

**ASSESSMENT OF BIOLOGICAL DRAWING AMONG THE SENIOR  
SECONDARY SCHOOLS STUDENTS IN NIGERIA**

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***Abstract***

*The achievements of students in the senior school certificate Biology examinations over the years have not been encouraging. Studies have indicated that this is partly due to students' poor knowledge in biological drawings. Evidence in the literature suggests that biological drawings could be used to facilitate students' learning. This study, therefore, assessed the knowledge of biological drawings possessed by senior secondary school (SSS) based on students' gender and school location in Oyo State, Nigeria. Descriptive research method of the survey type was employed. The population for the study was all SS2 Biology students in Oyo State, Nigeria. Sample of 658 Biology were used for study. The instrument was Students' Biological Drawings Achievement Test (SBDAT). Using test-retest method, SBDAT reliability value was 0.74. Three research questions and two research hypotheses were answered and tested, respectively. Data were analyzed using the percentage, mean scores and t-test. Findings of the study showed that: students possessed poor knowledge of biological drawings; there was no significant difference in the knowledge of biological drawings possessed by students based on gender; and a significant difference existed in the knowledge of biological drawings possessed by students based on their school location. The study concluded that Senior School students were unable to present biological drawings correctly due to inadequate knowledge possessed on biological drawings. It was recommended that teachers should give more practice in biological drawings to students to enhance better performance. Also, human and non-human resources should be adequately supplied to schools located in the rural areas.*

***Keywords: Assessment, Knowledge, Biological drawings, students etc.***

### **Introduction**

Science and technology are inevitable tools in the current drive towards a guarantee of good life, peace, security and survival of humankind. Science curricula are mainly aimed at helping students to acquire related knowledge and skills (Demir, Sipahi, Kahraman, & Yalcin, 2007) and to produce scientifically and technologically literate individuals (Tasdemir & Demirbas, 2010). Also, Elekwa, Bamiro, Oluyide, Ladoye, Nurudeen, Akuru and Olapade (2011) claimed that technology is the processes and products that make life easy and stress free to human beings by developing the nation in all facets of life.

Ezeh (2006) affirmed that the prestige and political power of any nation reside in its level of scientific activities since science is the key that unlocks the door to the modern development. Furthermore, Olagunju, Adesoji, Iroegbu and Ige (2003) remarked that the huge commitment and support, which most nations make and give to science and technological development was to a large extent dictated by the relevance of science to national goals, aspiration and economy. The relevance of science and technology to the nation had led governments, private organizations and individuals to invest in the teaching of science and scientific researches in Nigeria, in order to promote, hold and sustain the interests, needs and aspirations of our children, youths and teachers in science (Federal Republic of Nigeria, 2013; Daramola & Gbore, 2013).

Furthermore, Daramola and Gbore (2013) stated that, it is a thing of serious concern that secondary school science students steadily record the worst performance in the school certificate Biology among other science subjects. This was revealed by the candidates' achievement in the West African Senior School Certificate Examinations (WASSCE) conducted by the West African Examinations Council (WAEC) that consistently remain poor, with Biology having the highest enrolments and the poorest results over the years. This is evident in the results presented in table 1.

Table 1 *Students' Performance in May/June West African Senior School Certificate Examination in Biology, Chemistry and Physics from 2010-2016.*

Year	BIOLOGY			CHEMISTRY			PHYSICS		
	Total No of Students	Credit Passes	%	Total No of Students	Credit Passes	%	Total No of Students	Credit Passes	%
2010	1,300,418	427,644	33.90	465,643	236,059	50.70	463,755	237,756	51.30
2011	1,505,199	579,432	38.50	565,692	280,250	49.54	563,161	360,096	63.94
2012	1,646,150	587,044	36.66	627,301	270,570	43.13	624,658	429,415	68.74
2013	1,648,363	852,369	51.71	639,296	462,466	72.34	637,023	297,936	46.77
2014	1,365,348	766,916	56.17	636,268	397,540	62.48	635,729	628,609	98.88
2015	1,390,234	798,246	57.42	680,357	412,323	60.60	684,124	410,543	60.01
2016	1,200,367	740,345	61.68	706,873	408,122	57.74	705,125	415,655	58.95

*Sources:* Test Administration Division of the West African Examinations Council (2016).

However, there was a slight improvement in students' achievement in biology in 2016, yet not significant. Research findings by Egbunonu & Ugbaja (2011); Egbunonu, (2012); and Okoli and Egbunonu (2012) have indicated that students achieved poorly in Biology in both internal and external examinations. Several studies have revealed the important place of drawing's knowledge in the understanding of several science subjects with special reference to Biology. Among such studies are; Desjean-Perrotta and Utley (2010) that claimed that drawings have been used in science education for almost half a century. Open-ended questions and drawings have been used by several authors to determine the understanding of students at various grade levels with respect to different science concepts: university students' understanding of basic physics concepts by Popov, Zackrisson and Olofsson (2001); primary and secondary school students' understanding about the dissolution concept by Calik, Ayas and Unal (2006); high school students' understanding about the concept of cells by Yörek (2007); pre-service teachers' understanding of the light concept by Kara, Erduran-Aver & Cekbas (2008); and elementary students' understanding of the concept of force by Joung and Gunstone (2010).

All the domains of the students, that is, cognitive, affective and psychomotor are engaged in learning through drawing. These make students to be creative and learn at a deeper level as compared to surface learning (Rogers, 2008). Peggy, Maja, Schwartz and Garner (2006), in their research on learners' generated drawings as a strategy for learning, have found out that making of drawings made learners improve their problem solving skills apart from improving in examinations performance.

Biological drawing as described in the WAEC Chief Examiners' Report (2014) is different from artistic, architectural, mathematical or geographical drawings. Biological drawing do not involve painting, broken lines, too thick lines, too thin lines, woolly lines but free hand drawing with uniform relatively thin lines. Furthermore, biological drawing as stated in the WAEC Chief Examiners' Report (2014) involved: putting correct title on top or below the diagram; drawing according to the specified size; making labelling horizontal; using ruler to draw all the guide lines; ensure that the guide lines touched the labelled parts; drawing a proportionate diagrams and representing cut surfaces in double lines among others.

Considering the crucial place of biological drawings in Biology and understanding of other Biology related disciplines such as Medicine, Agricultural science, Anatomy, Physiology, Embryology and Parasitology, the researcher considered it very important to assess the

knowledge of biological drawings possessed by senior secondary school students in Oyo State. The researcher is prompted to assess the knowledge of biological drawings possessed by senior secondary school students to identify their strength and weaknesses in order to improve their understanding and general performance in Biology.

Gender influence has remained frequently attended to, by researchers with inconclusive results. For instance, the study of Ezirim (2006) observed that gender has significant influence on science achievement while Babajide (2010) found that gender has no significant influence on the students' achievement in science. More so, John (2007) concluded that no significant difference existed in the perceptions of male and female senior secondary school students in learning of biology. Thus, studies on gender has remained inconclusive,

The location of a school whether rural or urban areas had been identified from various studies as contributor to students' achievement. In the same vein, Ndukwu (2002) and Odinko (2002) noted that schools located in urban areas are better positioned to attract more quality students and teachers who exhibit the readiness to take academic business seriously. Therefore, it is essential to investigate the influence of school location on the knowledge of biological drawings possessed by senior school students in this study.

#### **STATEMENT OF THE PROBLEM**

The knowledge of drawing is essential for the understanding of various branches of Biology and some science subjects such as Embryology, Anatomy, Physiology, Genetics, Cytology, Botany, Zoology, Parasitology and other science disciplines such as Medicine, and Genetic engineering. Billiet (2003) claimed that drawing is the result of a long period of observation at different depth of focus. In this study, drawing is considered to involve paying attention to details about the specimen one is drawing which will enhance the students' knowledge of the specimen. Unfortunately, Motlhabane (2014) study on practical work revealed that biology teachers showed poor attitudes to the teaching of drawings in biology. Apart from poor attitudes of teachers toward teaching of Biology practical, the percentage of marks allotted to drawings in Biology practical is high (WAEC, 2016).

Despite the importance of drawings in Biology, the WAEC Chief Examiners' Reports (2010 & 2016) revealed poor achievements of students in Biology as a result of Students' weaknesses in the areas of labelling, title, wrong size, inappropriate proportion, and drawing. It was discovered that very few studies were recorded in biological drawings with larger

percentage of the students scored below the benchmark (50%). Also, influence of Students' Gender and School location were not investigated in the studies.

### **PURPOSE OF THE STUDY**

The main purpose of this study is to assess the knowledge of biological drawings possessed by senior secondary school students in Oyo State, Nigeria.

Specifically, the study will:

1. Assess the knowledge of biological drawings possessed by senior secondary school students.
2. Find out the influence of students' gender on the knowledge of biological drawings possessed by senior secondary school students.
3. Investigate the influence of school location on the knowledge of biological drawings possessed by senior secondary school students.

### **RESEARCH QUESTIONS**

In this study, the following answers will be sought for the following research questions:

1. What is the knowledge of biological drawings possessed by senior secondary school students?
2. Are there gender influences on the knowledge of biological drawings possessed by senior secondary school students?
3. What is the influence of school location on the knowledge of biological drawings possessed by senior secondary school students?

### **RESEARCH HYPOTHESES**

The following research hypotheses were tested in this study:

H<sub>01</sub>: There is no significant difference in the knowledge of biological drawings possessed by male and female senior secondary school students.

H<sub>02</sub>: There is no significant difference in the knowledge of biological drawings possessed by senior secondary school students based on their school location.

### **SCOPE OF THE STUDY**

The study was limited to all Senior Secondary School Two (SS2) Biology Students in Oyo State. The study focused on the assessment of the knowledge of biological drawings possessed by Senior Secondary School Students. The moderating variables that were involved in this

study are Students' gender, school location, students' score levels, Teachers' gender, Teachers' years of teaching experience, Teachers' academic qualification and frequency of Biology practical classes.

### **SIGNIFICANCE OF THE STUDY**

The result of this study may help to reveal the knowledge of biological drawings possessed by senior secondary school students which may serve as basis for improving students' performance in Biology in the Senior Secondary School Certificate Examinations and also as solid background for students' studies in Biology and related courses at the tertiary studies.

This study will also shed light on the moderating variables that contributed to the status of the extent to which students know how to draw. The analytical data obtained from this study will be of practical value to the stakeholders in science Education, Federal and State Ministries of Education, educational researchers, education policy makers, curriculum developers, teacher educators, publishers and text book writers, examinations bodies as well as students in our educational Institutions.

### **METHODOLOGY**

The study adopted descriptive research of the survey type using students' achievement test. The population for this study was all Senior Secondary School Two (SS2) Biology Students in Oyo State. Multistage sampling procedure was used. Purposive sampling technique was used to select 20 senior secondary schools, 9 schools from rural area and 11 schools from urban area which represent 20% of the schools from the sampled areas, respectively. Random sampling technique was used to sample 658 SS2 Biology students from the sampled school which represents 60% of the population.

The research instrument for this study was Students' Biological Drawings Achievement Test (SBDAT) drawn from validated West Africa Senior School Certificate Examinations and National Examination Council examination questions on biology practical. The instrument was of two sections. Section "A" requested for biographical information of respondents such as; Students' gender and school location. Part 1 of section "B" contained one plant and one animal theory diagrams while Part 2 of section B was real practical where students were asked to draw two plants' and two animals' specimens. Six diagrams were included in the instrument (three plants and three animals). The instrument was given both face and content validity through experts in biological drawings, English Language and research analyst. Using

test retest method, reliability index of 0.7 was obtained. The administration of SBDAT lasted for three weeks throughout the sampled schools in an organized manner.

Analyses were done using both descriptive and inferential statistics. Research questions 1-3 were answered using the percentage and mean score. Hypotheses 1 and 2 were tested and answered at .05 level of significant using *t*-test.

### **ANALYSES, RESULTS AND DISCUSSION**

**Research Question 1:** What is the knowledge of biological drawings possessed by Senior Secondary School Students?

Table 2 presents the results of analysis on knowledge of biological drawings possessed by Senior Secondary School Students

Table 2

*Analysis of Students' Scores Based on the Knowledge of Biological Drawings Possessed by Senior School Students*

<b>Knowledge possessed</b>	<b>Range of scores</b>	<b>Number of students</b>	<b>Mean score</b>	<b>Standard Deviation</b>	<b>%</b>
<b>Good</b>	<b>50-100</b>	<b>22</b>	<b>51.28</b>	<b>9.41</b>	<b>3.34</b>
<b>Poor</b>	<b>0-49</b>	<b>636</b>	<b>26.80</b>	<b>9.68</b>	<b>96.66</b>
<b>Total</b>	<b>0-100</b>	<b>658</b>	<b>39.04</b>	<b>9.55</b>	<b>100</b>

From Table 2, mean scores and standard deviation of the students that possessed good knowledge and poor knowledge of biological drawings were 51.28(9.41) and 26.80(9.68), respectively. This implies that students with poor knowledge of biological drawings had the lowest mean score. Therefore, the knowledge of biological drawings possessed by senior school students was poor.

**Research Question 2:** Are there gender influence on the knowledge of biological drawings possessed by Senior Secondary School Students?

Table 3 indicates the knowledge of biological drawings possessed by Senior Secondary School Students based on gender.

**Table 3**

*Analysis of Senior School Students' Scores on Knowledge of Biological Drawings Based on Students' Gender*

<b>Students' gender</b>	<b>Number of students</b>	<b>Mean score</b>	<b>Standard Deviation</b>
<b>Male</b>	<b>317</b>	<b>27.52</b>	<b>10.73</b>
<b>Female</b>	<b>341</b>	<b>27.71</b>	<b>11.52</b>
<b>Total</b>	<b>658</b>	<b>27.62</b>	<b>11.13</b>

From Table 3, the mean scores and standard deviation of male and female students in biological drawings were (27.52(10.73) and 27.71(11.52)), respectively. The result revealed a slight difference in students' performance on knowledge of biological drawings in favour of the female students. The implication of this is that, the performance of male and female students in biological drawings is almost the same. Therefore, there was no gender influence on the knowledge of biological drawings possessed by Senior School Students

**Research Question 3:** What is the influence of school location on the knowledge of biological drawings possessed by senior school students?

Table 4 shows the results on influence of school location on the knowledge of biological drawings possessed by senior school students.

*Table 4*

*Analysis of Senior School Students Scores on knowledge of Biological Drawings Based on School location*

<b>School location</b>	<b>Number of students</b>	<b>Mean score</b>	<b>Standard Deviation</b>
<b>Urban</b>	<b>523</b>	<b>29.19</b>	<b>10.08</b>
<b>Rural</b>	<b>135</b>	<b>21.53</b>	<b>11.51</b>
<b>Total</b>	<b>658</b>	<b>25.36</b>	<b>10.80</b>

From Table 4, difference was observed in the mean scores and standard deviation of students sampled from urban and rural schools (29.19(10.8) and 21.52(11.51)), respectively. By implication, students from schools located in rural area performed less than the students from schools located in urban area in biological drawings. Therefore, school location had influence on the knowledge of biological drawings possessed by senior school students in favour of students from schools that are located in urban area.

**HYPOTHESIS TESTING**

**H<sub>01</sub>**: There is no significant difference in the knowledge of biological drawings possessed by male and female senior secondary school students.

Table 5 depicts the results of analysis on hypothesis one that investigated whether gender has influence on the knowledge of drawings possessed by senior school students in biology.

Table 5

*Independent-samples t-test Analysis of Knowledge of Biological Drawings Possessed by Male and Female Senior School Students*

<b>Gender</b>	<b>N</b>	<b>X</b>	<b>SD</b>	<b>DF</b>	<b>t</b>	<b>Sig. (2-tailed)</b>	<b>Remark</b>
<b>Male</b>	<b>317</b>	<b>27.52</b>	<b>10.74</b>	<b>656</b>	<b>-0.22</b>	<b>0.82</b>	<b>Not Rejected</b>
<b>Female</b>	<b>341</b>	<b>27.71</b>	<b>10.52</b>				
<b>Total</b>	<b>658</b>						

Table 5 reveals that, there was no significant difference in the knowledge of biological drawings possessed by male and female senior secondary school students. This is, as shown in the results;  $t(656) = -0.22, p = 0.82 (p > 0.05)$ . Therefore, the stated null hypothesis was not rejected.

**H<sub>02</sub>**: There is no significant difference in the knowledge of biological drawings possessed by senior secondary school students based on their school location.

Table 6 reveals the result of analysis on hypothesis 2

Table 6:

*Independent-samples t-test Analysis of Knowledge of Biological Drawings Possessed by Senior Secondary School Student Based on their School Location*

<b>School Location</b>	<b>Number</b>	<b>Mean</b>	<b>SD</b>	<b>Df</b>	<b>t</b>	<b>Sig. (2-tailed)</b>	<b>Remark</b>
<b>Urban</b>	<b>523</b>	<b>29.19</b>	<b>10.08</b>	<b>656</b>	<b>7.81</b>	<b>0.00</b>	<b>Rejected</b>
<b>Rural</b>	<b>135</b>	<b>21.53</b>	<b>10.51</b>				
<b>Total</b>	<b>658</b>						

Table 6 reveals that there was a significant difference in the knowledge of biological drawings possessed by senior secondary school students based on their school location. This is as shown in the result:  $t(656) = 7.81, p = 0.00$  ( $p < 0.05$ ). Therefore, the stated null hypothesis was rejected.

## **DISCUSSION**

The first hypothesis is on the difference between the knowledge of biological drawings possessed by male and female senior secondary school students. Since the p-value is greater than 0.05 level of significant, it implies that the knowledge of biological drawings possessed by senior school students in Oyo State was not influenced by gender. This finding agrees with the result from the study of Babajide (2010) that gender had no significant influence on the students' achievement in science but disagrees with the studies of Ezirim (2006) and Ayodeji (2010) that a significant difference existed in the achievement of male and female students.

The second hypothesis examined if there was a significant difference in the knowledge of biological drawings possessed by senior school students from schools that are located in urban and rural areas of Oyo State. Since the p-value is less than 0.05, it was concluded that the difference is significant. This implies that there was a significant difference in the knowledge of biological drawings of senior school students from schools located in urban and rural areas in favour of the students from schools located in urban areas. The result of this finding agrees with that of Oginni (2012), Jegede (2007) and Okonkwo (2002) that student from schools that are located in urban areas performed better than students from schools that are located in rural areas. The results obtained, could be due to the facts that schools in urban areas are staffed with more qualified biology teachers than schools located in the rural areas. Also, students from schools located in urban areas have access to coaching, private teachers, internet

facilities, text books among others. Furthermore, most of the senior school students are from educated parents that helped them out to solve their assignments and also respond promptly to their academic needs. Also, most of the students in urban schools are taught by experienced biology teachers. The schools in urban locations are also closed to supervisors and stakeholders that are connected with education. Because of the frequent supervision from various quarters to schools in urban areas, teachers in urban schools are more committed to teaching than the teachers in the rural areas.

### **CONCLUSION**

The study concluded that; the knowledge of biological drawings possessed by senior secondary school students was poor, gender do not influence the knowledge of biological drawings possessed by students and students from schools that are located in urban areas performed better than students from schools that are located in rural areas in biological drawings.

### **RECOMMENDATIONS**

It was recommended that; qualified Biology teachers should be motivated to work in the rural school, and relevant Biology models, chart, and specimens should be supplied to rural schools to create similar learning situations of the urban schools for students in the rural schools

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