Effect of Guided Diagram Scoring Teaching Strategy on Students' Achievement in Biology at Senior Secondary School Level

Adipere Ebiye[1], Okpko, Valentine[1], Leghemo Ebifaghe K[2], Enareigha Esther B[3], & Epem Ubodiom[3]

[1]*Admiralty University of Nigeria, Ibusa/Ogwashi-Uku Express, Delta State, Nigeria*
[2]*Bayelsa State College of Health technology Otuogidi, Ogbia, Bayelsa State, Nigeria*
[3]*Bayelsa State College of Education, Sagbama, Bayelsa State, Nigeria*

Abstract: **A quasi-experimental study of non-equivalent control design was adopted to investigate the effect of guided diagram scoring teaching strategy on senior secondary school class 2 (SS2) students' achievement in biology. The study sample size consisted of 135 SS2 students consisting 70 students in one intact class from one school and 65 students from another school within Yenagoa metropolis of Bayelsa State. The aim of the study was to evaluate the students' achievement through GDSTS in one of the biology topics. The students were drawn from intact classes, were randomly selected into experimental group and control group. The study employed pretest and posttest on biology of nervous system in data collection. Data collected were analyzed using mean and standard deviation and independent t-test. Findings from the study revealed that students taught with guided diagram scoring teaching strategy scored higher in their achievement test items than those taught with conventional lecture method (control group (m=5.64, SD=1.08) and experimental group (m=7.31, SD=0.71) conditions t(133)=4.72, t-tab=1.97); which implied that guided diagram scoring teaching strategy was effective in improving students' achievement in learning. More so, it was revealed that gender is a significant factor in students' achievement when taught with guided diagram scoring strategy favouring the female gender. Since guided diagram scoring teaching strategy enhanced performance of students, we therefore recommend that guided diagram scoring teaching strategy be included as an integral part of instructional procedure of biology education in senior secondary schools.**

Keywords**: Teaching and learning, Guided diagram scoring teaching strategy, Students' achievement, Marking guide, Biology**

I. INTRODUCTION

Biology education remains a vital tool for the development of an individual and societal. The teaching and learning of biology education in Nigeria has been an issue of great concern to education stakeholders. Despite the efforts and investment made by government and individuals on education, not much could be said to have been achieved on students' performance judging from West African Examination Council (WAEC) reports. The persistent low levels of students' achievement in biology from the various public examinations in Nigeria have continued to draw the attention of major stakeholders in education. Consistently, the Chief examiner's report on senior secondary school students' academic achievement has revealed poor achievement in Biology in senior secondary school certificate examination conducted by the (WAEC) from 2002-2018 in Nigeria (Joda, 2019). On the factors contributing to students' poor academic achievement in Biology, stakeholders highlighted inadequate laboratories and Biology instructional materials, large class size, instructional strategy adopted by Biology teachers among others (WAEC, 2018; Joda, 2018; Joda & Mohammed, 2017; Osuafor & Okonkwo, 2013). In addition, inappropriate and uninspiring teaching strategies adopted by science teachers is another factor (Jongur, Abubakar &Aba, 2009; Abot, 2007). However the students' underachievement in biology does not suggest adequate implementation of the aims and objectives of the National Policy of Education of Nigeria, since Education is aimed at helping the child acquire appropriate skills, abilities and competencies, both mental and physical as equipment for the individual to live in and contribute to the development of his society' (FME, 2004). In view of this, the teaching of biology requires that biology teachers at the senior secondary school levels should have a sound knowledge and achievement boosting strategies.

In an attempt to mitigate poor performance of students in Nigeria, the United Nations Education, Social and Cultural Organization (UNESCO, 2006) advocated for a paradigm shift from being instructors, expositors, fact givers and verifiers to facilitators, stimulators, proactive and productive by Nigerian teachers at both, primary and secondary schools levels. In addition, curriculum developers have recommended some teaching approaches which are learned-centered for the effective teaching so as to bring the expected and desired learning outcomes. The approaches recommended was not only inquiry and concept mapping but also include Laboratory techniques and discovery teaching/ learning (Joda, 2019). Notwithstanding, Ugwuadu & Joda (2015) observed that students achievement in biology subject is still not encouraging despite the recommended teaching approaches by curriculum developers.

The recurrent poor performance in biology subject specifically where diagram construction and labelling is assessed at senior secondary certificate examination portray poor teaching

strategy used by biology teachers. Though, biology diagram construction and labelling is perceived to be difficult components in the learning of biology by secondary school biology students, it may be more of a wrong mindset of students about biology diagrams to be artistic and hence could account for students perceiving biology diagram construction and labelling to be difficult. Therefore, the concerns by the national examination bodies (WAEC and NECO) on students' poor performance in biology on diagram construction and labelling in external biology examinations requires some serious attention. Biology Chief Examiner's Report, (2008 & 2010) have spelt out the areas of students weaknesses in biology diagrams construction and labelling to include:

- Poor diagrams as a result of using blunt pencils, with broken lines;
- Free hand guidelines and non-horizontal labels;
- Not giving titles to diagrams;
- Poor spelling of labels;
- Poor diagrams with loss of details;
- Guidelines not touching the structures they were meant to label;
- Use of plural words for a guideline.

Surmounting the above enumerated weaknesses of the students need for a total integration of the learners into the evaluation processes; where they will have opportunity to appreciate the errors they commit in biology diagram constructions. Error minimization requires that students participate in the identification of their own errors (Onugwu, 1991). Therefore, an instructional strategy such as guided diagram scoring teaching strategy (GDSTS) that incorporates error identification may provide the requisite panacea for the endemic poor performance in biology at the secondary school level. According to Agbo and Nyam (2007), teaching is a system of communication between a teacher and a learner with the intention of bringing about certain cognitive and psychological changes in the learner. It is important to note that every human being is unique and this calls for teaching to be learner-centered on instructional approaches that ensures use of techniques that promotes students' achievement. Sani and Ochepa (2002) observed that practical discussion outside the classroom which is an instructional strategy can improve students' achievement in mathematics. This was corroborated by Odowu (2008) who also observed that quality diagrams are most effective content structure in improving students' performance in biology. Therefore, guided diagram scoring teaching strategy (GDSTS) may arouse the interest of the learners and demystify difficulty in this integral component of biology and contribute in mitigating the worrisome trend in poor academic achievement in biology as a subject.

Diagram is a condensed drawing, which is made up of lines and symbols. It is used to represent outlines, interrelationships of the most important aspects of process, object or area. The lines and symbols convey information. It provides means for visual referencing, recording of visual information and schematization of ideas. Diagrams maintain integral part of biology hence the teaching and learning of biology is inconclusive without diagrams. Biology involves diagrams that are process oriented and through the guided diagram scoring teaching strategy (GDSTS), the students acquire experiences, which not only exposes the characteristics of good diagrams but also appreciate the non-artistic nature of biological diagrams. GDSTS presents learning as a personal involvement through restructuring, re-organization of perception and gaining insight in a purposeful activity. The organization of allows the learner to perceive new relationship, solve new problems and gain basic understanding of the subject.

The guided scoring is an instructional approach that completely integrates the learners into the assessment exercise that offers the learners rare opportunity of witnessing their errors and sources of failures in accomplishing the tasks. Therefore, guided scoring strategy when used as assessment and instructional tool creates room for the students to be incorporated in scoring evaluation in the classroom. Guided scoring strategy is learner centered (Kwok, 2008). Brown (2004) noted that guided scoring instructional approach allows students direct involvement in judging the quality and enjoy the ownership of instruction and progress. This was supported by Topping (2003) who stressed that guided scoring instructional strategy does not only enhances learning and proper understanding of evaluation criteria but also promotes critical thinking. This strategy develops learners' social and communication skill and instils in them useful transferable skills like self-justification and assertion (Topping 2008)

Guided scoring gives students impetus to hold themselves mutually responsible for the successful completion of the instructional exercise directly or indirectly (Topping, 2003). It has been noted that when students are exposed to guided scoring strategy, they acquire the baseline knowledge that enables them to score marks on biology questions that require diagram construction or labelling. The procedure that is required to produce the desired diagram has been revealed in the marking scheme. The importance of the processes of arriving at making a diagram is contained in the scoring rubrics. Every well registered examination bodies like WAEC and NECO) adopts a procedural pattern on how marks are allotted to a given question.

The more students are guided in the evaluation process, the more interest they generate in learning and this helps them to discover their mistakes and adjust as appropriate (Inoue, 2005; Orogwu, 2006). For instance, the final marking scheme on biology (WAEC, 2008) required students to "make a diagram 10-12cm long of the reflex arc and label fully"

-Title	
Diagram of Reflex Arc **(T)**	=1 mark
-Details	
Three neurons shown **(TN)**	=1 mark
Motor neuron ending in effectors organ **(NE)**	=1 mark

-Quality	
Size (Sz) 10-12cm	=1mark
Neatness of labels **(NL)**	=1mark
Clarity of lines **(L)**	=1 mark
-Label	
Four correctly labeled parts 4 x 0.5	= 2 marks

(Source: Biology marking scheme, WAEC, 2008)

The above marking guided if incorporated into teaching in the classroom will help the students to understand what is needed on biology diagrams thereby boosting their confidence in the ability to learn effectively. This in turn will result in

positive outcomes in students such as; enabling students to view themselves as capable learners; develop learners confidence by breaking difficult tasks into simpler ones that they view as more manageable and achievable; give learners a reasonable level of control over their learning. This remains the central focus of GDSTS.

GDSTS is a teaching approach that exposes diagram marking guidelines that enable the assessment process of communicating expectations; providing basic rubrics on grading. It lays emphasis on articulated expectations for an assessment by listing the criteria, or what counts and describing levels of quality from excellent to poor. Apart from being considered as an effective tool for measuring, evaluating and reporting student achievement, guided diagram scoring teaching strategy enables the students to understand how marks are awarded to diagrams during the marking of their examination papers, especially external examination. Cindy (2002) noted that GDSTS is based on standards of what students should understand or be able to do. The strategy also gives clearer explanation of what should be assessed as well as standards that need to be met. This strategy could serve as remedy to the linkage of students' poor achievement to lack of knowledge of marking guidelines. The marking rubrics centered approach according to Glickman-Bond & Rose (2006) is designed to guide students' learning, teachers' instruction, course development and administrators' program observations. A teaching strategy that focuses on student learning or achievement using guided scoring or marking guides (rubrics) can be termed a change process. Teachers made use of scoring guide or marking scheme to communicate expectations for an assignment; provide focused feedback on works in progress, and grading final products (Andrade, 2000; Moskal, 2003). Andrade (2000) notes that scoring guide is a document that describes levels of quality from excellent to poor or articulates the expectations for an assignment by listing the criteria of what counts. Empirically, Guided scoring teaching strategy has been observed by other scholars (Usman and Memeh, 2007 Abonyi and Nweke, 2014) that improved students' achievement in mathematics. Similarly, Masayile et al (2017) noted the effectiveness of marking guides in instruction where it was observed that scoring guides as effective tools of instruction that enhance understanding amongst students. This was corroborated by other scholars (Wolf & Stevens, 2007; Reynolds-Keefer, 2010; Chinyemba, 2011) that a teaching strategy that incorporates marking rubrics had the potential of enhancing student learning and fosters high academic achievements in students. Hence, the Investigation and evaluation of the usefulness and effectiveness of GDSTS to the primary stakeholders in biology education is therefore an immediate necessity.

A growing gender gap in the academic achievement of students has been evidenced. For instance, some researchers have claimed that male students do better than female students, while the contrary have been observed by others. Adipere and Leghemo (2011) observed significant difference between male and female students in transferable skills, where male students in many countries had higher achievement in natural sciences and systematic thinking (Viehrig 2014). Similarly, Ballah (2015) and Ugwu (2014) in their study revealed significant gender difference in the academic achievement of students in favour of males on teaching strategies. More so, it is a common belief that male students perform better in science related disciplines than the female students (Nzewi, 2010). On the contrary, Ogbonna (2003) observed that gender was not a significant factor on students' achievement in mathematics. Similarly was also recorded by Nwagbo and Obiekwe (2010) who noted that gender did not have significant influence on students' achievement in ecological concept when the five Es were used (engagement, exploration, explanation, elaboration and evaluation); a constructivist instructional approach. The contradictions in the findings might be as a result of approaches or teaching strategies used in teaching by various scholars. Thus, it is paramount to observe the influence of gender on students' performance when taught with the guided diagram scoring teaching strategy.

This study therefore, investigates the effect of GDSTS on students' achievement in biology at senior secondary school level.

Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance.

HO1: Mean achievement scores of students taught with GDSTS do not differ with the mean achievement scores of students taught with conventional method.

HO2: There is no difference on the mean achievement scores of male and female students taught using guided diagram scoring teaching strategy.

II. METHODOLOGY

The study adopted a quasi-experimental approach of nonequivalent control group design. Intact classes were used with randomization as obtainable in true experimental design. The population of the study was all the senior secondary school class II (SS2) students in Yenagoa metropolis. The sample of this study was made up of 135 students consisting

of 70 students in one intact class and 65 students in another intact class. The two intact classes were randomly selected from two different schools in Yenagoa educational zone. The intact classes were randomly assigned to the experimental group and control group by a flip of coin. This approach of design was considered appropriate for randomly assigning subjects to experimental and control groups without disrupting school activities. The research instrument used for this study was named-biology diagram achievement test (BDAT). The instrument was content validated with a test blue print and face validated by three specialists. The reliability of the instrument was found to be 0.86 using Kendal coefficient of concordance. A pretest was administered to the two groups prior to the treatment. The experimental group was taught with a lesson plans of the nervous system with diagram emphasis of the reflex arc that specified the allocation of marks adopted from the final marking scheme on biology (WAEC, 2008) as presented above. The control group was taught with same lesson plans used for the experimental group but without allocation of marks. The teaching lasted for two weeks. After the teaching, a posttest was administered to the two groups on the same day. Data collected were analyzed using independent sample test (one tail test).

III. RESULTS

Null Hypothesis 1

H01: Mean achievement scores of students taught with guided diagram scoring teaching strategy do not differ with the mean achievement scores of students taught with conventional method.

Table 1: Mean and Standard Deviation of Students' Scores in BDAT

Group	Tests	No of Students	Mean	Standard Deviation
Control	Pretest Posttest	70 70	4.04 5.63	1.49 1.08
Experimental	Pretest posttest	65 65	4.08 7.31	1.42 0.71

Table 1 shows the mean achievement scores of the control group and the experimental group. The mean achievement scores of the pretest of the two groups are relatively equal. This means that academic performance of the students in the two groups are likely equal. The posttest mean achievement scores of the experimental group appears to be higher than the mean achievement scores of the control group as shown in Table 1. The higher mean achievement scores of the subjects in the experimental group than the subjects in the control group means improvement in mean achievement scores of the experimental group than the control group.

Table 2: T-Test Analysis of Mean Achievement Scores in BDAT

Group	No of Student	Mean	Standard Deviation	df	t-cal	t-tab
		Posttest	posttest			
Control	70	5.63	1.08	133	4.72	1.97
Experimental	65	7.31	0.71			

Table 2 indicates that calculated value of t at 0.05 level of significance with 133 degree of freedom is 4.71. This calculated t value is greater than the table value (critical value) of 1.97. Therefore the null hypothesis is rejected. Thus, the mean achievement scores of students taught with guided diagram scoring teaching strategy differ significantly from those taught without guided diagram coring teaching strategy.

Null Hypothesis 2

HO2: There is no difference on the mean achievement scores of male and female students taught using guided diagram scoring teaching strategy.

Table 3: Mean and Standard Deviation of Males and Females Students' Scores in BDAT

Group	Tests	No of Students	Mean	Standard Deviation
Males	Pretest Posttest	31 31	4.07 7.20	1.41 0.76
Females	Pretest posttest	34 34	4.07 7.53	1.41 0.59

Table 3 indicates that the difference in mean of the pretest and posttest of the female students is higher than the difference in the male students. It is clear that the female students improved in their achievement more than the male students.

Table 4: T-Test Analysis of Males and Females Mean Achievement Scores in BDAT

Group	No of Student	Mean	Standard Deviation	df	t-cal	t-tab
		Posttest	posttest			
Males	31	7.20	0.76	63	11.79	1.67
Females	34	7.53	0.59			

Table 4, indicates that the calculated value of t at 0.05 level of significance with degree of freedom 63 is 11.79. This value is greater than the table value of 1.67. Therefore, the null hypothesis is rejected. Thus, gender is a significant factor in influencing the mean achievement scores of students taught with guided diagram scoring strategy.

IV. DISCUSSIONS

An independent-sample t-test was carried out to compare the mean achievement scores of student taught with GDSTS with the mean achievement scores of students taught without GDSTS. There was a significant difference between the mean achievement scores of students taught with GDSTS (m=7.31, SD=0.71) and the mean achievement scores of students taught without GDSTS (m=5.64, SD=1.08) conditions t(133)=4.72, t-tab=1.97. These results from tables 1 and 2 revealed that guided diagram scoring teaching strategy improved more than those taught with the conventional lecture method. The knowledge acquired enable them avoid omitting the integral parts or details of biology diagrams. Guided diagram scoring teaching strategy emphasizes the allocation of marks concerning biology diagrams. The strategy builds confidence in the students and exposes how simple biology diagrams are through the teacher's instructional approach of showing the

students on how easy is it to have better grades with guided scoring teaching strategy.

After the exposure of the students in the experimental group to guided diagram scoring teaching strategy, their achievement in biology was significantly high. The study revealed that students taught biology using guided diagram scoring teaching strategy achieved higher posttest scores than those taught using convectional lecture method. This could be as a result of activities incorporated in the teaching strategy that might have strengthened the cognitive ability of students. The positive influence of this teaching strategy observed from the results might also be due to the opportunity of the teaching approach presenting learning as a personal involvement through restructuring; where learners re-organizes their perception and gain insight in a purposeful activity. The findings from the study were not different from previous scholars (Wolf & Stevens, 2007; Reynolds-Keefer, 2010; Chinyemba, 2011; Masayile et al., 2017) whose researches found scoring guides as effective tools of instruction for achievement boosting. This result is in line with the findings of other scholars on teaching strategy (Amaechi and Thompson 2016; Osuyi and Ainetor, 2018, Okotubu, 2020) whose works reported significant influence of demonstration teaching strategy on the posttest achievement scores of students. The revealed worth of the guided scoring instructional strategy in its superiority over the conventional instructional strategy and its ability to accommodate females and males students in fostering achievement in biology is highly commendable.

On the influence of gender, the study revealed that female performed in the treatment group better than their male counterparts. The achievement of the female students in the teaching strategy is higher than those of male students with statistically significant difference. The study confirms that guided diagram scoring teaching strategy approach is good for the males but much better for female students. Findings from the study is in contrast with the belief of Nzewi (2010) on the stereotypical view of science related disciplines as a male dominated area as male students usually outperform their female counterparts. Findings from this study is also not in agreement with other scholars (Ogbonna, 2003; Nwagbo and Obiekwe, 2010) whose works found that gender does significantly influence students' achievement with regards to teaching strategy.

V. CONCLUSION

The effect of guided diagram scoring teaching strategy on secondary school students' performance in biology was revealed in this study. It can be concluded on the basis of the study that instructional strategy improved students' achievement in biology. The findings of this study revealed also that gender influences achievement in biology. These results therefore show that guided diagram scoring teaching strategy is an effective strategy for teaching biology.

VI. RECOMMENDATIONS

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

1. Teachers of biology in the secondary schools should be encouraged to adopt guided diagram scoring teaching strategy as part of their teaching method.
2. The government in collaboration with curriculum developers and biology teachers should integrate guided diagram scoring teaching strategy in the curriculum.

REFERENCE

[1] Abonyi, O. S. & Nweke, I. (2014). Effect of Guided Scoring Approach to Science Instruction on Senior Secondary School Students Achievement in Algebra. Journal of Education and Practice, 5(14) 31-37.

[2] Amaechi, O. J. & Thompson, C. G. (2016). Practical skills in technical and Vocational training programmes in Nigeria. International Journal of Scientific Research Engineering & Technology, 5(12), 78 –82.

[3] Andrade, H. (2000). Using rubrics to promote thinking and learning. Educational Leadership, 57(5), 13-18.

[4] Ballah, A. G. (2015). Attitude and Academic performance of senior secondary school students in Physics in Nigeria. International Conference on Education, Social Sciences and Humanites. Proceedings of SOCIOINT, 15-22.

[5] Chinyemba, F. (2011). The impact of standardized marking scheme on improvement of instruction in design project work in technical subjects. Journal of Innovative Research in Education, 1(1): 102-113

[6] Glickman-Bond, J. and Rose, K. (2006). Creating and Using Rubrics in Today's Classrooms, Norwood, MA: Christopher-Gordon Publishers, Inc.

[7] Joda, F. M. & Mohamed, A. A. (2017). Effect of Guided Inquiry teaching method on senior secondary school Biology students' Academic Achievement and Retention in Yola Education Zone, Adamawa State, Nigeria. Multidisciplinary Journal of Science, Technology and Vocational Education, 5(1), 89-96.

[8] Joda, F. M. (2018). Effect of concept mapping teaching approach on senior secondary school Biology students Achievement in Biology in Adamawa State, Nigeria. Jigawa Journal of Multi-disciplinary Studies (JJMS), 1(1), 140-147.

[9] Joda, F. M. (2019). Effects of Instructional Scaffolding Strategy on Senior Secondary Biology Students' Academic Achievement and Retention in Taraba State, Nigeria. Asian Institute of Research Education Quarterly Reviews, 2(2).

[10] Kwok, L. (2008). Students' perception of peer evaluation and teachers role in serminar discussion. Electronic Journal of Foreign Language Teaching, 5 (1) 84–97.

[11] Masayile, Q., Nyoni, T., Nyoni, M., Bonga, W. G. & Musisinyani, B. J. (2017) An Evaluation of the use of Marking Schemes in the Teaching and Learning of Commerce at Ordinary level: A Case Study of Five (5) Secondary Schools in Chiefs Sayi and Jiri areas in Gokwe South District, Midlands, Zimbabwe. Dynamic Research Journals (DRJ) Journal of Economics and Finance (DRJ-JEF), 2(6): 01-19.

[12] Moskal, B. M. (2003). Recommendations for developing classroom performance assessments and scoring rubrics. Practical Assessment, Research & Evaluation, 8(14).

[13] Nwachukwu, J. N. & Nwosu, A. A. (2007) Effects of Demonstration Method on Different Levels of Students' Cognitive Achievement in Senior Secondary School. Journal of Science Teachers of Nigeria, 42 (182) 5O.

[14] Nwagbo, C & Obekwe, C. (2010) Effects of Constructivist Instructional Approach on Students' Achievement in Basic

Ecological Concepts in Biology. Journal of Science Teachers of Nigeria, 45 (3 & 2) 28-33.
[15] Nzewi, U. M. (2010). It's all in the brain of gender and achievement in science and technology education. 51st inaugural lecture of the University of Nigeria, Nsukka, P18-32.
[16] Ogbonna, C. C. (2003) Effect of Constructivist Instructional Approach on Senior Secondary School Students Achievement and Interest in Mathematics. Unpublished M.Ed Project University of Nigeria. Nsukka.
[17] Okotubo, J. O. (2020) Effect of Demonstration Teaching Method on Students' Academic Achievement and Retention in Auto Mechanics Trade in Technical Colleges in Delta State. International Journal of Education and Evaluation, 6(5), 6-13
[18] Onugwu, J. F. (1991). Identification of Kinds of Errors Secondary school Students make in Solving Problems in Mathematics Unpublished M.Ed. Thesis, University of Nigeria, Nsukka.
[19] Orogwu, E.O. (2006). Instructional sequence to teaching of number base. Journal of issues on mathematics 12 (1-2).
[20] Osuafor, A. & Okonkwo, I. (2013). Influence of family background on the academic achievement of secondary school Biology students in Anambra State. African Research Review: An International Multidisciplinary Journal, 7(3), 156-167.
[21] Osuyi, S.O. & Ainetor U.A (2018). Effect of Demonstration Teaching Method on Students' Academic Performance in Basic Electricity in Technical Colleges in Edo State. Journal of Education in Developing Areas (JEDA) 26 (2), 37 – 45.
[22] Reynolds-Keefer, L. (2010). Rubric referenced Assessment in teacher preparation. An opportunity to learn by using Practical Assessment. Research and Education, 15(8)
[23] Sanni, S.O. & Ochepe, I. A. (2002) Effect of Practical Discussion outside the Classroom on Students' Performance in Mathematics ABACUS: The Journal of Mathematics Association of Nigeria, 27(1) 45-49.
[24] Topping, K. (2003). Self and Peer Assessment in School and University: Reliability, Validity and Utility. In: Segers M, Dochy F, Cascallar E, editors. Optimising New Modes of Assessment: In Search of Qualities and Standards. Dordrecht, The Netherlands: Springer, 55-87.
[25] Topping, K. (2008). Peer assisted learning: A practical guide for teachers. Newton, Mass: Brookline Books.
[26] Viehrig, K. (2014). Exploring the effects of GIS use on students' achievement in Geography. Dissertation; Heideberg University of Education, Germany.
[27] Ugwu, T. U. (2014). Effects of guided inquiry method on students' achievement and interest in Basic Science. Theses in the Faculty of Education, University of Nigeria, Nsukka.
[28] Ugwuadu, O. R & Joda, F. M. (2015). Reality of teaching Biology in Secondary Schools in Adamawa State, Nigeria. Educational Forum A Journal of Institute of Education, Ahmadu Bello University Zaria, 24(1), 59- 75.
[29] United Nation's Education, Social and Cultural Organization (UNESCO) (2006) Nigeria UNESCO STE Project 931/NR/100. Speech by UNESCO, Abuja, Opening Ceremony of the Use of kits at the Zonal Workshops by STAN and Man.
[30] Usman, S. O. & Memeh, L. M. (2007). Using Guided Scoring Teaching Strategy to Improve Students' Achievement in Mathematics at Secondary School Level in Nigeria. Journal of Science Teachers Association of Nigeria, 42 (182) 60-64.
[31] Wolf, K., & Stevens, E. (2007). The role of rubrics in advancing and assessing student learning. The Journal of Effective Teaching 7(1)
[32] West African Examinations Council (2008) May/June 2008 WASSCE Final Marking Scheme biology 2 Essay Nigeria. Yaba: WAEC.
[33] West African Examinations Council (2010) May/June 2008 WASSCE Final Marking Scheme biology 2 Essay Nigeria. Yaba: WAEC.
[34] West African Examination Council (2018). Chief Examiner's report. Abuja; WAEC