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Instructional Challenges in Biology Classrooms in Selected Senior High Schools in the Eastern Region, Ghana

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ABSTRACT

This study examined the challenges associated with teaching and learning of biology across selected schools in the Eastern Region, Ghana. It also focused on the availability of resources as well as the dominant pedagogical approaches utilized in the teaching and learning of the subject. Data was obtained from 26 biology teachers and 480 students across 16 senior high schools (SHSs) within the region. The study was a descriptive study hinged on a quantitative approach. The main instrument for data gathering was a questionnaire which was also backed with the use of an observation checklist. The Cronbach alpha reliability of the main instrument was measured to be 0.86 which implied it was adequate to be used for data gathering. It was revealed that lack of instructional resources, use of poor teaching approaches and poor attitude of students were major challenges inhibiting the effective teaching and learning of biology at the SHS level within the region. Recommendations for addressing these challenges included the provision of resources and the conduct of professional development sessions for teachers on innovative instructional methods, teacher motivation among others.

Keywords: biology, instructional challenges, senior high schools, teaching learning resources.

BACKGROUND TO THE STUDY

Science is a body of knowledge as well as well as a key learning area that creates and arranges knowledge about the cosmos in the form of useful explanations and production. Across the globe, nations have relied on science as a vast enterprise in order to advance technologically leading to improvements in standards of living of their citizens. Science is thus given a lot of is emphasis in education because of its importance and connection to life and society. The study of biology, a branch of science, is required in many academic disciplines and significantly advances a wide range of fields, including those involving the comprehension of the natural world and effectively using its advantages for human benefit (Abdussemiu, 2022). These fields include nursing, biotechnology, forestry, and agriculture (Tholey, Taylor, Heazlewood &

Bendixen, 2017). As a result, the study of biology in Senior High School can provide students with practical ideas, theories and concepts that will help them meet the obstacles both before and after graduation. According to Okeke (2000), there is a positive correlation between students' performance in biology and their propensity to successfully pursue science related professions as students who did well in biology could have prospects of becoming medical doctors, nurses, pharmacists, dentist, biology teachers, medical technologists, and food technologists, among others. The science of biology is distinct from other science fields in that it employs specific philosophical ideas and methods. For teachers to effectively and efficiently teach biology to students and for that learning to be relevant, they must have a thorough understanding of the particular structure of biological knowledge, concepts, and methodology (Adegboye, Bello & Abimbola, 2017)

Within the Ghanaian context, biology is one of the key learning areas for ensuring academic progression of Senior High School students to the tertiary level. Biology is a required subject for gaining admission to programmes such as medicine, nursing, biomedical engineering, nuclear biology, biochemistry, physiotherapy amongst others. Thus, the Senior High School curriculum for biology rightly states that the rationale of biology is to enable students to develop an in-depth knowledge and understanding of the natural world and also develop skills for improving daily living" (NaCCA, 2023).

An analysis of the Chief Examiners' report shows that student's performance in biology calls for concern (WAEC, 2023). This situation is no different from that which pertains in the Eastern region of the country. The eastern region boasts some of the most glamorous schools in Ghana with respect to science. With over 90 senior high schools, the region has one of the highest number of schools in the country. In terms of population, it is one of the most populous regions in Ghana, with an approximate population of 3 million persons, making it the third most populous region. The region has fair representation of schools in terms of rural and urban distribution of schools as well as the official categorization of schools (into categories A, B, C and D).

Previous studies on the status of science teaching and learning revealed mixed findings, with respect to factors such as school location, school category as well as teacher qualification and academic background. Studies have shown that background factors such as school location (as in rural, urban or peri-urban), teacher qualification, status of school (private or public) have a direct influence on the level of resource availability and effectiveness of teaching and learning which ultimately impact the attainment of learning outcomes by learners. There is therefore the need for a study that provides a holistic view of the status quo regarding the teaching and learning of biology at the SHS level within the region.

Statement of the Problem

A perusal of previous studies into biology education in the senior high schools in Ghana paint a picture of a growing concern about how teaching and learning of biology is conducted (Ackon, 2014). Some concerns include the inability of teachers to provide practical tuition of the subject in some schools. Additionally, the unavailability and inadequacy of resources for teaching biology have been identified as key factors militating the effective teaching and learning of biology. A number of challenges arise from this approach, which includes poor attitude and

performance of students in the subject as well as low motivation of teachers. This in turn results in a drop in the academic performance of students in biology (Tordzro, Asamoah & Ofori, 2021). Unsurprisingly the WAEC (WASSCE) Chief examiners' reports reveal a decline in students' performance in the subject (WAEC,2023). Various studies show that biology is one of the subjects most disliked by students. Within the eastern region, several studies have focused on biology education at the SHS level. Whilst some studies focused on students' attitude, others looked at the effect of entry behavior. A review of literature reveals a dearth in the literature regarding distribution of resources with emphasis to location and categorization of schools. Again, it further seeks to fill the gap in terms of the selection of schools with respect to location and categorization across the entire region. Ultimately this study seeks to come out with findings that are adequately representative of the status quo with regards to the challenges confronting the teaching and learning of biology in the Eastern region.

Objective of the Study

The study sought to:

1. Examine the human and material resources available for teaching and learning of biology in the selected Senior High Schools in the Eastern region of Ghana.
2. Identify the teaching methods used by biology teachers that are specified in the syllabus during biology lessons in selected Senior High Schools in the Eastern region of Ghana.
3. Investigate the challenges biology teachers encounter in teaching biology in the selected Senior High Schools in the Eastern region of Ghana.

Research Questions

The following questions guided the study:

1. What are the human and material resources available for teaching and learning biology in the selected Senior High Schools in the Eastern region, Ghana?
2. What are the pedagogical strategies employed in teaching biology in the selected Senior High Schools in the Eastern region, Ghana?
3. What difficulties do biology teachers encounter in teaching biology in selected Senior High Schools in the Eastern region, Ghana?

Limitation of the Study

All the Senior High Schools in the Eastern region offering Elective Biology should have been included in the study, however due to budgetary restrictions and other resource constraints, such as lack of time, only a few Senior High Schools were included. It is also possible that some respondents might respond incorrectly as information they provide cannot be traced back to them.

Delimitation of the Study

Elective biology students and teachers from the chosen public senior high schools in the Eastern region were the focus of the research study. Only SHS 2 elective biology students were chosen to take part in this research.

REVIEW OF LITERATURE

Theoretical Framework

This study is hinged on the theory of constructivism as explained by Jean Baptist Piaget and

Vygotsky. Constructivism is a learning philosophy based on the idea that we create our own understanding of the world we live in by reflecting on our experiences. Each of us creates their own "rules" and "mental models," which we use to interpret our experiences. So learning is basically the act of changing our mental models to account for new information.

According to Piaget, through the process of accommodation and assimilation, individuals construct their own knowledge from their experiences and during assimilation they incorporate the new experiences without changing the already existing frame work. The theory of constructivism holds that:

a. Learning outcomes are influenced by the learner's knowledge as well as the learning environment;
b. Learning entails creating meaning;
c. The development of a meaning is significantly influenced by the existing knowledge;
d. The meanings created are assessed and are given the option to be approved or rejected;
e. There are patterns in the types of meanings pupils construct due to shared experiences with the physical world and through their natural language (Bennett, 2002; Vygotsky, 1978).

Piaget explores four sequential stages of the psychological development of the young learner and believes teachers should be cognizant of these stages. During the Sensory-motor Stage, (before the age of 2) sensory experiences and motor activities dominate.

Lev Vygotsky, known for his theory of social constructivism, believes that learning and development is a collaborative activity and that children are cognitively developed in the context of socialization and education. The perceptual, attention, and memory capacities of children are transformed by vital cognitive tools provided by culture, such as history, social context, traditions, language, and religion. For learning to occur, the child first makes contact with the social environment on an interpersonal level and then internalizes this experience. The earlier notions and new experiences influence the child, who then constructs new ideas. For Vygotsky, the zone of proximal development, that is “the distance between the actual development of a child as determined by the independent problem solving, and the level of potential development as determined through problem solving under adult guidance or in collaboration with more peers (Vygotsky, 1978)”.

This theoretical framework is relevant because it explains why pupils would struggle to comprehend complex biological concepts because their complexity has nothing to do with what they already know. The learner's prior knowledge and previous interactions with the learning environment have a role in how meaning is constructed. The students' previous learning environment would be regarded to exclude the sophisticated biological terms and concepts, such as genetics, the nervous system, and other related concepts. There is a lot of research to back up the idea that kids make up their own explanations for scientific occurrences, and that these explanations can be different from the ones that are generally accepted in the field. This has been shown to be true in the following contexts: photosynthesis, respiration, biological classification, and evolution. (Ozer, 2004).

In Piagetian classroom a variety of activities must be provided to challenge students to accept

individual differences, increase their readiness to learn, discover new ideas, and construct their own knowledge. Concrete learning experiences, such as drawing, drama, model building and field trips that involve hands-on opportunities to see, hear, touch, taste, and smell are essential.

Infrastructural Availability for the Teaching and Learning of Biology

The primary focus of science is the study of natural events. Some issues in the subject are connected to the dearth of biological education infrastructure, including laboratories. Buildings, playgrounds, ICT equipment, and educational resources help staff and students accomplish their objectives (Anaman, Zottor, & Egyir, 2022). Infrastructures are referred to as "buildings that make learning safe" by Hong & Zimmer (2016). Infrastructure in biology education could include things like classrooms, labs, reading rooms, libraries, etc. Laboratory experiments can be used to learn most skills.

Activities (that require special equipment) that are challenging to be carry out in typical classroom settings are done in laboratories, which are closed-off spaces. Understanding how and why strong educational accomplishment and enhancing school infrastructures should be prioritized is made possible by the high caliber of biology education infrastructure and the ability to provide an effective education notwithstanding historical changes (Assoumpta & Andala, 2020). Poor labs, libraries, and classrooms have the most an impact on students' performance, according to Tavares (2015). How effectively pupils are taught depends on the classrooms, laboratories, and educational found that poor classrooms, libraries, and labs affect student performance the most. The resources available for biology education. Without scientific laboratories, biology students cannot enrol in practical classes (Olufunke, 2012).

According to Allotey (2014) maintaining public high schools has a significant economic impact due to the size of the associated cost as well as the need to ensure that facilities are used as efficiently as possible. As a result, it is necessary to evaluate the upkeep of the facilities used for biology instruction in Senior High Schools.

According to literature, selecting the right teaching and learning resources is a crucial aspect of the teaching and learning process. Again, Opara and Etukudo (2014) stated that, having instructional resources like specimen for biology lessons, gives students the chance to use their senses, specifically of hearing, smell, sight, taste and physical touch.

Adopted Teaching Methods in Biology

The methodology of teaching biology investigates the substance of the educational process in this topic as well as the patterns of how pupils assimilate biological material (Aminjonovich & Akmalovna, 2021). Regarding the methods employed, the teaching of biology as a topic is of outmost importance.

The most crucial strategies teachers use to achieve class objectives are teaching approaches (Rido, 2020). numerous educational teaching strategies improve students learning process. A teaching strategy must take into account both the learner's characteristics and the type of learning it is meant to facilitate in order to be effective. Ganyaupfu (2013) claims that teaching is a continual process that entails bringing about desired changes in students via the use of effective teaching strategies. According to Ganyaupfu (2013), teachers shoud apply the most

effective teaching techniques for the lesson in order to affect the disired changes in the years, many different teaching strategies have been employed to teach science, but the following are the most noteworthy ones:

1. Lecture-based method
2. Project-based method
3. Demonstration method
4. The Practical Hand-On Approach

Lecture-based Method

The lecture-based approach merely involves an oral presentation of the subject matter for learning (Mladenovic, 2000). The lecturer, instructor, or speaker typically delivers this oral presentation to a group of people or students. It is characterized by one-way communication, with pupils listening and taking notes while the teacher speaks the majority of the time.

According to Kaur (2011) in practically all courses or learning sequences, the teacher is required to introduce concepts and information. He must introduce subjects, summarize has to present information and ideas. He has to introduce topics, summarise the key ideas of the learning activity, and encourage additional study. The employment of a lecture-based technique is necessary for all of these activities. The teacher has excellent control over time and materials while using this method, which is employed with a large number of students.

Project Method

According to Udo, Nsit, Onyebuchi, and North (2021), the project-based learning technique is a student-centred pedagogy that combines a dynamic classroom approach. It is thought that by actively exploring challenges and problems from the real world, students gain a deeper understanding of those issues.

The project-based method can be characterized as student-centred instruction that takes place over an extended period during which students choose, plan, research, and then creates a product, presentation or performance that responds to a genuine issue or a respond to a real-world topic. Teachers typically act as facilitators, building up the process as it goes along and offer scaffolding, direction, and strategic instruction. In a project-based learning settings students should be free to explore and interact with their surroundings through their senses and, in a way, to guide their learning based on their interests. In a project-based learning environment, students work together to solve "purposeful" challenges while emphasizing democracy (Johnson, 2002).

Demonstration Method

A demonstration is a process of teaching someone how to make or do something in a step-by-step process as you show how, you "tell" what you are doing (Amaewhule &Chukwudi, 2020). Ivanova and Nwosu (2013) claim that teachers can participate in demonstration classrooms to assist them improve their teaching practices, which may or may not involve demonstration of a specific learning concepts. Despite the paucity of the evidence, studies indicates that the consequences of demonstration classroom teachers include a shift in the way teachers relate to students, more reflection on their teaching methods, and a greater sense of personal accountability for students' learning. With this approach, the teacher plays the lead role while

the students observe and take the initiative later. A demonstration is an action that provides proof or evidence to support a claim. It is clear from the term that the goal is to demonstrate and describe how something operates or is completed. The instructor demonstrates the procedure for the class and walks them through it step-by-step (Daluba, 2013). When students struggle to relate theories to real-world situations or when they are unable to comprehend how to apply ideas, demonstration is frequently required.

The Practical "Hands-On" Approach

The practical "hand- on "approach was developed on the basis of the fact that learning by doing is the most effective way to gain scientific skills (Tordzro, Asamoah, & Nyeseh Ofori, 2021). The approach is basically concerned with the significant positive yields that can be realized when teaching and learning is done with a blend of theory and practice, as opposed to the solely theoretical approach. When students are made to actively participate in the learning process, they are able to develop a keener interest in the subject of study, enhance their capacity for laboratory work, and also deepen their insight into what is being taught. As the natural sciences emphasize the principles of empiricism and thus seek to describe, understand, predict and control phenomena, it is crucial that teaching and learning be done practically as well as theoretically. One of the proponents of this paradigm, Freedman (2009), argue that for a student to be motivated in a particular line of study, a practical exposure to what is being studied is as important as an interest in the area of study. Also, the similarity between laboratory work and real-life situations can be a contributory factor in the learning process. Here, researchers in the field assert that an application of real-world contexts in the study of science particularly helps to efficiently assimilate the various theoretical concepts and ideas concerning the subject (Wandersee et al., 2014). The active participation of students in the learning process made as a result of practical or hands-on study approaches have therefore been noted to facilitate learning, especially with regards to the natural sciences including biology (Torres, 2018).

Challenges of Teaching and Learning Biology

Researchers from all across the world have looked into how difficult it is for students to study biology (Cimer, 2012). Secondary school students may find it challenging to understand variety of biological ideas or topics, such as the transportation of water in plants, the synthesis of proteins, respiration and photosynthesis, gaseous exchange, energy, cells, mitosis and meiosis, organs, physiological processes, hormonal regulation, oxygen transport, genetics and the functioning of the central nervous system (Etobro & Fabinu, 2017).

Hormones, genes and chromosomes, mitosis and meiosis, the nervous system, and mendelian genetics were also discovered by (Tekkaya, Özkan, & Sungur, 2001) to be challenging subjects for secondary school pupils. Students' motivation and achievement are significantly impacted when they struggle with so many biology courses (Özcan, 2003). Students struggle to understand biological concept for a variety of reasons (Tekkaya, Özkan, & Sungur,2001; Çimer, 2004). Learning science can be challenging for a variety of reasons, including the nature of science and its teaching techniques. Etobro & Fabinu (2017) contend that learning biology is challenging because of the biological level of organization and the abstract nature of the concept. The other reasons hindering students from learning biology properly include overburdened biology curriculum, the abstract and multidisciplinary nature of biological

topics, and issues with the textbook (Chiapetta and Fillman, 1998; Tekkaya, Özkan, & Sungur, 2001). According to Chiapetta and Fillman (1998), overcrowded biology courses may not help students attain their goals and instead encourage them to memorise the content.

According to Osborne and Collins (2001), the lack of discussion of issues of interest and the lack of possibilities for creative expression are other factors contributing to students' declining interest in learning science. The curriculum content is also overloaded and often unrelated to working life. Biology instruction styles, methods, and strategies used by teachers may also have an impact on how well students understand the subject (Çimer, 2004). Science teachers encountered the challenges when attempting to teach biology concepts in the classroom, including the lack of teaching aids, a lack of school-provided reference material, a lack of class time, a lack of textbook content, and a high content level relative to students' comprehension levels (Rasmitadila, Aliyyah, Rachmadtullah, Samsudin, Syaodih, Nurtanto, & Tambunan, 2020).

METHODOLOGY

Research Design

In order to give pertinent and reliable information, the descriptive survey design was utilized in this study. Calmorin (2012) asserts that descriptive method concentrates on the present and the "what is" of the circumstance in order to uncover "new truth". The study adopted a quantitative approach of data gathering through the use of the questionnaire and an observation checklist. As asserted by Lim, Kumar & Ali (2022) quantitative research is the bedrock of evidence-based research and its importance in decision making cannot be over stated.

Population, Sample and Sampling Techniques Employed in the Study

A target population, according to Cohen (2004), is a collection of elements or cases that meet certain characteristics and from whom a study is intended to be generalized. All Elective Biology instructors and students from all the 90 Senior High Schools in the Eastern Region made up the target population. "Samples are selected based on the fact that they provide a research project insight into a specific experience" Smith, Flowers & Larkin (2009). Using stratified random sampling methods, 16 Senior High Schools formed the accessible population for the study. These schools were in 6 districts namely New Juaben North, New Juaben South, Upper Manya Krobo, Lower Manya Krobo, Akwapim North and Akwapim South. The schools included in the study were carefully chosen based on a number of criteria such as school location and category (category A through to category D). Thirty (30) students from each of the participating schools were chosen using stratified random sampling techniques. The researcher collected information from 506 respondents in all, including 26 teachers and 480 students.

Instrumentation

Data for this study was gathered using a variety of instruments. A questionnaire and an observation checklist were the two main tools used to collect the data. The questionnaire was used to gather data from the learners about the approaches used by biology teachers in the selected schools. It also helped to gather on the academic qualifications of biology teachers as well as the challenges faced by the biology teachers in the teaching of the subject. The checklist was used to augment data gathered using the questionnaire. It helped to gather data about the availability and adequacy of resources for teaching biology in each of the sixteen schools.

Validity and Reliability of the Instrument

Both instruments (the questionnaire and observation checklist) were pilot-tested in the Ashanti region of the country in four (4) schools. The region was selected because it shares similar characteristics with the Eastern region. The Cronbach Alpha reliability of the questionnaire was determined to be 0.86 which implied that it was suitable to be used for the substantive study (Amoah, Eminah, Nnmang-wara & Azure, 2023). Items on the questionnaire were validated by other lecturers in the Biology and Science education Departments of the University of Education, Winneba who were experts, to ensure that it measured the entire content area of study.

Data Analysis

The Statistical Package for Social Science (SPSS) version 27 was used for all statistical analysis. Descriptive statistics, such as frequencies, percentages and standard deviations, were used to analyze the quantitative data.

Ethical Consideration

By discussing and providing participants with specific information about the study's objectives, informed consent was sought and used in the study. The confidentiality of the participants was ensured by the researchers. The researchers rigorously abided by the principle of anonymity, which essentially states that no participant's identity would be divulged at any point during and after the study.

RESULTS AND DISCUSSIONS

Research Question 1:

This question sought to find out the logistical and human resources available for the teaching and learning of biology within the eastern region. It was answered with the aid of both instruments.

Academic Background of the Biology Teachers

From the academic qualifications of teachers from the data set, there were a total of 19 teachers holding Bachelor's degrees, then six (6) of them hold Master of Science (MSc) degrees and the remaining 1 had a Master of Philosophy (MPhil) degree. This clearly shows that in terms of qualification all of the 16 teachers met the criteria for teaching biology at the SHS level. This is illustrated in figure 1.

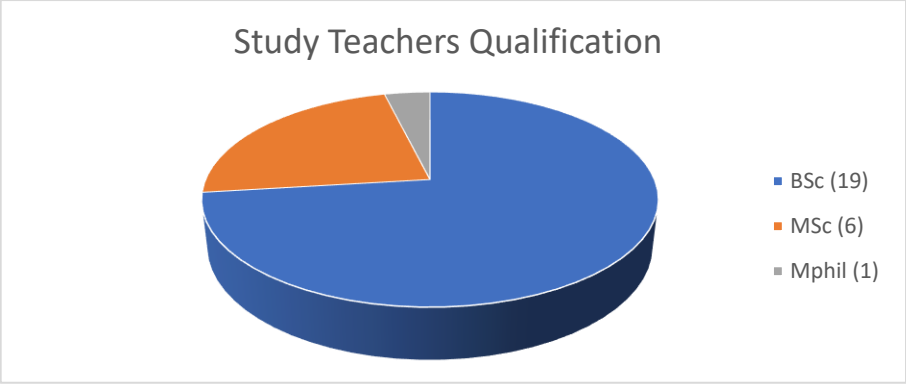

Figure 1: Distribution of teachers' highest academic qualifications

Area of Specialisation

With regards to the area of specialization, it was identified that 22 out of the 26 teachers had studied biology at the tertiary level of education. The remaining four had qualifications in other subject areas rather than biology.

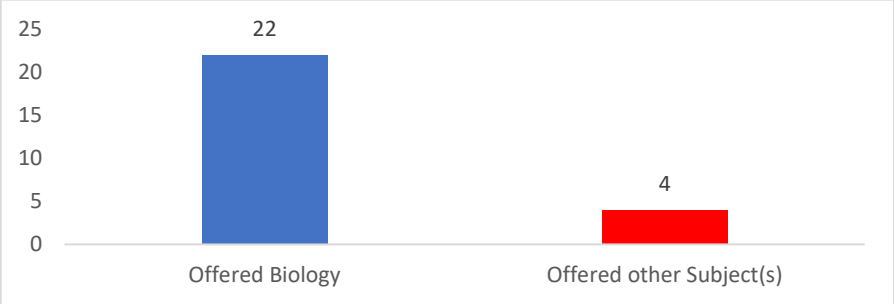

Figure 2: Area of specialisation of respondent teachers

Years of Experience of Respondent Teachers

Figure 3 gives a breakdown of the years of experience in teaching biology of the 26 respondent teachers. As many as 13 (50%) had taught for more than ten years. Only 2 teachers had taught for less than a year. The rest of the breakdown is provided in figure 3.

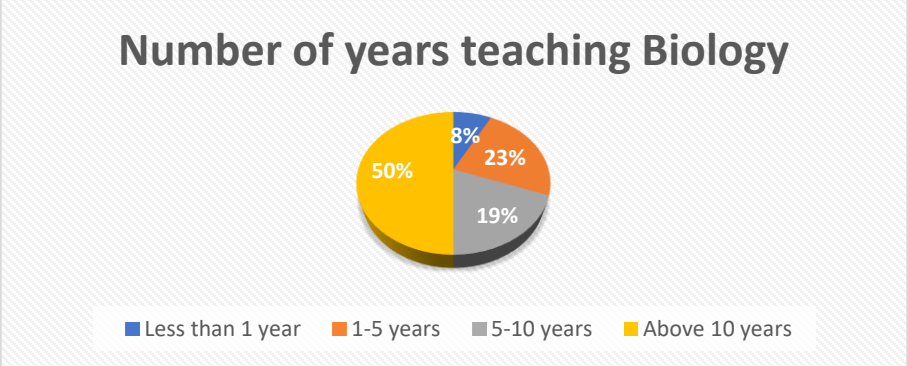

Figure 3: Number of years spent teaching Biology

Rating of Conditions of Facilities, Materials and Equipment for the Study of Biology

Conditions of Facilities and Material Resources:

The Part 1 of the observation checklist was used to rate selected facilities, materials and equipment as good, satisfactory or poor and the results are presented in Table 2.

Table 1: Teachers' and Centre Coordinators' Rating of States of Facilities and Material Resources in SRCs

Items	Proportion of Schools (%)		
	Good	Satisfactory	Poor
Laboratories	19.2	23.1	57.7
Physical state of laboratories	6.5	27.3	66.2
Chemical reagents	10.3	19.2	70.5
Equipment	18.2	16.9	64.9
Manuals	21.1	43.4	35.5

Table 2: Rating of Condition of Structures of the Laboratories in Various Schools

	Roofs	Floors	Walls	Windows	Doors	Pipes	Drainage
Very bad	13	17	17	15	20	23	20
Bad	23	17	27	25	23	30	23
Satisfactory	27	33	26	30	27	33	33
Good	20	13	7	17	17	13	11
Very good	17	20	23	13	13	11	13
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Based on the data provided in Table 2, it can be seen that only a few of the facilities in the schools were in very good shape. On the average, 27% to 33% of all the schools indicated that the selected items were in good conditions. However, between10% to 30% of the centres had their facilities in very bad conditions and 17% to 30% listed facilities as being in bad states.

Only 3% of doors in the schools were considered to be very good and 10% of the schools also could be considered as having very good pipes. As many as 43% of the schools had broken pipelines and about the same number had bad drainage system. Finally, 36% of the schools had roofs found to be in bad condition.

Extent of Usage of Selected Items in Laboratories

An analysis of the extent of usage of some selected items in the schools was conducted with the aid of the observation checklist designed for that purpose. The item was in use, spoilt or finished in boxes or other (meaning borrowed or cannot account for the item for one reason or the other). The percentage mean of items found in various stages are presented in Table 3.

Table 3: Extent of Usage of Selected Items in Laboratories

Item	In Use (%)	Spoilt/Finished (%)	Still in Boxes (%)	Other (%)
Glass Gas syringe	5	20	60	7
Red Pipette filler	25	2	45	17
Hand held thermometer	15	9	11	33
Boiling flask socket	70	0	18	12
Filter papers	87	5	5	3
Chemical balance	41	5	31	33
Litmus papers	36	37	24	3
Sulphuric acid	65	29	2	4
Glass blocks	34	0	40	26
Potentiometer	18	11	64	7
Pendulum bulbs	54	0	34	12
Alcohol fermentation kit	28	2	65	5
Stop watch	47	16	25	12
Gene kit	7	1	74	18
Pulse and BP monitor	10	8	63	19
Lung volume bag kit	0	4	91	5
Petri Dishes Disposable	31	41	18	10
Centrifuge	4	17	78	1
DNA Helix	12	24	58	6
Cover glasses	39	13	32	16

It could be seen on Table 3 that many of the items supplied to the centres were in their packaged boxes and thus still unused. These items included lung volume bag kits (91% of the schools), centrifuges (78% of the schools), gene kits (74% of the schools), alcohol fermentation kits (65% of the schools),) and Pulse and B.P monitors (63% of the schools). The data shows that sulphuric acid (2%) and litmus paper (5 %) were still in their boxes. On the average, 41% of schools had items still in their original boxes which apparently had not been used previously.

Research Question 2

The second research question related to how biology was taught and learned in the senior high schools that were chosen. It stated that teacher -students centered interaction would predominate over the student-student, and student-resources, and student-resources interactions with pupils. The type of interaction that occurs during the teaching and learning of biology in their classrooms was one of the questions given to the student participants. There were four different interaction techniques available: teacher-students centered, student-student centered, teacher-resources centered and the student-resources centered. Majority of students, that is 342 corresponding to 79.2% of the student participants, indicated that the nature of interaction used in the classroom was the teacher-student centered approach. The other student participants representing 11.1% and 9.7% respectively indicated that they experienced student-student and student-resources centered interaction respectively. Below is an illustration of the results of this analysis presented as descriptive analysis.

Table 4: Summary of Descriptive Analysis of Interaction Types in the Classroom

Variables	Frequency	Percentage
Teacher-Students centered	390	79.2
Student-Student centered	48	11.1
Student-Resources centered	42	9.7

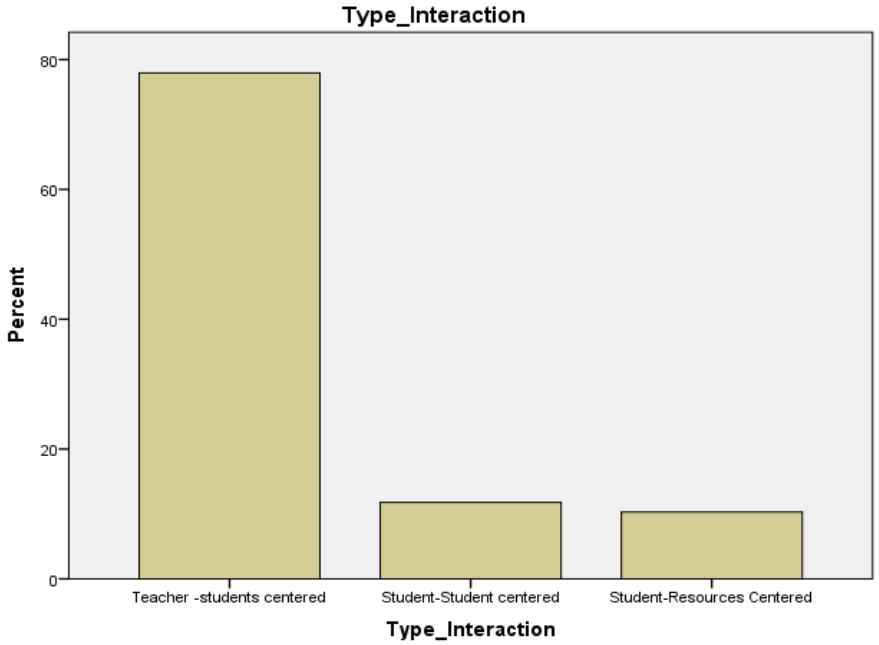

Fig 4: Type of Interaction

From the figure above, students would experience more of Teacher -Students Centered interaction than Student-Student Centered, Teacher-Resources Centered and Student-Resources Centered was confirmed from the analysis of the data set from the responses of the participants. It is important to note that this hypothesis also responds to the second research question, which explores the approaches adopted by biology teachers in the selected Senior High Schools in the Eastern region in the teaching and learning of Biology.

Teaching and Learning Strategies

Teachers mentioned such strategies as discussions, activity-based learning, group work and project-based learning as the main instructional strategies used during science lessons.

Table 5: Teaching Approaches Used

Teaching Approach	Frequency	Percentage
Discussion	10	39
Practical Activities	5	19
Group Work	4	15
Project Based Learning	1	4
Lecture Method (teacher-centred)	6	23
	26	100

Research Question 3

The final research question had to do with an exploration of the challenges confronting biology teachers and students in biology education in the Senior High Schools. The student and teacher participants in the study were asked if they experienced any challenges and then if yes, to mention some of the challenges they experienced as part of the questions presented on the questionnaire.

Table 6: Teachers Views on Factors that Militate Against the Teaching and Learning of Biology

Challenges	Yes Frequency	Percentage	No Frequency	Percentage
Lack of resources	8	31	6	23
Absence of Professional Development	11	42	5	19
Poor Attitude of Learners	2	8	3	12
Lack of motivation	26	100	26	100

Table 7: Students Views on Challenges that Inhibit their Study of Biology

Challenges	Yes Frequency	Percentage	No Frequency	Percentage
Lack of resources	365	76	115	24
Poor teaching strategies	48	10	225	47
Lack of interest	30	7	80	17
Poor entry behaviour	11	2	40	8
Other Factors	26	5	20	4
	480	100	480	100

DISCUSSION

Results from the study identified a number challenges with regards to the state of biology

education in the Senior High Schools. These challenges had to do with the availability of resources, that is the equipment needed for tuition. They also had to do with the approach that is adopted by the teachers for the teaching of biology in the senior high schools. the various specific challenges that were gleaned from the study includes the lack of equipment and laboratory facilities, theoretical teaching, lack of practical application, engagement and interest as well as teacher-related issues. In other words, a decline in class activity will be positively correlated with a fall in the resources available for teaching biology in the Senior High Schools. Resources in this context relates to the numerous buildings and pieces of machinery utilized in Senior High Schools to teach and learn biology practically. These include things like the laboratory, specimen, and microscopes, among others, that are utilized to provide students the chance to put what they are learning into practice. The teaching and learning process is facilitated by laboratory facilities, ICT gadgets, and educational teaching and learning materials (Anaman, Zottor, & Egyir, 2022).

The challenges of learning biology as reported by the student participants in the study is thus a confirmation of the need to enhance the facilities needed for biology education in the Senior High Schools in the region. Tavares (2015) found that poor classrooms, libraries, and labs affect student performance the most. The classrooms, labs and educational tools available for biology education determines how well students were taught. Biology students cannot take practical classes without scientific laboratories (Olufunke, 2012). The participants also reported large class sizes in some schools and there was the need for this to be addressed. Allotey (2014) also explored the nature of infrastructure in Senior High Schools in Ghana and indicated that some of the infrastructure for biology education such as classrooms and laboratories were in decay as a result of a poor maintenance culture. These need to be tackled to enhance the nature and quality of biology education.

Another key finding of the study was the fact that majority of participants reported to having the experience of being taught with the theoretical approaches as opposed to a blend of the theoretical and practical hands-on approach. While it was gleaned from the responses that 69% of the teacher respondents used the theoretical instructional approach for the tuition of their biology classes, as opposed to the rest who indicated that they adopt the practical approach of teaching. Similarly, from the responses of the student participants with regards to the nature of biology tuition, three hundred and eighteen (318) students indicated that the study was more of teacher-student nature, as opposed to the other methods of tuition. These findings are significant as they highlighted some key challenges of providing biology education to the students with minimal focus on the practical or hands-on, demonstrative, project teaching and learning strategies. From the literature review, project-based learning connotes a student-cantered teaching strategy that enable students to actively explore issues and problems from the real world in order to gain a deeper understanding of what is being taught. through active exploration of real-world challenges and problems (Udo, Nsit, Onyebuchi, & North, 2021).

Teachers typically act as facilitators, offering support, direction, and tactical teaching as the process develops. In a project-based learning environment, students work together to solve "purposeful" challenges emphasizing democracy (Johnson, 2002). In this regard, students are viewed as active agents who solve real-world problems, engage in realistic work, and develop knowledge and skills while interacting dynamically with their physical and social

environments. This allows them to give themselves and the world around them meaning. Contrarily, the demonstrative approach teaches students a step-by-step procedure (Amaewhule & Chukwudi, 2020). This approach is also very helpful in aiding students come to terms with and position them to replicate what has been done in class (Daluba, 2013). Demonstration often occurs when students have a hard time connecting theories to actual practice or when students are unable to understand the application of theories.

Finally, it is important to note that the hands-on approach is essential in dealing with some of the challenges presented as it is noted to be the most effective way of gaining scientific skills (Tordzro Asamoah, Nyeseh & Ofori, 2021). According to Freedman (2009), for a student to be motivated in a particular field of study, the practical exposure to what is being studied facilitates the process. This helps them to efficiently assimilate the various theoretical concepts and ideas concerning the subject (Wandersee, Mintzes, Novak, 2014; Hill, Fombelle, & Sirianni, 2016). A look at the findings of the study revealed that most of the students from the various categories consider the mode of tuition and as such the course as abstract due to the predominantly theoretical mode of instruction. This results in the view of biology as difficult as the students have the burden of thinking out the various concepts and ideas as well as solutions to problems. As a result, the initial interest in most students to take up the science programme and subsequently take up biology, dwindles and many of them find biology boring. Some responses from the student participants suggested that the lessons were boring.

According to Ruthledge and Warden (2002), the reliance on passing on of knowledge in biology using the theoretical approach alone in the absence of practical, hands-on activities has the tendency of making science lessons boring. Students are affected by the method of instruction and the amount of interest in their programme of choice. They need to have the opportunity to connect what they have learnt in theory to practical everyday life experiences in order for learning to be effective.

From the results of the study, some other challenges with regards to the teaching and learning of biology in the Senior High Schools included issues with engagement and interest as well as teacher related issues. In terms of engagement and interest, the responses from the data saw students indicating that lessons were not found to be interesting among others. From the above understanding of the various types of instruction methods, the challenge of interest and engagement could be handled. It is important to draw on the various methods, that is the theoretical, demonstrative, practical or hands-on, and student projects as discussed above in order to create an enabling and engaging study environment for students. Due to this, the orientation of the teachers was critical as these shaped the general learning experiences of students with regards to biology. It is important also to add that the results showed that the assessment of students' understanding of what had been taught was reported to be done mostly in organized examinations at the end of the term. This could be seen to pose a challenge as teachers are therefore unable to assess the understanding of the students on a topic-by-topic basis in order to clarify topics that were not well understood. This finding is essential as it can go a long way to shape the mode of teaching and assessment of students in biology and other subjects in order to achieve the most results. Other teacher constraints such as large class sizes were also gathered from the data set.

CONCLUSION

The study explored the various challenges of biology education in selected Senior High Schools in the Eastern region, Ghana. Results from the information gathered from the responses of student and teacher participants revealed some challenges regarding lack of or human personnel as well as insufficient laboratory facilities and equipment to facilitate the learning of the programme. A predominant reliance of the theoretical approach to instruction, challenges of engagement and interest of students in what is being taught, teacher related issues among others. The unavailability of and inadequacy of resources for the study of biology was understood in terms of inadequate equipment for practical, unavailability of specimen needed for students' experience of what is being taught, lack of well-equipped laboratory in some schools, among others. These issues were discussed in detail above. With regards to the challenge of the method of instruction, the discussion above brought to bear the need to have a blend of the various methods of instruction in order to get the highest results in terms of student understanding and ability to replicate what has been taught. It is important also to add that the assessment of lessons when done more frequently enables both teachers and students to have an idea of the progress of lessons. From the above as well as the other findings presented by the study, efforts can be made to provide needed resources, adopt the use of various methods of instruction, among others that will tackle the various challenges and ensure that students have the most of the biology programme in order to assimilate it and make effective use of the knowledge acquired while serving as a scaffold for higher learning in the various biology related programmes at the tertiary level.

Recommendations

- There must be regular in-service training on improvisation techniques in teaching biology for all biology teachers in the Eastern region of Ghana.
- The GES, other concerned agencies school administrators and stakeholders must organize training sessions for biology teachers on learner-centred approaches to teaching. This must focus on the effective application of various teaching techniques such as the activity method, discussions, role play, think pair share, group work in lesson delivery.
- In this era of modernization, the capacity of teachers, laboratory technicians and attendants must be enhanced in order to enable them make full use of ICT and internet resources in lesson planning, teaching and assessment of learners.
- Training of teachers on how to effectively teach perceived difficult topics conveniently.
- Through the help of the district STMIE coordinators, a of network of biology teachers within the Eastern region must be formed to enable them share ideas and experiences towards improvement in their lesson delivery.
- Science is a practical and activity-based subject. For this reason, resources such as charts, models, reagents, basic laboratory equipment must be supplied to all the Senior High schools in the Eastern region to help ensure effective teaching and Learning.
- Students must be supplied with relevant science textbooks to help them undertake independent and further study of the subject after school. This will help to boost their conceptual understanding of key science concepts.

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