



Lapses in Biological Drawings Amongst Secondary School Biology Students in Obollo – Afor Education Zone, Enugu State, Nigeria

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Abstract

This study identified Lapses in Biological Drawings amongst Senior Secondary School Biology Students. Three research questions were raised. The study adopted a descriptive survey design. The population of the study comprises 2,655 Senior Secondary II (SS2) students. A sample of 266 was used for the study. The instrument for data collection was a summary checklist for Students' Biological Drawing Lapses Test (SBDLT) on the five drawings under study. The instrument was face validated by three lecturers; two lecturers from Biology units and one lecturer from measurement and evaluation unit. There was no reliability of instrument since the researcher used a checklist. SBDLT were administered to the students to draw five biological diagrams on plain paper. Thereafter, the students' lapses in drawings were sorted using the summary checklist. These lapses collected were grouped into frequencies, computed, and arranged in tables. It was analyzed using frequency tables and percentages; the students' lapses in the biological drawings. The percentages of the students' errors in different aspects of biological drawings were used to answer the research questions. The findings of the study revealed that Students had lapses in; writing the title of the diagrams appropriately, working out magnification (size) of the diagrams and adhering to the rules of the drawing. Conclusion was drawn that students' lapses in biological drawings contribute to students' poor performance and gender is also a factor. It was recommended among others that Biology teachers should adopt innovative strategies to teach practically, biology diagrams and students should engage with drawing biological diagrams regularly.

Keywords: Biological Diagrams / Drawing, Lapses in Biological drawings, Rules and drawing skills for Biological Diagrams.

Introduction

Biology is the study of life and its evolution, organisms and their structures, functions, processes and interactions with one another and with their environment. In support, Hadjichambis, (2015) and Mouhamad, (2018) defined Biology as a Science concerned with the study of life and living organism, including their structure, function, growth, evolution, distribution, taxonomy and scientific exploration. Biological diagrams are simplified biological drawings showing the appearance, structures or workings of something; a schematic representation. Basically, the term, Diagram is a particular form of visualization that uses conventions to communicate meaning (McTigue & Flowers, 2011). These conventions are common markings used to communicate meaning, such as arrows, labels, coloring, and captions. A variety of diagram types are

found in biology, including representational drawings or photographs of objects, schematic depictions, and process diagrams. These diagrams vary not only in types, but also along other characteristics, such as complexity and abstractness (Offer dahl, Arneson & Byrne, 2017). The literature, however, suggests that many students have difficulty with diagram comprehension and drawing ability. Biology students, for example, score significantly lower on measures of visual knowledge compared with verbal knowledge of the same content, misinterpret parts of diagrams and have difficulty comprehending and reasoning with diagrams, particularly representations that contain unfamiliar content (Meter & Waters 2017).

Biological drawing does not involve painting, broken lines, thick lines, too thin lines, woolly lines but free hand drawing with uniform relatively thin lines.



However, Biological drawing as described in the WAEC Chief Examiners' Report (2018) is different from artistic, architectural, mathematical or geographical drawings. Furthermore, biological drawing as stated in the WAEC Chief Examiners' Report (2018) involve: 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 appropriate diagram and representing cut surfaces in double lines among others. As Biological drawings have rules, the researcher views biological drawings as pictorial representation of the essential details and compositions of the living organisms on a paper, to communicate meaning following the rules.

Biological drawings are essential to scientific development. This is because, drawing in itself is a scientific language. Scientists do not use words only but rely on diagrams, graphs, videos, photographs and other images to make discoveries, explain findings and excite public interests. (Ainsworth, 2011). Therefore, every meaningful Biological expression becomes embedded in drawings. Drawing as a means of expression dates back into antiquity and it is the simplest and most efficient means of communicating visual ideas, and it helps individuals to understand the world, think, feel, shape and communicate ideas. It is fun, accessible and invaluable (Makowska, 2012). That is why, Morkeh (2011) emphasized that drawing was the first means of expression and representation of ideas invented by man and it is still extremely valid both as an artistic representation of reality and as a means of expressing pure imagination. When the students fail to communicate effectively using drawing, it leads to lapses in biological drawing.

Lapse is slight mistake, an error, a slip, a falling or gliding. In the context of this study, lapses mean a common mistake in students' drawings. Lapses according to Nahum, (2011) is an error that are natural and unavoidable in part of scientific process but if made available to the students, such a knowledge will give students a deeper insight. Research has shown that lapses could be as a result of lack of experience, lack of confidence, not being familiar with the common requirement, (Maiorana & Mayer, 2018). At the same time, it has been seen that in the classroom situation, students make mistakes in biological drawings. This may be due to large class size; a class where little or no individual attention is given to students, it becomes difficult for the teacher to

establish close contact with the students, Srivastava, (2014). Being that there are almost always tasks that require this ability in biology, lapses in students' drawing continue to emerge. (Kotzebue, Gerstl & Nerdel, 2014). Which means specific knowledge of these lapses are required to be studied in detail.

Rules for Biological Drawings have been identified by (McTigue & Flowers, 2011), as the following: drawings, labels, label lines, title, and underlining must be done using pencil only on unlined paper (never lined, graph, or coloured paper); drawings should be large, preferably 1 drawing to a page (2 maximum), a space at the sides for labels, at the top for the title, and at the bottom for calculations and other information; the name and date must be in the top right-hand corner of the drawing. A detailed, underlined title must be centered at the top middle of the drawing. A real size / scale given, and diagram magnification must be written below the drawing; all labels must be written horizontally to the right of the drawing to uniform height. The label must be aligned or justified. The label lines must be drawn using a ruler, must not cross, and no arrows head. The plural term for single objects should be avoided and label lines must touch the structure being labeled; shading or coloring of drawings should be avoided, then, stippling should be used to show contrast; drawing must be neat; avoid sketchy lines, "rainy" stipples and broken lines; prerequisite knowledge is necessary to know which features to include as drawing is a pictorial representation, therefore it must resemble the diagram of any given task. (578–589).

Skills in drawing biological diagrams as it is very important to get one's ideas on the paper as quickly as possible thus it is considered to be a vital skill to master. From classroom experience, many students believe that the ability to draw is in-born. Therefore, whether drawing can really be learnt is now a question. Heideman, Flores and Trouton (n.d) strongly believe that students can really learn how to draw and that the responsibility of learning drawing skills by students lies with both parents and facilitators. In learning drawing skills, students should expect different types of diagrams from different aspects. This is to assess particularly their level of understanding and performance utilizing drawing skills, (Debarati & Gowramma, 2017). There are many skills that are required for learning science. The important among them are skills of observation, problem solving, drawing and labelling, analysis, synthesis and creativity. One of the essential skills of



science is drawing and labelling. For improving the interest towards science education among the students, mastery in drawing and labelling skills are important because an excellent way to describe a scientific phenomenon is through drawing. It helps to increase critical thinking, problem solving and creativity among students. Physics, chemistry and biology, all these school science subjects call for drawing skills. Debarati et al (2017) opined that there is especially unique need of drawing and labelling skills in biology because of the variety, complexity and intricacy of the diagrams. But the role of drawing skills in the teaching and learning of biology has often been underestimated.

The knowledge of drawing skills in learning biology will help students relate structure to function to a great extent. According to Mohapatra and Roy, (2019), Biology is the study of life which requires careful observation and description. One excellent way to describe an object is to draw it. Drawing, as a skill, is one of the basic communication skills which has not received due emphasis and yet, is very fundamental for effective instruction. Teachers do a great deal of telling and demonstrating at the expense of engaging learners in activities which will foster learning and even make the process enjoyable. All the domains of the education objectives, (i.e., cognitive, affective, psychomotor) are engaged in the learning process when they are involved in scientific drawing. These make students to be creative and learn at a deeper level as compared to surface learning. Mohapatra *et al*, (2019) noted that observing is a fundamental science process skill. Students observe objects and events using all five senses and learn about the world around. One has to look at a specimen very carefully to be able to draw it accurately, and labelling of a drawing forces one to think about the component structures and their positions. This means that labelling of drawings in Biology sharpens a student's observation and thinking skills making student able to relate structure to function. Drawing enhances communication skill especially where students are required to make a well labelled diagram in examination (Eliza, 2016).

In most cases, external examinations would have more than one question on drawings in addition to other related questions that students may not answer without the knowledge of the diagrams in question. Akintola and Ahmed (2018), opined that good Biology drawings should have the following qualities: Large in size, possess titles, have their views stated, have their magnification written; should have their labeling lines horizontally drawn with a ruler, should have details of

the diagram and features shown, and should not be shaded. That means, students failure to adhere to some of the listed qualities of good biological drawings will attract lapses in their drawings which leads to poor performance of the students in biology. Despite all the aforementioned rules for Biological Drawings, lapses still emerge in students' biological drawings especially during examination in secondary schools in Nigeria. (Kotzebue, Gerstle & Nerdel, 2014).

Indication that performance in public examination in Biology still remain poor due to poor knowledge of Biological drawings, lack of drawing skills or inappropriate acquisition and utilization of drawing skills were revealed by the findings of Akintola, et al (2018). More so, other science educators are of the view that the determining factor of the lapses in students' drawings is due to inadequate knowledge possessed on biological drawings. Not much effort seems to have been made towards finding out these lapses in students' drawings whereas in learning, majority of the concepts in Biology are represented in biological drawings especially those found in textual materials.

It is worrisome to note that the rules for biological drawing as well as the skills for drawing biological diagrams that supposed to have made impact in Biology students, still produce students with lapses in their biological drawing. Some related factors have been put forward as the determining factors. These factors include; poor knowledge of Biological drawings, lack of drawing skills or inappropriate acquisition and utilization of drawing skills as revealed by the findings of Akintola, et al (2018). Mohapatra and Roy (2019) states that students' knowledge of Biology is assessed from three perspectives; the practical, objective and the theory parts and all these aspects involve drawings in one way or the other. This shows that drawing is very fundamental for effective instruction in Biology, yet it has not received due emphasis. This is because evidence within the reach of the researcher seems to be lacking in literature, especially in Enugu State which is the area of the study. Hence, the present study is carried out to ascertain students' lapses in biological drawing in Obollo Education zone in Enugu State.

Statement of the Problem

Biological drawings play important role in diverse areas of Biology such as the practical, objectives and the theory aspects. Biological drawings are very fundamental and very important in Biology,



as a result every Biology student is expected to acquire drawing skills. Contrary to expectations, most Secondary School Biology Students are yet to achieve a high level of proficiency in Biological drawings. Evidence from available literatures have shown that students find drawings difficult and as a result make some mistakes in their drawings. These observed lapses have contributed to their deteriorating achievement in biology in both internal and external examination. For example; WAEC Chief Examiners' Report (2016-2021) revealed that inability of the students to follow the Basic Principles and Techniques of Biology Drawings such as; inappropriate title of the drawings, inaccurate labelling of the drawings, not adhering to the, rules of drawing lines, lack of proper details in drawings, lack of appropriate quality of the drawings among others are responsible for students' lapses in Biological drawing.

Furthermore, findings from the related empirical studies showed that most of the previous studies were mostly on Biology practical which resulted to little or no attention to other aspect of Biological drawings. There has been several efforts to solve the problem yet, it yielded little or no positive result. Thus, the major aim of this study is therefore to specifically identify the lapses in Biological drawings amongst Senior Secondary School Biology Students. Thus, the problem of this study posed in question form is: What are the lapses in biological drawings amongst Senior Secondary School Biology Students.

Research Questions

The following research questions guided the study:

1. What are students' lapses in writing the title of the diagrams appropriately?
2. What are the students' lapses in working out the magnification(size)of the diagram appropriately?
3. What are students' lapses in adhering to the rules of the drawing lines?

Methods

Design of the Study

The study adopted a survey design. The specific survey design used was descriptive survey design. Descriptive survey design are those studies which aim at collecting data on and describing in a systematic manner the characteristics features or facts about a given population (Nworgu, 2015). It was adopted by the researcher because it was best for this type of study which aims at collecting data on

Students' Lapses in Biological Drawings at Senior Secondary School level.

Area of the Study

The study was conducted using Senior Secondary Two Biology Students in Obollo - Afor Education Zone of Enugu State. Obollo - Afor Education Zone consists of three (3) local government areas, these were Udenu LGA with 18 secondary schools, Igbo-Eze South LGA with 12 secondary schools, and Igbo-Eze North LGA with 22 secondary schools. This zone was chosen because generally, there are reports of poor academic performance of Secondary School Students in Biology according to WAEC results, (2015– 2021). In addition to this Education Zone, the people are largely farmers, some are business men/women and civil servants. It is also a place where there is this cultural belief that males are superior to females in everything. Females are dependent on males for taking initiatives and for leadership.

Population of the Study

The population of the study comprises all senior secondary two (SS2) students who are offering Biology in the fifty (52) public secondary schools in Obollo Education Zone. The total population of the SS2 Biology students is two thousand six hundred and fifty-five (2,655) (1033 males and 1622 females) (Post Primary School Management Board, PPSMB, Obollo, 2021) Out of the 52 public senior secondary schools in Obollo Education Zone, Udenu LGA has 18 schools, Igbo-Eze South LGA has 12 schools, and Igbo-Eze North LGA has 22 schools. The choice of SS2 students is informed by the fact that the class is not preparing for any external examination and is more likely to respond to instructions because of lack of external examination consciousness and anxiety that may accompany such. Also, the students are more likely to have drawn so many biological drawing starting from SS1 and have been exposed to rules in Biological drawings.

Sample and Sampling Techniques

The sample size for the study consists of all SSII biology students in five co – educational schools in Obollo Educational Zone of Enugu state. The study adopted multi- stage sampling procedures in three stages. On the first stage, simple random sampling (balloting without replacement) was used to draw one Local Government Area out of three Local Government Areas of Obollo Education Zone. In the second stage, purposive sampling technique was used to select 5 co- educational schools for the drawing test



exercise. In the third stage, simple random sampling (balloting with replacement) will be used to draw two classes each from the five schools.

Instrument for Data Collection

The instrument for data collection was Students' Biological Drawings Lapses Test (SBDLT). The instrument was developed by the researcher. This instrument consists of two parts: Part I is concerned with the background information relating to the respondent such as the bio-data. Part II contain the instruction that guided the students on what to do. The Students' Biological Drawings Lapses Test (SBDLT) involved five drawings: the human digestive system, the human excretory system, a whole maize seedling, a typical plant cell and typical sperm cell. The students were asked to draw and label diagram within (10-12cm) long in the space provided keeping to the rules guiding biological drawings. The students' drawings revealed the lapses in Biological Drawings. The students' lapses in the drawing were identified using checklist developed by the researcher based on the characteristics of each specific purpose of the study.

Validation of the Instrument

The Students' Biological Drawing Lapses Test (SBDLT) instrument and the checklist were subjected to face validation to one lecturer in Measurement and Evaluation unit, and two lecturers in Biology Education unit, all in the Department of Science Education, University of Nigeria, Nsukka. The validators made corrections, changes, modifications, contributions and suggestions regarding the items in the SBDLT in line with the research purposes and questions. It was their corrections and suggestions that guided the researcher in reworking the draft and providing the final copy of the instrument.

Reliability of the Instruments

There was no reliability of instrument in this study because the researcher used a checklist that sought for the presence or absence of the students lapses in the Biological drawing

Method of Data Collection

With a letter of introduction from the researcher's supervisor, The researcher sought the co-operation of the principal of the schools involved to enable her build in her research programme into the school schedule without disrupting the latter. The researcher did this by explaining the purpose of the study and the benefits that could be derived if properly conducted. This helped the researcher to obtain their co-operation throughout the study.

The principal thereafter introduced the researcher to the Biology teachers that served as the research assistants. Two regular Biology teachers selected for the study were briefed by the researcher to assist in the study. This was done in one week before the study. Thereafter, the research assistants interacted with students and they were reminded of the materials to bring for the exercise. The Students' Biological Drawing Lapses Test (SBDLT) was administered to the students with the help of research assistants. The students are expected to read the necessary instructions on the question paper. The exercise lasted for two and half hours and their scripts were collected immediately. The data were then collected using a checklist.

Method of Data Analysis

The Students' Biological Drawing Lapses Test (SBDLT) were grouped into frequencies, computed and arranged in tables. It was analyzed using frequency tables and percentages to obtain the students' lapses in the biological drawings. The percentages of the students' errors in different aspects of biological drawings were used to answer the research questions.

Results

Research Question 1

What are the students' lapses in writing the appropriate title of the diagrams?

Table 1: Frequency and percentage distribution table of students' lapses in writing the appropriate title of the diagrams

| Appropriate Diagram | HDS frequency (%) | HES frequency (%) | WMS frequency (%) | TPC frequency (%) | TSC frequency (%) |
|---------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| VIEW | 145 (54.5) | 172 (64.7) | 182 (68.4) | 182 (68.4) | 148 (55.6) |
| CENTERED | 149 (56.0) | 179 (67.3) | 168 (63.2) | 185 (69.5) | 166 (62.4) |
| SPELLING | 179 (67.3) | 177 (66.5) | 174 (65.4) | 189 (71.1) | 170 (63.9) |

Human Digestive System; (HDS), Human Excretory System; (HES), Whole Maize Seedling; (WMS), Typical Plant Cell; (TPS), and Typical Sperm Cell; (TSC).

Table 1 show the frequency distribution of the students' lapses in writing appropriate title of the five diagrams under study; Human Digestive System; (HDS), Human Excretory System; (HES), Whole Maize Seedling; (WMS), Typical Plant Cell; (TPS), and Typical Sperm Cell; (TSC). Tables 1 shows the students lapses in writing appropriate title of the five diagrams under study with regards to indicating view, centered, and spelling aspect and section. The results show that students that committed the lapse (VIEW) were 145(55%), 172(65%), 182(68%), 182 (68%), and 148 (56%) of students who drew the diagrams had lapses on the five (5) diagram. This is an indication that the number of students who had the lapses in writing the appropriate title of the five diagrams under study. Central row, frequency distribution of the students' lapses in writing appropriate title of the five diagrams under study with regards to the title centered on top of

the paper. The results in the table also show that students that commit the lapse accordingly were 149 (56%), 179 (67%), 168 (63%), 175 (66%), and 166 (62%) of students who drew the diagrams had the lapses respectively. This is indicative that the number of students who had the lapses in writing the appropriate title of the five diagrams under study. In spelling row, the frequency distribution of the students' lapses in writing appropriate title of the five diagrams under study with regards to inappropriate spelling of the title of the diagrams. The results show that students that commit the lapse accordingly were 179(67%), 177 (67%), 174 (65%), 189 (71%), and 170 (64%) students had the lapses on the five diagrams under study. This is indicative that the students had lapses in writing the appropriate title of the five diagrams under study.

Research Question 2

What are the students' lapses in working out the magnification, (size) of the diagrams?

Table 2: frequency and percentage distribution table of students' lapses in working out the magnification, (size) of the diagrams

| SIZE | HDS frequency (%) | HES frequency (%) | WMS frequency (%) | TPC frequency (%) | TSC frequency (%) |
|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Below the Size | 173 (65.0) | 188 (70.7) | 189 (71.1) | 174 (65.4) | 180 (67.7) |
| Above the Size | 139 (52.3) | 178 (66.9) | 176 (66.2) | 152 (57.1) | 151 (56.8) |

Human Digestive System; (HDS), Human Excretory System; (HES), Whole Maize Seedling;

(WMS), Typical Plant Cell; (TPS), and Typical Sperm Cell; (TSC).

Tables 2 show the students' lapses in working out the magnification, (size) of the five diagrams under study with regards to below the size given. The results show that students that commit the lapses accordingly were 173(65%), 188 (71%), 189 (71%), 174 (65%), and 180(68%) of students had the lapses. This is indicative that students had the lapses that are below the size. Column 2b: in working out the magnification required,

(size) of the five diagrams under study with regards to above the size given. The results on table 2 show that students who had diagrams under study above the stipulated size were 139(52%), 178 (67%), 176(66%), 152 (57%), and 151(57%) for HDS, HES, WMS, TPC and TSC respectively. This is indicative that students had lapses in working out the magnification of the diagrams.

Research Question 3

What are the students' lapses in adhering to the rules of drawing lines?

Table 3: frequency and percentage distribution table of students lapses in adhering to the rules of drawing lines

| Lines | HDS frequency (%) | HES frequency (%) | WMS frequency (%) | TPC frequency (%) | TSC frequency (%) |
|---------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Woolly lines | 180 (67.7) | 168 (63.2) | 159 (59.8) | 169 (63.5) | 158 (59.4) |
| Broken lines | 177 (66.5) | 176 (66.2) | 186 (69.9) | 161 (60.5) | 172 (64.7) |
| Thick lines | 163 (61.3) | 171 (64.3) | 158 (59.4) | 180 (67.7) | 177 (66.5) |
| Colour lines | 184 (69.2) | 198 (74.4) | 173 (65.0) | 168 (63.2) | 137 (51.5) |
| Shady lines | 176 (66.2) | 181 (68.0) | 147 (55.3) | 156 (58.6) | 173 (65.0) |

Tables 3 show the students lapses in adhering to the rules of drawing lines in the five diagrams under study with regards to rules of drawing lines. For woolly lines; the lapse were 180 (68%), 168 (63%), 159 (60%), 169(64%), and 158 (59%) of students who drew the diagrams had lapses. In broken lines, the results show that students that committed the lapse were, 177 (67%), 176 (66%), 186 (70%), 161 (61%), and 172 (65%) of students who drew the diagrams had the lapses. For thick lines, students that committed the lapse were, 163(61.3%), 171(64.3%), 158(59.4%), 180(67.7%), and 177(66.5%) of students who drew the diagrams had the lapses. In regard to colour lines, the lapses were 184 (69.2%), 198 (74.4%), 173 (65.0%), 168 (63.2%), and 137(51.5%) students who drew the diagram had lapses. In regard to shady lines, the lapses were 176 (66.2%), 181(68.0%), 147 (55.3%), 156 (58.6%), and 173 (65.0%) students who drew the diagram had lapses. This is indicative that students had the lapses in adhering to the rules of

drawing lines in the five diagrams under study with regards to shady lines committed lapses.

Discussion

The result of the study according to the data collected with checklist from first three columns, revealed that students had inappropriate title for the five diagrams: Human Digestive System; (HDS), Human Excretory System; (HES), Whole Maize Seedling; (WMS), Typical Plant Cell; (TPS), and Typical Sperm Cell; (TSC). Students that did not indicate the view; (aspect or section) that lead to their inappropriate title had the higher percentage respectively for the above listed diagrams drawn. Also, the students did not write the title of the diagrams at the center on top of the diagrams. In addition, the students had the incorrect spelling of the title of the diagrams. This implies that students had lapses in writing the title of the diagrams appropriately. this The finding of this study was in agreement with the



findings of Akintola and Ahmed (2018) that student's possessed poor knowledge of biological drawings. The findings also corresponds with the findings of Okereke (2019) that students' difficult areas in Practical Biology drawings were their inability to draw the given specimens within the instructed size range, writing of incorrect titles of the drawn specimens, stating the magnification wrongly, using bad drawing outline, neat label issues, actual label challenges and their inability to represent the detail of specimen drawn.

The result from research question two revealed that most of the students did not keep to the size given to them, which lead to their lapses in working out the correct range of the magnification. Students that their diagrams measured below the size of the diagrams respectively for Human Digestive System; (HDS), Human Excretory System; (HES), Whole Maize Seedling; (WMS), Typical Plant Cell; (TPS), and Typical Sperm Cell; (TSC) were revealed. More so the students' their diagrams measured above the stipulated size given were also revealed. This indicated that students' lapses in working out magnification of the diagrams, were as a result of students' poor knowledge of the use of meter rule. This also contribute to students' failure in Biology. The findings of this study is consistent and in agreement with the findings of Debarati and Gowramma, (2017) that indicated that majority of the respondents lacked all the 10 drawing and labelling skills tested. The findings of the study also corresponds with the findings of Mohapatra and Roy, (2019) that Drawing Skills and Mental Images of Secondary Students had several misconceptions that are prevailing in the mind of the students in related to the position, shape, size among others.

The result from research question three revealed that most of the students did not adhere to the rules of drawing lines in the five diagrams; Human Digestive System; (HDS), Human Excretory System; (HES), Whole Maize Seedling; (WMS), Typical Plant Cell; (TPS), and Typical Sperm Cell; (TSC). Accordingly, the students drew using wooly lines which is against the rule of biological drawing. The students also committed the error by using broken lines in their drawings. More so, did not adhere to the rules by using thick lines to draw. The students were identified with shady lines in their diagrams which is inappropriate. This implies that students lack knowledge of rule of drawing lines of biological diagrams. This is to say that students with mastery of

the rules of biological drawings will be able adhere to all the rule and are able to draw appropriately. This agrees with the findings of The findings of this study was in agreement with the findings of Wekesa (2013) that indicated that on average, over 68% of the respondents lacked biological drawing skills. The findings also correspond with the findings of Anguh (2020) that: students possessed poor of biological drawings, labeling and identification and the use of CAI was able to improve the competencies of the sampled students.

The result from research question four revealed that students had lapses in labeling the five diagrams under. The diagrams are: Human Digestive System; (HDS), Human Excretory System; (HES), Whole Maize Seedling; (WMS), Typical Plant Cell; (TPS), and Typical Sperm Cell; (TSC). Accordingly, For instance, 58%, 92%, 71%, 49%, and 54% of the students had wrong spelling in their label. It is expected that each guideline should be horizontal but 50%, 55%, 49%, 50%, and 50% of the students were identified inappropriate guidelines. 47%, 55%, 38%, 69%, and 49% were the students that crossed guideline against each other. Students' horizontal guideline were expected to touch the structure being labelled but 52%, 47%, 70%, 37%, and 39% of the students fell to adhere. Lastly, 32%, 39%, 55%, 42%, and 35% of the student used freehand on drawing the guideline instead of meter rule. This implies that students inaccurate label of the diagrams carries the highest percentage. Continuous practice will help students to build good understanding of biological diagrams which in turn will promote ways of drawing with accurate labeling. The findings of this study is in line and in agreement with that of Kotzebue, Gerstl and Nerdel (2014) who identified some deficits in students constructing diagrams, some of the deficits having previously been identified in students. Additionally, mistakes based on the specific context of the tasks set, such as labelling, wrong spelling in their label, crossed their guideline, among others. This study agrees with Ihejiamaizu, Etop, & Obi (2020) that students had significant effect of practical drawing.

Conclusion

In line with the findings of the study on students' lapses in biological drawings among senior secondary students for five diagrams; Human Digestive System; (HDS), Human Excretory System; (HES), Whole Maize Seedling; (WMS), Typical Plant Cell; (TPS), and Typical Sperm Cell; (TSC), it is



concluded that students' lapses in biological diagrams attribute to their poor performance. On the other hand, students should comply with all the rules guiding drawing of biological diagrams. It is further concluded that poor knowledge of spelling among biology students had the highest percentage.

Recommendations

Based on the findings of the study and their educational implications, the following recommendations are made:

1. The number of underlying rules for an appropriate title in Biological diagrams should be emphasized. To achieve this, students' frequent practice of different diagrams in the contents of the biology scheme for senior secondary school should be strengthened and as well students' strengths and weaknesses shared to meet the needs of drawing in examinations wherever they are required.
2. Teachers should be encouraged to use the recommended evaluation techniques very often in assessing the students drawing. The biology teachers should give continuous assessment on biological drawings to test the students ability on drawing lines as at and when due. This will go a long way moderating the extent of students' lapses in biological drawing thereby increasing students' performance.
3. Biological drawing is recommended in every Biology examination as the framework to be used in determining the students' mastery of the rules in biological drawings. As a result, teachers should be engaged in in-service training programmes such as workshops and seminars to equip them with the current practices in drawing as well as attend WAEC and NECO coordination for marking.
4. Biology teacher should adopt innovative strategies to teach practically, biology diagrams and students should engage with drawing biological diagrams regularly.

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