X. (2016). Motivation Management of project-based learning for business English adult learners. *International Journal of Higher Education,* 5(3): 137-145.

Mangvwat, C. (2016). Gender difference in cognition: A function of maturation role. Science, 193 (190), 157-163.

Michael, M. C. (2021). *Essential Biology for Secondary School*. Lagos Tonad Publishers.

Miller, A. (2018). *Time Management with PBL*. Retrieved from https://www.edtopia.org/article/time-management-pbl.

Ntibii, J. E and Neji, H. A. (2018). Effect of problem-solving Method of teaching on students' academic performance in physics and chemistry in Calabar Municipality, Cross River State, Nigeria. *Global scientific Journal* 6(2), 121-140

Nwagbo, T. E., (2016).Levels of Acquisition of Science process skills among year one senior secondary school students. *Journal of Science Teachers Association of Nigeria*, 29(18), Lagos, pp. 47-53.

Nwakonahi, F. E. (2013). Realizing the vision of National Economic Empowerment and Development Strategies (NEEDS) and Millennium Development Goals (MDGs): Implication for Biology Education. *Journal of Education,* 8(1): 58-65.

Olatubesun, E. O. (2020). Effects of Scaffolding Strategy on Learners' Academic Achievement in Integrated Science at the Junior Secondary School Level. *European Scientific Journal*, 9(19): 149-155.

Oluwasegun, O. G., Niedder, H. (2020). Effects of Scaffolding Strategy on Waves among low and high ability levels secondary school students Achievement and Retention in Abuja. *Journal of Science, Technology and Education.*

Onoshakpokaiye O. (2021). The study skills; an educational implication on students' performance in Secondary School Mathematics. *Journal of Mathematics education.* Delta State University, Abraka, Nigeria.

Onyeukwu, D. (2020). Psychological analysis of juvenile delinquency. Nigeria *Journal of Applied Psychology*, 1 (3), 228 - 237.

Opitz, S. T. Neumann, K., Bernholt, S. and Harms, U. (2017). Students'energy understanding across biology, chemistry, and physics context. *Research in Science Education.*

Pandhu, N. (2018). Effects of instruction with scaffolding on school students' achievement in science in relation to cognitive styles and intelligence. *Journal of Advanced Research in Psychology & Psychotherapy,* 1(1&2), 53-59

Santi, N., Holwarni, B. Azmi, J. (2017). The application of Cooporative Learning Roundrobin to improve students learning achievement on the subject of electrolyte-nonelectrolyte and redox in class X SMAN I Seberide Proceeding of the 2nd Annual international seminar of Transformative education and educational leadership (AISTEEL) e ISSN: 2548-4613.

Singh, Y. K. (2020). Dictionary of Education. New Delhi: A. P. H Publishing Corporation.

Udoh, N. M. (2020). *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.

Udoh, Udo and Anidu (2019). Effects of acronym and expression Mnemonics on science students academic Achievement and Retention in Animal Hormones in Uyo Municipality. *Nigerian Journal of Science and Science Education.* 8(3): 85-105

Uduafemhe, M. E. (2021). Comparative Effects of Scaffolding and collaborative instructional approaches on Secondary School students' psychomotor achievement in Basic Electronics in North-Central Nigeria. *International Organization of Scientific Research,* 5(6): 23-3

Ugwu, C., and Nzewi, U. M. (2015). Effect of two instructional delivery approaches on senior secondary schools students' achievement in Biology. *Journal of Science Teachers Association of Nigeria,* 56(1, 2): 95-99.

WAEC (2016-2018). *West Africa Examination Council Chief Examiner Report*.