International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Improving First Year Integrated Science Students' Biological Drawing at Mfantsipim School

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Abstract

This study was action research, descriptive in nature and designed to improve first year Science students' biological drawing skills at Mfantsipim School. The study was descriptive in nature. The main instruments used to collect data were observation schedules, interviews and a set of questionnaires. A sample of 74 students and 7 teachers were involved in the study. During the pre-intervention stages an exercise was used to assess the magnitude of students' problems. After which, intervention activities were designed and implemented to help students improve their performance in their Biology and Integrated Science drawings to be specific. The outcome of the study revealed that students' drawing skills had improved in Biology and Integrated Science respectively.

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Based on the findings, it was recommended that all stakeholders in Education should review the biology syllabus, equip teachers with the basic skills of biological drawing and organize frequent In-service Training for teachers, as this will enhance the performance of students in biological drawings in Biology and Integrated Science subjects respectively.

Keywords: biological drawings; teaching and learning resources; science education; tool requirements; biology; integrated science.

1. Introduction

Science education is very important to the development of any nation. The advances in science and technology have influenced the rate of economic development of nations, improved the quality of life in most parts of the world, and provided solutions to some major problems and needs of societies [1]. The impact of science and technology is felt on education, health, nutrition, transport and communication. Our continued existence depends on our ability to harness scientific and technological knowledge to solve practical human problems. In view of this, Ghana has made science a core component of the school curriculum, which would produce scientifically literate citizens, who can make informed choices in their personal lives and approach challenges in the workplace in a systematic and logical order. They also need to become competent professionals in the various scientific disciplines, who can carry out research and development at the highest level [2]. The Biology and Integrated Science programmes has been designed to help students solve basic problems within their immediate environment through analysis and experimentation, and also to develop scientific approaches to the solution of personal and societal (environmental, economic and health) problems [2]. Additionally, the curriculum was meant to help students develop practical skills required to work with scientific equipment, biological materials and living things; collect, analyse and interprete biological data; and also, to present data graphically [2]. More so, students are to be aware of the existence of interrelationships between biology and other scientific disciplines and sustain their interest in studying biology. Again, students are to appreciate and understand the interrelationships between organisms and themselves, and with the environment. Students are to recognize the value of Biology and Integrated Science to society and use it responsibly to develop a sense of curiosity, creativity and critical mindedness as well as providing a foundation for those who will develop a career in the biological sciences [2]. There were also suggestions for teaching Integrated Science and Biology in the senior high schools. The teaching of biology was to be student-centred and activity-oriented. The teacher was to act as a facilitator. For effective teaching and learning in this course, it was recommended that the school should establish small botanical gardens, animals in cages, fishponds and insects in cages. Video clips were to be shown where these were available. Additionally, classroom teaching should be supplemented with field trips wherever appropriate. The provision of well-equipped laboratories would enhance teaching and learning biology [2]. A review of students' performance in Biology and Integrated Science in the West African Senior Secondary Certificate Examination (WASSCE) for two decades in Ghana revealed fluctuations and downward trends in students' performance. This has attracted a lot of concern among science educators. In order to achieve the objectives and the aspiration of the government and to improve students' performance in biology, efforts should be directed towards improving teaching and learning of the subject [3].

Also, biological drawing support or provide evidence of the descriptions of organisms or objects or biological structures. Drawings in biology serve as summaries of what normally would be described in several sentences before they can be understood, that is biological drawings are comprehensible and concise, they are cost effective and have the potential of imprinting information to facilities learning. A number of factors have been identified to be responsible for the poor performance in science from the various studies conducted in Ghana. These include the lack of motivation for most teachers, poor infrastructural facilities, inadequate textual materials, and the negative attitudes of students to learning and the lack of teaching skills of the teachers [4]. Students' poor performance in biology especially at the West African Senior Secondary Certificate Examinations (WASSCE) level has become a source of concern to all stakeholders in Ghana [5]. One of the major reasons for this anomaly was the lack of or inappropriate application of laboratory facilities in the teaching of science by senior high school science teachers [6,7,8,9], also found that the shortage of funds for equipment and materials for fruitful practical work; especially in view of large class size in most schools was a problem. Teachers attributed the poor performance of biology students in schools to improper utilization of laboratory equipment. Lack of adequate supply of science equipment and improper management and utilisation of available equipment in teaching is what leads to the low achievement in science. Studies in Ghana by [10] and [3], focused on problems encountered during practical lessons in Biology and Integrated Science respectively. Shortage of instructional resources in our Senior High Schools was not new. What seems to be the practice is that some teachers have not been able to utilize the available resources and by implication, these resources were wasted [3]. A large number of students offering Biology and Integrated Science at Mfantsipim School have problems with the basic principles for drawing biological diagrams. According to [11] biological diagrams are making of a drawing in connection with botany and zoology. Biological drawings have not only been an accepted technique but have sometimes reached a stage in which proficiency as a draughtsman has been mistaken for competence as a biologist. Drawings are made for varying reasons; thus, a drawing can be made to represent an imagination or dream or an abstract shape. Drawings can also be made of plans and sections of known or seen objects. Children draw as a means by which they reconstruct and assimilate their experiences. Drawings can be images constructed from direct observation of an object with the intention of representing what has been seen. In this type of drawing, an attempt is made to discover the essential appearance of an object by a close study. Such drawings are referred to as objective drawings. In the subject of biology objective drawings are often required. Biology as a subject deal with both plant and animals, concisely with the study of nature. Living things share the following basic characteristics: a degree of orderliness, the ability to respond to stimuli, capacity to grow, develop and reproduce using hereditary molecules and the possession of processes that control and co-ordinate life functions [5]. Forming a specimen and recalling the details about them in memoir is not an easy task. Biological drawings studied, imprint, details of the items being studied on the mind. Biological drawings facilitate easy recall and can be referred to when the need arises [3]. Problems of the basic principles for drawing biological diagrams were discovered after several biological practical lessons, which were taken. Students' drawings were without headings/titles, outlines, magnification and above all artistic in nature. There was therefore the utmost need to investigate this problem, find solutions to investigate this problem and find solutions to them and imbue basic principles governing biological drawings. This will therefore enhance as well as arouse their interest in the teaching and learning process of biology. It was therefore based on the poor performance in biological drawings with the students that the researcher carried out

this study to identify and address hindrances to effective teaching and learning of biology and also to design interventions that will boost students' interest in biological drawing.

1.1 Research Questions

In this study, the following research questions were addressed:

- Are students' aware of the basic requirements of biological drawings?
- How proficient are the students in drawing and labelling biological specimen?
- What are the probable causes of students' difficulties and how are their mistakes corrected and discussed?

2. Literature Review

In Ghana, the introduction of educational reform emphasizes on practical work as a means of learning science, specifically biology. The syllabus viewed practical work as an integral part of learning [12]. More so, since Biology is activity based, it is the responsibility of the teacher to ensure that there is adequate interaction between the parties involved. Biology practical which is an aspect of the integrated science practical enable both teacher and student to:

1. Have a feel of the learning instruments.
2. Develop or formulate hypothesis.
3. Develop an investigative attitude towards a problem.
4. Developing manipulative skills for both parties.
5. Emphasize biological information or the essential facts that are strictly relevant to the West African Examinations Council and the Senior High School syllabus.
6. Facilities stimulate and encourage self-tuition of the senior high school student.

It is therefore imperative, that practical lessons be so designed as to enable students to develop collaborative skills. [13] after studying students cognitive and mastering of skills indicated that, there was no substitute for practical work, the same authors are of the view that the theoretical and practical components of teaching biology cannot be separated.

2.1 Students' Attitude towards Practical Work

The Chief Examiners' report [14] complained of students' inability to describe experiments and experimental data. It also complained about students' poor drawings and incorrect spelling of biological terms. Another report [15] indicated just about the same thing with regards to biological diagrams. This performance of students in practical work can be attributed to a basic problem in the teaching of Biology and Integrated Science. It is because previous studies represented that there is little to show that practical work is effective in helping students in learning science knowledge than other methods of learning science [13]. This situation arises as a matter of most students seeing practical work as boring, time consuming and non-beneficial. However, [16] have also agreed that there is no substitute for practical work. They, thus continue to agree that the theoretical

and practical components of teaching biology cannot be segregated. Again [16] emphasized that most practical work in school is not taken. The reason given was that there is no clearly known policy that is followed by schools with regards to practical work. It is widely recognized and acknowledged that all sciences have empirical basis and they involve practical pursuits and activities. Practical skills and abilities are those that form an integral process in science through which the investigator obtained first-hand experience of some scientific phenomenon or relationship [17]. The responsibility for operating the system of practical assessment for senior high school (S.H.S) lies with the teachers in the school who carry it out internally with external moderation. Practical assessments are not easy and doubt, does persist about its credibility and about carrying it out efficiently under natural circumstance of science teaching. A worthwhile aim of practical assessment is to be ensured of purposeful practical work [18]. Where facilities and resources are available, a qualified and motivated science teacher will deploy learner-centred approaches to teaching and learning. Such an approach emphasizes practical activities and students will be involved in practical hands-on-activities. This approach stimulates curiosity, imagination and critical thinking. It keeps the lessons exciting and captivating to the young scientists [19]. The WAEC senior high school biology syllabus emphasises the acquisition of scientific skills (e.g., accurate observation, measurement and recording), laboratory skills as well as scientific attitudes (e.g., Concern for accuracy, objectivity, integrity, initiative etc.). It is therefore expected that students would go through practical work in preparation for the final WAEC science practical examinations. With the provision of science resource centres, it is also expected that students in disadvantaged schools would have the opportunity to undertake practical activities. However, a variety of specific students' weaknesses in the practical examinations reported by the Chief Examiners cast serious doubts on senior high school students' involvement in practical activities in the schools. This gives the impression that students are either not taken through practical activities or do not take them seriously [5]. Some of the persistent weaknesses identified over the years (2000-2020) by the Chief Examiners for biology are as follows:

Biology:

i. Technical terms were wrongly spelt and also failure to adhere to the convention of writing scientific names.
ii. Candidates were incapable of critical analysis and interpretation of biological data.
iii. Candidates were not having adequate practical work as shown by the answers provided.
iv. Most candidates could not draw diagrams from observation of specimen; thus, the standards for drawing were very poor.
v. Descriptions of graphs drawn were inaccurate and explanation of the data deduced from the graphs was poor.
vi. Some candidates presented very poor and inaccurate genetic diagrams.
vii. Difficulty in relating observable features to their functions.

The importance of practical work cannot be overemphasised. Learners' involvement in practical activities in the laboratories assists them to better understand scientific processes. The issue of the importance of a laboratory in science teaching, therefore, cannot be overemphasised. In a laboratory and with the relevant material and equipment, learners are provided with the chance to actively learn science, which is by nature investigative [20]. The importance of learners' active involvement in science learned is further emphasised by [21], who argued that learners construct meaningful scientific knowledge and investigative processes by being actively involved

in science knowledge construction. Similarly, [22], noted that the availability and proper use of relevant materials such as library materials and science laboratory equipment have a positive influence on learner performance and ultimate attainment.

3. Methodology

The study was conducted to improve first year science students' biological drawings at Mfantsipim School, Cape Coast in the Central Region of Ghana. The research is in two parts; the Pre-intervention where students problems were identified. The technique of this Pre-intervention employed in collecting the data on sample biological drawing exercise. The problems were identified through observation interviews and Pre-intervention questions. Based on the findings from the pre-intervention an intervention strategy was put in place to help solve the problem. After the intervention strategy post-intervention question(s) were used to check the impact of the intervention strategy and students' performance.

3.1 Educational Action Research

"The collaborative effort by all groups and individuals (teachers, students, mentor and mentee) directly or indirectly with educating the child to reflect on the present educational practices individually or in groups, identifying specific contextual problems that militate against the quality of education and developing approaches thus interventions will lead to the solution of those problems all in the effort of improving the quality of education" [23]. This study is action research which has its foundations in the writings of Thomas Dewey an American philosopher who believed that professional educators should become involved in community problem solving. Proponents of Dewey's philosophy focus on development of curriculum, professional development and applying learning in a social context. Action research is a situational that is being concerned with diagnosing and attempting to solve a problem.

3.2 Population

The target population comprised all biology teachers and first year biology students in Mfantsipim senior high school, Ghana. The selection of an accessible population is that a smaller population gives in-depth views of a research. Seven (7) biology teachers and 74 biology students formed the accessible population. Two (2) science classes out of a total of 6 were used for the study making up 33.3% of the entire accessible population. Biology teachers and first year biology students formed this population since they would not be focusing on writing their final examination.

3.3 Sampling Procedure

First year Integrated Science students at Mfantsipim School, Cape Coast in the Central Region of Ghana were used for the study. Out of twelve form one classes, six were Science biased. Two classes 1 G and 1 J were selected from the science classes this in itself was a limitation to the study. This was because; these were the classes the researcher handled in Integrated Science and Biology respectively. The 1G and J class was made up of thirty-seven (37) students each, making up a total population of seventy-four (74) students.

3.4 Pre-intervention Activities

Pre-intervention activities were designed for students to locate more information about their drawing skills and also to collect data. The technique employed in collecting data was simple biological drawing exercises.

The seventy-four (74) students in the two classes were instructed to;

1. Draw and label a typical plant cell.
2. Draw and label an animal cell.

3.5 The Interventions

The result which emanated from the Pre-Intervention activities enabled the researcher to plan appropriate measures to ameliorate the situation at stake. The following measures were taken:

1. Teaching of principles needed to make accurate and neat biological drawings.
2. Taking students through regular biological drawing sessions to enable them improve on their skills.
3. Guiding students to apply the knowledge of principles for making accurate and neat biological drawings through regular practice.

Aims for these intervention activities was to assist the students to:

1. Position, observe and draw from a provided specimen using hand lens or microscope(s).
2. Apply all the Basic principles in making biological drawings.
3. Use the right and correct drawing materials.
4. Confidently make accurate and neat biological drawings.
5. Develop the attitude of regular practice.

These stated objectives were to be achieved over a ten-week period. Within this period students are advised to use the right materials e.g., well sharpened HB pencil, A4 bond paper etc. in making biological drawings. It was also stressed that students apply the Basic Principles taught in all the drawings they make of which some include; writing of appropriate headings for drawings, writing the magnification by every drawing, making sharpened clear outlines, large diagrams that exhibit proportionality of parts and providing details of specimen if the need arises /be. Students were also instructed to pick up simple specimen such as seeds insects etc. from their environs at least twice a week to draw as a mode of assessment. This was to encourage students to have regular practice to help them develop their skills. Practical lessons were conducted once a week, specimen was also provided for students in some cases, to observe, draw and label. The researcher supervised and corrected the errors which students brought out as a result of the practical. All the exercises given to students were collected, marked and corrected before the books were returned to the students. This enabled the students to identify their errors and the necessary corrections made to improve on “the students” drawings.

3.6 Post Intervention Activity

Practical tests were conducted after students had been taken through regular practice and discussions for the ten-week period. Specimen were provided for students to observe draw and label. This test was scored over 20 and used to assess the performance of the students.

3.7 Instrumentation

An adapted questionnaire "Improving First Year Integrated Science/ Biology Students Biological Drawings at Mfantsipim School Questionnaire", a structured interview and an observation schedule were the instruments used to augment the data collection procedure. The questionnaire was specifically for teachers and students, comprising of 2 sections (A and B), where sections A involves the demographics or bio data of the respondents and 8 items followed by teachers' questionnaire respectively. Again, the questionnaire was used to diagnose students' difficulties in biological drawings. The questions for the structured interview were predetermined and set by the researcher based on a strict procedure. All the 10 questions were open-ended for the teachers' interview.

3.8 Reliability and Validity

Questions for the pre-intervention activities and post-intervention activities were up to standard and relevant to the study with due regard to and in recognition of the new reformed senior high school syllabus and can stand the test of time over a period. This was so because the questions were duly prepared and up to standard. The exercise was conducted to ensure reliability and validity of the items. The instruments used were observation, interview and a set of questions. The questions were well scrutinized with the help of colleagues and other teachers especially my mentor and pre-tested to avoid any biases and ambiguity. To ensure confidentiality, students were asked not to write their names on the questionnaire given them. Also, to ensure reliability the questions were up to standard and relevant to the study and can stand the test of time over a period.

3.9 Data Collection Procedure

Teachers' and students' consent were sought to participate in the study before the instruments were administered. In order to ensure reliability in an uncontrolled environment, the respondents were informed that the questionnaire and questions are not tests and that their responses were not going to be used to change their status or affect their promotion(s). The researcher by making appointment with some teachers who could not complete the questionnaires was carried out at later dates.

3.10 Data Analysis

Descriptive statistics was used to analyse the data. Microsoft Excel was used by the researcher to analyse the data. The means, frequencies and percentages were calculated using the descriptive statistics function of the software and were presented as tables. The results were thoroughly explained with tables used in answering the research questions.

4. Results

Research Question 1: Are students aware of the basic requirements for biological drawings?

Pre-intervention Findings

Data collected on the marks obtained by the students were collated in Table 1. According to Table 1, it was realized from data gathered that, most of the students were unable to formulate a simple heading for the drawing provided. The few students who were able to write the titles could not construct their headings well thus making up the 2.70% above average students. Most students after drawing could not use their guidelines in labeling; guidelines were found below it; others were crossing and some were carrying arrowheads. The students were also putting up thick and wooly outlines representing the 59% of students below average. It was also observed that only 19 students, representing 25.67% were using recommended pencils to make their biological drawings. More so, these students were shading their drawings. It was also found that students had problems with finding the magnification for their drawings, just a handful were able to write correct magnification.

Table 1: First exercise collected at the pre-intervention stage**.**

Marks Obtained	Frequency	Percentage
20 – 18	0	0.00
18 – 16	0	0.00
16 – 14	0	0.00
14 – 12	0	0.00
12 – 10	2	2.70
10 – 08	28	37.84
08 – 06	10	13.51
06 – 04	22	29.73
04 – 02	7	9.46
02 – 00	5	6.76

Percentage of above average students = 3%

Percentage of average students = 38%

Percentage below average students = 59%

Students views about practical lessons were thoroughly discussed in Table 2. Data from Table 2 revealed that approximately 95% did not enjoy practical lessons whilst 95.95% never learnt new things from practical activities. Also 64.80% encountered problems during practical activities. Another figure of 77.03% were unable to complete practical work within the stipulated time and 85.14% did not perform practical lessons to their satisfaction. On the whole 100% of students stated emphatically that practical lessons were seldom organised for them.

Table 2: Students' views about practical lessons**.**

Questions		Yes	%	No	%
1.	Do your science teachers often organise practical lessons for you?	0	0	74	100
2.	Do you enjoy practical lessons?	4	5.41	70	94.59
3.	Do you ever learn new things from practical activities that are organized for you?	3	4.05	71	95.95
4.	Do you encounter problems during practical activities?	48	64.86	26	35.14
5.	Do you complete the practical work within the stipulated time?	17	22.97	57	77.03
6.	Do you usually perform practical work to your satisfaction?	11	14.86	63	85.14

Interview

There was an interview with students to verify what occurs in the classrooms and it yielded these results:

1. Students equating biological drawing with artistic drawings were 28 [37.84%].
2. Students who were able to distinguish the differences between biological drawings and artistic drawings were 10 [13.51%].
3. Also, 6 students could not state whether a drawing was artistic or biological making up 8.11% of the sample.

Research Question 2: How proficient are the students in drawing and labelling biological specimen?

Intervention Findings

After implementing the intervention measures, about two-thirds (49.33%) of the sample (74) could:

1. Use the hand lens in conjunction with the microscope to observe specimen properly.
2. Make good labelling
3. Formulate good headings.
4. Write out good magnification
5. Cut and draw sections well.

The frequency distribution of students' performance on biological drawings during practical activities observed was collated in Table 3. Data from Table 3 revealed the pre-intervention stage of students' performance on the rubrics of biological drawings. Only, 10.81 % could put up smooth outlines in their drawings. Also 21.62% were able to draw reasonably large diagrams. Again 27.03% were able to put up guidelines without errors whilst 8.11% displayed guidelines not carrying labels. Horizontal labelling's recorded 6.76% whilst 17.57% of drawings had titles. Interestingly, 14.86% of students shaded their work. None of the students displayed a magnification.

Table 3: Frequency distribution of students' performance on biological drawings during practical activities.

Description of Activity		Frequency	Percentage
1.	Smooth outline	8	10.81
2.	Reasonably large diagrams	16	21.62
3.	Guidelines without errors	20	27.03
4.	Guidelines not carrying labels	6	8.11
5.	Horizontal labelling	5	6.76
6.	Drawings with title	13	17.57
7.	Drawing with magnifications	0	0.00
8.	Drawings not shaded	11	14.86

Observation of the students' activities were duly observed and recorded. From Table 4, considering the use of hand lens and microscopes, many students were able to use the hand lens to observe specimen correctly thus 90.54%, but had problems with the use of microscopes this recorded 89.19%. The reason was that, most of the microscopes were malfunctioning. Since most of them were unable to focus on the specimen properly, they could not make good biological drawings of the specimen observed under the microscope because the microscopic details of the specimen could not be seen. Also, 16.22% of students could not draw to occupy two thirds of the drawing sheet. In labelling 94.59% executed that rubric responsibly whilst 81.10 were also able to produce good titles. Again 87.84%, were able to calculate and write out good magnification whist 79.73% could section and label appropriately. This was because they had been taught the basic skills in biological drawings.

Table 4: Observing students' activities.

Activities		Successful	%	Unsuccessful	%
1.	Using microscopes to view specimen	8	10.81	66	89.19
2.	Using hand lens to view specimen	67	90.54	7	9.46
3.	Making good biological drawings	62	83.78	12	16.22
4.	Making good labelling	70	94.59	4	5.14
5.	Formulating good titles	60	81.10	14	18.90
6.	Writing good magnification	65	87.84	9	12.16
7.	Making a section/cut to draw and label	59	79.73	15	20.27

Research Question 3:

What are the probable causes of the students' difficulties and how are their mistakes corrected and discussed?

Post Interventions Findings

Activities pertaining to post-intervention findings about the students' occurred through the following means.

Observation

It was observed from the 3 exercises given during the period of study that (93.24%) 69 students could:

1. Draw specimen neatly with smooth outlines.
2. Label their drawings correctly.

3. Formulate good headings for their biological drawings.

4. Draw large drawings that covered about two thirds of their drawing sheets with appropriate magnifications.

Data presented at the post-intervention stage is reported in Table 5. From Table 5, only 35.14% of students encountered problems during practical activities as compared to 64.86% at the pre-intervention stage. An overwhelming improvement. Again, 77.03% of students were able to complete their practical work within the stipulated time. Also, 85.14% of students were able to complete their practical satisfactorily. Students who enjoyed practical lessons had appreciated to a value of 95.95% as compared to 5.41% in Table 2. In learning new things during practical activities 95.95% of students agree to learn new things. Finally, 100% of the students attested to the fact that there were frequent practical lessons organised for them.

Table 5: Students' views about post-intervention practical activities.

Questions	**Yes**	**%**	**No**	**%**
1. Do your science teachers often organise practical lessons for you?	74	100	0	0
2. Do you enjoy practical lessons?	70	94.59	4	5.41
3. Do you ever learn new things from practical activities that are organized for you?	71	95.95	3	4.05
4. Do you encounter problems during practical activities?	26	35.14	48	64.86
5. Do you complete the practical work within the stipulated time?	57	77.03	17	22.97
6. Do you usually perform practical work to your satisfaction?	63	85.14	11	14.86

Table 6: 3 exercises collected after post-intervention activities**.**

Marks obtained	**Frequency**	**Percentage**
60 – 55	3	4.05
54 – 50	4	5.41
49 – 45	6	8.11
44 – 40	5	6.76
39 – 35	16	21.62
34 – 30	10	13.51
29 – 25	6	8.11
24 – 20	12	16.22
19 – 15	9	12.16
14 – 10	3	4.05
09 – 05	0	0.00
04 – 01	0	0.00

Percentage of students above average = 46%

Percentage average students = 14%

Percentage of students below average = 40%

The students were positive about practical lessons organised by their teachers after the intervention. This was because on answering the questionnaire for the second time; students could then give more positive answers as they were then capable of performing practical tasks more efficiently. Results from Table 6 depicted that, approximately 46% were students classified as above average, after three successful exercises or practical lessons taken. They were in the ranges of 60-35 marks. Again the average mark, which was in the 30-34 ranges, recorded approximately 14% and also an approximate value of 40% were below average, thus between the ranges 29-01 respectively.

5. Discussion

The data in Table 1, indicated that most students could not draw with confidence, calculate the magnification of their drawings correctly, give precise and descriptive headings to their drawing as well as make smooth outlines and finally showing details of their drawing. In biology, the three profile dimensions that have been specified for teaching, learning and testing are: Knowledge and Comprehension 30%, Application of Knowledge 40%, Practical and Experimental Skills 30%. The weights indicated shows the relative emphasis that the teacher should give in the teaching, learning and testing processes. The focus of this was to get students not only to acquire knowledge but also to be able to understand what they have learnt and apply them practically. Combining the three dimensions in teaching would ensure that science (Biology and Integrated Science) is taught not only at the factual knowledge level but that students would also acquire the ability to apply scientific knowledge to issues and problems; as well as built their capacity in practical and experimental skills that are needed for scientific problem-solving [2]. From Table 2, some teachers at Mfantsipim School did not see significant roles practical work and biological drawings exhibited in Integrated Science and Biology respectively. Literature posits that, most biology teachers and for that matter science teachers seemed to ignore the practical aspect due to non-availability of equipment, poorly resourced laboratories coupled with their perception that the syllabus was broad. A perception, which in the opinion of the researcher actually influenced how these teachers, taught the subject. This behaviour on the part of teachers with regards to the approaches used in teaching of the sciences does not give room for students to develop their creative abilities as opined by [24]. Data gathered also revealed that, some biology teachers often used demonstrational methods due to inadequate teaching and learning materials. This resulted in students' inability to duly pay attention and concentrate which yielded ineffective class control. Although Ghanaian schools have a good number of quality teachers, there are others who scarcely apply the teaching methods and psychological principles, they have learnt in the Colleges of Education and Universities. This was to recognize and make use of individual differences, interests, abilities and needs of students in a way to help them develop their talents and potentialities. Some teachers do not provide opportunities for independent critical thought with emphasis on freedom of expression and open-mindedness [10;3]. Those teachers bow to the pressure of preparing students to pass competitive academic examinations by resorting to cramming students with pre-digested information, and thereby encouraging passive learning and rote memorization. Because teachers are the overriding factor, they should be willing to use, interpret and implement the curriculum as prescribed. The West African Examinations Council (WAEC) Chief Examiners Reports of the years (2000-2020) in Ghana revealed fluctuations and downward trends in students' performance. The general comments on biology stated that "the standard of the paper compared favourably with that of previous years but candidates' performance was far from satisfactory"

[p.1]. Some teachers are therefore not adhering to the recommended teaching approaches as directed by the curriculum. Practical work constitutes an integral part of biology. [25], stated that practical work helps students to learn various skills, and gives students a sense of achievement, when they themselves make discoveries, and arrive at scientific conclusion through their own experiments. From the interview and in Table 2 it was observed that, teachers did not have enough teaching learning materials and skills to teach practical lessons and this deterred them from organizing practical activities. Similarly, Young [26], emphasised that teachers in science education, should guide students to fish out for information on their own through activities rather than feeding them with information. He explained that when students were involved in most of the activities during lessons, not only do they learn to be inquisitive and creative but they also acquire knowledge more meaningfully. This knowledge acquired is then applied to problem-solving, a profile dimension referred to as Application of Knowledge. This is in accordance with the biology curriculum prescription, which categorically suggests that the teacher should act as a facilitator for effective teaching and learning in this course. Practical activities should therefore be used by teachers to help their students achieve better results in biology. Data from Table 3 revealed that students, at first did not have interest in learning biological practical because they had not been taught the rubrics, therefore, performing practical activities was problematic. [27], said “if learners learning styles are compatible with teachers teaching styles, they were likely to retain information longer, apply it more effectively and is also inclined to have more positive attitudes towards the subject than anyone who experiences learning mismatch”. However, if learner-centred environments are to be created, then biology teachers must be made to feel confident in the handling of interpersonal behavior and interact cordially with their students. Teachers can evoke the interest in students to learn biology when they attempt to create and maintain favourable classroom learning environments through positive interpersonal relationships as prescribed by the biology curriculum, which categorically states that biology should be student-centred, and activity oriented. These findings were in agreement with [28] who noted that simply telling or explaining concepts to learners is no guarantee that they would receive the message or understand it. The post-intervention results reported in Tables 4,5 and 6, showed that their scientific process skills had improved, especially manipulation, equipment handling, drawing and observation of specimen. [29] also provides us with a framework for thinking about an important function of teaching and the multicultural perspective. His research suggests that school learning enables students to connect their "everyday concepts" to "scientific concepts." In other words, schools help students draw generalizations and construct meaning from their own experiences, knowledge, and strategies.

Knowledge learned in the community and knowledge gained from school are both valuable. Neither can be ignored if students are to engage in meaningful learning. Effective teachers help students make these connections by scaffolding and dialogue. In fact, these are the essence of mediating. Teachers plan learning activities at points where students are challenged. Teachers plan activities and experiments that build on the language of students' everyday lives through familiar examples and behaviours, analogies and metaphors, and the use of commonly found materials. Teachers demonstrate, do parts of the task students cannot do, work collaboratively with students where they need help, and release responsibility to students when they can perform the task independently [29]. Finally, it was also observed that the students were very excited and participated actively in the biological drawing practical activities after the post-intervention activities; this supported [30]

assertion that biology is fun and interesting because of its great variety.

6. Conclusion

Practical work in science requires resources, but because these resources are expensive and lack of support from the authorities, teachers' demonstrations are the norm instead of learner's individual "hands on" practical. This seems to minimize the critical and supportive role of practical work for the learners during science therefore the necessary measures need to be taken to enhance practical lessons. Also due to outmoded equipment and teaching learning material in conducting practical work in senior high schools (S.H.S) educational authorities should consider advocating for the extensive use of locally available materials culminating into investigative technologies. Practical work has its own values and it involves a lot of processes like manipulating equipment, scientific methods, observations and methods used to support observation. Science teachers must therefore make the effort of taking students through the basic skills in biological drawings, to prepare them towards the ideas and objectives of Biology and Integrated Science practical in the curricula. It can be concluded then, that, when students were taken through the basic principles needed in satisfying a good biological drawing, using the right materials and with regular practice it improved students' confidence, skills and performance in making accurate and neat biological drawings.

7. Recommendations

Improving biological drawing skills requires a concerted effort by all stakeholders in education, Ministry of Education Science and Sports (M.O.E.S.S), the Ghana Education Service (G.E.S), Curriculum Research and Development Division (C.R.D.D) now National Council for Curriculum and Assessment (NaCCA), Biology teachers and students. The Ministry of Education Science and Sports should review the elective Biology and Integrated Science syllabi to include treating basic principles of biological drawings through the NaCCA (National Council for Curriculum and Assessment). Frequent In-service Training (INSET) should be organized for biology teachers by the GES to update and refresh their concepts in biological drawing. Ghana Association of Science Teachers (G.A.S.T) should also take Chief Examiners Report issued by the West African Examinations Council (W.A.E.C) seriously and take teachers through the basics of biological drawing at their annual meeting. This will equip teachers with the basic skills of biological drawing. Teachers should also do well to make time to teach and take students through regular practical. Practical exercises given to students should be marked bringing to bear their weaknesses and also discouraging textbook referencing during practical work which involves drawing. Students must make enough effort to practice regularly on their own, building up their confidence and improve their skills in making accurate and neat biological drawings.

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